Environment and
Climate Change Canada
Meteorological Service
of Canada

Environnement et
Changement climatique Canada
Service météorologique
du Canada

MANOBS

Manual of Surface Weather Observations

Seventh Edition, Amendment 19

April 2015

Canada

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Foreword

This manual prescribes the standard procedures of the Meteorological Service of Canada for observing, recording and reporting weather conditions. It has been prepared in accordance with internationally recommended procedures as established by the World Meteorological Organization (WMO).

Amendments will be issued when warranted. All holders of the manual are responsible for keeping their copies current. When amendments have been entered, this fact should be recorded on the page headed Record of amendments.

Inquiries on the content of this manual should be directed to the Meteorological Service of Canada through appropriate channels.

This supplement contains the amendments adopted by the *Manual of Surface Weather Observations* (MANOBS) Working Group.

Note (1): Amendment 19 will implement the following requirements:

- A full element SPECI as specified in the WMO Manual on Codes Volume 1.I, International Codes 2011 edition updated in 2012. FM 16-XII requires a full element SPECI.
- Remove the standard for the reporting of Recent Weather (RE) phenomena in METAR/SPECI to comply with ICAO Annex 3 Eighteenth Edition July 2013, Appendix 3 Section 4.8.1.1 removal of the requirement for Recent Weather (RE) phenomena where METAR/SPECI are issued.
- Inclusion of Observer Circulars OBS 1-2012, OBS 1-2013 and OBS 2-2013.
- Update to Appendix "V" for the IFR Approach and Alternate Limits for Canadian Aerodromes.

Note (2): Following consultation between Environment Canada, NAV CANADA, and the Department of National Defense in February 2015, it was agreed that necessary modifications to MANOBS would be applied in the form of an addendum. The addendum to MANOBS 7th Edition, Amendment 19, is effective as of May 2016. Effected sections are listed within the Record of Revisions. Effected pages are labelled in their respective page headers as *Seventh Edition, Amendment 19, Addendum, May 2016*.

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Record of Revisions — MANOBS Amendment 19

Section	Revision description	Effective Date
Miscellaneous corrections		
1.4.1 1.4.1.1 1.4.2 1.4.2.1 1.4.2.2 1.4.3 1.4.4	Added reference to oktas	May 2016
1.8.3.1	Added subsection to section 1.8.3: *“Data from the Ceilometer shall be correlated with visual observations to determine cloud amount and to ensure that the cloud height is representative of the layer.”*	April 2015
3.9.5	Replaced the term “*Visibility*” with “*Intensity*”	April 2015
5.1.3.1	Updated Maximum Correction Card	April 2015
5.1.3.2 5.1.3.3	Revised to match Maximum Correction Card	April 2015
7.7	Updated Beaufort Scale of Wind	April 2015
8.2.10.1	Removed requirement for completion of column 42a on form 63-2322	May 2016
10.2.8.8	Removed the wording: “*… or when the ceilometer is inoperative*”	April 2015
10.2.10.1	Added (*Visibility > 6mi.*)	May 2016
10.2.10.3 (7)	Revised item seven to read: “*Additional phenomena and vicinity phenomena*”	April 2015
10.2.10.8 16.3.8.6.2	Added paragraph to section: “*To meet Canadian standards, when ice crystals (IC) are observed it shall be reported in the METAR/SPECI with any visibility.*”	May 2016
10.2.19.8.1	Removed sentence: “*It is very important to report CB in remarks when it is observed but it is not the predominant cloud type.*”	April 2015
10.6.1	Changed hour 13:00 UTC wind from *0201* to *0000*	May 2016
16.3.3	Example (2): Added *TCU* to sky condition and remarks	May 2016
16.3.6.2	Example (2): Changed altimeter from *A2989* to *A2948*	May 2016
16.3.7.1	Changed Altimeter from *A2992* to *A3002* in example	May 2016
16.3.8.3	Example (1): Changed light rain showers (*-SHRA*) to light rain (*-RA*)	May 2016
16.3.8.4	Changed *proximity* to *vicinity* in the heading and first sentence	April 2015

Section	Revision description	Effective Date
16.3.8.5	Changed example for shallow fog visibility from *5SM* to *7SM*. Added remark *CVCTV CLD EMBD* to example for rain showers.	May 2016
16.3.8.8	Examples (3) and (6): Changed *moderate rain* to *moderate rain showers*. Added Remark *HAIL DIAM 12 MM* to SPECI.	May 2016
16.3.9.8	Example (3): SLP changed from *SLP14* to *SLP140* Example (9): Dew point changed from *19* to *22* Example (11): Dew point changed from *16* to *20* Added Example (12)	May 2016
16.3.13	Changed example light rain showers (-*SHRA*) to light rain (-*RA*)	May 2016
16.3.13.2.1	Changed wind remark from *05007* to *05009*	May 2016
16.3.13.2.2	Added visibility Remarks for BCFG, MIFG and FG BANK	May 2016
16.3.13.2.3	Changed weather Remark *CLR* to *SKC*	May 2016
16.3.13.2.3	Note (4): Added guide for the frequency of lightning	May 2016
16.3.13.2.7	Revised rainfall Remarks for a clearer explanation	May 2016
16.4.3	Revised for clarification on transmission time of a SPECI	May 2016
16.4.4.7	Changed example for Remark *INMT* to *INTMT*	May 2016
16.4.4.11	Revised fourth point to read: *"Immediately upon learning of an aircraft accident, at or in the vicinity of the weather observing station. The observer shall make an Accident Observation unless a complete METAR has been issued subsequent to the accident. The Accident Observation shall be as complete and accurate as possible, with particular care being taken to include in "Remarks" any meteorological facts that might relate to the accident, or which might be of significance to the aircraft accident investigator."*	April 2015
Appendix IV	Removed	April 2015

Section	Revision description	Effective Date
Full element SPECI		
10.3.4	Revised section to read: "*An observation shall be taken promptly to report changes which occur between scheduled transmission times. A SPECI observation shall include the following:* • *Sky condition* • *Visibility* • *Weather and obstruction to vision* • *Sea level pressure* • *Temperature* • *Dew point* • *Wind* • *Altimeter setting* • *Clouds* • *Remarks (if required)* • *Runway Visual Range (RVR) (where available)*"	April 2015
10.3.7.1	Revised note to read: "*If any of the observed elements warrant a SPECI, as defined in Section 10.3.4 (Criteria for taking a SPECI), a SPECI shall be transmitted and recorded on Form 63-2322.*"	April 2015
10.6	Added full element SPECI for all SP examples on Form 63-2322	April 2015
Pilot Report (PIREP)		
14.3.1(6)	Revised to read: "*Low-level wind shear 1500 feet AGL and below.*"	April 2015
14.4.4	Changed ICAO documentation reference to "*ICAO DOC 8643 – Aircraft Type Designators*"	April 2015
14.4.15	Revised to read: "*A pilot report of low-level wind shear 1500 feet AGL and below will be recorded in the Remarks (/RM) field of the PIREP and will be transmitted as an Urgent PIREP.*"	April 2015
14.4.16	Inserted new sub-section: **No turbulence or icing encountered**	April 2015
14.5	Example (3): Changed *Whitehorse FSS* to *Whitehorse FIC*	May 2016
16.4.4.11	Added "*when a pilot reports wind shear in the lower layers (see 16.3.12)*"	May 2016

Section	Revision description	Effective Date
Wind Shear		
10.2.19.6.4	Revised to read: "*Wind shear information on the existence of wind shear 1500 feet AGL and below along the take-off path or approach path of runway significant to aircraft operations shall be reported in Column 41 (Remarks) whenever available and local circumstances so warrant. The information will be reported in the following format: When wind shear is reported on take-off or landing on one runway 1500 feet AGL and below it will be reported as: WS RWY DRDR (Official Runway Designation); or, When wind shear is affecting all runways 1500 feet AGL and below, it will be reported as: WS ALL RWY*"	April 2015
16.3.12	Revised to read: "*Information on the existence of low-level wind shear along the runway takeoff or approach path 1500 feet AGL and below that is considered significant to aircraft operations shall be reported.*"	April 2015
Recent Weather		
10.2.10.1	Removed Recent Phenomena from table listing weather and obstruction to vision symbols for Column 32	April 2015
10.2.10.3 (7)	Revised item seven to read: "*Additional phenomena and vicinity phenomena"*	April 2015
10.2.10.4	Revised to read: "*Record in Column 32 only those phenomena which are occurring at the station, in the vicinity of the station, at the time of observation with the following exceptions:*" Removed first part of second paragraph containing recent weather reporting procedures.	April 2015
10.2.19.4	Removed Remark RERA	April 2015
10.6	Removed all references to recent weather phenomena from Form 632322 examples 1 and 2.	April 2015
16.2	Removed reference to Recent Weather code REw'w' from Symbolic form of the Canadian METAR code.	April 2015
16.3.12	Removed reference to: Recent Weather (RE) of operational significance	April 2015
16.3.12.1	Removed reference to: List of Recent Weather (RE) phenomena in Appendix III	April 2015
16.3.12.2	Removed section 16.3.12.2	April 2015
Appendix III	Removed all references to recent weather (RE) phenomena	April 2015

Section	Revision description	Effective Date
Sky Condition		
1.7.1	Removed opacity and replaced with amount to determine ceiling	May 2016
1.7.2	Added oktas for ceiling definition	May 2016
10.2.18.1	Revised to read: "*When a layer consists of two or more types, e.g., SC and CU, the predominating type by amount shall be recorded. If a cloud layer consists of any amount of TCU or CB, the TCU or CB shall be reported as the predominant type. However when an individual layer of cloud is composed of Cumulonimbus (CB) and Towering Cumulus (TCU) with a common cloud base, the type shall be reported as Cumulonimbus only.*"	April 2015
10.2.19	Revised note to read: "*Late weather observation shall be recorded first in Column 41 as a general weather remark (See 10.2.19.14.1)*"	April 2015
10.2.19.8.1	Revised to read: "*If clouds which indicate unstable conditions (CB, TCU or ACC) are observed and not reported in Column 40, they shall be reported in Remarks*"	April 2015
16.3.13.2.4	Added note to examples of sky condition remarks for convective clouds: "*If TCU or CB clouds base are not observed and not reported in the sky condition, they shall be reported in Remarks.*"	April 2015
Runway Visual Range (RVR)		
10.2.19.13	Revised to read: "…*Stations with the capability to display values for multiple RVR's may record and transmit a maximum of four RVR values and may include RVR data for runway(s) other than the active or most-aligned into-the-wind. ...*"	April 2015
10.6.1	Changed RVR Remarks at given times to read: *0539Z OBS: RVR RWY 15 3500FT* *0548Z OBS: RVR RWY 15 3500 FT*	April 2015
10.6.2	Changed RVR Remarks at given times to read: *0700Z OBS: RVR RWY 15 1800FT* *0900Z OBS: RVR RWY 15 1600FT*	April 2015
13.8.2	Changed RVR Remark at 0900Z to read: /S08/ *RVR RWY15 1600FT*	April 2015
16.3.7	Revised for clarity.	May 2016

Section	Revision description	Effective Date
Synoptic Coding		
11.3 11.4	The following groups from Section 3 have been enclosed in square brackets "[ ]" to signify they are not reported in Canada: *[5EEEi$_E$]* *[55SSS j$_5$F$_{24}$F$_{24}$F$_{24}$F$_{24}$]* *[8N$_s$Ch$_s$h$_s$]*	April 2015
12.3.2.1.4 (2)	Revised to include: "*…or summation amount of 8/8*"	April 2015
12.3.11.5.1	Revised to read: "*CM = /: If CM clouds invisible owing to continuous layer of lower clouds or because of fog, blowing dust or other similar phenomena.*"	April 2015
13.8.1	Changed *8802X* to *8802/*	April 2015
12.3.2.1.2 12.3.11.3.7 12.4.10.2.1	Inserted Code Table for N, N_h and N_s in oktas	April 2015
IFR approach and alternate limits for Canadian aerodromes		
Appendix V	Updated IFR approach and alternate limits for Canadian aerodromes	April 2015
Appendix V	Added two new stations: Yellowknife CYZF; Yorkton Muni CYQV April 2016	May 2016
Wind		
7.4.2	Added "*Note: Do not estimate the peak speed of a gust or a squall*"	May 2016
16.3.4	Note (1): Added "*Use the Beaufort scale knots average for the speed.*"	May 2016
Appendix III		
Obstruction to Vision	Added Volcanic Ash (VA)	May 2016

Record of Amendments

AMD No.	Effective date	Entered by	Date of entry
1–10	1977–1989	Amendment 11 printing	June, 1992
11	January, 1992	Amendment 11 printing	June, 1992
12	June, 1992	Amendment 12 printing	June, 1992
13	October, 1994	Amendment 13 printing	March, 1995
14	June, 1996	Amendment 14 printing	August, 1996
15	April, 2006	Amendment 15 printing	April, 2006
16	September, 2008	Amendment 16 printing	September, 2008
17	January, 2011	Amendment 17 printing	January, 2011
18	January, 2013	Amendment 18 printing	January, 2013
19	April, 2015	Included in this printing	February, 2015
19(a)	May, 2016	Addendum to Amendment 19	May, 2016

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Table of Contents

Introduction

Purpose

The purpose of weather observations is to provide detailed information of weather and climate to meet the needs of the various users. Some users require up-to-the-minute information; others require daily, monthly or long term climatological data. For example, an aircraft operator wants current weather reports and forecasts; a heating company requires degree day data. The farmer is interested in temperature, sunshine and precipitation information. The decision to construct an airport in a certain locality, or how strong a building should be to withstand the weight of rooftop snow accumulation or wind stress, may depend on weather data obtained over a long period. Thus, weather observations and carefully prepared records have long range, as well as immediate value.

World Meteorological Organization (WMO)

Since weather systems and climatic conditions do not recognize international boundaries, it is necessary that weather information be freely exchanged throughout the world. This requires coordination and standardization of practices and procedures and the efficient exchange of weather transmissions. To promote these services and to further the application of meteorology to aviation, shipping, agriculture and other human activities, the WMO was formed. Its membership is drawn from more than 100 countries and territories. Its weather reporting codes are called International Codes.

To carry out the resolutions of the WMO, and to discuss and coordinate meteorological activities within certain geographical areas, there are six regional associations in the WMO. One of these associations, Region IV, comprises Canada, the United States and the Central American countries. Because of differences in units of measure, national development, etc., between Regions, some of the International Code forms have been modified slightly or additional codes have been introduced for Regional use. These codes are known as Regional Codes.

Again, because of differences in climate or to meet special requirements, a Member or group of Members within a Region may develop a special reporting code. An example of this is the Hourly Weather Code developed through bilateral agreement between Canada and the United States to meet the requirements of Aviation and other users. Such codes or code changes are called National Practices.

Although International, Regional and National Codes may all be used in weather reporting, weather messages for interregional broadcast are in international code form. All of the codes, International, Regional and National are listed in WMO Publication No. 306, *Manual on Codes*, Volumes I and II.

Manual content

This manual has been prepared with due consideration to the recommended practices and procedures set down by the World Meteorological Organization (WMO). Five parts are included containing instructions on the following:

Part A: Observing procedures – general

Part B: Hourly observations – detailed coding and reporting

Part C: Synoptic observations – detailed coding and reporting

Part D: Pilot Reports (PIREP)

Part E: Rate of Rainfall and METAR

Authority

All statements throughout this manual **shall** be regarded as authoritative and **shall** be considered by the observer to be instructions. Where the term "ADM" is used, it means the Assistant Deputy Minister, Meteorological Service of Canada.

The bolded word "**shall**" is used in this manual to indicate that instructions are mandatory, or must be followed. The word "should" is used to denote a recommended practice, or a good way to do something.

Duties

It is the duty of the weather observer to report weather conditions as they actually exist at the time of observation. While on duty, weather observers are required to keep a close and continuous watch on the weather. Their records and reports **shall** be as complete and accurate as possible. Prompt and accurate reporting is vital for forecasting and weather warning services. They may be the means of preventing property damage and loss of life. Delayed reports rapidly lose their value for forecasting. However, if communication or other difficulties delay or prevent distribution of reports, the observer **shall** continue to observe the weather and record their observations on schedule. It is essential that climatological records be complete. Neatness is necessary for ready reference and for quick processing of the data; illegible or doubtful records are of little use.

Note: It is particularly emphasized that any attempt by anyone to have the observer alter any portion of an observation in such a manner as to decrease its accuracy to suit the purposes of an individual or organization, **shall** be reported by letter immediately, giving full details to:

Assistant Deputy Minister
Meteorological Service of Canada
4905 Dufferin Street
Toronto, Ontario M3H 5T4

A meteorological officer (inspector or instructor) authorized by the ADM may instruct an observer to change their observation to improve its accuracy and completeness.

Priority of duties

Weather observing personnel whose duties include observing and reporting weather conditions, **shall** give highest priority to weather observing duties, except when the imminent occurrence of severe weather conditions (e.g. tornadoes, waterspouts, funnel clouds, severe thunderstorms), either observed or forecast, and posing a threat to life and major property, requires the rapid dissemination of a warning or advisory. In these circumstances, a weather report is to be prepared and transmitted immediately following the dissemination of the warning. Other personnel (i.e. non-MSC employees) who take weather observations **shall** give such duties the priority specified by their employing agency.

Qualifications

The weather observer must be competent and trained to make observations accurately and to code the resulting reports within the time allotted. The observer should realize however, that it is neither possible nor desirable to prepare detailed instructions to cover the variety of weather in all its forms. Therefore, initiative and resourcefulness in dealing with unusual conditions are most important qualities in an observer.

Weather observing station

A weather observing station is any site where an observer is located and from which weather observations are made. It is normally equipped with instruments for measuring some of the meteorological elements.

Point of observation

A point of observation is any site at which meteorological instruments are exposed or from which visual observations are taken. The term "At the Station" as used in this manual refers to any point of observation from which the weather data are gathered.

Surface weather observation

A surface weather observation is an evaluation of meteorological elements, visually and/or by measurement at a specified location on the earth's surface (usually a weather observing station).

Observations at night

Prior to making an observation during darkness, the observer should spend several minutes outside so that their eyes will become dark adapted.

Times of observations

Standard time of observation

The standard time of observation is determined by international agreement; it is with reference to Coordinated Universal Time (UTC*) and is published in the Technical Regulations of the WMO. For example, the standard times for the main synoptic observation are 0000, 0600, 1200 and 1800 UTC; for Upper Air observations, the Standard Times are 0000 and 1200 UTC.

***Note**: In the aviation community, Z is often used in lieu of UTC and MANOBS reflects the use of both abbreviations.

Surface observations

The time of a surface observation **shall** be the time at which the barometer is read. In the case of a Aerodrome Special Meteorological Report (SPECI) the time of the observation is the time at which the element necessitating the SPECI was observed. The time assigned to a SPECI issued to report the end of a thunderstorm, showery precipitation or intermittent precipitation would normally be 15 minutes later than the actual time of the last occurrence of thunder or precipitation.

Official time of observation

In Canada, the official time of a surface weather observation is the same as the standard time.

Local standard time

The local standard time used for record purposes **shall** normally be that of the standard time zone in which the station is located, whether or not "daylight saving time" is adopted for other purposes. If there are any changes in standard time zones, stations affected, for record purposes, **shall** first coordinate the effective date of change by a letter to the ADM, through the appropriate channels.

Quality standards – observations

Data held in the national meteorological archives are used in the preparation of official publications and by both government and industry in the preparation of statistical analyses as a basis for decision making. The accuracy of the archived data determines, to a large degree, the quality of the publication or analysis, and hence it is extremely important that suitable measures be taken to ensure that archived data are of the highest quality, consistent with reasonable cost.

Before being transferred to the archives, observational data are subjected to a computer analysis or review which reveals possible errors in recording or transmission, and gross errors only in instrumental readings, calculations and estimation of parameters. The suspect data are checked by technical staff and corrected where necessary.

Because the computer review of data is incapable of uncovering all errors and it is neither possible nor desirable to create a large quality review unit at MSC Downsview, it is extremely important that Regions establish and maintain satisfactory data quality control programs for stations falling within their jurisdiction. Normally, the minimum program should consist of thorough checking of data by station personnel. However, additional measures should and must be taken where a need is indicated.

Although the data review at MSC Downsview does not reveal all errors in observational data, experience has shown that the number of corrections required in this quality control program is a reliable indicator of the likely overall quality of the data. As an aid to regional network managers and operators in appraising station performance and identifying those stations requiring augmented or alternate quality checking programs, MSC Downsview supplies a listing of the corrections made to the data for each month from individual stations and a monthly report indicating, for each observing station, the error count as a percentage of observations taken requiring one or more corrections.

Rounding of data

When a figure is to be rounded to fewer digits than the total number available, the procedure **shall** be as follows:

1) When the first digit discarded is less than five, the last digit retained **shall not** be changed.

Examples:

3.44 rounded to two digits becomes 3.4

3.49 rounded to one digit becomes 3

-1.849 rounded to two digits becomes -1.8

2) When the first digit discarded is five, or greater than five, the last figure retained **shall** be increased by one unit.

Examples:

2.51 rounded to one digit becomes 3

2.66 rounded to two digits becomes 2.7

3) The algebraic sign of the number **shall** remain unchanged.

Examples:

-0.5 rounded to one digit becomes -1

0.5 rounded to one digit becomes 1

1.5 rounded to one digit becomes 2

-2.5 rounded to one digit becomes -3

Additional examples:

Figure	Rounded to two digits	Rounded to one digit
5.49	5.5 see (2)	5 see (1)
6.501	6.5 see (1)	7 see (2)
6.50	6.5 see (1)	7 see (2)
-0.15	-0.2 see (2)	0 see (1)*
-0.55	-0.6 see (2)	-1 see (2)
-1.45	-1.5 see (2)	-1 see (1)

***Note**: When a negative quantity rounds to exactly zero, the negative sign **shall** be omitted in the rounded value.

Observer's Notebook

The Observer's Notebook (Form 63-2321) is a pad of work sheets to be used by the observer in making calculations and recording data during the observation. The Observer's Notebook should be used for all surface weather observations and should be retained on the station for at least two months so that the original data are available if required in checking the permanent station records.

Meteorological instruments

Instruments are generally installed by an Inspector or other person with special training. This manual deals only with the use of instruments as part of the general observing procedure. Instructions for the routine care and maintenance of instruments will be found in the appropriate instrument circulars and manuals and in the reference manual *Installation, Maintenance and Repair of Meteorological Instruments and Instrument Systems, Reference Manual for Supervisory Personnel*, 2nd edition, November 1976.

Instrument manuals

Each observing station **shall** have copies of the instrument manuals which deal with the instruments installed at the station, copies of INS[1] and OBS[2] circulars, relevant instrument Information Bulletins and SPC circulars. The following is a list of manuals or bulletins for the various types of instruments:

Manual	Title
11	Barographs
15	Altimeter Setting Indicator
20	Liquid-in-Glass Thermometers
21	The Bimetal Thermograph
30	MSC Psychrometers
32	Remote Temperature and Dewpoint Measuring System – Type 2
TM 01-005-A	Vaisala Barometer Instructions for Observers
TM 02-04-01	Remote Temperature/Dewpoint System
TM 04-01-03	Tipping Bucket Rain Gauge System Sept. 1981
TM 04-02-01	MSC Rain Gauge Type B System Sept. 1985
50	Wind Measuring Equipment, Type U2A
51	MSC Anemometer Type 45B
TM 05-01-04	Type 78D Anemometers and Display Unit
70	Ceiling Projectors and Associated Equipment
TM 07-01-01	Ceiling Balloon Equipment, 76 mm (3 inch) Nov. 1977
IB 04-03-01/1	Nipher Snow Gauge
IB 07-005	Description and Operation (ASEA Laser Control Unit and Chart Recorder)
IB 07-006	Operation and Maintenance Procedures (ASEA Laser Ceilometer QL1212)
IB 07-013-A	A Laser Ceilometer CT25K
TM 14-01-01	Solar Radiation
81	Sunshine Jan. 1974 Evaporation May 1978 Snow Surveying, Second Edition Soil Temperature, March 1978

In addition, each station **shall** have the appropriate books of psychrometric tables, both "ventilated" and "non-ventilated" to conform to the station elevation.

Note (1): INS circulars and Data Sheets deal with interim instructions on the installation, operation and routine maintenance of instrument equipment.

Note (2): OBS circulars contain supplemental observing instructions. The contents of these Circulars and Data Sheets will be included in later editions of the manuals concerned.

Distribution of reports

In Canada the distribution of coded weather reports is done with computer, using software such as WinIDE or MIDS. In areas not equipped with these systems, other methods of communication are employed in accordance with the station's current communications instructions.

Retention

Meteorological records, charts, forms, etc., are retained at the station for various periods of time. Procedures regarding the retention of documents are given elsewhere in this manual with detailed instructions pertaining to each chart or document.

Station name

The station name, entered on any meteorological observing chart or form, **shall** be the official name of the station, as published in METSTAT. For newly-established stations, the official name selected for the station **shall** be submitted to the ADM, through appropriate channels, for approval.

Part A
Observing procedures – general

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Chapter 1 Sky

1.1 Celestial dome

In this manual “celestial dome” refers to that portion of the sky which is visible in all directions of the local horizon from the point of observation.

1.1.1 Sky condition

An observation of the sky requires an examination and identification of the clouds and obscuring phenomena (fog, smoke, precipitation, etc.) which prevent an uninterrupted view of the sun, moon, stars or the clear blue of the celestial dome. Such obstructions occur as layers aloft with comparatively level bases or as surface-based layers. Each layer is analysed for its type, amount, opacity, and height of base or vertical visibility.

1.1.2 Clear sky

Clear sky describes the complete absence of layers of cloud or other phenomena obscuring the celestial dome.

1.2 Layer determination

1.2.1 Single layer

A layer is any amount of cloud or obscuring phenomena, the bases of which are at approximately the same level. A layer may be continuous or formed of detached elements. A similarity in cloud form indicates a formation at about the same level and is therefore a guide in determining that a number of detached elements compose a single layer.

1.2.2 Multiple layers

The existence of more than one layer is a common occurrence. Differences in cloud form or in direction of motion are valuable aids in distinguishing different layers. Upper layers may also be seen through openings or thin spots in lower layers.

1.2.3 Interconnected layers

Clouds of vertical development may build up to reach or penetrate upper layers. Also, by horizontal extension, swelling Cumulus or Cumulonimbus may form Stratocumulus, Altocumulus, or dense Cirrus. Careful examination is often necessary to determine the relationship and to distinguish such layers.

1.2.4 Layers aloft

Most layers occur as “layers aloft” whose bases are sufficiently high above the surface to show clear spaces beneath, e.g., “Stratus Fractus at 120 m; Smoke at 600 m; Stratocumulus at 1500 m; Altocumulus at 3000 m.”

1.2.5 Surface-based layers

A “surface-based layer” is a layer whose base is at ground level; e.g., fog, smoke, blowing dust, blowing sand, falling snow and blowing snow.

1.3 Layer identification

1.3.1 Cloud layers

The description and pictures given in the *International Cloud Atlas* **shall** be used for identifying cloud types.

1.3.2 Obscuring layers

An “obscuring layer” is a non-cloud layer which either wholly or partly prevents an observer from seeing the sky or clouds at higher levels. It may be a layer aloft such as smoke, or a surface-based layer such as fog or blowing snow. Precipitation, if heavy enough, can constitute an obscuring surface-based layer.

1.4 Layer amount and opacity

1.4.1

Layer amount is the amount in tenths or oktas of the whole sky that is observed to be covered (not necessarily concealed) by a layer aloft or concealed by a surface-based layer.

1.4.1.1

Layer amount (and layer opacity, see 1.4.4) are observed and recorded in tenths or oktas of the whole sky (celestial dome). An amount of less than one tenth or less than one okta **shall** be called a “trace”.

1.4.1.2

Layer amount is determined by mentally dividing the sky in halves and estimating the amounts in each half. The halves should be selected to suit the prevailing sky condition. For example, if most or the entire layer is in the northern portion of the sky, the sky should be mentally divided into a northern half and a southern half.

1.4.1.3

During darkness, if stars are plainly visible and no cloud or obscuring phenomenon is observed, the sky **shall** be considered to be clear. When the stars are dimmed, the dimming is evidence of the presence of cloud or obscuring phenomenon and will be of assistance in determining the amount and opacity of the layer.

1.4.1.4

If the sky is covered by middle or high cloud on a dark night, and a lower layer is present, the amount of the lower layer may be estimated with the aid of the ceiling projector beam or ceilometer recorder record with appropriate software. The proportion of time the layer is observed crossing the projector beam gives some indication of the amount. Reflection (sky glow) from city or other lights may also be used to estimate the amount of low cloud (see “Reflection of city lights at night” in 1.8.5).

1.4.2

Summation amount at any level is the amount in tenths or oktas of the whole sky that is covered by layers at and below that level.

1.4.2.1

In general, the summation amount is the sum of individual layer amounts. However, traces of layers, aloft or surface-based, **shall** be disregarded when determining summation amount. The summation amount cannot exceed 10 tenths or 8 oktas.

Example: A trace of Cumulus, 9/10 or 7/8 Altocumulus, and a trace of Cirrus would give a summation amount of 9/10 or 7/8.

1.4.2.2

Portions of upper layers seen through transparencies in lower layers do not increase the amount of sky cover and **shall not** be counted when determining the summation amount.

Example: 5/10 or 4/8 Stratus with a layer above of 4/10 or 3/8 Altostratus, of which 2/10 or 2/8 are seen through thin portions of the Stratus layer, would give a summation amount of 7/10 or 5/8.

1.4.3 Total amount

Total amount is the amount in tenths or oktas, of the whole sky that is covered by all layers observed. It is determined in the same way as the summation amount taking all layers into consideration.

1.4.4 Layer opacity

Layer opacity represents the portion of the whole sky that is observed to be concealed (hidden, rendered invisible) by the layer. Layer opacity is reported in tenths or oktas. No layer can exceed ten tenths or eight oktas, nor can the total of the opacities for all layers exceed ten tenths or eight oktas.

1.4.4.1

If a layer does not conceal any part of the sky, its opacity is zero.

1.4.5 Summation opacity

Summation opacity is reported in tenths and represents the portion of the whole sky concealed by layers at and below a given level. It is the sum of the opacities of the layers at and below a given level. The opacity of a layer whose amount is a trace **shall** be disregarded when determining summation opacity.

1.4.6 Total opacity

Total opacity is reported in tenths and represents the portion of the whole sky that is concealed by all layers observed. It is determined in the same way as the summation opacity taking all layers into consideration.

1.5 Direction of motion of layers

1.5.1

The direction of motion of a layer **shall** be the direction from which the layer is moving with respect to true north.

1.5.2

Direction of motion is recorded to eight points of the compass, i.e. N, NE, E, SE, etc.

1.5.3

Layers at different levels are often seen to move in different directions and the observer must guard against being deceived when the lower layer is moving rapidly. In such cases higher layers appear to move in the opposite direction to that in which the lower layers are moving, regardless of the true direction of motion of the higher layers.

1.5.4

The observer will find that the direction of motion may be most readily observed if they look at the layer along a stationary object such as a vertical pole, a building, a tower, etc. If the object and observer are aligned in one of the cardinal directions, it will be simpler to estimate the direction of motion of the layer.

1.5.5

In order that the observer may have ample time to make an accurate observation of the direction of motion of layers, they may make this part of the observation before the main portion of the observation.

1.6 Height

1.6.1 Height to be observed

1.6.1.1

For a layer whose base is above the surface, the height of the base of the layer **shall** be observed.

1.6.1.2

When it is possible to see a considerable distance into the layer, (as shown by a balloon fading very slowly from sight, or by a considerable penetration by the beam of a ceiling projector, or by examination of a ceilometer record with appropriate software) or if it is possible to see out of the layer (as reported by a pilot), the height of the upper limit of such visibility **shall** be noted if it differs by at least one reportable value. This information, in addition to the height of the base, is important to aircraft operators.

1.6.2 Reference level

At airport locations, height **shall** be determined with reference to the official aerodrome level. At non-airport locations, it will be with reference to ground level at the observing station.

1.6.3 Units

Height of layers **shall** be determined to the nearest 30 m as this represents the order of accuracy that is usually obtainable. However, in some cases the method of measurement and the character of the base of the layer may allow more precise determination and, in such cases, the height **shall** be determined as precisely as possible.

1.6.4 Vertical visibility

Vertical visibility is the distance an observer on the ground can see vertically into a surface-based layer. To an observer in an aircraft, ascending or descending through a surface-based layer which completely obscures the sky, vertical visibility is the maximum height from which the observer can see the ground directly below.

1.6.4.1

Vertical visibility **shall** be considered as unlimited for a given layer when the observer can see through the layer.

1.6.4.2

The height at which a balloon disappears from sight may be used as a guide when estimating the vertical visibility.

1.6.5 Variable height

When the height of the base of a layer is observed to be fluctuating, rising and falling from a mean value by 1/4 or more of the mean value, the height is said to be “variable.” Use the mean (average) of all observed values as the recorded height.

Example: When the height varies from 300 to 600 m it is considered to be 450 m variable.

1.7 Ceiling

1.7.1 Ceiling

The term ceiling is usually used with reference to the base of a layer aloft. It may on other occasions refer to the height of vertical visibility in a surface-based layer. In determining the ceiling, both the height and the amount of the layer(s) are considered.

1.7.2 Ceiling definition

The ceiling is defined as the lesser of:

1) The height above ground or water of the base of the lowest layer of cloud where the summation amount exceeds half the sky (more than 5/10 or 4/8); or
2) the vertical visibility in a surface-based layer that completely obscures the whole sky.

1.8 Method of determining heights of layers

1.8.1 Ceiling balloons

The free flight of balloons which have been inflated with gas to rise at certain assumed rates may be used in determining heights. The table of cloud heights from ceiling balloon ascent (see 1.8.7) is provided to convert the elapsed time of flight into height. When a ceiling balloon is used to determine the height of a layer aloft, the height at which the balloon begins to fade or appears to change colour **shall** be considered as the base of the layer. When a ceiling balloon is used to determine the vertical visibility in a surface-based layer, the point at which the balloon disappears **shall** be used as a guide in estimating the vertical visibility. Weather conditions, however, may adversely affect the accuracy of balloon determinations as indicated below.

1.8.1.1

Rain and wet snow reduce the rate of ascent and the results in such conditions must be used with caution. Light precipitation such as drizzle or very light rain and dry forms of precipitation such as snow, do not greatly affect the rate of ascent.

1.8.1.2

Strong winds associated with poor horizontal visibility may result in too low an indication of height. The large horizontal movement of the balloon in flight and the reduced visibility may make it appear that the balloon entered cloud before it actually did.

1.8.1.3

Breaks in the layer may result in inaccurate heights unless the balloon is watched carefully to see whether it enters the base of the layer or goes through a break. Although the height at which a balloon enters a break, or the side of a cloud, is a guide for estimating the height of the layer, another balloon should be used if time is available in an attempt to hit the cloud base.

1.8.2 Ceiling projector

This is a small searchlight which projects a narrow beam of light upwards. Heights are determined by the use of an alidade or clinometer. For layers aloft, the alidade **shall** be directed at the lowest portion of the spot as this represents the actual base of the layer. The remainder of the spot represents penetration into the layer. The apparent top of the beam of light may serve as a guide in estimating the vertical visibility into a surface-based layer.

1.8.2.1

Multiple layers are indicated by the appearance of two or more spots at different levels.

1.8.2.2

False spots, due to reflection from ice crystals, may occur in cold weather. Stepping 5 to 6 m to one side of the alidade will make such false spots disappear. A false spot will appear only when the projector is directed at an angle to the vertical. For projectors directed at 71° 34′, the height of the false spot will appear at:

- 450 m (1500 ft) if the base line is 1000 ft (305 m)
- 342 m (1125 ft) if the base line is 750 ft (230 m)
- 230 m (750 ft) if the base line is 500 ft (152 m)

1.8.2.3

Just before daylight the heights of layers **shall** be measured with the projector to provide a reliable and recent check during the uncertain light at dawn, before it is light enough to use a balloon. In some instances it may also be possible to use a balloon during the faint light of dawn, if the height of the layer is very low.

1.8.3 Ceilometers

These are electronic devices which measure cloud heights during daylight and darkness. A ceilometer consists of a projector/transmitter and detector/receiver either combined in a single unit, or housed in two separate units. Indicator and recorder units in the observing office are connected to the field unit(s) by signal and control cables. The type of ceilometer currently in use is the laser ceilometer. Operating instructions for the Vaisala CT-25K are given in information bulletin IB-07-013-A, and in *CT-View user's guide* and in *Procedures for Interpreting Clouds Bases from CT-View Program*. Operating and first line maintenance procedures for the ASEA laser ceilometer QL1212 are given in information bulletins IB 07-005 and IB 07-006.

1.8.3.1

Data from the Ceilometer **shall** be correlated with visual observations to determine cloud amount and to ensure that the cloud height is representative of the layer.

1.8.4 Pilot reports

Heights reported by pilots are usually given as heights above mean sea level (in feet) and require conversion to heights above aerodrome or ground level as appropriate. A report by a pilot on the height of cloud bases or vertical visibility as observed within 1.5 SM of the observing site may be regarded as highly accurate and representative of conditions at the observing site. Such reports, taken at greater distances from the site should be used by the observer in estimating heights.

1.8.5 Estimation

Heights of layers may be estimated with a reasonable degree of accuracy. Vertical visibility, however, is very difficult to estimate even with the aid of balloons or a ceiling projector. Estimation is a matter that requires careful study and continual practice on the part of the observer. Correlation of estimated values with those determined by other methods, such as pilot reports or balloon measurements will improve the observer's ability. When the lack of a more accurate method requires the observer to estimate, they may be guided by the following:

- The apparent size of the elements, the rolls or features visible in the layer, i.e., large rolls or elements usually indicate that the layer is relatively low while small rolls or elements usually indicate that the layer is relatively high.
- The height of one layer relative to another.
- The known heights of hills, towers, etc. in the vicinity.
- The difference between temperature and dewpoint may be used as a guide in estimating the height of cumuliform cloud when the surface temperature is above freezing in non-mountainous country (see 1.8.5.2).
- The height at which a balloon enters the side of a cloud or a break in a cloud.
- During strong winds, the height at which a balloon disappears in a surface-based layer should be used as a guide only in estimating vertical visibility.
- Reflection of city lights at night. During darkness the reflection of city lights may serve not only to indicate the presence of a layer but may also be used as a guide in estimating its height. For example, through experience and reliable measurements obtained from the ceiling projector and from pilot reports, observers located at an airport 6 km east of a city and 2 km west of a village learned that during darkness when cloud over the city was based at approximately 1500 m or lower, its base would in most cases be noticeably illuminated by the city lights. However, a layer over the village showed appreciable illumination from the village lights only when the layer was based at 300 m or lower.

1.8.5.1

Although no rigid rules can be given relating the types and heights of clouds, it is possible to specify the height ranges in which clouds of each genera are usually found. The observer must understand that there are large divergences from these heights. In general, cloud bases follow the temperature; lower in winter and in Arctic regions, and higher in summer and in southerly regions. At middle latitudes the following may be used as a guide.

Definitions of clouds	Approximate height of base	Remarks
Cirrocumulus: thin, white patch, sheet or layer of cloud without shading, composed of very small elements in form of grains, ripples etc., merged or separated, and more or less regularly arranged; most of the elements have an apparent width of less than one finger held at arm’s length.	6-12 km	Average height of base 9 km in summer, in winter 8 km. If very thin, average height of base 10 km.
Cirrus: detached clouds in the form of white, delicate filaments of white or mostly white patches or narrow bands. These clouds have a fibrous (hair-like) appearance, or a silky sheen, or both.	6-12 km	Average height of base 9 km in summer, in winter 8 km. If very thin, average height of base 10 km.
Cirrostratus: transparent, whitish cloud veil or fibrous (hair-like) or smooth appearance, totally or partly covering the sky, and generally producing halo phenomena.	6-12 km	Bases more often near the lower 6-12 km limit of this range averaging about 6 km in winter and 8 km in summer.

Note: Cirriform clouds in the high Arctic may be observed at very low levels.

Definitions of clouds	Approximate height of base	Remarks
Altocumulus: white or grey, or both white and grey, patch, sheet or layer of cloud, generally with shading, composed of laminae, rounded masses, rolls, etc., which are sometimes partly fibrous or diffuse and which may or may not be merged; most of the regularly arranged small elements usually have an apparent width of between one and three fingers held at arm's length.	2-6 km	Small elements with little shading usually based at approximately 5 km, larger and darker elements based lower.
Altocumulus Castellanus: Altocumulus with cumuliform protuberances, at least in some portion of the upper part. The turrets, some of which are taller than they are wide, are connected by a common base and seen to be arranged in lines.	2-6 km	Small elements with little shading usually based at approximately 5 km, larger and darker elements based lower.
Altostratus: greyish or bluish cloud sheet or layer of striated, fibrous or uniform appearance, totally or partly covering the sky, and having parts thin enough to reveal the sun at least vaguely, as seen through ground glass. Altostratus does not show halo phenomena.	2-6 km	When no sun or moon is visible the average height of the base is 2.5 km, thin layers are higher.
Nimbostratus: grey cloud layer, often dark, the appearance of which is rendered diffuse by more or less continuously falling rain or snow, which in most cases reaches the ground. It is thick enough throughout to blot out the sun.	Near Surface to 2 km	Usually the darker the cloud the lower the base. Stratus Fractus usually forms in precipitation below Nimbostratus and may or may not merge with the higher layer.
Stratocumulus: grey or whitish, or both grey and whitish, patch, sheet or layer of cloud which almost always have dark parts, composed of tessellations, rounded masses, rolls, etc., which are non-fibrous (except for virga) and which may or may not be merged; most of the regularly arranged small elements have apparent width of more than three fingers at arm's length.	150 m to 300 m	Few rolls, large cloud elements.
	300 m to 2 km	More rolls and smaller cloud elements as the height of the base increases.

Definitions of clouds	Approximate height of base	Remarks
Stratus: generally grey cloud layer with a fairly uniform base, which may give drizzle, freezing drizzle, snow grains. When the sun is visible through the cloud, its outline is clearly discernible. **Stratus Fractus**: (ragged stratus)	Near surface to 450 m	Usually based below 300 m.
Cumulus: detached clouds, generally dense and with sharp outlines, developing vertically in the form of rising mounds, domes or towers, or which the bulging upper part often resembles a cauliflower. The sunlit part of these clouds shows dazzling white colour; their bases are relatively dark and almost flat. **Cumulus Fractus**: (ragged cumulus)	Usually 450 m to 2 km but up to 3 km or higher	Highest bases occur in summer in very dry air.
Towering Cumulus: strongly sprouting cloud with generally sharp outlines and often great vertical extent. The bulging upper part resembles a cauliflower. This cloud looks sometimes narrow with very high towers. Sides are white in the sun; when overhead, its base is dark, flat and almost horizontal.	Usually 450 m to 2 km but up to 3 km or higher.	Highest bases occur in summer in very dry air.
Cumulonimbus: heavy and dense cloud with considerable vertical extent, in the form of a mountain or a huge tower. At least part of its upper portion is usually smooth, or fibrous or striated, and nearly always flattened; this part often spreads out in the shape of an anvil or vast plume. Under the base of this cloud which is often very dark, there are frequently low ragged clouds either merged with it or not, and precipitation, sometimes in the form of virga.	Usually 450 m to 2 km but up to 3 km or higher.	Highest bases occur in summer in very dry air.

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1.8.5.2

The height of the base of cumuliform cloud may be estimated with a fair degree of accuracy by multiplying the difference between the temperature and the dewpoint (°C) by 120 to give the height in metres. Observers in mountainous districts should not use this rule; it does not apply in these regions. Also, this method should be used with caution when the temperature is below freezing, because of the difficulties inherent in the accurate determination of the dewpoint at low temperature. To facilitate the use of this method the following table may be used.

Approximate height of base of cumuliform cloud

Temperature/ dewpoint difference (°C)	Height (nearest 30 m)	Coded value*	Temperature/ dewpoint difference (°C)	Height (nearest 30 m)	Coded value*
3	360	12	17	2040	68
4	480	16	18	2160	72
5	600	20	19	2280	76
6	720	24	20	2400	80
7	840	28	21	2520	84
8	960	32	22	2640	88
9	1080	36	23	2760	92
10	1200	40	24	2880	96
11	1320	44	25	3000	100
12	1440	48	26	3120	100
13	1560	52	27	3240	110
14	1680	56	28	3360	110
15	1800	60	29	3480	120
16	1920	64	30	3600	120

***Note**: See 10.2.8.6, “How to obtain the coded height.”

1.8.5.2.1

The above table gives the lower limit of the cumulus cloud when the temperature dewpoint spread is representative of a location of the cumulus formation. When the air mass is reasonably dry aloft the base of the cumulus cloud may be considerably higher than the height suggested by the above table.

1.8.5.3

Since the estimation of the height of such clouds as Stratus, Nimbostratus and Altostratus is particularly difficult due to the lack of pronounced structure in the cloud base, the observer, whenever possible, should use information obtained from pilot reports, ceiling balloons etc., to provide reliable measurements, or reliable estimated cloud heights. For example, even though a ceiling balloon disappears before entering the cloud base the observer may have gained definite knowledge that the cloud base was above the height at which the balloon was last observed and the observer is thus able to provide a more reliable estimate.

1.8.6 Comparison with heights of objects

When a layer intersects a hill or mountain, the height of the layer may be estimated with considerable accuracy. However, the base of such a layer should be studied carefully to determine and allow for any difference in the layer at the hill or mountain and at the station. Towers and buildings at known heights are also valuable aids in determining heights of layers which intersect them.

1.8.7 Table of cloud heights from ceiling balloon ascent

(Rate of ascent 140 m/min)

Time from release (min:s)	Cloud height (metres)	Reportable value
0:07–0:19	30	1
0:20–0:32	60	2
0:33–0:45	90	3
0:46–0:58	120	4
0:59–1:12	150	5
1:13–1:24	180	6
1:25–1:37	210	7
1:38–1:50	240	8
1:51–2:04	270	9
2:05–2:17	300	10
2:18–2:30	330	11
2:31–2:43	360	12
2:44–2:56	390	13
2:57–3:09	420	14
3:10–3:22	450	15
3:23–3:35	480	16
3:36–3:48	510	17
3:49–4:01	540	18
4:02–4:14	570	19
4:15–4:27	600	20
4:28–4:40	630	21
4:41–4:53	660	22
4:54–5:06	690	23

Chapter 2 Visibility

2.1 General

Visibility is the greatest distance at which objects of suitable dimensions can be seen and identified.

2.1.1

The visibility to be reported is the prevailing visibility observed at eye level (eye level is internationally defined at 1.8 m above the ground).

2.2 Prevailing visibility

It is the maximum visibility value common to sectors comprising one-half or more of the horizon circle (see 10.2.9).

2.3 Determination of prevailing visibility

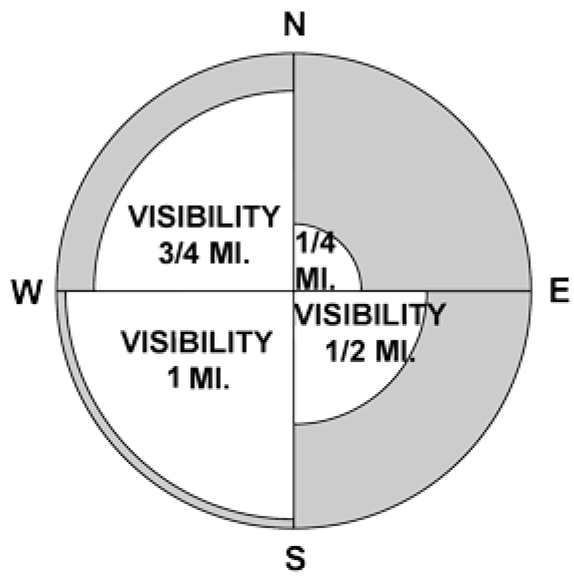
For this purpose, the horizon circle **shall** be divided into as many sectors as there are different values of visibility. The highest visibility value that is common to sectors which cover one-half or more of the horizon circle **shall** be taken as the prevailing visibility.

2.3.1

When the observed visibility in one or more sectors differs significantly from the prevailing visibility, it is sometimes necessary to record and report, not only the prevailing visibility but the variations as well. Details in this regard are included with the procedures for reporting visibility in the hourly observations (see Chapter 10, “Recording the hourly observations on Form 63-2322”).

How to determine prevailing visibility:

Example (1): Prevailing visibility = 3/4 mi.

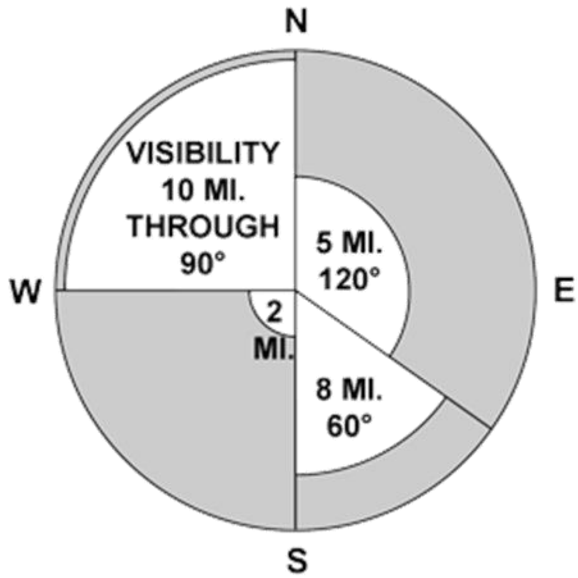


Note(1): Point of observation is centre of circle.

Note (2): The prevailing visibility is not 1 mi. because 1 mi. is common to only 90° of the horizon circle.

Note (3): 3/4 mi. is considered to be the prevailing visibility because this is the greatest value common to 1/2 or more (180°) of the horizon circle.

Example (2): Prevailing visibility = 5 mi.



Note (1): Point of observation is centre of circle.

Note (2): The prevailing visibility is not 10 mi. because 10 mi. is common to only 90° of the horizon circle.

Note (3): The prevailing visibility is not 8 mi. because 8 mi. is common to only 150° of the horizon circle (90° + 60°).

Note (4): The prevailing visibility is considered to be 5 mi. because this is the maximum value common to 1/2 or more of the horizon circle, i.e. 90° + 60° + 120°.

2.4 Units of measure

Visibility **shall** be reported at land stations in statute miles (SM), and at ocean stations in nautical miles.

2.5 Variable visibility

When the visibility is observed to be fluctuating rapidly and increasing and decreasing from a mean value by 1/4 or more of the mean value, the visibility is said to be “variable.” Use the mean (average) of all observed values as the prevailing visibility.

Example: If the observed visibility fluctuates rapidly between 3/4 mi. and 1 1/4 mi., the prevailing visibility would be reported as 1 mi.. To report the variability, see 10.2.19.3, “Visibility (Remarks).”

2.6 Guides in determining visibility

2.6.1 Point of observation

A roof is convenient for enabling the observer to obtain a complete view of the horizon circle. However, if the observer has any reason to believe that the visibility near the ground is different, the observer **shall** make an observation from the ground and record it as the prevailing visibility. If the roof-top visibility is significantly different from the ground visibility, i.e., if it differs by a reportable value or more, Remarks concerning the roof-top visibility **shall** be recorded.

2.6.2

Optical devices such as binoculars, etc., **shall not** be used by the observer when determining visibility.

2.6.3

Visibility markers **shall** be selected with a view to choosing prominent objects so located that they may be viewed against a background of the horizon sky. One must not, for example, select a building on the side of a hill, which would be viewed with the hill as background. The distance of markers such as hills and mountains may be determined with the aid of a large scale map of the vicinity. A suitable visibility marker should subtend an angle at the observer’s eye of not less than 0.5°* vertically and horizontally above the horizon. Objects such as radio masts are therefore not desirable visibility markers for daytime use. During darkness unfocussed lights of moderate intensity at known distances should be used for visibility markers.

***Note**: 0.5° is approximately the angle subtended at the eye by a hole 8 mm in diameter punched in a card and held at arm's length.

2.6.4 Visibility charts

Form 63-9046, "Visibility Markers," **shall** be prepared for each observing station. It consists of charts marked in degrees of azimuth and in distances (statute miles), for three different ranges. On these charts, day and night visibility markers **shall** be indicated in their proper positions by means of the designated symbols listed on the chart.

2.6.5

Visibility at night **shall** be determined with the aid of markers in the form of lights. Very powerful or focussed lights should be used with caution, as their great penetrating power tends to result in too high a value for the visibility. However, obstruction lights on towers and buildings and the various marker lights around an airport may be used for visibility markers.

2.6.5.1

At night, in the absence of visibility markers, the visibility may be estimated by studying the appearance of a ceiling projector beam. Under conditions of good visibility, the light source is visible, but the beam is not. As the visibility deteriorates, the projector beam begins to show and becomes increasingly evident as visibility decreases. When the visibility becomes quite low, the beam takes on a diffuse appearance, and the projector itself becomes blurred. Under conditions of very low visibility, beam and projector disappear completely. With practice, the observer will find that visibility may be judged with reasonable accuracy in this way. When the relative humidity is high, the choke device (if so equipped) of the projector should be left on long enough to ensure that any condensation on the glass has evaporated.

2.6.5.2

Recorded visibility **shall not** be reduced on account of darkness alone.

2.6.5.3

The principal difficulty in determining visibility at night lies in the uncertainty as to the state of accommodation of the eyes of an observer who has recently left a brightly lighted office. Therefore, in order that the observer's eyes may become as well accommodated as possible, the visibility should be the last of the outdoor observations.

2.6.5.4

Although optical devices are not to be used when determining visibility, an observing aid (dark adapter goggles) is available from MSC Downsview stores, Stock 6532-21-866-0046, and may be worn if the observer wishes for either of the following reasons:

- To enable the night-time observer to have their eyes practically dark adapted when they arrive at the outdoor observing site.
- To assist the day-time observer in cloud identification, especially during periods of bright sunshine, haze or snow glare.

2.6.5.4.1 How to use adaptor goggles during darkness

When the goggles are used during darkness, it is suggested that the observer put them on in the office, about 10 minutes prior to going outside for the observation, and they should be worn until the observer is outside at the observation site.

Remove the goggles at the out-door observation site. The eyes should now be considerably adapted to darkness. Proceed with the observation.

Note (1): Goggles **shall not** be used when assessing prevailing visibility.

Note (2): Previous testing has indicated that routine office duties can normally be performed while wearing goggles; however, testing has also indicated that some observers, wearing goggles, experienced difficulty walking along corridors, down or up stairs. Observers who experience these difficulties are instructed not to use dark adaptor goggles as an observing aid.

2.6.5.4.2 How to use dark adaptor goggles during daylight

During daylight many observers will find the dark adaptor goggles to be an aid in observing the sky during periods of bright sunshine, especially during bright haze or snow glare.

Note: Goggles **shall not** be used when assessing prevailing visibility.

2.6.6 Estimating visibility beyond farthest marker

When the visibility is greater than the distance to the farthest marker, note the sharpness with which the object stands out. Sharp outlines in relief, with little or no blurring of colour, indicate that the visibility is much greater than the distance of the reference object. A blurred or indistinct object indicates the presence of haze or some other obstruction to vision that has reduced the visibility to not much more than the distance to the object.

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Chapter 3 Atmospheric phenomena

3.1 General

The instructions given in this chapter together with the “Definitions and Descriptions of Meteors” contained in the Annex of the *International Cloud Atlas* **shall** be used for identifying atmospheric phenomena. Also included are instructions for measuring precipitation, for determining its intensity and character, and for observing miscellaneous phenomena and unusual weather conditions.

3.2 Tornadoes and Waterspouts (+FC)

These phenomena are associated with a violently rotating column of air, pendant from a Cumulonimbus cloud. This violent whirlwind is nearly always observable as a cloud column or inverted cloud cone (funnel cloud), and a “bush” composed of water droplets raised from the surface of the sea or of dust, sand, or litter, raised from the ground (see photo on following page).

3.2.1

This phenomenon is called a “tornado” when it occurs over land and a “waterspout” when it occurs over water.

3.2.2

The observer **shall** note the direction of the storm from the station and the direction towards which it is moving. Intensity values are not ascribed to tornadoes or waterspouts. The plain language words “tornado” or “waterspout” **shall** be inserted in the coded weather reports whenever these phenomena are observed.

3.2.3

A tornado or waterspout **shall not** be reported when the vortex does not reach the ground, or when the observer is not sure that the vortex of the funnel reaches the ground (or water), that is, a “bush” is not observed. In this case, “funnel cloud” and its direction from the station **shall** be reported.

G. Tsuchida, Masuda (Shimane, Japan),
21 September 1952, 10:30 (towards N)

Waterspout

This photograph was taken looking towards the base of a Cumulonimbus cloud. The heavy rain forms a dark background for the lower portion of the spout, which is illuminated by light coming from behind the photographer. The usual tapering of the tuba where it emerges from the base of the Cumulonimbus is hidden by ragged clouds. The lower end of the tuba, which is very narrow, disappears into a mass of spray “bush,” carried up from the sea by violent whirl of which the tuba is the core.

The spout was 3 km from the shore; it was estimated to be several tens of meters in diameter and several hundreds of meters in height. It moved towards the east (left to right). A cold front was passing the area in a south-easterly direction.

Note: The above photo is a reproduction (Plate No. 214) from the *International Cloud Atlas,* Volume II, 1956.

3.3 Thunderstorm (TS) definition

A thunderstorm is a local storm produced by a Cumulonimbus cloud, and is always accompanied by lightning and thunder, usually with strong gusts of wind, heavy rain, and sometimes with hail.

3.3.1 Identification

Thunderstorm activity at the station **shall** be reported when:

1) Thunder is heard within the past 15 min; or
2) Overhead lightning is observed within the past 15 min and the local noise level is such as might prevent hearing thunder. In this case, hail may also be an indicator of a thunderstorm in progress.

3.3.2 Time of beginning of thunderstorm

For record purposes, the time of beginning of a thunderstorm **shall** be the time of the earliest occurrence that indicates thunderstorm activity at the station.

3.3.3 Time of ending of thunderstorm

As soon as it is no longer possible to report thunderstorm activity at the station for 15 min (see 3.3.1, “Identification”), the observer **shall** record the thunderstorm as having ended 15 min ago.

3.3.4 Intensity

No intensity is ascribed to thunderstorms.

3.4 Precipitation

Any product of the condensation of atmospheric water vapour that is deposited on the earth’s surface is a type of precipitation. The types of precipitation that originate aloft are classified in the following sections under liquid precipitation, freezing precipitation, and frozen precipitation.

3.4.1 Liquid precipitation

3.4.1.1 Drizzle (DZ)

Fairly uniform precipitation composed exclusively of fine drops of water (diameter less than 0.5 mm). Drizzle drops are too small to cause appreciable ripples on the surface of still water. The drops appear almost to float in the air making visible even slight movements of the air.

3.4.1.1.1

Drizzle falls from fairly continuous and dense layers of Stratus, usually low, sometimes even touching the ground (fog).

3.4.1.2 Rain (RA)

Precipitation of liquid water particles, either in the form of drops of larger diameter than 0.5 mm, or of smaller widely scattered drops.

3.4.1.2.1

Rain drops are normally larger than drops of drizzle. Nevertheless, drops falling on the edge of a rain zone may be as small as drizzle drops, owing to partial evaporation.

3.4.2 Freezing precipitation

3.4.2.1 Freezing Drizzle (FZDZ)

Drizzle, the drops of which freeze on impact with the ground or with other objects at or near the earth's surface.*

3.4.2.2 Freezing Rain (FZRA)

Rain, the drops of which freeze on impact with the ground or with other objects at or near the earth's surface.*

3.4.2.3

Freezing drizzle or freezing rain **shall** be reported when the temperature is below zero degrees or when rain or drizzle is freezing on the ice accretion indicator or on other objects at or near the earth's surface.*

***Note**: It is of course assumed that the objects are not artificially heated above or cooled below the temperature of the ambient air.

3.4.2.4 Ice accretion indicator

Two ice accretion indicators are supplied at each station. One or the other of the indicators **shall** be exposed continuously. The indicator in use is normally attached to the Stevenson Screen, while the other is kept in the screen (free of ice, moisture, etc.) to ensure that it will always be at air temperature when it is required as a replacement for the one in use. However, at stations equipped with the MSC dewcel, more convenient locations for exposure and storage may be selected, provided they have been approved locally by the meteorological inspector.

3.4.2.4.1

Any accumulation of snow on the indicator **shall** be cleared off after each observation and the metal surface left dry. Ice formed by freezing precipitation **shall** be removed by melting. Rime ice or frost may be wiped from the indicator. During periods of precipitation it will normally be more convenient, after each observation, to replace the exposed indicator by the one taken from the screen.

3.4.2.4.2

When an observation is made during rain or drizzle, the horizontal surface of the ice accretion indicator **shall** be examined, and if ice has formed on it, freezing precipitation **shall** be reported. If frost has formed on the indicator, or if ice is detected during fog conditions, appropriate Remarks for “frost on indicator,” “rime icing on indicator,” etc., **shall** be recorded and reported.

3.4.3 Frozen precipitation

3.4.3.1 Snow (SN)

Precipitation of mainly hexagonal ice crystals, most of which are branched (star-shaped). The branched crystals are sometimes mixed with unbranched crystals. At temperatures higher than about -5 °C, the crystals are generally clustered to form snowflakes.

3.4.3.2 Snow Pellets (GS)

Precipitation of white and opaque particles of ice; these ice particles are either spherical or conical; their diameter is about 2 to 5 mm.

3.4.3.2.1

Snow pellets are brittle and easily crushed; when they fall on hard ground, they bounce and often break up. Snow pellets always occur in showers and are often accompanied by snowflakes or rain drops, when the surface temperature is around 0 °C.

3.4.3.2.2

The abbreviation GS **shall** also be used to report small hail with a diameter of the largest hailstones less than 5 mm.

3.4.3.3 Snow Grains (SG)

Precipitation of very small white and opaque grains of ice. These grains are fairly flat or elongated; their diameter is generally less than 1 mm. When the grains hit hard ground, they do not bounce or shatter. They usually fall in very small quantities, mostly from Stratus or occasionally from fog, and never in the form of a shower.

3.4.3.4 Ice Pellets (PL)

Precipitation of transparent or translucent pellets of ice that are spherical or irregular, rarely conical, having a diameter of 5 mm or less. Ice pellets are subdivided into two main types:

- Frozen raindrops, or snowflakes that have largely melted and then refrozen, the freezing process usually taking place near the ground. They generally fall as continuous precipitation; and
- Pellets of snow encased in a thin layer of ice that has formed from the freezing, either of droplets intercepted by the pellets, or of water resulting from the partial melting of the pellets. They occur in showers.

3.4.3.4.1

The pellets of ice usually bounce when hitting hard ground and make a sound on impact. Unlike snow pellets, ice pellets are not opaque or easily crushable and may fall continuously as well as in showers.

3.4.3.5 Hail (GR)

Precipitation of small balls or pieces of ice (hailstones) with a diameter ranging from 5 mm to 50 mm or sometimes more, and which fall either separately or fused into irregular lumps.

3.4.3.5.1

Hailstones are composed almost exclusively of transparent ice, or of a series of transparent layers of ice at least 1 mm in thickness, alternating with translucent layers. Hail is generally observed during heavy thunderstorms.

3.4.3.5.2

Small hailstones meet the above but, the diameter of the largest stones are smaller than 5 mm. Small hail **shall** be abbreviated as SHGS. Unlike ice pellets small hail may be irregular in shape, and is composed of alternating or concentric layers of transparent and translucent ice.

3.4.3.6 Ice Crystals (IC)

A fall of non-branched ice crystals, in the form of needles, columns or plates, often so tiny that they seem to be suspended in the air. These crystals may fall from cloud or from a cloudless sky. In WMO terminology, ice crystals are referred to as diamond dust.

3.4.3.6.1

The crystals are visible mainly when they glitter in the sunshine; they may then produce a luminous pillar or other halo. This hydrometeor, that is frequent in polar regions, occurs only at very low temperatures and in stable air masses.

3.4.4 Other hydrometeorological deposits

3.4.4.1 Dew

Dew forms when water is condensed on grass and other objects near the ground. The surface on which the dew forms has been cooled by radiation during the night, to a temperature below the dew point of the surrounding air, but is still above freezing.

3.4.4.2 Hoar frost

Hoar frost (commonly called frost), forms when air with a dew point temperature below freezing is brought to saturation by cooling. Hoar frost is a deposit of interlocking ice crystals formed by direct sublimation on objects, usually of small diameter such as tree branches, plant stems, leaf edges, wires, poles, etc.

3.4.4.3 Rime

Rime is a white or milky and opaque “granular” deposit of ice formed by the rapid freezing of super-cooled water drops as they contact an exposed object.

3.4.4.4 Glaze

Glaze is a coating of ice, generally clear and smooth, formed on exposed objects by the freezing of a film of super cooled water deposited by rain, drizzle, fog or possibly condensed from super cooled water vapour. Glaze is denser, harder and more transparent than either rime or frost.

3.5 Obstructions to vision

3.5.1

An “obstruction to vision” is a meteor, other than precipitation, that reduces the horizontal visibility at eye level. Obstructions may be suspended in the atmosphere, e.g., fog or haze, or blown from the earth’s surface, e.g., blowing snow or blowing sand.

3.5.2 Fog (FG)

Fog is suspension of very small water droplets or ice crystals in the air, reducing the visibility to 1/2 SM or less at the earth’s surface.

3.5.2.1

The ice crystals in the fog may produce phenomena such as small haloes and luminous pillars around lights, the sun or the moon.

3.5.2.2

When sufficiently illuminated, individual fog droplets are frequently visible to the naked eye; they are then often seen to be moving in a somewhat turbulent manner.

3.5.2.3

This hydrometeor forms a whitish veil that covers the landscape; when mixed with dust or smoke, it may, however, take on a faint coloration, often yellowish. In the latter case, it is generally more persistent than when it consists of water droplets only.

3.5.2.4

Fog (see 3.5.2) is rarely observed when the temperature and dew point differ by more than 2 °C.

3.5.2.5 Fog Patches (BCFG)

Fog patches consist of fog extending to at least 2 m above ground level and whose area extent comprises less than 50% coverage of the ground normally visible from the observing point. The letter abbreviation BCFG **shall** be used to report fog patches covering part of the aerodrome; the apparent visibility in the fog patch **shall** be 1/2 SM or less. BCFG should be used only when the visibility in parts of the aerodrome is more than 1/2 SM, although when the fog is close to the observing point, the minimum visibility will be 1/2 SM or less.

3.5.2.6 Fog Covering Part of Aerodrome (PRFG)

Non-patchy fog (more or less continuous fog) extending to at least 2 m above ground level covering part of the aerodrome. The apparent visibility within the area of fog **shall** be 1/2 SM or less. “Fog Covering Part of Aerodrome” describes a fog bank or area of fog (or freezing fog) which may have small breaks, however within the area of fog at least 50% of the ground must be covered.

3.5.2.7 Mist (BR)

The definition of mist is the same as for fog, (see 3.5.2 to 3.5.2.4), except that mist reduces visibility to the range 5/8 to 6 SM inclusive.

3.5.3 Freezing Fog (FZFG)

Freezing fog consists mainly of super-cooled droplets that usually deposit rime or glaze on objects or surfaces with below freezing temperatures.

3.5.3.1

The definition of freezing fog is the same as for fog (see 3.5.2 to 3.5.2.4), except that it occurs when the temperature is in the range of -0.1 to -30.0 °C and the visibility is 1/2 SM or less or at temperatures colder than -30.0 °C when there is a clear physical evidence of ice accretion from the fog and the visibility is 1/2 SM or less.

3.5.3.2

Freezing fog may not always deposit rime icing or glaze on ice accretion indicator or cold exposed objects.

3.5.4 Blowing Snow (BLSN)

Snow particles raised by the wind to sufficient heights above the ground to reduce the horizontal visibility at eye level to 6 SM or less. If the visibility is reduced to 1/4 SM or less, blowing snow, if occurring alone*, will be reported as heavy (+BLSN). The concentration of snow particles may sometimes be sufficient to veil the sky and even the sun. The snow particles are nearly always violently stirred up by the wind. The observer should use caution in reporting a combination of falling snow and blowing snow.

***Note**: “Alone” means, in this case, that no other precipitation and/or obstruction to vision is present.

3.5.5 Haze (HZ)

A suspension of extremely small, dry particles invisible to the naked eye and sufficiently numerous to give the air an opalescent (milky or pearly) appearance.

3.5.5.1

Haze imparts a yellowish or reddish tinge to distant objects or lights seen through it, while dark objects appear bluish. This effect is merely a result of scattering of light by the haze particles. These particles may have a colour of their own that also contributes to the coloration of the landscape.

3.5.6 Dust Haze (DU)

A suspension in the air of dust or small sand particles, raised from the ground, prior to the time of observation, by a duststorm or sandstorm.

3.5.6.1

The duststorm or sandstorm may have occurred either at or near the station or far from it.

3.5.7 Dust/Sand Whirls (PO)

Dust or sand whirls (commonly known as a dust devil) consist of an ensemble of particles of dust or sand, sometimes accompanied by small litter, raised from the ground by the wind, in the form of a whirling column of varying height with a small diameter and an approximately vertical axis.

3.5.8 Blowing Dust (BLDU) or Blowing Sand (BLSA)

Dust or sand, raised by the wind to moderate heights above the ground. If the visibility is reduced to 1/4 SM or less, blowing dust and blowing sand will be reported as heavy (+BLDU, +BLSA). The visibility at eye level is sensibly reduced.

3.5.9 Duststorm (DS)

Dust raised to great heights by a strong turbulent wind. The forward portion of the storm may have the appearance of a wide high wall. The visibility at eye level is reduced to 1/2 SM or less. If the visibility is reduced to 1/4 SM or less, the phenomena will be reported as heavy (+DS).

3.5.10 Sandstorm (SS)

Sand raised to great heights by a strong turbulent wind. The forward portion of the storm may have the appearance of a wide high wall. The visibility at eye level is reduced to 1/2 SM or less. If the visibility is reduced to 1/4 SM or less, the phenomena will be reported as heavy (+SS).

3.5.11 Smoke (FU)

A suspension in the air of small particles produced by combustion.

3.5.11.1

Viewed through smoke, the sun appears very red at sunrise and sunset; it shows an orange tinge when high in the sky. Smoke from nearby cities may be brown, dark grey or black. Smoke in extensive layers originating from forest fires scatters the sunlight and gives the sky a greenish-yellow hue. Evenly distributed smoke from very distant sources generally has a light greyish or bluish hue. When smoke is present in large quantities, it may be distinguished by its smell.

3.5.11.2

Smoke which is surface-based is distinguished from layers or clouds of smoke (clouds of smoke from nearby fires or layers resulting from industry) by the diffuse appearance of the former and by the absence of any discernible outlines. Plumes of smoke of local origin are not reported as an atmospheric phenomenon.

3.5.12 Volcanic Ash (VA)

Volcanic ash consists of fine particles of rock powder that have been blown out from a volcano. The ash may remain suspended in the atmosphere for long periods, producing red sunsets thousands of kilometres away.

3.6 Visibility reduced below eye level

3.6.1 Drifting Dust (DRDU), Drifting Sand (DRSA) and Drifting Snow (DRSN)

When particles of dust, sand or snow are raised by the wind in such a quantity that very low objects are veiled or hidden and yet the visibility at eye level is not appreciably restricted, the phenomenon is referred to as drifting dust, drifting sand or drifting snow respectively.

3.6.2 Shallow Fog (MIFG)

A suspension of very small water droplets in the air, reducing the visibility at the earth’s surface, but not appreciably reducing the visibility at eye level (1.8 m above the surface), although the visibility within the fog is 1/2 SM or less.

3.7 Measurement of precipitation amounts

3.7.1 General

The measurement of precipitation is expressed in terms of vertical depth of water (or water equivalent in the case of solid forms) that reaches the ground during a stated period. Suitable measuring gauges and calibrated graduates are supplied for this measurement.

3.7.2 Unit of measurement

The millimetre is the unit of measurement of liquid precipitation. The vertical depth of water or water equivalent is normally expressed to the nearest 0.2 mm (see 3.7.3.1 and 3.7.6.1). Less than 0.2 mm is called a "trace." Depth of freshly fallen snow is measured to the nearest 0.2 cm. Less than 0.2 cm is called a "trace."

3.7.3 Rainfall

Liquid catch of the rain gauge **shall** be measured to determine the amount of rain or drizzle. The catch of the rain gauge **shall** also be used to measure the amount of freezing rain, freezing drizzle, and hail (see 3.7.3.1) and the amount of water accumulated from these types of precipitation **shall** be recorded as "rainfall."

3.7.3.1

When measuring rainfall, the level of the water in the plastic graduate is correctly taken to be that of the lowest part of its curved surface or meniscus. When this lies between two scale marks, the amount is that of the nearest mark. In the exceptional case where the level is exactly midway between two scale marks, the amount reported is the intermediate (odd) value, e.g., 0.3 mm.

3.7.3.2

Whenever the level of the meniscus is below the 0.2 scale mark, a "trace" will be reported.

Note: Precipitation amounts up to 0.2 mm are exceedingly difficult to measure. Therefore, all observations will be recorded as "trace" or 0.2 mm. The amount 0.1 mm will not be recorded at any time.

3.7.3.3

If the catch of liquid or freezing precipitation has frozen in the funnel or gauge, it **shall** be melted by adding a measured quantity of warm water. The quantity of water added **shall** then be subtracted from the contents of the gauge to determine the actual precipitation amount.

Example:
Measurement of total contents of gauge: 1.4 mm
Added warm water: 1.0 mm
Actual precipitation: 0.4 mm

3.7.4 Hail

When hail falls, a great deal usually bounces out of the rain gauge. When the fall of hail has been sufficient for a layer to completely cover the ground, the top of the rain gauge **shall** be removed as soon as possible after the hail storm has ended; invert the top over a horizontal surface and collect the amount of hail contained within the area of the top of the rain gauge. Melt this amount of hail to obtain the water content. Include hail amount in the amount of “rainfall.”

3.7.5 Dew

The amount of dew collected by the rain gauge **shall** be included in the precipitation amount without comment when other precipitation has also occurred. When the observer is certain that no other precipitation has fallen, the amount of dew **shall** be measured and recorded and the word “dew” **shall** be noted in the precipitation record. This is necessary not only for general record purposes, but also because measured precipitation resulting from dew alone **shall not** be reported in synoptic messages.

3.7.6 Snowfall

The amount of snow that has fallen in a given period **shall** be determined by measuring and averaging the depth of new snow in several places using a ruler. As far as possible, the depth of new snow **shall** be measured in spots where the snow has fallen undisturbed by the wind. When snow has been drifted by the wind, the depth of new snow in the drifts and in exposed areas **shall** be measured, and the observer **shall** then estimate the depth of snow that would have accumulated if the fall had been undisturbed by the wind. Due allowance for the relative sizes of the drifts and exposed areas **shall** be made. During the periods when melting occurs between observations, the amount of snow left at the time of the observation will not be the same as the total depth of the snow that has fallen since the previous observation. Under such conditions the amount reported will be an estimate of what the depth would have been if no melting had occurred.

The MSC approved Weaverboard may be used as an observer's aid for measuring the depth of newly fallen snow. At each synoptic observation:

1) Measure the amount of newly fallen snow on the board with a snow ruler;
2) Take several measurements and average the results;
3) Record the depth to the nearest 0.2 cm in the Observer's Notebook;
4) Clean the board and relocate it in a level location that is free from obstructions or wind shadows. If melting occurs, the observer **shall** estimate what the depth would have been if no snow had melted.

3.7.6.1 Measurement of water equivalent

At stations equipped with a snow gauge, two catchment containers are provided. One of these is exposed in the gauge and the other held as a replacement. At each observation when snow has occurred, the observer **shall** remove the exposed container from the gauge, insert the replacement container, and melt the snow caught in the exposed container. A measured quantity of warm water or a source of low heat, such as a radiator, should be used for melting the snow. The water content of the snow **shall** be measured in the special graduate provided. During the summer, the catchment container should be brought indoors. When the snow gauge container is in service, it **shall** be checked and emptied whenever a measurable amount of precipitation is found in the rain gauge. Although water equivalent is normally expressed to the nearest 0.2 mm, in the exceptional case where the meniscus is exactly midway between two scale marks, the amount reported may be the intermediate (odd) value, e.g., 0.9 mm.

3.7.6.1.1

When snow has occurred without rain, and some or all of the snow has melted by the time of observation, the amount of water collected in the snow gauge **shall** be measured to obtain the water equivalent of the snowfall. The water equivalent **shall** be multiplied by ten and converted to centimetres to obtain an estimated value for the amount of snowfall.

3.7.6.1.2

When the observer is reasonably sure that the catch in the snow gauge is due largely to “blowing snow,” the water equivalent of the newly fallen snow **shall** be estimated (see 3.7.6.2). During and/or after “blowing snow” conditions, when no falling snow has occurred, the snow gauge **shall** be checked and emptied of any accumulated snow, at each scheduled time for measuring precipitation.

3.7.6.2 Estimating the water equivalent

At stations not equipped with a snow gauge, it is necessary to estimate the water equivalent of the new snow that has fallen. The depth of the freshly fallen snow **shall** be divided by 10 and converted to mm to obtain the water equivalent.

Example: 3.0 cm of newly fallen snow has an estimated water equivalent of 3.0 mm.

3.7.6.2.1

When snow has occurred without rain, and the snow has melted by the time of observation, the amount of water collected in the rain gauge **shall** be measured to obtain the water equivalent of the snowfall. The water equivalent **shall** be multiplied by 10 and converted to centimetres to obtain an estimated value for the amount of snowfall.

Example: If the rain gauge contains 1.4 mm of water (melted snow), the estimated depth of the snow that melted would be 1.4 cm.

3.7.6.3 Snow pellets, snow grains, ice pellets and ice crystals

The accumulation on the ground is measured as for snowfall (see 3.7.6) and **shall** be included in the amount of snowfall. “Water equivalent” **shall** be measured (see 3.7.6.1) or estimated (see 3.7.6.2) in the same way as for snow.

3.7.7 Mixed rain and snow

3.7.7.1 Stations equipped with a snow gauge

When all or part of the snow has melted, the total amount of precipitation **shall** be obtained from the contents of the snow gauge. The relative amounts of rainfall and snowfall **shall** be estimated, taking into consideration the amount of snow, if any, that accumulated on the ground previous to melting, and the intensity and length of time during which the snow fell. For example, if the total precipitation measured in the snow gauge was 2.8 mm, and the snowfall was estimated as 1.0 cm (water equivalent of 1.0 mm) then subtracting the water equivalent of the snowfall from the total precipitation (2.8 - 1.0) would give the amount of rainfall as 1.8 mm.

3.7.7.2 Stations not equipped with a snow gauge

The amount of new snow that has not melted **shall** be measured as instructed in 3.7.6. The catch of the rain gauge **shall** also be measured as instructed in 3.7.3.3, using a measured amount of warm water, if necessary, to melt any snow that accumulated in the rain gauge. The precipitation measured by the rain gauge in this case is the total amount of the actual rainfall plus the water content of the snowfall. The amount of the rainfall may then be determined as shown by the example in 3.7.7.1.

3.7.7.2.1

When the snow has melted, the total amount of precipitation **shall** be obtained from the rain gauge. The relative amounts of rainfall and snowfall **shall** be estimated as indicated in 3.7.7.1.

3.8 Depth of snow on the ground

3.8.1

The total depth of snow on the ground at the time of the observation **shall** be determined, (in whole centimetres) by making a series of measurements and taking the average. The area selected for the measurement **shall** be chosen with a view to avoid drifts. Care **shall** be taken to ensure that the total depth is measured including the depth of any layers of ice which are present.

3.8.2

A number of snow stakes, painted with rings of alternate colours or other suitable scale, provide a convenient means of measuring the total depth of snow on the ground.

3.8.3

Measurements taken in 3.8.1 **shall not** be adjusted to agree with the weekly or bi-weekly snow survey (as they are usually at different locations).

3.9 Intensity of precipitation

3.9.1

The precipitations classified above as liquid, freezing and frozen (with the exception of ice crystals) are always qualified as to intensity: light, moderate or heavy.

3.9.2

The term “light” also includes scattered drops, flakes, grains, pellets or stones accruing at a rate which would not wet or cover a surface, regardless of the duration.

3.9.3

The intensities “light,” “moderate” and “heavy” are determined by considering either the effect on visibility or the rate of fall.

3.9.4 Intensity by visibility criteria

Visibility for the following conditions: snow, snow shower, snow grains, snow pellets, drizzle, and freezing drizzle **shall** be defined using the following criteria:

- Light: if visibility is 5/8 mi. or more
- Moderate: if alone* and visibility is reduced to 1/2 or 3/8 mi.
- Heavy: if alone* and visibility is reduced to 1/4, 1/8, or 0 mi.

***Note**: "Alone" means no other precipitation and/or obstruction to vision is present.

3.9.4.1 Mixed precipitation

When two or more of the above types of precipitation are occurring together without any "obstruction to vision," the intensity of the predominant type **shall** be determined according to the visibility and the intensity of the less dominant type(s) **shall** be judged, as well as possible, on a rate of fall basis.

3.9.4.2 Mixed precipitation

When one or more of the above types of precipitation is occurring with any other precipitation and no "obstruction to vision" is present, the predominant type from the above group **shall** have its intensity determined according to the visibility and all other intensities **shall** be judged, as well as possible, on a rate of fall basis.

3.9.5 Intensity by rate of fall criteria

Intensity for the following conditions: rain, rain showers, and freezing rain **shall** be defined using the following criteria:

- Light: if rate of fall is 2.5 mm/h or less
- Moderate: if rate of fall is 2.6 to 7.5 mm/h
- Heavy: if rate of fall is 7.6 mm/h or more

3.9.5.1

Although the above rates of fall are given in millimetres per hour, the intensity at the actual time of observation **shall** be determined by the rate of fall using the shortest practical period. For example, if from the chart of the automatic rain gauge, it was determined that 1.0 mm of rain was recorded during the 5 min prior to the observation, the rate of fall would be 12.0 mm/h and the intensity of the rain at time of observation would be classified as "heavy," unless there were obvious reasons to indicate otherwise.

3.9.5.2

The previous "rate-of-fall criteria" may also be used to determine the intensity of frozen precipitation, considering its water equivalent, when the intensity is not directly indicated by the visibility.

3.9.5.3

When a recording rain gauge is not available and when the rate of fall is fairly uniform, the intensity of rain may be determined by exposing a spare rain gauge for a 10-minute period.

Example: If the catch is 1.4 mm for 10 min, the rate of fall is 8.4 mm/h (6 X 1.4), the intensity is "heavy." If a spare gauge is not available, two measurements from the standard gauge could be made, to determine the 10-minute catch, taking the necessary precautions to ensure that all the precipitation for the period will be measured at the time of the scheduled observation.

3.9.5.4

When the intensity of rain, rain showers or freezing rain must be determined without the aid of instrument measurements, the following table may be used as a guide.

-	Light rain	Moderate rain	Heavy rain
Individual drops	Easily seen	Not easily seen	Not identifiable (rain in sheets)
Spray over hard surface	Hardly any	Noticeable	Heavy to a height of several centimetres
Puddles	Form slowly	Form rapidly	Form very rapidly

3.9.5.5

When the intensity of hail or ice pellets cannot be determined from the measured water equivalent, the following may be used as a guide:

- Light: few stones or pellets, slow accumulation on the ground
- Moderate: rapid accumulation on the ground
- Heavy: very rapid accumulation on the ground

3.9.5.6

When the intensity of drizzle, freezing drizzle, or snow grains cannot be determined by visibility, the following may be used as a guide for “rate-of-fall” accumulation:

- Light: less than 0.2 mm/h
- Moderate: 0.2 mm to 0.4 mm/h
- Heavy: 0.5 mm to 1.0 mm/h

Note: When the rate-of-fall for liquid or freezing precipitation exceeds 1.0 mm/h, the precipitation should be classified as rain or freezing rain rather than drizzle or freezing drizzle.

3.9.5.7 Ice crystals

No intensity is ascribed to ice crystals.

3.10 Intensity of precipitation with an obstruction to vision

3.10.1

When precipitation occurs together with an “obstruction to vision,” the intensity of the precipitation **shall** be determined on a “rate of fall” basis, irrespective of whether its intensity is normally defined in terms of visibility. However, “rate of fall” intensities **shall** be consistent with visibility criteria.

Example (1): Drizzle occurring with fog **shall not** be reported as moderate or heavy when the visibility is 5/8 mi. or more.

Example (2): Snow with blowing snow **shall not** be reported as heavy when the visibility is 3/8 mi. or more.

3.11 Character of precipitation

3.11.1

Under the term “character,” precipitation can be classified as showery, continuous or intermittent.

3.11.2 Showers

Showery precipitation falls from cumuliform cloud and can be further identified by one or more of the following features:

- Showers often (but not always) begin and end abruptly.
- Showers usually occur in periods of short duration, perhaps 15 min or so, but they may last much longer.
- Usually there are rapid fluctuations in the intensity of the precipitation.
- There is a noticeable brightening of the sky between showers.

3.11.2.1

Certain types of precipitation, such as snow pellets and hail, always occur as showery precipitation. Rain, snow and ice pellets, can occur either with showery or non-showery characteristics; to indicate a showery character, the terms “rain showers,” “snow showers” and “ice pellet showers” are used.

3.11.3 Continuous precipitation

Precipitation that is not showery is considered to be continuous when:

- It continues without a break for at least one hour preceding the time of observation; or
- It continues without a break since beginning in the hour preceding the time of observation.

3.11.4 Intermittent precipitation

Precipitation that is not showery is considered to be intermittent when it has stopped and recommenced at least once during the hour preceding the actual time of observation.

Note: Continuous precipitation may on occasion become showery without the precipitation stopping, and showery precipitation may become continuous without stopping.

3.12 Notes on unusual weather

3.12.1

Notes on unusual weather **shall** be kept by all stations. Such notes are of considerable value, particularly for climatological purposes, in providing information to hydro electric systems, public carriers, insurance companies and many other users. Notes of unusual weather **shall** be kept in the designated spaces on Form 63-2322. If no space has been designated for the particular phenomenon observed, it **shall** be entered under a heading of “Notes.” Should more space be required, as would be the case when a sketch is involved, the information **shall** be entered on the back of the form with a notation to this effect on the front. Copies of all such notes, sketches, etc., **shall** also be made on the station copy of the form, so that the station record will be complete.

3.12.2

In all cases where notes are made regarding unusual weather, the times and dates **shall** be recorded with the greatest care.

3.12.3

The following are some of the conditions that should be described under “Notes” on Form 63-2322:

- Heavy and killing frosts;
- Damage to life or property by high winds, tornadoes or hail. Particulars of the extent and location of the damage should be given;
- The thickness of the accumulation of ice on wires, trees or other exposed surfaces during periods of freezing precipitation;
- Unusual floods or droughts; and
- Other unusual occurrences such as frequent dust whirls, severe lightning, etc.

Chapter 4 Atmospheric pressure

4.1 General

Atmospheric pressure, also called barometric pressure, is the force per unit area exerted by the atmosphere as a consequence of its weight, and thus is equal to the weight of a vertical column of air of unit area, extending from the level in question to the outer limit of the atmosphere.

4.1.1

The standard instrument for the measurement of atmospheric pressure at staffed observing stations in Canada is a multi-cell digital barometer. Measurement principle is based on an advanced RC oscillator and three reference capacitors against which the capacitive temperature compensation sensor is continuously measured. The microprocessor of the barometer performs compensation for pressure linearity and temperature dependence. Unit of measurement is hectopascals. See *Barometer Vaisala 1999 User's Guide* and *Vaisala Digital Barometer Instructions for Observers* 2000-02-08.

4.1.2

The symbol for hectopascals is hPa.

4.1.3

The following procedures apply to sites that have software that will calculate the hourly station pressure, the Mean Sea Level (MSL) pressure, the altimeter setting, and every three hours, the pressure tendency amount.

4.1.3.1

At stations equipped with a digital barometer or Automated Weather Observation System (AWOS) pressure sensor, transfer the pressure reading from the pressure sensor display to the data entry screen. (At some locations, the electronic barometer will interact directly with the computer so no transfer of data is required of the observer.)

4.1.3.2

The observer will operate the barograph according to 4.4, "Pressure tendency." The three-hour pressure tendency amount will be calculated and displayed on the data entry screen. The observer **shall** determine the tendency characteristic from the barograph trace and enter the code figure (see 4.4.2.2) on the data entry screen.

4.2 Barometric pressure computations

4.2.1 Station elevation

Prior to January 1, 1977, the term “established elevation” was used. It referred to the elevation of the barometer (cistern) when a barometer was initially installed at a weather station, and no distinction was made between observing sites on airports and off airports. Also, an established elevation of 0 m (MSL) was assigned to all stations where the barometer elevation (cistern) was less than 15 m. As a consequence, the station pressure and MSL pressure were identical at these stations

4.2.1.1

The station elevation is the vertical distance in metres above Mean Sea Level (MSL) of the datum level to which barometer readings are corrected to give station pressure.

4.2.1.2

At surface weather observing sites on airports, the station elevation is equal to the aerodrome elevation as reported in the Canada Flight Supplement.

4.2.1.3

At surface weather observing sites off airports the station elevation is equal to the elevation of the electronic barometer (cistern).

4.2.1.4

The only time that the station elevation **shall** be revised is when the following occurs:

1) At surface weather observing sites on airports whenever there is a change in the aerodrome elevation;
2) At surface weather observing sites off airports whenever there is a change in the elevation of the pressure sensor;
3) When a new, more accurate survey indicates the need for a change.

4.2.2 Determination of station pressure

4.2.2.1

Station pressure is the atmospheric pressure at the station elevation.

4.2.2.2

Station pressure is determined by applying to the barometer reading a reduction figure obtained from the “Reduction of barometer readings to station pressure” table. This table incorporates corrections for barometer calibration, departures from standard conditions of temperature and gravity, and an additional correction to account for the difference in height between station elevation and the actual barometer elevation (cistern). This latter correction, called a removal correction, is usually a small constant. It is therefore necessary, at most stations, to use only the correction supplied on the “Reduction of barometer readings to station pressure” table to obtain the station pressure from the barometer reading. See Figure 1 on the computation of station pressure.

4.2.2.3

The “Reduction of barometer readings to pressure at the cistern” table is used to determine the atmospheric pressure at the level of the digital barometer. This table includes the calibration temperature corrections.

How to calculate station pressure

Station pressure is usually determined by applying to the barometer reading a reduction figure obtained from the “Reduction of barometer readings to station pressure” table. This table incorporates corrections for barometer calibration and an additional correction to account for the difference in height between station elevation and the actual barometer elevation (cistern). This later correction, called a removal correction, is usually a small constant.

Example (1): How to calculate station pressure using only the reduction of barometer readings to station pressure

CHIBOUGAMAU-CHAPAIS A
Reduction of barometer readings to station pressure

Climate ID:	7091404	**Report Date:**	2000-01-10 15:41
Province:	QUEBEC	**Comm. ID:**	YMT
Elevations:	Station 387.1 m	**Cistern:**	389.0 m
		Serial Number:	U3740006

Apply to barometer reading

°C	**900**	**930**	**960**[a]	**990**	**1020**	**°C**
-50.0	0.3	0.3	0.3	0.3	0.3	-50.0
-40.0	0.3	0.3	0.3	0.3	0.3	-40.0
-30.0	0.2	0.2	0.3	0.3	0.3	-30.0
-20.0[b]	0.2	0.2	0.2[c]	0.3	0.3	-20.0
-10.0	0.2	0.2	0.2	0.2	0.3	-10.0
0.0	0.2	0.2	0.2	0.2	0.2	0.0
10.0	0.2	0.2	0.2	0.2	0.2	10.0
20.0	0.2	0.2	0.2	0.2	0.2	20.0
30.0	0.2	0.2	0.2	0.2	0.2	30.0
40.0	0.2	0.2	0.2	0.2	0.2	40.0

Note (a): Use nearest barometer reading
Note (b): Use nearest current outdoor temperature
Note (c): Total correction

Current Outdoor Temperature	-22.4 °C
Barometer as read	962.1 – transfer to line 18 on the 2332
Total Correction	0.2 – transfer to line 19 on the 2322
Station Pressure	962.3 – transfer to line 20 on the 2322

Note (1): If the barometer reading is exactly half way between listed values, select the “correction” for the higher value.

Note (2): If the temperature value is exactly half way between two reportable values, use the higher temperature value.

4.2.3 Mean sea level pressure

4.2.3.1

Mean sea level pressure is computed from the station pressure and reported in observations so that the barometric pressures at stations of different elevations can be compared at a common level for synoptic purposes. Each station is supplied with a table “Reduction of station pressure to sea level” which gives the equivalent pressures in hectopascals of an imaginary column of air extending from the station elevation to mean sea level, as determined by the station pressure and an assumed temperature of the imaginary air column (the mean of the air temperatures, now and 12 hours previously).

4.2.3.2

If, when calculating the mean temperature, the dry-bulb temperature of 12 hours previously is not known, use the temperature of 12 hours before as determined from the thermograph. Stations collocated with an automatic station may use the temperature derived from the automatic station for the temperature of 12 hours before. When the temperature of 12 hours before cannot be determined from any of the foregoing methods, the observer, using data available, **shall** make an estimate of the temperature 12 hours previously.

4.2.3.3

The mean sea level reduction **shall** be calculated for each measurement of sea level pressure taken at 0000, 0300, 0600, 0900, 1200, 1500, 1800 and 2100 UTC. For observations of pressure taken at times other than the above, the previously calculated sea level reduction may be used, provided it was determined not more than two hours previously; otherwise a sea level reduction **shall** be calculated at the time of the observation. See example (2), How to calculate the mean sea level pressure.

Example (2): How to calculate the mean sea level pressure

CHIBOUGAMAU-CHAPAIS A
Reduction of Station Pressure to Sea Level

Climate ID: 7091404 **Report Date:** 2000-01-10 16:35
Province: QUEBEC **Comm. ID:** YMT
Station Elevations: 387.1 m 387.2 GPM

Add to Station Pressure (hPa)

	Station Pressure							
Temperature °C	**907.5 912.4**	**912.5 917.4**	**917.5 922.4**	**927.5 932.4**	**927.5 932.4[(a)]**	**932.5 937.4**	**937.5 942.4**	**942.5 947.4**
-45.5 to -44.6	50.4	50.7	51.0	51.3	51.5	51.8	52.1	52.4
-44.5 to -43.6	50.3	50.5	50.8	51.1	51.4	51.6	51.9	52.2
-43.5 to -42.6	50.1	50.4	50.7	50.9	51.2	51.5	51.8	52.0
-42.5 to -41.6	49.9	50.2	50.5	50.8	51.0	51.3	51.6	51.9
-41.5 to -40.6	49.8	50.1	50.3	50.6	50.9	51.2	51.4	51.7
-40.5 to -39.6	49.6	49.9	50.2	50.5	50.7	51.0	51.3	51.5
-39.5 to -38.6	49.5	49.8	50.0	50.3	50.6	50.8	51.1	51.4
-38.5 to -37.6[(b)]	49.3	49.6	49.9	50.1	50.4[(c)]	50.7	51.0	51.2
-37.5 to -36.6	49.2	49.5	49.7	50.0	50.3	50.5	50.8	51.1
-36.5 to -35.6	49.6	49.3	49.6	49.8	50.1	50.4	50.7	50.9
-35.5 to -34.6	48.9	49.2	49.4	49.7	50.0	50.2	50.5	50.8
-34.5 to -33.6	48.8	49.0	49.3	49.6	49.8	50.1	50.4	50.6
-33.5 to -32.6	48.6	48.9	49.1	49.4	49.7	49.9	50.2	50.5

Note (a): Select the appropriate range for station pressure
Note (b): Select the appropriate range for mean temperature
Note (c): Select reduction to MSL

Station Pressure	**930.2** Transfer the last three digits to the station pressure Remarks Col. 41
Mean Temperature	(-37.8 °C)
Reduction to Sea Level	+50.4
Sea Level Pressure	**980.6** Transfer to Column 33 on the 2322 (enter the last three digits only)

4.3 Altimeter setting (QNH)

4.3.1

The altimeter setting is a computed value of mean sea level pressure expressed in inches and hundredths of mercury, which is used to set the sub-scale of an altimeter so that the height scale of the altimeter indicates the height of the instrument above mean sea level.

4.3.1.1

The altimeter setting is obtained by applying the station pressure to the table “Altimeter setting from station pressure in hectopascals” which is supplied to each station where it is required.

4.3.2

The pressure values given in the table are computed on the basis of assumed averages of atmospheric pressure and temperature known as the “International Civil Aviation Organization (ICAO) Standard Atmosphere,” which are the conditions to which altimeters are calibrated. It is therefore apparent that the mean sea level pressure computed in this way will not, in general, correspond to the MSL pressure obtained using the “Reduction of station pressure to sea level” referred to in 4.2.3. It should also be noted that since the altimeter setting is obtained directly from the station pressure, the height datum from which the table is computed is the station elevation. This figure will be seen printed in the heading of the station’s altimeter setting table.

How to calculate altimeter setting

The altimeter setting is a computed value of mean sea level pressure which is used to set the sub-scale of an altimeter so that the height scale of the altimeter indicates the height of the instrument above mean sea level.

The altimeter setting is normally calculated by the input software; however when necessary it **shall** be obtained by applying the station pressure to the table “Altimeter settings from station pressures in hectopascals” which is supplied to each station where it is required. See Example (3).

Example (3): How to determine the altimeter setting

CHIBOUGAMAU-CHAPAIS A
Altimeter Settings from Station Pressures in Hectopascals

Climate ID: 7091404 **Report Date:** 2000-01-10 18:24
Province: QUEBEC **Comm. ID:** YMT
Station Elevations: 387.1 m 1269.9 feet

	965	**970**	**975**	**980**	**985**[1]	**990**	**995**	**1000**	**1005**	
0.0	2984	2999	3015	3030	3045	3061	3076	3091	3107	**0.0**
0.2	2985	3000	3015	3031	3046	3061	3077	3092	3107	**0.2**
0.4	2985	3001	3016	3031	3047	3062	3077	3093	3108	**0.4**
0.6	2986	3001	3017	3032	3047	3063	3078	3093	3109	**0.6**
0.8	2987	3002	3017	3033	3048	3063	3079	3094	3109	**0.8**
1.0	2987	3003	3018	3033	3048	3064	3079	3094	3110	**1.0**
1.2	2988	3003	3018	3034	3049	3064	3080	3095	3110	**1.2**
1.4	2988	3004	3019	3034	3050	3065	3080	3096	3111	**1.4**
1.6	2989	3004	3020	3035	3050	3066	3081	3096	3112	**1.6**
1.8	2990	3005	3020	3036	3051	3066	3082	3097	3112	**1.8**
2.0	2990	3006	3021	3036	3052	3067	3082	3098	3113	**2.0**
2.2	2991	3006	3022	3037	3052	3067	3083	3098	3113	**2.2**
2.4	2991	3007	3022	3037	3052	3068	3083	3099	3114	**2.4**
2.6	2992	3007	3023	3038	3053	3069	3084	3099	3115	**2.6**
2.8	2993	3008	3023	3039	3054	3069	3085	3100	3115	**2.8**
3.0	2993	3009	3024	3039	3055	3070	3085	3101	3116	**3.0**
3.2	2994	3009	3025	3040	3055	3071	3086	3101	3117	**3.2**
3.4	3995	3010	3025	3041	3056	3071	3086	3102	3117	**3.4**
3.6	2995	3010	3026	3041	3056	3072	3087	3102	3118	**3.6**
3.8[1]	2996	3011	3026	3042	3057[2]	3073	3088	3103	3118	**3.8**
4.0	2996	3012	3027	3042	3058	3073	3088	3104	3119	**4.0**
4.2	2997	3012	3028	3043	3058	3074	3089	3104	3120	**4.2**
4.4	2998	3013	3028	3044	3059	3074	3090	3105	3120	**4.4**
4.6	2998	3014	3029	3044	3060	3075	3090	3105	3121	**4.6**
4.8	2999	3014	3029	3045	3060	3075	3091	3106	3121	**4.8**

Note (1): Use the two values which added together to equal the station pressure. The example uses station pressure 988.9 hPa.
Note (2): Altimeter setting in 30.57 inches. Transfer to Column 39 of the 2322 (omitting the tens digit and the decimal point).

Note (3): When values cannot be selected to exactly equal the station pressure, the station pressure selected **shall** be the next lower value i.e., the altimeter setting above is for a station pressure of 988.8 hPa, because tabulated values cannot be selected to exactly equal the station pressure of 988.9 hPa.
Note (4): Should the station pressure be outside of the range on your altimeter setting table, do not extrapolate. Report the altimeter setting as missing and notify your regional headquarters. An extension to the altimeter setting table **shall** then be provided to your station.

4.4 Pressure tendency

4.4.1

Pressure tendency is defined as the characteristic and the amount of the change in station pressure in the three hours preceding the observation. The tendency is included in weather reports which are taken at 0000, 0300, 0600, 0900, 1200, 1500, 1800 and 2100 UTC.

4.4.1.1 Amount

The amount of the pressure tendency is the net change in station pressure in the three hours preceding the observation. When the amount cannot be determined from measurements of station pressure obtained from the digital barometer, the amount **shall** be calculated from the barograph.

4.4.1.2

Tendency amount is determined in tenths of hectopascals.

Example: If the station pressure at 0900 UTC was 998.2 hPa and the station pressure at 1200 UTC is 999.0 hPa, the tendency amount will be 0.8 hPa.

4.4.1.3

Time marks **shall** be made on the barograph chart at 0000 and 1200 UTC and they should be made each time tendency is determined. Time marks **shall** be made immediately after the reading of the barometer. As per the MSC Instrument Manual “*Barographs*,” charts should be carefully and accurately annotated when changed to enable identification of the station and events.

4.4.1.4

Under some conditions, it may be necessary to adjust the barograph scale to accommodate anticipated pressure values beyond those shown on your chart. This is easily accomplished by changing the scale by 10 hPa or more , by using the zero adjusting screw and renumbering the scale. When the extreme of pressure has passed, the process is reversed.

4.4.2 Characteristic

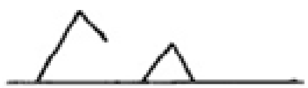
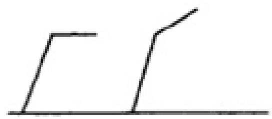
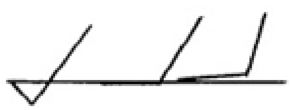
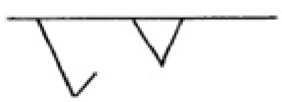
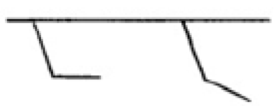
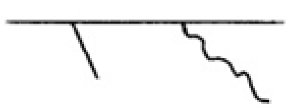
The tendency characteristic is the nature of the pressure change in the three hours preceding the observation. It **shall** be determined by a study of the barograph trace.

4.4.2.1

The tendency characteristic **shall** be coded as outlined in the following instructions; these are designed to provide a uniform basis for coding three hour tendency characteristics.

4.4.2.2

The tendency characteristic code table with a graphical representation corresponding to each code figure follows:

Code figure	Graphic representation	Characteristic	Atmospheric pressure
0		Increasing, then decreasing	Same as or higher than three hours ago
1		Increasing then steady, or increasing then increasing more slowly	Higher than three hours ago
2		Increasing steadily or unsteadily	Higher than three hours ago
3		Decreasing or steady, then increasing; or increasing then increasing more rapidly	Higher than three hours ago
4		Steady	Same as three hours ago
5		Decreasing, then increasing	Same as or lower than three hours ago
6		Decreasing then steady, or decreasing then decreasing more slowly	Lower than three hours ago
7		Decreasing steadily or unsteadily	Lower than three hours ago
8		Steady or increasing then decreasing; or decreasing, then decreasing more rapidly	Lower than three hours ago

4.4.2.3

The following instructions **shall** be used as a guide for coding the tendency characteristic.

4.4.2.3.1

When the trace is a smooth curve which clearly resembles one of the graphic representations, see 4.4.2.2, the tendency characteristic can be coded without difficulty. However, it may be difficult in some cases to decide whether the trace approximates a straight line (/ or \), or contains an angle. The observer must use their own best judgment to decide which code figure to use in such cases.

4.4.2.3.2

When the trace contains minor irregularities but in general resembles one of the graphic representations, see 4.4.2.2, disregard the minor irregularities and code the general characteristic of the trace.

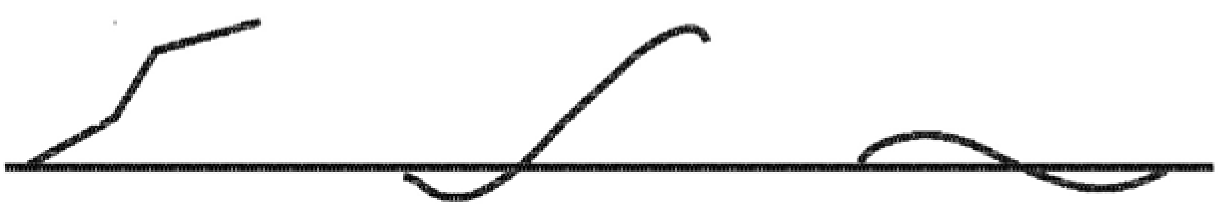
Example:

Code 0 Code 5

4.4.2.3.3

When the trace may apparently be represented by two characteristics, code the characteristic which represents the last part of the trace provided this agrees with the net three-hour pressure change.

Example:

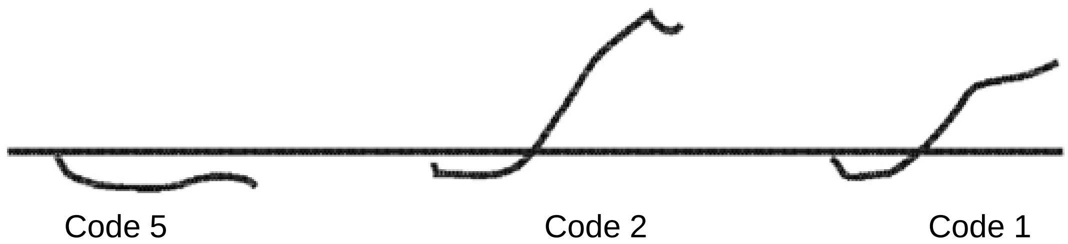


Code 1 Code 0 Code 5

4.4.2.3.4

When the trace may apparently be represented by two characteristics and the characteristic of the last part of the trace is not compatible with the net three-hour pressure change, code the characteristic which is most representative of the whole three hour trace.

Example:

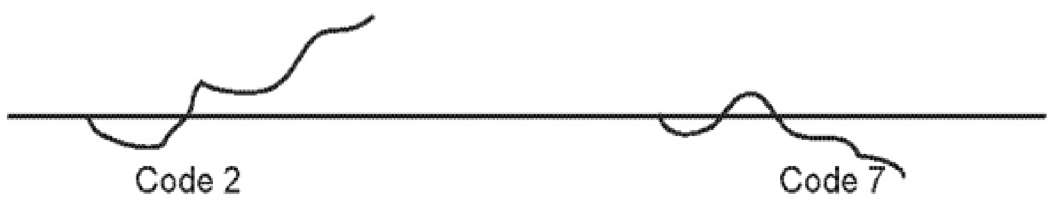


Note: In the two examples on the right above, it is rather difficult to decide whether to use code figures 1 or 2. The observer must use their own best judgment in such cases.

4.4.2.3.5

When the trace contains three or more clearly identifiable characteristics, use code figure 2 or 7 as appropriate for the net three hour pressure change.

Example:



4.4.2.3.6

When the trace is not steady but the net three-hour pressure change is zero, use code figure 0 or 5 as appropriate for the last part of the trace (code figure 4 is only used when the trace is steady and the net pressure change is zero).

Example:

4.5 AWOS pressure comparison readings

4.5.1

These instructions apply to sites that are equipped with data entry screens that perform pressure calculations and are co-located with an Automated Weather Observation System (AWOS).

4.5.2

At sites where the pressure calculations have been accepted the following procedures may be used:

- The hourly AWOS station pressure value may be used as an entry on the data input screen.
- When the AWOS station pressure is being used, then the AWOS station pressure must be compared to the station digital barometer once each day (recommended at the start of the day).
- The AWOS station pressure must be within ±0.4 hPa of the digital barometer station pressure calculation if the AWOS station pressure is to be used.
- If the AWOS station pressure is outside of the limit above, then the digital barometer must be used to calculate station pressure. Report such cases to the Regional Inspector.
- Record the comparison reading and time (UTC) in Column 1 of Form 63-2322.

Chapter 5 Temperature

5.1 General

A full description of thermometers, psychrometers and associated equipment is given in instrument manuals 20 and 30. Therefore the instructions in this chapter are confined mainly to temperature observing procedures.

5.1.1 Definition

The temperature of a body is the condition which determines its ability to communicate heat to other bodies or to receive heat from them. In a system of two bodies, that which loses heat to the other is said to be at the higher temperature.

5.1.2 Reading the thermometer

The main steps in reading thermometers are given below:

1) Stand as far from the thermometer as is consistent with accurate reading, to prevent body heat from affecting the thermometer.
2) Ensure that the line of sight from the eye to the top of the liquid column makes an angle of 90º with the thermometer tube, to avoid an error due to parallax.
3) Read the thermometer to the nearest tenth of a degree.
4) Recheck the reading to ensure that it was not misread by five or ten degrees.

5.1.2.1

When readings are required from two or more thermometers, they **shall** be observed in the following order:

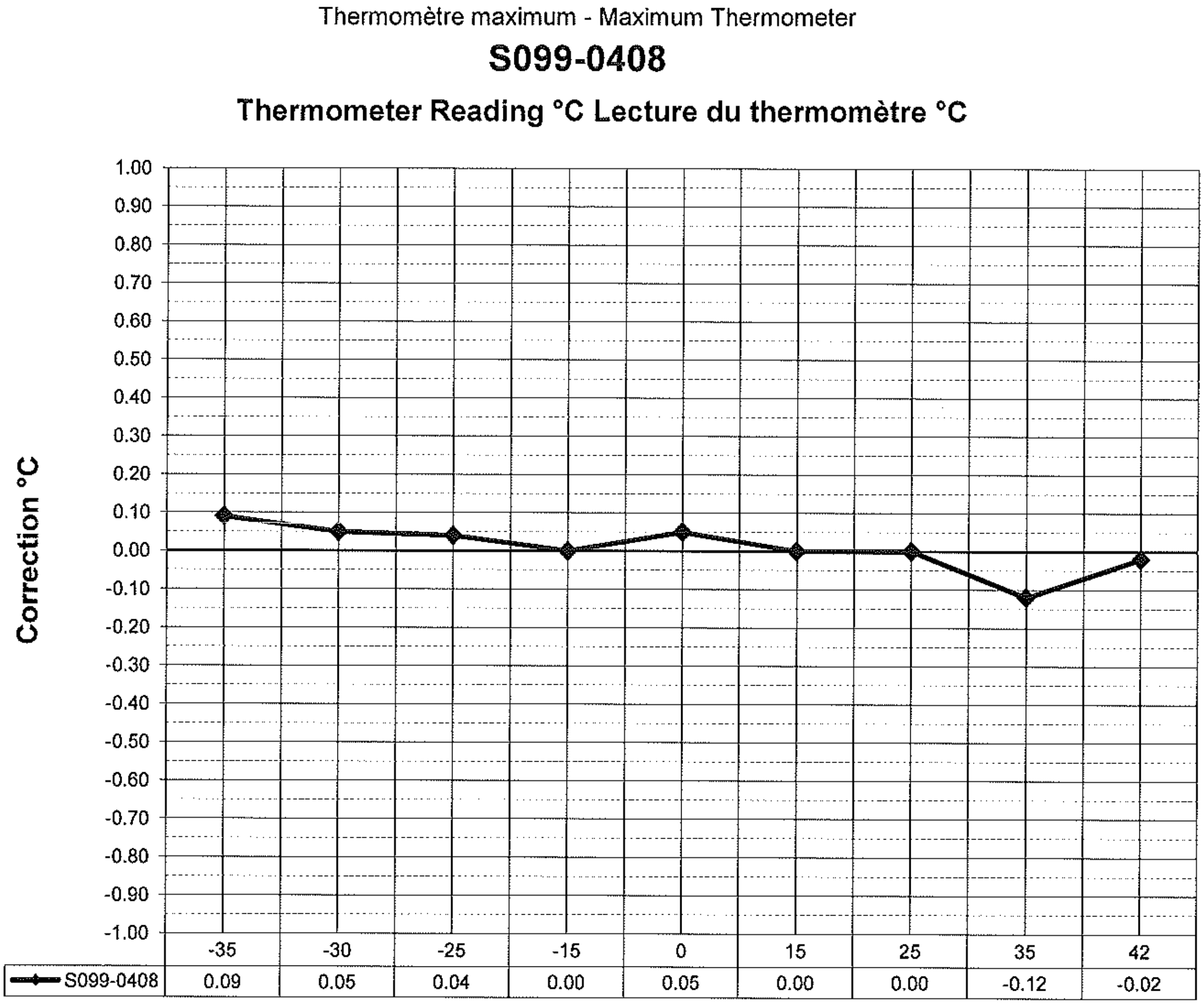
1) Dry bulb
2) Wet bulb
3) Maximum
4) Minimum

5.1.3 Correction cards

Thermometer calibrations are given on a correction card supplied with each thermometer. Correction values from this card **shall** be applied to thermometer readings to obtain the true temperature. (If a correction card is lost or becomes unreadable, a replacement card should be requested from Regional Headquarters. Be sure to use a spare thermometer with its correction card while awaiting the replacement card.)

5.1.3.1

The following is a copy of a correction card for maximum thermometer No. S099-0408:



5.1.3.2

Where the graph is above the zero reference line the true temperature is warmer than that shown by the thermometer.

Example: When this thermometer reads -35.0 °C, it has a correction factor of +0.1 °C, thus the true temperature would be -34.9 °C.

5.1.3.3

Where the graph is below the zero reference line the true temperature is colder than that shown by the thermometer.

Example: when this thermometer reads 35.0 °C, it has a correction factor of -0.1 °C, thus the true temperature would be 34.9 °C.

5.1.4 Freezing of thermometers

Mercury filled thermometers (ordinary, maximum) freeze at approximately -39 °C; spirit-filled thermometers (minimum) freeze well below -75 °C. Mercury thermometers **shall** be moved indoors when the temperature falls to within 2 °C of their freezing point, -37 °C.

5.1.5 Stevenson Screen

The Stevenson Screen is a louvered wooden box especially designed to shield thermometers from the effects of radiation, while at the same time allowing the free flow of air over the thermometer bulbs. Ordinary maximum and minimum thermometers are exposed in it. The screen is so located as to have a standard exposure in order that meaningful comparisons of temperature observations may be made between stations.

5.1.6 Psychrometer

The psychrometer is a device for determining the moisture content of the air. It consists of two “ordinary” thermometers placed side by side, one known as the “dry-bulb” and the other as the “wet-bulb.” The bulb of the wet-bulb thermometer is covered by a thin wet cloth or with a continuous film of water or ice.

5.1.6.1

In order to obtain representative temperatures, the psychrometer requires ventilation. In some cases the natural movement of air is relied upon and the arrangement is known as a “simple” or non-ventilated psychrometer. Artificial ventilation is applied in other types, such as the “sling psychrometer” and the “motor psychrometer” (ventilated psychrometer). A motor psychrometer should be turned on at least two minutes before the thermometers are read to allow equilibrium with the air to be reached.

5.2 Dry-bulb temperature

Dry-bulb temperature is the value obtained after the appropriate thermometer correction has been applied to the observed reading of an “ordinary” thermometer. If any moisture is found on the dry-bulb, it **shall** be wiped off and a short time allowed before reading, to permit the thermometer to reach equilibrium. When the dry-bulb has been moved indoors to prevent the mercury freezing (see 5.1.4) the spirit column of the “minimum” thermometer **shall** be read to obtain the current dry-bulb temperature.

5.2.1

Dry-bulb temperatures may be read and recorded directly from the left display of the MSC Remote Temperature and Dewpoint (1987) System (RTD-87) at stations so equipped. Operating instructions are found in Section 4 of the *Technical Manual TM 02-04-01*.

5.3 Wet-bulb temperature

Wet-bulb temperature is the value obtained after the appropriate correction has been applied to the observed reading of an “ordinary” thermometer whose bulb is covered by a thin film of water or by a thin coating of ice. The wet-bulb thermometer is cooled by evaporation of the water or by sublimation of the ice. The wet-bulb temperature differs from the dry-bulb temperature by an amount dependent on the moisture content of the air; it is normally the same as or lower (colder) than the dry-bulb temperature. The difference is called the “depression” of the wet-bulb temperature.

5.3.1

Depression of the wet-bulb temperature **shall** be obtained by subtracting the value of the wet-bulb temperature from the value of the dry-bulb temperature.

5.3.2 Negative depression

On some occasions the wet-bulb temperature will be higher (warmer) than the dry-bulb temperature, resulting in a “negative depression.” When this occurs, the subtraction of the wet-bulb temperature from the dry-bulb temperature **shall** be done algebraically.

Example:
Dry-bulb temperature: -3.3 °C
Wet-bulb temperature: -3.2 °C
Depression: -0.1 °C

5.3.2.1

The depression can be negative only when the wet-bulb is actually covered with ice and the humidity is very high. Fog, precipitation or the formation of rime ice is usually present in such cases. When a negative depression is observed, the observer should carefully check the following points:

- Has too heavy a coating of ice been allowed to accumulate on the wet-bulb?
- Has sufficient time been allowed since wetting the bulb for the temperature to fall to a true wet-bulb reading?
- Have the thermometer corrections been applied?
- Is there moisture on the dry-bulb?

5.3.2.2

If fog, precipitation, rime, ice, etc., is not occurring when a negative depression is observed, or if any depression is observed which is outside the values listed in the psychrometer tables, a check reading of the wet and dry-bulb thermometers **shall** be made in the period between observations. The muslin or coating of ice **shall** be removed from the wet-bulb and both thermometers operated as a dry-bulb. After sufficient time has elapsed, the thermometers **shall** be read, corrections applied, and the resulting temperatures compared and recorded under “Notes.” If the thermometers differ by more than 0.1 °C in this check, they **shall** be checked against a spare and the defective thermometer returned for replacement. The above check should also be performed at any time when the psychrometer data appear unreliable.

5.4 Operation of the wet-bulb

To obtain correct results from a psychrometer it is essential that the wet-bulb be given frequent and careful attention. Detailed instructions follow.

5.4.1 Cleanliness

The wet-bulb and everything connected with its operation, (wicks, muslin sleeves, water, observers’ hands, etc.) **shall** be kept clean.

5.4.2 Water supply

Commercial distilled water, if available, should be used but clean rain water (rain collected in cities is not usually clean enough) or clean melted snow is satisfactory. Ordinary tap water or well water **shall not** be used. Any impurities contained in the water will be left on the muslin and wick as the water evaporates, causing the wet-bulb to read higher than it should. The water container **shall** be kept at least half full and checked frequently.

5.4.3 Muslin sleeves

Sleeves which fit over the bulb of an ordinary thermometer are supplied. They should be tied to the neck of the thermometer bulb with a piece of fine thread. If the simple psychrometer or motor psychrometer is used, the sleeve should be changed once a week (more often in very dusty locations, as at some airports). If the sling psychrometer is employed, the sleeve should be changed at least once a month.

5.4.4 Wicking

A wick of special rayon yarn, just sufficient for one thermometer is attached to the wet-bulb thermometer. The best method of attaching the wick is to make a slipknot in a loop, and pull it tight around the thermometer just above the bulb. If it is immediately wetted it will stay in place. The wick **shall** run horizontally from the water container to the bulb and **shall not** be allowed to fall down over the sides of the bulb. The wick should be changed once a week, the same as the sleeve.

5.4.5 Rayon tubing

Rayon tubing is also provided which serves as both muslin and wick. One end of a length of tubing (about 20 cm) should be tied to the thermometer bulb, and the remainder should stretch horizontally to the top of the water container.

5.4.5.1

In general, a wick of rayon tubing will be found most practical during the summer months when temperatures are consistently above freezing. However, during the spring and fall when temperatures are likely to fluctuate above and below freezing, it is better to use a wick of rayon yarn together with a muslin sleeve, for the reasons that follow.

5.4.6 Operation below freezing

5.4.6.1 Removal of rayon tubing

Rayon tubing does not make a suitable covering for the wet-bulb when the temperature is below freezing because the ice coating formed with it is too thick. The rayon tubing **shall** be replaced by a muslin without a wick when the wet-bulb temperature goes below 0 °C.

5.4.6.2 Removal of yarn wick

If a simple psychrometer is in use, the wick should be removed when the water on it is frozen. Where a motor psychrometer is in use, the wick should be removed when the temperature is expected to go below freezing, lest the thermometer be damaged during the removal of a frozen wick. When the temperature fluctuates above and below freezing, and the wick is removed, the muslin should be left on and the wet-bulb wetted before each reading. When not frozen, the wet-bulb should be wetted about five minutes before each reading if used in a simple psychrometer; in a motor psychrometer it should be wetted about two minutes before reading. Experience on the part of the observer will indicate the time required. If not enough time is allowed, the wet-bulb will not have reached a steady, equilibrium temperature by the time it is read and the correct wet-bulb temperature will not be obtained; below freezing, see instructions in 5.4.6.3.

5.4.6.3 Removal of muslin sleeves

From 0 °C down to about -10 °C, a thin coating of ice on the wet-bulb can best be maintained by leaving the muslin on the bulb. However, at lower temperatures the muslin should be removed and a coating of ice formed on the bulb itself. This is a general rule and the stated temperature of -10 °C is not intended as a rigid specification. The frequency of observations will influence this operation and the observer should use their own judgment.

5.4.6.4 Formation of ice coating

A fresh coating of ice **shall** be formed on the wet-bulb before each reading in sufficient time to allow equilibrium to be reached before the time of reading; fifteen minutes or more are usually required. If hourly observations are being taken, it will usually be adequate to form a new ice film on the bulb after each observation so that it will be ready for the next. To form a fresh coating of ice, the bulb **shall** be dipped in pure water until the indicated temperature rises to a few degrees above freezing; this ensures that all the old ice is removed. Then withdraw the bulb from the water, hold the thermometer in a position nearly horizontal, and rotate it slowly until the water coating turns to ice. This method produces an even coating of fresh ice on the bulb, with or without muslin covering, and prevents the formation of an ice button on the bulb.

5.4.6.4.1

The wet-bulb of the sling psychrometer should be wetted immediately before it is used.

5.4.6.4.2

If, in freezing weather, the thermometer is watched after it has been moistened, we will see the temperature falling slightly below 0 °C, then suddenly rising to 0 °C and remaining at that temperature for about a minute until all the water is frozen; then it will descend to its proper wet-bulb temperature. If the temperature falls straight to its final reading, with no pause at 0 °C, it is highly probable that the water has not frozen on the bulb (water can exist in a supercooled state at temperatures several degrees below the freezing point). It can usually be determined from the appearance of the bulb whether it is covered with ice or water, but if there is any doubt, freezing can generally be initiated by touching the bulb with a fragment of ice or snow. As the water freezes, the temperature will rise toward 0 °C, and then fall again.

5.4.6.4.3

Numerous coatings of ice **shall not** be allowed to accumulate on the wet-bulb, as correct results will not be obtained because of the poor thermal conductivity of the ice, and the thermometer may be broken during removal from the psychrometer duct.

5.5 Maximum temperature

5.5.1

This is the highest temperature reached during the interval under consideration. Maximum temperatures may be read and recorded directly from the left display of the MSC Remote Temperature and Dewpoint (1987) System (RTD-87), at stations so equipped. Operating instructions are found in Section 4 of the *Technical Manual TM 02-04-01*. At stations not equipped with the RTD-87, the maximum temperature is the highest of the following values:

1) The value obtained after the appropriate correction has been applied to the observed reading of the maximum thermometer, or
2) The highest corrected dry-bulb temperature during the period under consideration provided that readings were taken at hourly intervals, or
3) The highest temperature recorded from hourly readings of the spirit column of the minimum thermometer, when the maximum thermometer is out of service or cannot be used due to low temperatures (below -37 °C).

5.5.2

At stations which operate during part of the day, seven days a week, but do not take an observation at 0600 UTC, the thermograph chart, in conjunction with the maximum thermometer, may be used to obtain maximum temperature data (see 10.4.4.1 and 13.3.4.1).

5.5.2.1

At such stations, if collocated with an automatic station, maximum temperature data may be obtained from the automatic station (see 10.4.4.4 and 13.3.4.4).

5.6 Minimum temperature

5.6.1

This is the lowest temperature reached during the interval under consideration. Minimum temperatures may be read and recorded directly from the right display of the MSC Remote Temperature and Dewpoint (1987) System (RTD-87), at stations so equipped. Operating instructions are found in Section 4 of the *Technical Manual TM 02-04-01*. At stations not equipped with the RTD-87, the minimum temperature is the lower of the following values:

1) The value obtained after the appropriate correction has been applied to the observed reading of the minimum thermometer, or
2) The lowest corrected dry-bulb temperature recorded during the period under consideration provided that readings were taken at hourly intervals.

5.6.1.1

If the minimum thermometer is out of service, the lowest corrected dry-bulb reading **shall** be recorded as the minimum temperature provided that readings were taken at hourly intervals.

5.6.2

At stations which operate during part of the day, seven days a week, but do not take an observation at 0600Z, the thermograph chart, in conjunction with the minimum thermometer, may be used to obtain minimum temperature data (see 10.4.5.1 and 13.3.6.1).

5.6.2.1

At such stations, if collocated with an automatic station, minimum temperature data may be obtained from the automatic station (see 10.4.5.4 and 13.3.6.4).

5.7 Resetting and check readings – maximum and minimum thermometers

5.7.1

The maximum thermometer **shall** be reset after the reading. To reset, remove the thermometer from its supports,* grasp it firmly at the end opposite the bulb and hold it with the bulb down. Allow the mercury to come into contact with the constriction before starting the reset motion. Swing the thermometer, briskly, through an arc that prevents the bulb from rising above the horizontal. This is to prevent damage to the thermometer.

***Note**: The maximum thermometer is positioned horizontally in the Stevenson Screen below the minimum thermometer. Its bulb should be slightly lower than the opposite end.

5.7.1.1

Re-check the reading after resetting. This is to ensure the reset value is representative of the ambient temperature.

5.7.2

The minimum thermometer **shall** be reset after reading. To reset, remove the bulb end from its support and raise it until the index slides down and rests against the meniscus. The bulb end **shall** then be carefully returned to its support.

5.7.3

Check readings of maximum and minimum thermometers **shall** be made after each resetting. This is done to check for the occurrence of breaks or bubbles in the column and to ensure that the thermometers are reset correctly.

Note: Maximum thermometers manufactured by the JUMO company may appear to have a short break in the mercury column in the area of the constriction. This break is caused by a small glass rod inside the bore of the thermometer. No attempt to re-unite the column in this area should be made after the thermometer has been reset to the current air temperature.

5.8 Grass minimum temperature

5.8.1

The grass minimum temperature is used mostly to provide information on “ground frosts” at night. It is obtained from a minimum thermometer exposed horizontally over short grass (about 8 cm high) with the bulb of the thermometer just touching the tips of the blades of grass.

5.9 Thermographs

5.9.1

Many stations are equipped with thermographs from which a continuous record of temperature against time may be obtained. Refer to manuals 21 and 22. Although the thermograph is not regarded as a primary standard, it may be used as a reference for temperature data (maximum and/or minimum for 6, 12, or 18 hours, temperature 12 hours ago, etc.) which occurred during periods when the weather watch was not continuous.

5.9.2

When temperature data, required in the completion of Form 63-2322, are not available from maximum, minimum or dry-bulb thermometers, the thermograph may be used to obtain corrected temperatures provided that the following procedures (additional to those in manuals 21 and 22) are observed:

1) The thermograph **shall** be housed in a thermometer shelter located no farther than necessary from the one which contains the dry-bulb thermometer. It may be possible in some cases to locate the thermograph and the thermometer in the same shelter.
2) At each time of chart change:
   (i) Adjust the thermograph so that the temperature indicated by the beginning of the trace on the new chart agrees with the dry-bulb temperature at the time of chart change.
   (ii) Enter the dry-bulb temperature to the nearest degree just above the end of the temperature trace on the chart just completed.
3) At the time of each main synoptic observation:
   (i) Make a time check mark across the trace by raising and lowering the pen the width of two printed temperature intervals.
   (ii) Enter above each time check mark the difference (in whole degrees with proper algebraic sign) between the thermograph reading and the corresponding dry-bulb temperature.
4) Adjust the thermograph promptly, if at any time, the recorder trace is in error by more than 1.5 °C.
5) Except for reading and routine maintenance, the thermograph **shall** be kept in the appropriate screen.

Example :

Thermograph	Dry-bulb reading	Difference (correction)
14	15	+1
21	19	-2
-4	-3	+1
+1	-1	-2
10	10	0

5.10 Water temperature

5.10.1

Designated stations are required to measure water temperature. Special instructions on the use of the thermometers and other special equipment are given in *Instrument Manual 20*.

5.11 Computer generated temperatures, dewpoints and humidities

5.11.1

These instructions are for use by sites that are equipped with software which will apply corrections to readings of ordinary, maximum, and minimum thermometers; will calculate dew point and relative humidity; and will select maximum and minimum temperatures for the various synoptic hours based on up to the previous 30 hours of temperature data.

5.11.1.1

Enter all temperatures directly as read, to the nearest tenth of a degree Celsius, on the data input screen. Depending on station equipment, readings may be derived from dry and/or wet-bulb thermometers, maximum and minimum thermometers, the MSC dewcel, a remote temperature indicator, or the MSC Remote Temperature and Dewpoint (1987) System (RTD-87).

5.11.1.2

Although observing and recording procedures are simplified, no change is made to station operating procedures with regard to the operation and routine maintenance of the Dewcel, wet-bulb, maximum and minimum thermometers and other temperature/humidity sensors.

Chapter 6 Humidity

6.1 General

Humidity is a measure of the water vapour content of the air. It is calculated with respect to water, both at temperatures above and below freezing. Humidity is commonly expressed in terms of dewpoint temperature and relative humidity.

6.2 Dewpoint – definition

The dewpoint is the temperature at which the air would become saturated (with respect to water) if cooled at constant pressure and without the addition or removal of water vapour. The dewpoint is expressed in degrees Celsius.

6.3 Relative humidity – definition

Relative humidity is the ratio, expressed as a percentage, of the amount of water vapour actually present in the air to the amount of water vapour which would be present if the air were saturated with respect to water at the same temperature and pressure.

6.4 Determination of relative humidity

The wet and dry-bulb psychrometer is the standard equipment used to determine relative humidity. The computation of the dewpoint temperature and relative humidity **shall** be carried out using the approved psychrometric tables. Each observing station is provided with the appropriate books of psychrometric tables for both ventilated and non-ventilated psychrometers. The various psychrometric tables with form numbers are listed below:

Ventilated psychrometer

Book 1 – Form 63-2201 – Station elevation less than 305 m (1000 ft)

Book 2 – Form 63-2202 – Station elevation 305 m to 760 m (1000 to 2500 ft)

Book 3 – Form 63-2203 – Station elevation more than 760 m (2500 ft)

Non-ventilated psychrometer

Book 4 – Form 63-2204 – Station elevation less than 305 m (1000 ft)

Book 5 – Form 63-2205 – Station elevation 305 m to 760 m (1000 to 2500 ft)

Book 6 – Form 63-2206 – Station elevation more than 760 m (2500 ft)

Note (1): For detailed instructions with examples on the calculation of dewpoint and relative humidity, refer to the *Manual of Psychrometric Tables*, page vi, paragraph 3.
Note (2): The discontinuity in relative humidity and dewpoint values, which appears in the psychrometric tables along a diagonal line through points corresponding to the change in the wet-bulb temperature from 0 °C to less than 0 °C, is not an error in the tables. Refer to the *Manual of Psychrometric Tables*, page vii, paragraph 3.2.2.

6.4.1 Humidity at low temperature

Great care **shall** be taken to ensure proper functioning of the wet-bulb (see 5.4) particularly at low temperatures when the difference between the wet and dry-bulb temperatures is small, as errors in reading, correcting and maintaining the thermometer result in large humidity errors.

6.5 Dewcel

The dewcel is an instrument used to determine the dewpoint. It consists of a temperature sensor covered with wicking soaked in a solution of lithium chloride, and over which is wound a pair of bare gold wires, which do not touch each other. An electrical potential applied to the wires causes a flow of current through the lithium chloride solution and raises the temperature of the solution until its vapour pressure is in equilibrium with that of the ambient air.

6.5.1

At certain designated stations the MSC dewcel, in conjunction with a dry-bulb thermistor and remote temperature indicator, is used as operational equipment for the purpose of determining air temperature, dewpoint and relative humidity. Detailed instructions regarding the operation, maintenance and limitations of this equipment are given in *Instrument Manual 32 – Remote Temperature and Dew-point Measuring System Type 2*. From the readings of the remote temperature indicator, the temperature and dewpoint may be determined for instrument exposures up to 300 m distant. The wet-bulb temperature and the relative humidity cannot be obtained directly from this equipment; they can, however, be determined by referring the derived dry-bulb and dewpoint temperatures to the appropriate book of Psychrometric Tables.

6.5.2 Low temperature limit

The MSC dewcel will not operate below ambient temperatures of -45 °C. It will not be damaged however, by exposure to temperatures below its effective limit. The associated dry-bulb thermistor may be used throughout the entire range of ambient air temperature.

6.5.3

Dewpoint temperatures may be read and recorded directly from the right display of the MSC Remote Temperature and Dewpoint (1987) System (RTD-87), at stations so equipped. Operating instructions are found in Section 4 of the *Technical Manual TM 02-04-01*.

6.6 Dewcel/psychrometric comparisons

6.6.1 Purpose

Comparisons of the dewpoints obtained from a psychrometer and from a dewcel are required to confirm the accuracy of the dewcel system, to help to establish the washing frequency of the dewcel and to ensure that a serviceable psychrometer is available in the event that the dewcel becomes inoperative. All comparisons **shall** be made with a ventilated psychrometer, motor or sling.

6.6.2 Frequency of comparisons

During the initial installation, inspector on site: To the extent possible, comparisons should be made hourly for the first 24 hours of operation. Comparisons should be made at least during daylight hours.

After acceptance: During the first 4 months following acceptance, dewcel-psychrometric comparisons **shall** be made 4 times daily, at the synoptic hours. This comparison is to help establish the cleaning frequency.

6.6.2.1 Comparisons after cleaning

After the installation of a cleaned and activated dewcel, verify its operation by making four comparisons at consecutive hourly observing times. When the dewcel operation is verified, make comparisons once a week. It is left to the discretion of the station manager to set a specific time and day of the week for a dewcel comparison check.

6.6.3 Recording of comparisons

Except for the comparisons made during the initial installation, all comparisons are to be recorded.

6.6.3.1

On form 63-2325: Record the time (UTC) of the comparison reading and the values observed.

6.6.3.2

On form 63-2322: In Column 1, record only the time (UTC) of the comparison.

6.6.3.3

The above schedule of comparison readings is essential.

6.6.4 Dewcel unserviceable

When the dewcel is unserviceable for any reason, other than low temperature limit, the psychrometric data **shall** be calculated from dry and wet-bulb readings obtained from one of the following: Motor ventilated psychrometer, sling psychrometer or simple psychrometer.

6.7 Hygrograph

Some stations are equipped with a hygrograph, which consists of humidity-sensitive elements (strands of hair) whose movements are communicated by suitable linkage to a pen, marking a chart mounted on a clockwork-driven drum. This instrument is calibrated to provide a continuous record of relative humidity. Even at temperatures below freezing, the hair continues to indicate humidity with respect to water and is, therefore, quite suitable for meteorological purposes. However, at low temperatures, other effects result in lack of correct response. The hygrograph is not regarded as a primary standard for measuring humidity, but if it is maintained in good condition and check readings indicate that it is reasonably close to values of humidity determined from the wet and dry-bulb psychrometer, it may be used when the regular wet-bulb psychrometer is out of service. When the relative humidity and dry-bulb temperature are known, it is possible to work back through the tables to determine the dewpoint.

In all cases when the relative humidity and dewpoint are determined by use of the hygrograph, rather than the wet and dry-bulb psychrometer, an identifying mark (*) **shall** be made over the recorded entries and a note made on the page to indicate that the values entered were determined from the hygrograph.

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Chapter 7 Wind

7.1 General

Wind is defined as air in motion. It represents the horizontal flow of air at a height of 10 m. Wind information is included in all surface weather reports and **shall** contain both velocity (direction and speed) and character. For meteorological purposes, the wind direction is reported with respect to true north and the speed is expressed in nautical miles per hour (knot).

7.1.1 Direction

The wind direction is the direction from which the air is moving. It represents the average direction during the two-minute period ending at the time of observation.

7.1.2 Speed

The wind speed is the rate of airflow past a fixed point. It represents the average speed during the two-minute period ending at the time of observation. The term “calm” is used to describe winds less than 2 kts.

7.1.3 Character

Wind character is reported when there are significant variations in the wind speed, during the ten-minute period ending at the time of the observation. The character will be reported as a “gust” or “squall” depending on the magnitude and duration of the variation.

7.1.3.1 Gusts

Gusts are sudden, rapid, and brief changes in the wind speed. They are characterized by the more or less continual fluctuations between the high (peak) and low (lull) speed.

7.1.3.1.1

These criteria for reporting gusts are the same as criteria used by autostations. Gusts **shall** be reported when:

1) The highest peak speed is at least 5 kts higher than the current two-minute average; and
2) The highest peak is at least 15 kts.

7.1.3.2 Squalls

Squalls are essentially gusts with a longer duration of higher speeds. Squall speeds are reported only by stations with a recording wind instrument and then only when the following criteria are recorded:

1) The wind speed increases by 15 kts or more over the two-minute average speed that preceded the increase;
2) The duration of the peak speed period is at least 2 min;
3) The wind speed attains a one-minute mean of at least 20 kts, during the peak speed period;
4) The wind speed diminishes by at least 5 kts.

7.1.3.2.1

The speed to be reported is the highest one-minute mean speed.

7.1.3.2.2

When the Beaufort scale is used for estimating wind speed, (see 7.4) the following criteria should be used for the reporting of squalls: “A sudden increase in wind speed, by at least three stages of the Beaufort scale, the speed rising to force 6 or more, lasting for at least 2 min, and then diminishing by at least one stage or more.”

7.1.4 Wind shift

Wind shift is a definite change in the general direction from which the wind is blowing.

7.1.4.1

A wind shift **shall** be recorded when all of the following occur:

1) The direction from which the wind is blowing changes by 45° or more;
2) The change in direction takes place in less than 15 minutes; and
3) The average wind speed at the completion of the shift is 10 kts or more.

7.1.4.2

The time of the wind shift **shall** be the time at which the wind begins to shift.

Note: A change in wind speed from “calm” to 10 kts or more is not considered a wind shift.

7.1.5 Variations in wind direction

Wind direction is defined as variable when the wind direction varies by 60° or more and less than 180º, in the 10-minute period preceding the observation, and the mean wind speed is 3 kts or greater.

7.1.5.1

When direction is variable, the two extreme directions **shall** be reported in a clockwise fashion.

7.2 Wind instruments

The standard instrument for measuring the wind is the anemometer, which is normally exposed at the internationally agreed height of 10 m. Several types of anemometers are used in Canada. They are described in detail in the appropriate instrument manuals and briefly in the following pages.

7.2.1 The U2A system

This system consists essentially of two parts: a wind speed measuring system and a wind direction measuring system.

7.2.1.1

The wind speed measuring system comprises a small direct current generator driven by a cup wheel, which in turn is driven by the force of the wind. The output voltage of the generator is proportional to the speed of rotation of the cup wheel, and therefore proportional to the wind speed. The output of the wind speed detector is connected to a remote dial indicator by means of cables.

7.2.1.2

The wind direction measuring system comprises a precision positional motor or synchro, controlled by a wind vane, which in turn reacts to the ambient wind direction. The output of the detecting positional motor is connected to a receiving positional motor by means of cables. The receiving positional motor is fitted with a pointer and housed in a remote dial indicator.

7.2.1.3

The outputs from the wind speed and wind direction detectors may also be connected to a remote strip chart recorder, which provides a continuous analog record of the wind speed and wind direction at the station.

7.2.1.4

The wind speed system is self energized and requires no external power supply.

7.2.1.5

The wind direction system requires a power supply of 32 v or 115 v, 60 Hz connected through a suitable transformer and normally applied at an indicator panel.

7.2.1.6

The U2A anemometer has a fairly low lag factor and produces more or less instantaneous values of speed and direction. By examining the chart record for the appropriate period or by observing the dial indicators over a period of time, mean values of wind speed and direction can be approximated and gust or squall conditions determined.* To obtain mean values, the dial indicators or the recorder chart traces should be observed for the required period. The position on the dial or chart over which the indicator or recorder pen moved for the major part of the time **shall** be determined, neglecting brief movements above and below this position. The mid-point of this position **shall** be taken as the mean value, for example, if the dial indicator or recorder pen moved mainly in the range 12 to 18 kts, with gusts up to 28 kts, and lulls down to 8 kts, the mean wind speed **shall** be taken as 15 kts. The same method **shall** be followed in determining the mean wind direction.

***Note**: See 7.5.3 and 7.6.4 for order of preference when both U2A dial and U2A recorder equipment are available.

7.2.2 The 78D anemometer system

The basic system consists of a 78D anemometer and a display. The anemometer is a cup and vane anemometer using U2A cups, vanes, and housings. The 78D anemometer uses low power, high reliability, optoelectronic transducers and has a built-in microcomputer to sample and calculate five-second vector components of wind. Every five seconds a wind message is transmitted to the display unit which provides further averaging for periods of two and ten minutes as well as displaying these values and determining and displaying significant wind gusts. The display unit operates on 115 VAC and supplies the 12 VDC necessary for the anemometer. The observer can select the two or ten-minute average wind on the display by means of a simple switch. Different configurations possible with the 78D system include the addition of an analog type chart display and multiple displays on a single anemometer.

7.2.3 Collocated automatic weather stations

Wind direction and speed may be derived hourly from transmitted reports of collocated automatic stations. Automatic stations currently in use, AWOS use a variety of sensors, generally exposed at the standard 10-metre height. The wind velocity is averaged over a two-minute period and the wind speed is reported in knots. Hourly wind reports from an AWOS station are averaged over a two-minute period; synoptic wind reports from an AWOS station are averaged over 10 minutes. Wind directions from all of the above autostations are reported in tens of degrees.

7.3 Anemometer unserviceable due to ice accretion

During periods of freezing precipitation (i.e., freezing rain, freezing drizzle or prolonged periods of freezing fog), wind sensing equipment is subjected to ice accretion which may reduce, or cause complete failure of, anemometer performance. The nature of this problem is that ice accretion on the wind speed detectors slows or totally impedes the rotation of the sensing cups, resulting in wind speed readings which are lower than actual wind speeds or reading “calm” when in fact they are not. Also, erroneous wind direction readings can occur due to ice accretion on the wind direction vane. Ice loading on the vane will reduce the efficiency of direction sensor movement or totally restrict movement, resulting in unreliable wind direction readings. As erroneous anemometer readings result in a real hazard to aviation, the observer must use extreme care when determining wind data during conditions of ice accretion.

7.3.1

The observer **shall** determine if ice accretion is resulting in an unserviceable anemometer and, if so, estimate the wind direction and/or speed, see 7.4 to 7.4.3.

7.3.2 Determination of reliable wind data

In determining the reliability of wind data, the observer should consider the following:

- Visual ice accretion on detectors
- Ice accretion rate on ice accretion indicator
- Duration of freezing precipitation
- Intensity of freezing precipitation
- Comparison of wind data prior to ice accretion
- Wind data inconsistent with windsock, flags or other visual reference
- Erratic direction readings, sluggish response to direction variability
- Speed readings lowering, sluggish response to gusts
- Comparison of measured wind with sensation of actual wind on ones face or hands
- Wind data in relationship to pressure system
- Comparison of wind data with other stations in proximity

Note: Stations equipped with only 78D digital or U2A dial and no wind recorder may find it more difficult to recognize decreasing anemometer performance.

7.4 Estimation of wind

When suitable instruments are lacking or when the instruments are not in operating condition, the wind direction (to eight points of the compass) and the wind speed and character **shall** be estimated. This can be done with a fair degree of accuracy by observing the common effects of the wind.

7.4.1

The direction of the wind may be determined by watching a wind vane, windsock or the drift of smoke.

7.4.2

The speed may be estimated by using the Beaufort Scale of Winds which relates common effects of the wind and equivalent speeds in knots (see 7.7). Care must be taken when applying scale specifications (twigs, branches) as they may also be affected by ice accretion resulting in lower estimated wind speed.

Note: Do not estimate the peak speed of a gust or squall.

7.4.3

If winds are estimated due to ice accretion, the following remark **shall** be included in the report: WND ESTD DUE ICE ACCRETION

7.4.4

If winds are estimated for reasons other than ice accretion, the following remark **shall** be included in the report: WND ESTD

7.5 Reporting wind – hourly observations

7.5.1

The wind direction and speed reported in the hourly observation **shall** be a two-minute mean. The direction **shall** be determined to the nearest ten degrees and the speed to the nearest knot. The occurrence of gusts, squalls and wind shifts **shall** be reported. The time of a wind shift **shall** also be recorded in Remarks (see 10.2.19.6).

7.5.2

The two-minute mean may be readily determined at stations equipped with dial or digital indicators or with a U2A recorder or other analog chart recorders.

7.5.3

When there is more than one type of wind instrument installed at a station, the following order of preference **shall** apply in determining both direction and speed:

1) U2A or other analog chart recorder
2) 78D display or voice generated module output
3) U2A indicator (dial)
4) Collocated Automatic Station (to obtain an estimated two-minute mean)

7.6 Reporting wind – synoptic observations

7.6.1

The wind direction and speed reported in the synoptic observation **shall** be a ten-minute mean. If the ten-minute interval prior to the observation includes a discontinuity in the wind data (i.e., an abrupt change in direction or speed or a break in the record), only data occurring after the discontinuity **shall** be used for obtaining mean values: Hence the time interval in these circumstances will be correspondingly reduced. The wind direction **shall** be reported in tens of degrees, using WMO code 0877 (see 12.3.2.2) and the speed **shall** be reported in knots.

7.6.2

The wind direction **shall** be observed to the nearest ten degrees or to the nearest 16 points of the compass, depending on the type of anemometer available or to eight points of the compass when it is necessary to estimate the wind direction. For record purposes, the wind direction **shall** be recorded to the nearest ten degrees.

7.6.3

Wind speeds in knots **shall** be determined from the anemometer. If speeds from the anemometer are obtained in miles per hour, they **shall** be converted to knots, using the "Conversion of miles per hour to knots" table (see 12.3.2.3).

7.6.4

When there is more than one type of wind instrument installed at a station, the following order of preference **shall** apply in determining both direction and speed:

1) U2A recorder
2) 78D display
3) U2A indicator (dial)
4) Collocated Automatic Station

7.7 Beaufort scale of winds

Force	Wind Speed Knots average	Wind Speed Knots	Descriptive Term	Effects Observed at Sea	Effects Observed on Land
0	0	Less than 1	Calm	Sea surface like a mirror, but not necessarily flat.	Smoke rises vertically.
1	2	1–3	Light air	Ripples with the appearance of scales are formed, but without foam crests.	Direction of wind shown by smoke drift, but not wind vanes.
2	5	4–6	Light breeze	Small wavelets, still short but more pronounced. Crests do not break. When visibility good, horizon line always very clear.	Wind felt on face. Leaves rustle. Ordinary vane moved by wind.
3	9	7–10	Gentle breeze	Large wavelets. Crests begin to break. Foam of glassy appearance. Perhaps scattered whitecaps.	Leaves and small twigs in constant motion. Wind extends light flag.
4	14	11–16	Moderate breeze	Small waves, becoming longer. Fairly frequent whitecaps.	Raises dust and loose paper. Small branches are moved.
5	19	17–21	Fresh breeze	Moderate waves, taking a more pronounced long form. Many whitecaps are formed. Chance of some spray.	Small trees with leaves begin to sway. Crested wavelets form on inland waters.
6	25	22–27	Strong breeze	Large waves begin to form. The white foam crests are more extensive everywhere. Probably some spray.	Large branches in motion. Whisteling heard in telephone wires. Umbrellas used with difficulty.
7	31	28–33	Near gale	Sea heaps up and white foam from breaking waves begins to be blown in streaks along the direction of the wind.	Whole trees in motion. Inconvenience felt in walking against wind.
8	37	34–40	Gale	Moderately high waves of greater length. Edges of crests begin to break into the spindrift. The foam is blown in well-marked streaks along the direction of the wind.	Breaks twigs off trees. Generally impedes progress. Walking into wind almost impossible.
9	44	41–47	Strong gale	High waves. Dense streaks of foam along the direction of the wind. Crests of waves begin to topple, tumble and roll over. Spray may affect visibility.	Slight structural damage occurs, e.g. roofing shingles may become loose or blow off.

Force	Wind Speed		Descriptive Term	Effects Observed at Sea	Effects Observed on Land
	Knots average	Knots			
10	52	48–55	Storm	Very high waves with long overhanging crests. Dense white streaks of foam. Surface of the sea takes a white appearance. The tumbling of the sea becomes heavy and shock-like. Visibility affected.	Trees uprooted. Considerable structural damage occurs.
11	60	56–63	Violent storm	Exceptionally high waves. Sea completely covered with long white patches of foam. Visibility affected.	Widespread damage.
12	-	64+	Hurricane	Air filled with foam and spray. Sea entirely white with foam. Visibility seriously impaired.	Rare. Severe widespread damage to vegetation and significant structural damage possible.

7.7.1 Northern Beaufort scale and wind effects on land

Beaufort number	Speed range	Knots average	Effects
1	1–3	2	No noticeable wind. Smoke rises nearly vertically.
2	4–6	5	Wind felt on face, leaves rustle.
3	7–10	9	Hair is disturbed, clothing flaps.
4	11–16	14	Dust and loose paper raised, hair is disarranged.
5	17–21	19	Force of wind felt on body. Limit of agreeable wind on land.
6	22–27	25	Some inconvenience in walking.
7	28–33	31	Difficulty when walking against wind.
8	34–40	37	Difficulty with balance in walking.
9	41–47	44	Danger in being blown over.
10	48–55	52	Trees uprooted; considerable structural damage.

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Chapter 8 Surface weather record forms 63-2322, 63-2330, and 63-2325

8.1 Purpose

Form 63-2322 provides space for recording and coding surface weather observations in both the hourly and synoptic formats, as well as space for recording observed data and computations, climatological data, and other information such as notes on unusual weather and instrument changes.

Note: All references in this manual relating to Form 63-2322 apply equally to the French language version of the form, that is, Form 63-2330.

8.1.1

Form 63-2325 provides a monthly summary of the station observing program regarding:

- The number of daily scheduled observations.
- The type of equipment used in the measurement of wind, humidity, snowfall, and rainfall.
- Instrument installations, changes, relocations and defects.
- Any changes in or other pertinent detail relating to the scheduled observing program.

8.1.1.1

The heading of Form 63-2325 should be completed as in 8.1.2. A computer printed gummed label on which is printed the station name, province, and listing number **shall** be affixed to the upper right-hand corner of the original copy sent to MSC Downsview.

8.1.2 Typical entries – Form 63-2325

Environment Canada / Environnement Canada
Meteorological Service of Canada / Service météorologique du Canada

YARMOUTH A CYQI **PROV.** **NOVA SCOTIA** **MONTH:** **Jun-00**

MONTHLY SUMMARY OF INSTRUMENT MALFUNCTIONS
CHANGES AND NEW INSTALLATIONS

FOR MSC DOWNSVIEW USE ONLY

ACTION COMPLETED

	OPTR. NO.	ERROR COUNT
NO. 1 CARDS PUNCHED		
NO. 4 CARDS PUNCHED		
MICROFILMED		

FOR STATION USE

1. **OBSERVING PROGRAM**

(a) Number of Scheduled observations taken daily and entered in Section II of Form. [24]

(b) Was the observing program during this month carried out as published in the current issue of "METSTAT" - Meteorological Stations in Canada? If "no" give details in Remarks. YES [X] NO [ ]

(c) Are 24 hr-hour wind observations recorded? YES [ ] NO [ ]

2. **WIND RECORDERS (Graph or Chart)**

- MSC Anemograph (step recorder) [ ]
- U2A - Munro (gust recorder) [X]
- Bendix-Friez (gust recorder) [ ]
- Other (specify) [ ]

3. **WIND INDICATORS (No graph or chart)**

- 78D (digital) [ ]
- U2A (direct dial reading) [X]
- Other (specify) [ ]

4. **WIND ESTIMATED**

- No wind equipment operational [ ]

5. **PSYCHROMETER**

- Ventilated - Motor or Sling [X]
- Non-Ventilated [ ]
- Dewcel [X]

6. **NIPHER SNOW GAUGE** [X]

7. **RAIN GAUGES**

- Standard, Type B (large capacity [X]
- Recording (MSC) [X]
- Other (specify) [ ]

8. **COLLOCATED AUTOMATIC STATION** - [ ]

DAILY SUMMARIES

DAY 1
INSTALLATION OF RECORDING
RAIN GAUGE COMPLETED
CALIBRATED BRIDGE
#R879-852M OPERATIONAL
AT 14:00 UTC

DAY 2

DAY 3

DAY 4
PSYCHROMETRIC COMPARISON
AT 19:20 UTC

	DB	WB	DP
STANDARD	8.5	4.7	0.4
DEWCEL	8.2		0 .0

DAY 5

DAY 6

DAY 7

DAY 8

DAY 9
POWER FAILURE 19:47 to 20:25 UTC
WIND ESTIMATED
and NON VENITALTED PSYCHROMETER
USED FOR 20:00 UTC OBSERVATION

DAY 10

DAY 11
PSYCHROMETRIC COMPARISON
AT 19:20 UTC

	DB	WB	DP
STANDARD	11.7	8.5	5.5
DEWCEL	11.9		5.2

DAY 12

DAY 13

DAY 14

DAY 15
CEILING PROJECTOR U/S AT 05:50 UTC
BULB REPLACED
AT 06:35 UTC

DAY 16
PSYCHROMETRIC COMPARISON
AT 19:20 UTC

	DB	WB	DP
STANDARD	10.8	9.2	7.8
DEWCEL	10.5		7.4

DAY 17

DAY 18

DAY 19

DAY 20

DAY 21

DAY 22

DAY 23
MERCURY BAROMETER #C79
REMOVED FROM SERVICE
REPLACE BY VAISALA V1320027
NEW CONSTANT FILE AND
PRESSURE TABLES AT 14:15 UTC

DAY 24

DAY 25
PSYCHROMETRIC COMPARISON
AT 19:20 UTC

	DB	WB	DP
STANDARD	13.2	12.6	12.0
DEWCEL	13.3		12.4

DAY 27

DAY 28

DAY 29
ORDINARY THERMOMETER
#RC83-1002 BROKEN
AT 11:45 UTC REPLACED BY
#RC83-0427 AT 12:20 UTC

DAY 30

DAY 31
WIND SPEED DETECTOR
SR8D92-263 DEFECTIVE,
REPLACED BY SR8D95-372
AT 21:25 UTC.
WIND ESTIMATED AT 21:00 UTC

REMARKS (PROGRAM CHANGES,ETC.)

OBSERVING AGENCY

MSC ☐ TC ☐ Contract ☐

Other________________________

INSTRUCTIONS

1. All stations shall complete three copies of Form 0063-2325; the original for MSC Downsview, one carbon copy for the MSC Regional Headquarters and the other carbon copy for the station record.

2. At the top of Form 0063-2325 print or stamp the Station name, Province, Month and Year. Enter the Station name as published in METSTAT, followed by the three-letter station identifier. Affix a preprinted, gummed label bearing the station name, province, and listing number to the upper right hand corner of the original sent to MSC Downsview

3. Whenever it is necessary to make entries on major changes in the observing program in column 1 of Form 0063-2322, identical entries shall be made in the appropriate space under "Daily Summaries" of this form. Entries on instrument changes, relocation of instruments, changes in observing schedule, new installations and new programs shall be considered major. Minor entries, such as " wick changes", should not be transferred to this Form. Use that "Day" space which corresponds to the "Day" entry in Col. 44 of Form 0063-2322.

4. Do not make entries in the section marked "For MSC Downsview Use Only".

5. In the section marked "For Station Use" appropriate entries shall be made in the boxes provided. Make check ( ) entries except in Part 1 (a) where a "number" entry is required . In Part 1 (b), if "No" is checked, state the reason in the "Remarks" Section of this form. In Part 2 and 3, all types of wind equipment in operation at the Station shall be checked.

6. The "Remarks" Section may be used at the discretion of the observer. For example, it may be used as additional space whenever a daily space is completely filled.

7. At the end of each month distribute completed copies of Form 0063-2325 as follows:
   (a) Forward the original to MSC Downsview as the top sheet of the Surface Weather Record Forms 0063-2322. Do not mail this copy seperately.
   (b) Forward one of the carbon copies to MSC Regional Headquarters.
   (c) Retain one copy for the station record.

8. Although this form reports instrument defects to the MSC Regional Headquarters, it is nevertheless the responsibility of the field office to notify MSC Regional Headquarters immediately of any instrument problems.

0063-2325 (8/95)

8.2 General instructions – Form 63-2322

8.2.1

Form 63-2322 is divided into four sections which are completed in whole or in part at all stations, depending on the type of observing program. Detailed instructions for completing the various sections are given in Part B, “Hourly observations”, and Part C, “Synoptic observations”, in this manual. A brief description of each section is given below.

8.2.2 Section I – observed data and computations

This section **shall** contain a record of:

- Notes and instrument defects and changes.
- Duration of weather and/or obstructions to vision.
- Observed data and computations at the time of each main and intermediate synoptic report.

8.2.2.1

Section I **shall** be completed in full by all stations which transmit synoptic reports.

8.2.2.2

When two or more sheets are required for a 24-hour period, all data for Sections I, III and IV **shall** be recorded on the first sheet; i.e., only hourly, SPECI, and check observations in Section II **shall** appear on the additional sheet(s).

8.2.3 Section II – hourly observations

Section II **shall** contain a record, in chronological order, of all observations, (i.e., hourly, SPECI and check).

8.2.3.1

Stations designated to transmit observations in the synoptic code only **shall** record the observations in Section III in accordance with the instructions, see Chapter 13, “Recording the synoptic observation on Form 63-2322.”

8.2.3.2

Stations which transmit hourly observations **shall** record the observations in Section II in accordance with the instructions, see Chapter 10, “Recording the hourly observation on Form 63-2322.”

8.2.4 Section III – coded synoptic reports

This section provides space for coded synoptic reports. It **shall** be completed by all stations designated to transmit observations in the synoptic code.

8.2.5 Section IV – summary for the climatological day

This section is provided for data required in the “Summary for the climatological day ending at 0600 UTC.” All stations **shall** complete this section unless otherwise instructed.

8.2.6 Headings

A new sheet (Form 63-2322) **shall** be used for the record of each day’s weather beginning at 0601 UTC. The headings for each new sheet **shall** include:

1) Station name as listed in METSTAT, followed by the three-character identifier in brackets.
2) The province, encoded as follows: British Columbia – BC, Alberta – AB, Saskatchewan – SK, Manitoba – MB, Ontario – ON, Quebec – QC, New Brunswick – NB, Nova Scotia – NS, Prince Edward Island – PE, Newfoundland and Labrador – NL, Yukon Territory – YK, Nunavut – NU and Northwest Territories – NT (compatible with the MSC computerized Station Information System (SIS)).
3) A four-figure group for the hour, two figures for the date (UTC in both cases), and the first three letters of the month, indicating the beginning of the period for which observations are recorded on that sheet.
4) A four-figure group for the hour, two figures for the date (UTC in both cases), and the first three letters of the month, indicating the end of the period for which observations are recorded on that sheet.

8.2.6.1

When the entire 24 hour observing period can be recorded on one sheet, the four-figure hour groups **shall** be 0601 UTC and 0600 UTC respectively.

8.2.6.2

When two or more sheets are required for a 24-hour period the following procedures **shall** apply:

1) The four-figure hour groups for each additional sheet **shall** be determined by adding one minute to the time of the last observation on the previous sheet to obtain the beginning of the period.
2) The four-figure hour group for the end of the period of observations **shall** be the time of the last observation as recorded in Column 29.

8.2.6.3

Stations which do not operate 24 hours a day and are not equipped with a wind recorder, **shall** enter the times, (see 8.2.6.1) to ensure that any occurrence for that day will be recorded.

8.2.7 Duplicate copies

Two copies of Form 63-2322 are required: the original and one carbon copy. The original and carbon copies must be identical and reflect all changes in accordance with 8.2.10 to 8.2.10.2.1.

8.2.8 Legibility

Black ball point pens **shall** be used to provide a permanent record on the original copy and, at the same time, to provide a clean carbon copy. Writing must be clear and legible, in block letters, so that copies, suitable for legal purposes, can be obtained. When not in use, the record should be kept in a drawer or otherwise protected so that the sheets will not be soiled, creased or crumpled.

8.2.9 Missing data

An "M" entry **shall** be used to indicate missing data where entries would ordinarily be made in an hourly observation (or "X" in the case of a synoptic observation), except when a scheduled observation is not taken, the words "observation missing" **shall** be entered for the appropriate hour.

Note: In METAR communication of hourly observations, the "M" is not transmitted, the element will be missing in the report. However, in the transmission of synoptic observations, a solidus "/" is used in place of the "X".

8.2.10 Correction of entries on Form 63-2322 – at originating station

When a correction is made before the report is transmitted, draw one horizontal line through the erroneous entry and record the correction neatly above.

8.2.10.1

If a correction is made to an hourly entry, in any column 28 to 41, after the report is transmitted, but before the next hourly is transmitted, make the corrections according to 8.2.10.

8.2.10.1.1

If a correction is made to any of the above entries (see 8.2.10.1) after the next hourly observation is transmitted, the corrections **shall** be made in red on the original and carbon copy. In addition, the date in Column 28 **shall** be circled in "red," for each observation that contains a "red" change. An asterisk **shall** be scribed in "red" in the lower right hand corner of the Form 63-2322.

8.2.10.1.2

If an hourly is transmitted incorrectly, but recorded correctly, and it is too late to transmit a correction when the error is discovered, circle the date and place a "red" asterisk as above.

8.2.10.1.3

If a correction is made to a SPECI after the next SPECI or hourly is transmitted, the correction **shall** be made in red.

8.2.10.2

For synoptic reports, corrections to synoptic messages **shall** be transmitted within one hour and fifteen minutes (1:15 h) after the synoptic hour. Corrections made (and transmitted) within this time period (syno. + 1:15 h) **shall** be made according to 8.2.10.

8.2.10.2.1

Any correction made in Section III Form 63-2322, after the 1:15 h time allowance, **shall** be made in red.

8.2.11 Priority

At stations which take both hourly and synoptic observations, the instructions given in Part B **shall** be followed when making entries in Sections I and II of Form 63-2322. Where additional observed data are needed to complete the coded synoptic, (e.g., a 10-minute mean wind), these observations **shall** be recorded in the Observer's Notebook, Form 63-2321.

8.2.12 Limited observing program

Stations taking fewer daily synoptic observations than for the times indicated on Form 63-2322, **shall** complete the entries only for the appropriate times and the other lines **shall** be left blank.

8.2.13 Disposal

The originals of Form 63-2322 for each day of the month **shall** be arranged with the first day of the month on top and succeeding days underneath, in order, down to the last day of the month at the bottom. These forms, with the original of Form 63-2325 attached as a cover page for Form 63-2322, **shall** be forwarded promptly at the beginning of each month, (no later than the 5th) through designated channels to MSC Downsview.

8.2.13.1 Complete record

When forwarding Forms 63-2322 to the ADM, it is essential that the record for the entire climatological month be included. It is also essential that a complete record of the observations be included for the calendar month, based on Local Standard Time (LST). To provide the complete record for the calendar month (LST), an extra Form 63-2322 is required from all stations other than those using Mountain Standard Time (MST).

8.2.13.2

At stations using Newfoundland Standard Time (NST), Atlantic Standard Time (AST), Eastern Standard Time (EST) and Central Standard Time (CST), Form 63-2322 for the first day of the month will not contain in Section II, the record of all observations for the first calendar day of the new month (LST). The observations which are not included on the sheet for the first day of the new month have previously been recorded with the observations for the last day of the month just completed. They are as follows:

Time zone	Observations UTC
NST, AST	0400, 0500, 0600
EST	0500, 0600
CST	0600

Before sending Form 63-2322 to MSC Downsview, the observations for the above times **shall** be copied on a separate Form 63-2322 which is dated the first day of the new month. This form **shall** be held at the station until the end of the new month, when it **shall** be forwarded as the top sheet of the records.

8.2.13.3

At stations using Pacific Standard Time (PST), Form 63-2322 for the last day of the month will not contain in Section II, a record of all observations for the last calendar day of the month (LST). The observation needed to complete the calendar day will be recorded with the observations for the first day of the new month as follows:

Time Zone: PST

Observation UTC: 0700

The observation for the above time **shall** be copied on a separate Form 63-2322, which is dated the first day of the month just beginning, and it **shall** be forwarded as the last sheet of the records for the month which has just ended.

Example: When forwarding Form 63-2322 for June (24 hourly observations daily):

- A station located in the PST Zone would forward at least 30 sheets, each with 24 hourly observations (0700 UTC – 0600 UTC inclusive) **and** one additional Form 63-2322 dated July 01 containing the 0700 UTC observation (2300 PST of June 30th).
- A station located in the MST Zone would forward at least 30 sheets, each with 24 hourly observations (0700 UTC – 0600 UTC inclusive).
- A station located in the AST Zone would forward at least 30 sheets, each with 24 hourly observations (0700 UTC – 0600 UTC inclusive) **and** one additional Form 63-2322 (top sheet) dated June 1 containing the 0400, 0500 and 0600 UTC observations (0000, 0100 and 0200 AST).

8.2.14 Retention

Hard copies of observational data and recorder records, etc., **shall** be retained at the station for a period of at least 60 days. Electronic copies of data to be retained for at least 12 months. Arrangements should be made with MSC through appropriate channels (MSC contact or inspector) to remove surplus records.

8.2.14.1

Some stations may have a large accumulation of surplus records. At observing sites where it has been determined that there is no local or regional requirement for reference to the older records, the documents which are more than five years old may be destroyed, providing a request, listing in detail all records to be destroyed, has been submitted to MSC Downsview through the appropriate channels and permission has been granted. This procedure is necessary to ensure complete microfilm records at MSC Downsview.

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Part B
Hourly observations

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Chapter 9 Observing and reporting priorities

9.1 General

Selected meteorological observing stations are designated to take weather observations and supply reports, in a form designed primarily to meet the requirements of flight personnel and other users. These reports are called hourly observations. The observers assigned to take hourly observations **shall** keep a close watch on the weather and report significant changes without delay. The continuity of the scheduled observing program **shall** be maintained at all times so that discontinuities will not occur in the records.

9.2 Scheduled observations

Hourly observations **shall** be taken each hour on the hour. Ideally all elements should be observed exactly at the hour; however, in practice, a certain interval of time is required to make an observation. The barometer **shall** be read exactly at the hour. Other elements **shall** be observed in the few minutes preceding the hour and as close as possible to the hour. The computations, coding and recording of hourly observations **shall** be done immediately after the hour. The following observing schedule will best conform to the principles laid down above.

9.2.1

When the hourly observation only is required:

Time schedule		Duty
From	**To**	
Hour minus six minutes	Hour	Observe all weather elements except pressure.
Hour	Hour + one minute	Read the barometer and the barograph.
Hour + one minute	Hour + seven minutes	Input the hourly observation for transmission and complete necessary entries on Form 63-2322.

9.2.2

When both hourly and synoptic observations are required:

Time schedule		Duty
From	**Until**	
Hour minus ten minutes	Hour minus three minutes	Observe all weather elements except pressure.
Hour minus three minutes	Hour	Make necessary entries on Form 63-2322 in Sections I, II and III.
Hour	Hour + one minute	Read the barometer and the barograph.
Hour + one minute	Hour + seven minutes	Input hourly observation for transmission. Complete necessary entries on Form 63-2322 in Section III.
Hour + seven minutes	Hour + twelve minutes	Input the synoptic observation for transmission.

9.2.3

The preceding tables indicate the order of observing and recording weather observations, but the times shown need not be followed rigidly, except for reading the barometer. Under easy observing conditions it may be possible to commence the observation closer to the hour than the times shown. When weather conditions are difficult it may be necessary to begin the observation earlier, in order to complete it in time to take the pressure reading at the hour.

9.2.4

The exact order in which the weather elements (other than the pressure) are to be observed is not rigidly specified. This order will depend somewhat on the location of the instruments and on weather conditions. It is suggested that the elements which fluctuate most rapidly (ceiling and visibility), be left as late as possible. Thus under conditions of low ceiling and visibility, these elements would be best observed just before the barometer is read.

9.2.5

All stations **shall** conform to these schedules of observing, unless special permission to deviate is obtained from the ADM.

9.2.6

When weather conditions change while the observation is being taken, the scheduled report **shall** describe, as nearly as possible, the conditions which existed just prior to the reading of the barometer (see 10.3.3). When significant weather changes occur after the barometer has been read and prior to the transmission of the scheduled report, transmit the scheduled report, followed by the transmission of a special observation as soon as possible thereafter.

Example:

- Light rain began at 11:57 UTC; record -RA / 11:57 in columns 2 and 3; indicate -RA as weather in hourly for 1200 UTC.
- Light snow shower began at 18:03 UTC; record -SHSN / 18:03 in columns 2 and 3; SA (indicating no snow) for 1800 UTC was offered at 18:04; a SPECI, indicating -SHSN and time 18:03, was offered at 18:07.

9.2.7

It should be noted that both the hourly observation and the synoptic observation aim to describe identical conditions at the hour. However, this is only possible insofar as the codes permit; for example, the synoptic observation reports a ten-minute mean wind direction and speed, whereas the hourly observation for the same time reports a two-minute mean wind direction and speed.

9.3 Aircraft accidents

For procedures for taking “Accident Observations” and for the protection of the official record, see 10.3.7.

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Chapter 10 Recording the hourly observations on Form 63-2322

10.1 General

The following instructions deal with entries in the various lines and columns of Form 63-2322, although not necessarily in the order in which the elements are observed or that the entries will be made by the observer; For example, the type of report is usually determined after all other data have been observed.

10.2 Section II – hourly observations “UTC”

10.2.1 Column 23 – corrected wet-bulb

Enter the corrected wet-bulb temperature to the nearest tenth degree Celsius. Leave this column blank when the dewpoint is obtained from the MSC dewcel.

10.2.1.1

When the corrected dry-bulb temperature is lower than -37 °C, enter "M" in Column 23.

10.2.1.2

Add "NV" in this column at each hourly observation that the psychrometer motor is unserviceable. If the psychrometer motor is unserviceable for more than a day add "NV" once each day at the time of the first scheduled observation and explain under "Notes and Instrument Defects and Changes," Column 1 (at those stations not equipped with a sling psychrometer).

10.2.2 Column 24 – relative humidity

Enter the relative humidity as a percentage if there is a regional or local need, otherwise this column may be left blank (see 6.7).

10.2.3 Column 25 – total opacity

Enter, in tenths of the whole sky, the total opacity for all layers. This cannot exceed 10 tenths. If blue sky or stars are visible, the total opacity **shall not** exceed 9/10.

10.2.4 Column 26 – total amount

Enter, in tenths of the whole sky, the sum of the amounts for all layers. In determining the total amount, disregard portions of upper layers which are seen through transparencies in lower layers (the total amount cannot exceed 10 tenths).

Note: In determining total opacity and total amount (25 and 26), any layer whose amount is a trace **shall** be disregarded (e.g. Trace of cumulus in each observation):

II HOURLY OBSERVATIONS							Sky condition	Visibility (mi.)	Weather and obstructions to vision	Sea level pressure (hPa)	Temperature (°C) (tenths)		WIND			AT 06Z	CLOUDS and/or OBSCURING PHENOMENA
Corrected wet bulb (°C)	Relative humidity (%)	Total opacity	Total amount	Type	Date (UTC)	Hour (UTC)					Dry-bulb	Dew-point	Direction	Speed (kt)	Character	Altimeter setting (in.)	Type/Opacity
23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
		0	**0**				**30 FEW**										**CU1**
		0	**4**				**30 FEW 300 -SCT**										**CU1 CS**
		3	**4**				**10 -SCT 30 -SCT**										**ST3 CU1**

10.2.5 Column 27 – type of report

Enter one of the following to indicate the type of report:

- SA for Hourly
- SP for SPECI
- C for Check

Note: For criteria for determining the various types of reports, see 10.3.

10.2.6 Column 28 – date (UTC)

Using two digits, enter the date of each observation, specials and checks included, based on Coordinated Universal Time (UTC). For example, if an observation is recorded at 2300 UTC on the 9th of the month, enter 09. For the observation one hour later at 0000 UTC, the date would be entered as 10. The change of date **shall** take place at 0000 UTC.

10.2.7 Column 29 – hour (UTC)

Using a four-digit group enter the Coordinated Universal Time (UTC) of the observation.

10.2.7.1 Time assigned to SPECI observations

The time assigned to a SPECI observation **shall** be the time at which the element necessitating the SPECI was observed (except in the case of end of thunderstorm or precipitation, see 10.3.5.5 and 10.3.5.6). If more than one element has changed sufficiently to cause a SPECI, the time **shall** be the time of observation of the element considered to be most important to aviation.

10.2.7.2 Time assigned to Check observations

The time assigned to a Check observation **shall** be the time at which the observation was completed.

10.2.8 Column 30 – sky condition

10.2.8.1 Sky cover – terms and abbreviations

Term	Symbol abbreviation	Symbol used to represent
Clear	CLR	The sky condition when no cloud or obscuring phenomenon is present.
Partially obscured	-X	A surface-based layer with summation opacity of at least 1/10 but less than 10/10.
Obscured	X	A surface-based layer with a summation opacity of 10/10.
*Few	FEW	A layer aloft with a summation amount of 3/10 or less.
*Scattered	SCT	A layer aloft with a summation amount of 4/10 to 5/10 inclusive.
*Broken	BKN	A layer aloft with a summation amount of 6/10 to 9/10 inclusive.
*Overcast	OVC	A layer aloft with a summation amount of 10/10.

***Note**: The symbol for "thin" (-) may be prefixed to these symbols (see 10.2.8.2).

10.2.8.2 Thin layers

A layer aloft **shall** be described as "thin" when both:

1) The summation amount of the layer exceeds the summation opacity of the layer by 1/10 or more of the whole sky; and
2) The summation opacity of the layer is 5/10 or less of the whole sky.

10.2.8.3 Order of sky cover symbols and/or contractions

A sky cover symbol **shall** be recorded for each layer observed. Multiple layers **shall** be reported in order of their height, starting with the lowest. When used in combination with other abbreviations, -X (partially obscured) **shall** be reported first, and X (obscured) **shall** be reported last.

Note: -X and X **shall not** be used in the same report.

10.2.8.4 Heights of layers aloft

A coded numerical value, giving the height of the base of the layer aloft, **shall** be prefixed (with one space) to FEW, SCT, BKN or OVC. Heights are with reference to the official aerodrome level of the station, or, if this has not been established, with reference to the ground level.

10.2.8.5 Vertical visibility

A coded numerical value giving the height of the vertical visibility in a surface-based layer **shall** be prefixed (with one space) to the symbol "X".

10.2.8.6 How to obtain the coded height:

1) Heights of bases of layers or height of vertical visibility **shall** first be determined to the nearest:
   (i) 30 m from the surface up to 3000 m; i.e., 0 m, 30 m, 60 m, 90 m, 120 m etc.
   (ii) 300 m above 3000 m; i.e., 3000 m, 3300 m, 3600 m, 3900 m, etc.
2) After the height has been determined to the nearest 30 m, or 300 m (see 10.2.8.6 (1)) this value **shall** be divided by 30 to obtain the coded height which will precede with one space the symbol FEW, SCT, BKN, OVC or X; see 10.2.8.4.
3) If the actual observed height is exactly halfway between any two values which satisfy the increments in 10.2.8.6 (1), the lower value **shall** be used to obtain the coded height: e.g., the coded height of a layer based at 75 m would be 2, i.e., 60 ÷ 30.

10.2.8.6.1

Example:

Height of base of layer	Coded height	Equivalent height in feet*
30 m	1	98
120 m	4	393
1500 m	50	4921
6000 m	200	19686
9000 m	300	29529

***Note**: The coded height recorded in Column 30 is a direct reading of height in units of 30 meters and is a close approximation of the height in hundreds of feet.

10.2.8.6.2

One space **shall** be used between the coded height and the contraction or symbol, and one space **shall** be used to separate the data which apply to one layer from the data which apply to the next higher layer.

Example:

II HOURLY OBSERVATIONS							Sky condition	Visibility (mi.)	Weather and obstructions to vision	Sea level pressure (hPa)	Temperature (°C) (tenths)		WIND			AT 06Z	CLOUDS and/or OBSCURING PHENOMENA
Corrected wet bulb (°C)	Relative humidity (%)	Total opacity	Total amount	Type	Date (UTC)	Hour (UTC)					Dry-bulb	Dew-point	Direction	Speed (kt)	Character	Altimeter setting (in.)	Type/Opacity
23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
		9	10				15 -SCT E75 OVC										
		7	7				-X A25 BKN										
		10	10				6 SCT P12 X										

10.2.8.6.3

When heights referring to surface-based layers or to layers aloft are given in the "Remarks" of the hourly observation (see 10.2.19.2), the heights **shall** be expressed as coded heights, see 10.2.8.6. If the observer has confidence in the accuracy of a height available to them, the height reported in "Remarks" should be expressed in feet to the accuracy available.

Example: CIG 140 FT

10.2.8.6.4 Height in metres to coded height

Metres	Coded height
< 16	0
30	1
60	2
90	3
120	4
150	5
180	6
210	7
240	8
270	9
300	10
330	11
360	12
390	13
420	14
450	15
480	16
510	17
540	18
570	19
600	20
630	21
660	22
690	23
720	24
750	25
780	26
810	27
840	28
870	29
900	30
930	31
960	32
990	33

Metres	Coded height
1020	34
1050	35
1080	36
1110	37
1140	38
1170	39
1200	40
1230	41
1260	42
1290	43
1320	44
1350	45
1380	46
1410	47
1440	48
1470	49
1500	50
1530	51
1560	52
1590	53
1620	54
1650	55
1680	56
1710	57
1740	58
1770	59
1800	60
1830	61
1860	62
1890	63
1920	64
1950	65
1980	66
2010	67
2040	68

Metres	Coded height
2070	69
2100	70
2130	71
2160	72
2190	73
2220	74
2250	75
2280	76
2310	77
2340	78
2370	79
2400	80
2430	81
2460	82
2490	83
2520	84
2550	85
2580	86
2610	87
2640	88
2670	89
2700	90
2730	91
2760	92
2790	93
2820	94
2850	95
2880	96
2910	97
2940	98
2970	99
3000	100
3300	110
3600	120
3900	130

Metres	Coded height
4200	140
4500	150
4800	160
5100	170
5400	180
5700	190
6000	200
6300	210
6600	220
6900	230
7200	240
7500	250
7800	260
8100	270
8400	280
8700	290
9000	300
9300	310
9600	320
9900	330
10 200	340
10 500	350
10 800	360
11 100	370
11 400	380
11 700	390
12 000	400
12 300	410
12 600	420
12 900	430
13 200	440
13 500	450
13 800	460
14 100	470
14 400	480

Metres	Coded height
14 700	490
15 000	500
15 300	510
15 600	520
15 900	530
16 200	540
16 500	550
16 800	560
17 100	570
17 400	580
17 700	590
18 000	600
18 300	610
18 600	620
18 900	630
19 200	640
19 500	650
19 800	660
20 100	670
20 400	680
20 700	690
21 000	700

10.2.8.7 Ceiling definition

The ceiling is the lesser of:

1) The height above ground of the base of the lowest layer aloft at which the summation opacity is 6/10 or more of the whole sky.
2) The vertical visibility into a surface-based layer which completely obscures the sky.

Note: When the sky condition is such that neither of the above conditions is satisfied, the ceiling is said to be “unlimited.”

10.2.8.7.1

The summation opacity is the sum of the opacity of a given layer and the opacities of all lower layers. Thus, the layer which constitutes the ceiling may be determined by adding up the opacities of individual layers, until 6/10 or more is reached. However, the second part of the ceiling definition should be noted. If a layer is surface-based and its opacity is less than 10/10, the surface-based layer cannot constitute a ceiling. Thus, surface-based layers must have an opacity, or summation opacity, of 10/10 in order to constitute the ceiling layer. For example, if 6/10 of fog were present, it would not constitute the ceiling layer, but if there were 1/10 Altocumulus cloud above the fog, making the summation opacity 7/10 at the level of the Altocumulus, the Altocumulus would constitute the ceiling layer and its height would be reported as the ceiling in Column 30.

10.2.8.8 Measurement of ceiling

The determination of the ceiling is an extremely important part of the observation. At stations so equipped, the laser ceilometer **shall** be used at each observation. At stations not equipped with a laser ceilometer, the following procedures **shall** apply:

1) During the hours of darkness, the ceiling projector **shall** be used at each observation.
2) During daylight hours, a ceiling balloon **shall** be used when the ceiling is estimated to be 300 m or less (coded height 10). Should there be any doubt whether the ceiling is above or below 300 m (coded height 10) a balloon **shall** be used.
3) During daylight hours, a ceiling balloon **shall** be used whenever requested by a forecast office or responsible flight personnel (such as pilots, Air Traffic Control (ATC), Flight Service Station (FSS)).
4) During daylight hours, when the ceiling is estimated to be more than 300 m (coded height 10), a ceiling balloon may be used on the initiative of the observer.

10.2.8.9 Ceiling classification

The ceiling is classified according to its nature and the method by which it is determined.

10.2.8.9.1

When the height of a layer aloft is designated as the ceiling, the ceiling classification **shall** be one of the following (the listed order also indicates priority when two or more of these classifications apply).

Classification:

1) Measured: M
2) Aircraft: A
3) Balloon: B
4) Estimated: E

10.2.8.9.2

When the vertical visibility, in a surface-based layer which completely obscures the sky, is designated as the ceiling, the ceiling classification **shall** be one of the following (the listed order also indicates priority).

Classification:

1) Aircraft: A
2) Precipitation: P
3) Indefinite: W

10.2.8.9.3

To indicate the ceiling classification, prefix the appropriate abbreviation (without spacing) to the numerical value of the ceiling. Details regarding the requirements of the various classifications are given below.

10.2.8.9.4

Measured is the ceiling classification employed when:

1) The height of the base of a layer aloft is determined by use of a ceiling projector or ceilometer, and the projector spot or ceilometer reaction is sharply defined.
2) The height of the base of a layer aloft is determined from the known heights of unobscured portions of objects such as buildings, towers, etc., within 1 1/2 miles of the boundary of the field, if the observer believes that the height of the layer at the location of the tall object concerned is representative of the height of the layer at the station.

10.2.8.9.5

Aircraft is the ceiling classification employed when:

1) The height of the base of a layer aloft or the vertical visibility in a surface-based layer is determined from information reported by the pilot of an aircraft and the height measurement was obtained by the pilot while over the geographical limits of the aerodrome itself, and the report is not more than 15 minutes old and the conditions reported by the pilot are considered by the observer to be representative of conditions at the time of the observation.
2) A report, not more than 15 minutes old, is received from an aircraft which was not over the aerodrome at the time of the height measurements, but was within 1 1/2 mile of the boundary of the field, and the observer considers the conditions where the observation was made to be representative of conditions over the aerodrome.

10.2.8.9.6

Balloon is the ceiling classification employed when the height of the base of a layer aloft is determined by observation of a ceiling balloon, and the height of the base of the layer is computed from the assumed rate of ascent and the time interval between the release of the balloon and its entry into the base of the layer.

10.2.8.9.7

Indefinite is the ceiling classification used when, in a surface-based layer not composed of precipitation, the height of vertical visibility constitutes a ceiling and the classification "Aircraft" is not appropriate.

10.2.8.9.8

Precipitation is the ceiling classification used when, in a surface-based layer composed of precipitation, the height of vertical visibility constitutes a ceiling and the classification "Aircraft" is not appropriate.

Note: When appropriate, "Aircraft" (see 10.2.8.9.5) **shall** be the classification employed for the value of the vertical visibility into a surface-based layer which completely obscures the sky. When the classification "Aircraft" is not appropriate, either "Indefinite" or "Precipitation" **shall** be the classification regardless of the aids (e.g., balloons, ceiling projector etc.) which may have been used in estimating the vertical visibility.

10.2.8.9.9

Estimated is the classification employed when the height of the base of a layer aloft is determined by visual estimation or by means other than those that would allow one of the classifications "Measured," "Aircraft" or "Balloon" to be used.

10.2.8.10 Variable ceiling

When the ceiling is 900 m or less and is observed to be "variable," (i.e., rising and falling from a mean value by 1/4 or more of the mean value (see 1.6.5)), the range of variation **shall** be indicated in Remarks (41).

Sky condition	Visibility (mi.)	Weather and obstructions to vision	Sea level pressure (hPa)	Temperature (°C) (tenths)		WIND				CLOUDS and/or OBSCURING PHENOMENA Type/Opacity	REMARKS
				Dry-bulb	Dew-point	Direction	Speed (kt)	Character	Altimeter setting (in.)		
30	31	32	33	34	35	36	37	38	39	40	41
M7 OVC										**ST10**	**CIG VRB 5-9**
W2 X										**FG10**	**CIG VRB 1-3**

10.2.8.11 Additional instructions

10.2.8.11.1

In the hourly observation, the ceiling may be recognized as the height ascribed to the lowest layer of cloud or obscuring phenomenon that is reported as broken, overcast or obscured, and not qualified by "thin" or "partially." The ceiling is also distinguished from other coded heights in the sky condition group by the letter which designates the ceiling classification and which immediately precedes the coded numerical value of the ceiling. The absence of a ceiling classification letter indicates "ceiling unlimited."

Note: In a METAR, ceiling classification letters are not used. In a METAR, the ceiling is the lowest height at which a broken or overcast condition exists or the vertical visibility when an obscured condition such as snow, smoke or fog exists, whichever is the lower.

10.2.8.11.2

The sky cover symbol X (obscured) **shall** be used in conjunction with the symbols FEW, SCT or BKN when a cloud, at a height less than the vertical visibility, assists in hiding the sky.

II HOURLY OBSERVATIONS												Temperature (°C) (tenths)		WIND			AT 06Z	
Corrected wet bulb (°C)	Relative humidity (%)	Total opacity	Total amount	Type	Date (UTC)	Hour (UTC)	Sky condition	Visibility (mi.)	Weather and obstructions to vision	Sea level pressure (hPa)	Dry-bulb	Dew-point	Direction	Speed (kt)	Character	Altimeter setting (in.)	CLOUDS and/or OBSCURING PHENOMENA Type/Opacity
23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
		10	10				P15 X										SN10
		10	10				5 FEW P15 X										SF3 SN7
		10	10				B5 BKN 15 X										SF7 SN3

10.2.8.11.3

A height is not ascribed to sky-cover term CLR or -X (partially obscured).

10.2.8.11.4

Surface-based layers such as fog, blowing snow, etc., are reported by sky cover symbols X or -X as appropriate. Surface-based layers within sight but not at the point of observation **shall** be reported in Remarks (41).

Note: A surface-based layer which conceals less than 1/10 of the sky (summation opacity) **shall** be disregarded.

10.2.8.11.5 Examples of sky cover reports

Layers	Opacity	Amount	Summation opacity	Summation amount	Sky condition (Col. 30)	Clouds and/or obscuring phenomena Type/Opacity (Col. 40)
Fog, surface SF, 300 m SC, 1500 m	4 3 2	4 3 2	4 7 9	4 7 9	-X M10 BKN 50 BKN	FG4 SF3 SC2
CF, 240 m SC, 600 m AC, 2250 m	2 4 4	2 4 4	2 6 10	2 6 10	8 FEW E20 BKN 75 OVC	CF2 SC4 AC4
SF, 150 m Snow, 450 m	3 7	3 7	3 10	3 10	5 FEW P15 X	SF3 SN7
Fog, surface Smoke 150 m	6 2	6 3	6 8	6 9	-X B5 BKN	FG6 FU2
Smoke 240 m ST, 360 m	4 4	6 4	4 8	6 10	8 -BKN M12 OVC	FU4 ST4
Smoke, 90 m SC, 1050 m	1 4	3 5	1 5	3 8	3 -FEW 35 -BKN	FU1 SC4
Smoke, 90 m SC, 1050 m	2 5	3 7	2 7	3 10	3 -FEW E35 OVC	FU2 SC5
ST, 150 m SC 750 m	2 8	10 8	2 10	10 10	5 -OVC E25 OVC	ST2 SC8
ST, 150 m AS, 2550 m	2 3	10 3	2 5	10 10	5 -OVC 85 -OVC	ST2 AS3
ST, 150 m AS, 2100 m	9 1	10 1	9 10	10 10	M5 OVC 70 OVC	ST9 AS1
CF, 150 m SC, 750 m	1 5	1 5	1 6	1 6	5 FEW E25 BKN	CF1 SC5

10.2.9 Column 31 – visibility

Enter the prevailing visibility (see 2.2) to the nearest reportable value (see 10.2.9.1). If the observed prevailing visibility is exactly half-way between two reportable values, use the "lower" value.

10.2.9.1 Reportable values of visibility

The following values (in statute miles) **shall** be used for reporting visibility:

1) 0, 1/8, 1/4, 3/8, 1/2, 5/8, 3/4 (increments of 1/8 mile);
2) 1, 1 1/4, 1 1/2, 1 3/4, 2, 2 1/4, 2 1/2 (increments of 1/4 mile);
3) 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15 (increments of 1 mile);
4) 15+ (if suitable markers beyond 15 miles are lacking);
5) 20, 25, 30, 35, etc., (increments of 5 miles) **shall** be used only if suitable visibility markers are available.

10.2.9.2 Variable visibility

If the prevailing visibility is observed to be variable (see 2.5) i.e., increasing and decreasing from a mean value by 1/4 or more of the mean value. Indicate the range of variation in Remarks.

Example:

Visibility (mi.)	Weather and obstructions to vision	Sea level pressure (hPa)	Temperature (°C) (tenths)		WIND			Altimeter setting (in.)	CLOUDS and/or OBSCURING PHENOMENA	REMARKS
			Dry-bulb	Dew-point	Direction	Speed (kt)	Character		Type/Opacity	
31	32	33	34	35	36	37	38	39	40	41
1	**BR**									**VIS VRB 3/4-1 1/4**
7										**VIS VRB 5-9**

10.2.9.3 For different directions

If the visibility in one or more directions is half or less, or double or more the prevailing visibility, details of the visibility in such directions **shall** be recorded in Remarks (41).

Example:

Visibility (mi.)	Weather and obstructions to vision	Sea level pressure (hPa)	Temperature (°C) (tenths)		WIND				CLOUDS and/or OBSCURING PHENOMENA	REMARKS
			Dry-bulb	Dew-point	Direction	Speed (kt)	Character	Altimeter setting (in.)	Type/Opacity	
31	32	33	34	35	36	37	38	39	40	41
12										**VIS SW 6 BR**
10	**VCFG**									**VIS NE 2**

10.2.9.4 Additional instructions

When observing visibility from elevated positions, such as a control tower or roof, if the visibility differs by a reportable value from the prevailing visibility observed on the ground (at eye level), the visibility from the elevated position and the identification of the position **shall** be reported in Remarks.

Example:

Sky condition	Visibility (mi.)	Weather and obstructions to vision	Sea level pressure (hPa)	Temperature (°C) (tenths)		WIND				CLOUDS and/or OBSCURING PHENOMENA	REMARKS
				Dry-bulb	Dew-point	Direction	Speed (kt)	Character	Altimeter setting (in.)	Type/Opacity	
30	31	32	33	34	35	36	37	38	39	40	41
A15 OVC	**3**	**BLDU**									**ROOF VIS 10**

10.2.9.4.1

With "blowing snow" conditions, the reporting of roof-top visibility is particularly important. Frequently, visibility is much better a short distance above ground level. Ground-level visibility alone in such circumstances does not give a full description of the visibility that would be experienced by the pilot of an aircraft.

10.2.9.4.2

With low-lying "fog" conditions, the observer should provide an estimate of the depth of the fog as well as the roof-top visibility.

Example:

Sky condition	Visibility (mi.)	Weather and obstructions to vision	Sea level pressure (hPa)	Temperature (°C) (tenths)		WIND			Altimeter setting (in.)	CLOUDS and/or OBSCURING PHENOMENA	REMARKS
				Dry-bulb	Dew-point	Direction	Speed (kt)	Character		Type/Opacity	
30	31	32	33	34	35	36	37	38	39	40	41
-X	**1/4**	**FG**									**ROOF VIS 10 FG 30FT THK**

10.2.9.4.3

Directions in Remarks **shall** be recorded in a clockwise order from true north.

10.2.10 Column 32 – weather and obstructions to vision

10.2.10.1

Symbols for the conditions of weather and obstructions to vision which may be reported in Column 32 are listed below:

Weather and obstructions to vision	Symbols
Tornadoes	
Tornado	+FC (TORNADO in Remarks)
Waterspout	+FC (WATERSPOUT in Remarks)
Funnel cloud	FC (FUNNEL CLOUD in Remarks)
Thunderstorms	
Thunderstorm	TS

Weather and obstructions to vision	Symbols
Precipitation	
Rain	-RA, RA, +RA
Rain showers	-SHRA, SHRA, +SHRA
Drizzle	-DZ, DZ, +DZ
Freezing rain	-FZRA, FZRA, +FZRA
Freezing drizzle	-FZDZ, FZDZ, +FZDZ
Snow	-SN, SN, +SN
Snow showers	-SHSN, SHSN, +SHSN
Snow grains	-SG, SG, +SG
Ice crystals	IC
Ice pellets	-PL, PL, +PL
Ice pellet showers	-SHPL, SHPL, +SHPL
Hail (diameter of largest stone ≥5 mm)	-SHGR, SHGR, +SHGR
Hail (diameter of largest stone <5 mm)	-SHGS, SHGS, +SHGS
Snow pellets	-SHGS, SHGS, +SHGS
Obstructions to vision (visibility ≤ 6 mi.)	
Fog (visibility <5/8 mi.)	FG
Freezing Fog (visibility <5/8 mi., temp <0 to -30 °C)	FZFG
Mist (visibility 5/8 mi. to 6 mi.)	BR
Haze	HZ
Smoke	FU
Blowing snow	BLSN, +BLSN
Blowing sand	BLSA, +BLSA
Blowing dust	BLDU, +BLDU
Duststorm	DS, +DS
Sandstorm	SS, +SS

Weather and obstructions to vision	Symbols
Additional phenomena (visibility > 6 mi.)	
Dust haze	DU
Shallow fog patches	MIFG
Fog patches	BCFG
Fog covering part of aerodrome	PRFG
Drifting dust	DRDU
Drifting sand	DRSA
Drifting snow	DRSN
Dust/sand whirls	PO
Volcanic ash	VA
In the vicinity phenomena	
Showers in the vicinity	VCSH
Duststorm in the vicinity	VCDS
Sandstorm in the vicinity	VCSS
Fog in the vicinity	VCFG
Dust/sand whirls in the vicinity	VCPO
Blowing dust in the vicinity	VCBLDU
Blowing sand in the vicinity	VCBLSA
Blowing snow in the vicinity	VCBLSN
Volcanic ash in the vicinity	VCVA

10.2.10.2 Intensity of precipitation

The intensity of precipitation **shall** be indicated by the symbol "+" to indicate "heavy," the symbol "-" to indicate "light" and the absence of such a symbol indicates "moderate" intensity. An exception to the foregoing is ice crystals, to which no intensity is ascribed. The criteria for determining the intensity of precipitation are given in Part A, Chapter 3, “Atmospheric phenomena.”

10.2.10.3

Two or more entries for a single observation **shall** be made in the following order:

1) Tornado, waterspout, funnel cloud
2) Thunderstorm
3) Liquid precipitation, in order of decreasing intensity
4) Freezing precipitation, in order of decreasing intensity
5) Frozen precipitation, in order of decreasing intensity
6) Obstructions to vision, in order of decreasing predominance
7) Additional phenomena and vicinity phenomena

10.2.10.4

Record in Column 32 only those phenomena which are occurring at the station, in the vicinity of the station, at the time of observation with the following exceptions:

1) Tornado, waterspout or funnel cloud **shall** be recorded if within sight at the time of observation.
2) Thunderstorm **shall** be recorded when:
   (i) Thunder is heard within the past 15 minutes; or
   (ii) Overhead lightning is observed within the past 15 minutes and the local noise level is such as might prevent hearing thunder. In this case, hail may also be an indicator of a thunderstorm in progress.

Note: Additional phenomena and in the vicinity phenomena **shall** be recorded in Column 32 and if not enough space in Column 41 (Remarks).

VC indicates significant weather phenomena observed in the vicinity of the aerodrome (the point of observation). "In the vicinity" means within 8 km (5 miles) but not within the perimeter of the aerodrome. VC codes **shall** be reported in hourly reports and SPECIs. VC codes **shall** replace the corresponding remark i.e. VCSH would be used to replace the remark SN SH 3 MI E.

10.2.10.5

Precipitation of an intermittent or showery character, which has been active at the station within the preceding 15 minutes, is not occurring at the time of observation, but is expected to begin again soon, **shall** be reported by remarks in Column 41.

Example:

Sky condition	Visibility (mi.)	Weather and obstructions to vision	Sea level pressure (hPa)	Temperature (°C) (tenths) Dry-bulb	Dew-point	WIND Direction	Speed (kt)	Character	Altimeter setting (in.)	CLOUDS and/or OBSCURING PHENOMENA Type/Opacity	REMARKS
30	31	32	33	34	35	36	37	38	39	40	41
E40 BKN	**10**									**TCU8**	**OCNL -SHRA**
E80 OVC	**10**									**AS10**	**INTMT -RA**

When intermittent precipitation is occurring at the time of observation, the remark is of the form "-RA INTMT".

10.2.10.6

Obstructions to vision (see 10.2.10.1) **shall** be recorded in Column 32 only when the prevailing visibility is 6 miles or less.

Note: Precipitation of sufficient intensity may account for a considerable reduction in visibility without the presence of any obstruction to vision. However, when rain is occurring with visibilities less than 2 miles some "obstruction to vision" should be reported with the rain, unless there is evidence that only the rain is restricting visibility. Light or moderate rainfall (e.g., -RA or SHRA), without an obstruction to vision, will not be sufficient to reduce visibility to less than 2 miles.

10.2.10.7

When precipitation, low cloud or an obstruction to vision, within sight but not at the station, restricts the prevailing visibility to 6 miles or less, an entry **shall** be made in Column 32. Explanatory Remarks clarifying the precipitation or obstruction to vision could be entered in Column 41.

Example:

Sky condition	Visibility (mi.)	Weather and obstructions to vision	Sea level pressure (hPa)	Temperature (°C) (tenths) Dry-bulb	Dew-point	WIND Direction	Speed (kt)	Character	Altimeter setting (in.)	CLOUDS and/or OBSCURING PHENOMENA Type/Opacity	REMARKS
30	31	32	33	34	35	36	37	38	39	40	41
E35 BKN	4	VCSH								TCU7	
250 FEW	3	VCFG								CI2	VIS N 10 FG BKN E-SW
E20 BKN	6									SF8	FG BANK ALQDS

Note: When the prevailing visibility reported in Column 31 is 6 miles or less, an entry is required in either Column 32 or Remarks to explain the reduced visibility.

10.2.10.8

Ice Crystals (IC) are a common form of precipitation at very low temperatures. This type of precipitation may continue for several days without interruption and frequently falls from a cloudless sky. The restriction to vision may or may not be severe.

To meet Canadian standards, when ice crystals (IC) are observed it **shall** be reported in the METAR/SPECI with any visibility.

10.2.10.9

Snow and fog should not be reported together unless there is very good evidence that fog exists. The occurrence of hoar frost or rime constitutes evidence to support a report of fog.

10.2.10.10

Drifting snow, sand or dust **shall not** be reported in the same observation as blowing conditions of the same phenomena; by definition one excludes the other. For example drifting snow **shall not** be reported with blowing snow.

10.2.10.11

Liquid precipitation and freezing precipitation **shall not** be reported in the same observation. By definition one excludes the other.

10.2.11 Column 33 – sea level pressure

Enter the atmospheric pressure, reduced to sea level in hectopascal and tenths with the initial 9 or 10 and the decimal point omitted, e.g., record 1013.2 hPa as 132; record 990.6 hPa as 906.

10.2.11.1

The digital barometer **shall** be used for determining atmospheric pressure. A reduction to sea level **shall** be computed at the time of each main and intermediate synoptic report, i.e., at 0000, 0300, 0600, 0900, 1200, 1500, 1800 and 2100 UTC; at sites equipped with data entry screen, it will be obtained from the data entry screen.

Note: If the mean sea level pressure is manually calculated, enter the mean sea level reduction in brackets in Column 41 “Remarks” each time that a new mean sea level reduction is calculated and at the time of the first observation for use until the next correction has been determined (see 4.2.3.3).

10.2.12 Column 34 – dry-bulb temperature

Enter the corrected dry-bulb temperature in degrees and tenths Celsius.

10.2.12.1

Entries which are below zero Celsius **shall** be prefixed with a minus (-) sign.

Example:

Sea level pressure (hPa) 33	Temperature (°C) (tenths) Dry-bulb 34	Dew-point 35	WIND Direction 36	Speed (kt) 37	Character 38	Altimeter setting (in.) 39
	-0.4					
	-1.2					

10.2.13 Column 35 – dewpoint temperature

Enter the corrected dewpoint temperature in degrees and tenths Celsius.

10.2.13.1

Entries which are below zero Celsius **shall** be prefixed with a minus (-) sign.

Example:

Sea level pressure (hPa) 33	Temperature (°C) (tenths) Dry-bulb 34	Dew-point 35	WIND Direction 36	Speed (kt) 37	Character 38	Altimeter setting (in.) 39
		0.4				
		-0.4				
		-0.6				
	-39.2	M				

Note (1): When the MSC dewcel is unserviceable for any reason, other than low temperature limit, the psychrometric data **shall** be calculated from dry-bulb and wet-bulb readings obtained from one of the following: motor ventilated psychrometer, sling psychrometer or simple psychrometer.

Note (2): In no case **shall** the entry in Column 35 be higher (warmer) than that of Column 34. When such a value is obtained from the dewcel or the psychrometric tables, the value of the dewpoint **shall** be reduced to correspond to the dry-bulb temperature.

Note (3): Enter "M" in Column 35 whenever:

- The corrected temperature from the dry-bulb thermometer is colder than -37 °C;
- The corrected temperature from the dry-bulb thermistor is colder than -45 °C; or
- The dewcel reading is off the scale.

10.2.14 Column 36 – wind direction

Enter the two-minute mean direction from which the surface wind is blowing to the nearest ten degrees (00–36).

Example: 130 degrees **shall** be reported as 13; 060 degrees **shall** be reported as 06. When the wind is “calm,” enter 00. Directions from wind equipment which can be read only in compass points **shall** be converted to tens of degrees as follows:

Compass point	Tens of degrees	Compass point	Tens of degrees	Compass point	Tens of degrees	Compass point	Tens of degrees
N*	36	E*	09	S*	18	W*	27
NNE	02	ESE	11	SSW	20	WNW	29
NE*	05	SE*	14	SW*	23	NW*	32
ENE	07	SSE	16	WSW	25	NNW	34

***Note**: Estimated wind direction **shall** be to eight points of the compass and converted to tens of degrees using the above table.

10.2.15 Column 37 – wind speed

Enter the two-minute mean wind speed in knots. If either the speed or the direction is estimated, enter the letter “E” immediately after the wind speed. Estimates do not apply to conditions of very low wind speeds less than 2 kts. These **shall** be reported as “calm” (see 7.1.2). Wind speed **shall** always be reported as a two or three-digit group. Enter 00 for calm. For speeds of 2-9 kts, enter 02, 03, etc. For speeds of 100 kts or over, enter 100, 101, 102, etc.

Note: “Calm” is reported for mean wind speeds of less than 2 kts.

Temperature (°C) (tenths)		WIND			
Dry-bulb	Dew-point	Direction	Speed (kt)	Character	Altimeter setting (in.)
34	35	36	37	38	39
		18	**109**		

Note (1): When both synoptic and hourly observations are recorded at the same hour, the two-minute mean wind data **shall** be entered in columns 36 and 37 of Form 63 2322. At these times, an additional observation of the ten-minute mean wind is required for synoptic coding. This observation **shall** be entered in the Observer's Notebook.
Note (2): When suitable instruments are lacking, or when the instruments are not in operating condition, the wind direction and speed **shall** be estimated (see 7.4).

10.2.16 Column 38 – wind character

10.2.16.1 Gusts

Enter the letter “G” if gusts (see 7.1.3.1.1) have been observed in the 10-minute period ending at the time of the observation. The symbol is followed by the numerical value of the peak speed of the gust.

10.2.16.1.1

Enter the highest of the peak speeds observed or recorded during the 10 minutes ending at the time of the observation.

10.2.16.1.2

If the station is not equipped with instruments that indicate wind speed fluctuations but the observer is confident that the gust criteria have been met, record the symbol G for the character. Do not enter a peak speed. Do not estimate the peak speed of a gust.

Example:

Temperature (°C) (tenths)		WIND			
Dry-bulb	Dew-point	Direction	Speed (kt)	Character	Altimeter setting (in.)
34	35	36	37	38	39
		36	17	G28	
		36	84	G115	
		27	16	G	

10.2.16.2 Squalls

Enter the symbol “Q” when a squall (see 7.1.3.2) has been observed during the 10-minute period ending at the time of the observation. The symbol is followed by the numerical value of the peak speed of the squall.

10.2.16.2.1

The squall speed entered is the highest one-minute speed observed or recorded during the squall period. Squall speeds **shall** be obtained from recording wind devices.

10.2.16.2.2

If the station is not equipped with recording devices, but the observer is confident that the criteria for squalls are being met, then enter the symbol Q only. Do not enter a squall speed. Do not estimate a squall speed. (The situations most likely to produce squalls are thunderstorms and rapidly moving cold fronts.)

Example:

Sea level pressure (hPa)	Temperature (°C) (tenths)		WIND			AT 06Z
	Dry-bulb	Wet-bulb	Direction	Speed (kt)	Character	Altimeter setting (in.)
33	34	35	36	37	38	39
			27	25	Q40	
			04	18	Q35	
			32	21	Q	

10.2.17 Column 39 – altimeter setting

Enter the altimeter setting (QNH) in inches, omitting the tens digit and the decimal point.

Example: An altimeter entry of 992 indicates an altimeter setting of 29.92 inches (see table in 4.3.2)

Note (1): To prevent any gross errors, always compare the altimeter setting which has just been calculated with the one previously reported. The difference between these two altimeter settings should be consistent with the change in the computed station pressure, and as indicated by the barograph for the same period.

Example: If the barograph indicates an increase of 1.0 hPa during the last hour, the altimeter setting should increase by approximately 0.03 inches.

Note (2): To assist in checking the 0700 UTC altimeter setting, a space is provided at the top of Column 39 where the previous altimeter setting (0600 UTC) should be recorded.

10.2.18 Column 40 – clouds and/or obscuring phenomena

Enter the type and opacity of each layer for which a sky-cover symbol is given in Column 30.

10.2.18.1

When a layer consists of two or more types, e.g., SC and CU, the predominating type by amount shall be recorded. If a cloud layer consists of any amount of TCU or CB, the TCU or CB **shall** be reported as the predominant type. However when an individual layer of cloud is composed of Cumulonimbus (CB) and Towering Cumulus (TCU) with a common cloud base, the type **shall** be reported as Cumulonimbus only. Clouds and obscuring phenomena abbreviations are listed below:

Clouds	Abbreviations
Altocumulus	AC
Altocumulus Castellanus	ACC
Altostratus	AS
Cirrocumulus	CC
Cirrostratus	CS
Cirrus	CI
Cumulonimbus	CB
Cumulus	CU
Cumulus Fractus	CF
Nimbostratus	NS
Stratocumulus	SC
Stratus	ST
Stratus Fractus	SF
Towering Cumulus	TCU

Note: The cloud type described in the *International Cloud Atlas* as "Cumulus Congestus" is listed above as "Towering Cumulus” (TCU).

Obscuring phenomena	Abbreviations
Blowing snow	BLSN
Drizzle (including freezing drizzle)	DZ
Dust, blowing dust	BLDU
Duststorm	DS
Fog (any form)	FG
Hail	GR
Haze	HZ
Ice crystals	IC
Ice pellets (including ice pellet showers)	PL
Rain (any form including SHRA and FZRA)	RA
Sand, blowing sand	BLSA
Sandstorm	SS
Smoke	FU
Snow (snow showers, snow pellets, and snow grains)	SN
Volcanic ash	VA

10.2.18.2

Opacity **shall** be expressed in tenths of the whole sky. If the opacity of a layer aloft (excluding traces of cloud) is zero, enter only the type, e.g., CI. If the opacity is 1/10 or the layer is a trace, the opacity in Column 40 is entered as "1".

10.2.18.3

Examples of type and opacity entries in Column 40 (note that obscuring phenomena which constitute layers are also included):

II HOURLY OBSERVATIONS											Temperature (°C) (tenths)		WIND			AT 06Z	
Corrected wet bulb (°C)	Relative humidity (%)	Total opacity	Total amount	Type	Date (UTC)	Hour (UTC)	Sky condition	Visibility (mi.)	Weather and obstructions to vision	Sea level pressure (hPa)	Dry-bulb	Dew-point	Direction	Speed (kt)	Character	Altimeter setting (in.)	CLOUDS and/or OBSCURING PHENOMENA Type/Opacity
23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
							E20 BKN										**SC6**
							5 FEW										**FU1**
							E30 BKN 80 OVC										**SC9 AC**
							-X E300 BKN										**FU3 CS3**
							-X E40 BKN										**FG2 SC6**
							3 -SCT A8 X										**CF4 SN6**

Note: The third entry of this report indicates SC cloud 9/10 opacity and 9/10 amount and AC cloud with 0 opacity and 1/10 amount.

10.2.19 Column 41 – Remarks

Meteorological information of importance to aviation and other users which has not been given previously in the report **shall** be recorded under Remarks. Weather symbols and abbreviations authorized in *MANAB* (*Manual of Word Abbreviations*) **shall** be used to conserve space as much as possible. However, plain language, English words **shall** be used as necessary to amplify or clarify the information.

Information not of direct importance to aviation and not intended for transmission is recorded in Remarks and it **shall** be enclosed in brackets, e.g., the sea level reduction. Hourly station pressure values **shall** be recorded in the partial column to the right of Remarks wherever a regional or local need exists.

Priority – recording

The following priority **shall** be observed when recording Remarks in the hourly observation:

1) General weather Remarks (see 10.2.19.1 to 10.2.19.8)
2) Snowfall (see 10.2.19.9)
3) Rainfall (see 10.2.19.10)
4) Hail size (see 10.2.19.12)
5) Runway Visual Range (RVR) (see 10.2.19.13)

Priority – transmitting

When transmitting Remarks in the hourly observation, the above priority **shall** be observed.

Note(1): The observer is encouraged to use the Remarks portion of the hourly observation. Entries in Remarks are by no means restricted to the examples over the next few pages.

Note (2): Late weather observation shall be recorded first in Column 41 as a general weather remark (See 10.2.19.14.1).

10.2.19.1 Sky cover (Remarks)

Sky condition	Visibility (mi.)	Weather and obstructions to vision	Sea level pressure (hPa)	Temperature (°C) (tenths)		WIND			Altimeter setting (in.)	CLOUDS and/or OBSCURING PHENOMENA	REMARKS
				Dry-bulb	Dew-point	Direction	Speed (kt)	Character		Type/Opacity	
30	31	32	33	34	35	36	37	38	39	40	41
E70 BKN										**AC8**	**AC XTNDG RPDLY FM SW**
E7 OVC										**ST10**	**OVC TPG HILLS NE**
250 FEW										**CI2**	**CONTRAILS**

"CONTRAILS" **shall** be used when the CM or CH cloud consists in whole or in part of persistent (15 minutes or more) condensation trails. Rapidly dissipating condensation trails **shall not** be reported.

10.2.19.2 Ceiling (Remarks)

Sky condition	Visibility (mi.)	Weather and obstructions to vision	Sea level pressure (hPa)	Temperature (°C) (tenths)		WIND			Altimeter setting (in.)	CLOUDS and/or OBSCURING PHENOMENA	REMARKS
				Dry-bulb	Dew-point	Direction	Speed (kt)	Character		Type/Opacity	
30	31	32	33	34	35	36	37	38	39	40	41
E8 BKN										**SF8**	**BLN ESTD**
A4 OVC										**ST10**	**CIG VRB 3-5**
B6 OVC										**ST10**	**CIG LWR SE**
B3 OVC										**ST10**	**CIG DFUS VERT VIS 5**
M0 OVC										**SF10**	**CIG 35 FT**
B4 OVC										**ST10**	**BLN DSAPRD 550 FT**

10.2.19.3 Visibility (Remarks)

Visibility (mi.)	Weather and obstructions to vision	Sea level pressure (hPa)	Temperature (°C) (tenths)		WIND			Altimeter setting (in.)	CLOUDS and/or OBSCURING PHENOMENA	REMARKS
			Dry-bulb	Dew-point	Direction	Speed (kt)	Character		Type/Opacity	
31	32	33	34	35	36	37	38	39	40	41
1/2	**FG**									**VIS VRB 1/4-3/4**
4	**BR**									**VIS VRB 2-6**
10	**PRFG**									**FG BNK W VIS 2**
3/4	**BR**									**VIS IMPRG RPDLY**
1/2	**BLSN**									**TWR VIS 2**
0	**FG**									**VIS 100 FT**

10.2.19.4 Weather (Remarks)

Sky condition	Visibility (mi.)	Weather and obstructions to vision	Sea level pressure (hPa)	Temperature (°C) (tenths)		WIND			Altimeter setting (in.)	CLOUDS and/or OBSCURING PHENOMENA	REMARKS
				Dry-bulb	Dew-point	Direction	Speed (kt)	Character		Type/Opacity	
30	31	32	33	34	35	36	37	38	39	40	41
E30 OVC	7	+FC									TORNADO SW MOVG E
E35 BKN	10	-SHRA									FUNNEL CLOUD REPD 15 S MOVG NE 0830
A45 OVC	10	TS									TS MOVG N
E40 OVC	8	-RA									-RA INTMT
E40 OVC	8										INTMT -RA
35 SCT	10										OCNL DIST LTGCC SW
35 SCT	10										OCNL -SHRA
P7 X	1/2	SN									SN WET
E30 BKN	15	DRSN									VIRGA N
CLR	15										FROIN

TORNADO SW MOVG E: If a tornado, water spout or funnel cloud is reported by the public, the following **shall** be indicated:

1) The location with respect to the station, city or town;
2) The direction towards which it is moving; and
3) The time the phenomenon was observed.

INTMT -RA: Intermittent rain was not occurring at the time but was active within 15 minutes preceding the time of the observation.

OCNL DIST LTGCC SW: When lightning is observed, indicate frequency, type (LTGCG, LTGIC and LTGCC) and direction from station.

OCNL -SHRA: Rain showers were not occurring at the time but were active within 15 minutes preceding the time of the observation.

FROIN: is used to report frost on the ice accretion indicator.

10.2.19.5 Obstruction to vision (Remarks)

Sky condition	Visibility (mi.)	Weather and obstructions to vision	Sea level pressure (hPa)	Temperature (°C) (tenths)		WIND			Altimeter setting (in.)	CLOUDS and/or OBSCURING PHENOMENA	REMARKS
				Dry-bulb	Dew-point	Direction	Speed (kt)	Character		Type/Opacity	
30	31	32	33	34	35	36	37	38	39	40	41
-X	3/4	BR									FG DSPTG RPDLY
-X	1/4	FG									FG 45 FT DEEP ROOF VIS 2
CLR	10										FU DRFTG OVR FLD VIS N 1

10.2.19.6 Wind (Remarks)

Temperature (°C) (tenths)		WIND					
Dry-bulb	Dew-point	Direction	Speed (kt)	Character	Altimeter setting (in.)	CLOUDS and/or OBSCURING PHENOMENA Type/Opacity	REMARKS
34	35	36	37	38	39	40	41
		22	**110**				
		27	**40**	**G65**			**WSHFT 0860**
		22	**07**				**180V250**
		06	**07E**				**WND ESTD DUE ICE ACCRETION**
		14	**15E**				**WND ESTD**

10.2.19.6.1

If winds are estimated due to ice accretion, the following remark **shall** be included in the report: WND ESTD DUE ICE ACCRETION

10.2.19.6.2

If winds are estimated for reasons other than ice accretion, the following remark **shall** be included in the report: WND ESTD

10.2.19.6.3 Wind direction variation

If, during the 10-minute period preceding the observation, the total variation in wind direction is 60° or more and less than 180° and the mean wind speed is 3 kts or greater, the observed two extreme directions between which the wind has varied **shall** be given for $D_nD_nD_nVD_xD_xD_x$ in clockwise order. Otherwise this group **shall not** be included. Enter wind direction variation in the specific field or enter in Remarks in the following format:

$D_nD_nD_n$ – Extreme counter clockwise wind direction

V – Variable

$D_xD_xD_x$ – Extreme clockwise wind direction

Example: 240V350

10.2.19.6.4 Low-level wind shear

Wind shear information on the existence of wind shear 1500 feet AGL and below along the take-off path or approach path of runway significant to aircraft operations **shall** be reported in Column 41 (Remarks) whenever available and local circumstances so warrant. The information will be reported in the following format:

- When wind shear is reported on take-off or landing on one runway 1500 feet AGL and below it will be reported as: WS RWY DRDR (Official Runway Designation)
  or
- When wind shear is affecting all runways 1500 feet AGL and below, it will be reported as: WS ALL RWY

10.2.19.7 Pressure change (Remarks)

CLOUDS and/or OBSCURING PHENOMENA Type/Opacity 40	REMARKS 41
	PRESRR
	PRESFR

PRESRR is used when the barograph trace indicates that the station pressure is rising at the rate of 2.0 hPa or more per hour.

PRESFR is used when the barograph trace indicates that the station pressure is falling at the rate of 2.0 hPa or more per hour.

Note: If the barograph trace shows a steady increase of 0.5 hPa during the last 15 minutes, the rate of increase would be 2.0 hPa per hour and the remark PRESRR would be appropriate.

10.2.19.8 Clouds (Remarks)

10.2.19.8.1

If clouds which indicate unstable conditions (CB, TCU or ACC) are observed and not reported in Column 40, they **shall** be reported in Remarks.

Sky condition 30	Visibility (mi.) 31	Weather and obstructions to vision 32	Sea level pressure (hPa) 33	Temperature (°C) (tenths) Dry-bulb 34	Temperature (°C) (tenths) Dew-point 35	WIND Direction 36	WIND Speed (kt) 37	WIND Character 38	Altimeter setting (in.) 39	CLOUDS and/or OBSCURING PHENOMENA Type/Opacity 40	REMARKS 41
E100 BKN										**AC6**	**ACC W**
40 SCT										**CU4**	**CB TOP DIST NW**

10.2.19.8.2

Orographic clouds, also known as “Mountain” or “Standing Wave Clouds” **shall** be reported in Remarks whether or not the clouds are predominant. These clouds sometimes indicate severe turbulence aloft and are normally seen in areas up to 350 km to the leeward of mountains or hills and may occur for a period of five or six hours or longer. Throughout the period during which orographic clouds are observed, Remarks **shall** be used to indicate their presence. Typical Remarks are:

WIND Direction 36	WIND Speed (kt) 37	WIND Character 38	Altimeter setting (in.) 39	CLOUDS and/or OBSCURING PHENOMENA Type/Opacity 40	REMARKS 41
				AC4	**ACSL OVR RDG NW**
				TCU3	**ROTOR CLDS NW**
				AC2 AC2	**RDG LENTICULARS IN LYRS W**

Note: ACSL indicates Standing Lenticular Altocumulus.

10.2.19.8.3

Cloud direction may be given in Remarks if the observer considers the information significant. Typical remark is:

WIND				CLOUDS and/or OBSCURING PHENOMENA	REMARKS
Direction	Speed (kt)	Character	Altimeter setting (in.)	Type/Opacity	
36	37	38	39	40	41
				SC4	**SC MOVG RPDLY FM SE**

10.2.19.9 Snowfall (Remarks)

10.2.19.9.1

The increasing depth of newly-fallen snow, since the time of the last main synoptic report, **shall** be reported in the Remarks section of an hourly report by means of a /Sss/ group. The letter "S" identifies the precipitation as snow and "ss" the units as whole centimetres.

10.2.19.9.2

The accumulating depth of newly-fallen snow, since the last main synoptic report, is normally obtained by ruler and rounded-off to whole centimetres.

Note: If all the snow melts as it hits the ground, /Sss/ would not be reported.

10.2.19.9.3

/Sss/ **shall** be reported only at the hours when the accumulated (rounded) value increases to equal or exceed 1 cm, or exceeds the previously reported value by 1 cm or more.

Example:

II HOURLY OBSERVATIONS											Temperature (°C) (tenths)		WIND			AT 06Z		
Corrected wet bulb (°C)	Relative humidity (%)	Total opacity	Total amount	Type	Date (UTC)	Hour (UTC)	Sky condition	Visibility (mi.)	Weather and obstructions to vision	Sea level pressure (hPa)	Dry-bulb	Dew-point	Direction	Speed (kt)	Character	Altimeter setting (in.)	CLOUDS and/or OBSCURING PHENOMENA Type/Opacity	REMARKS
23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41
						0700	P2 X	1/8	+SN								SN10	/S01/
						0800	P4 X	1/2	SN								SN10	
						0900	P1 X	1/8	+SN								SN10	/S03/
						1000	P1 X	0	+SN								SN10	/S05/
						1100	B6 OVC	2	-SN								SF10	
						1200	B12 OVC	3	-SN								SF10	/S06/
						1300	A7 X	1/2	SHSN								SN10	
						1400	E25 BKN	2	-SHSN								TCU9	/S01/

Note: Codes for phenomena are entered in Column 32 in the appropriate order. If there is not sufficient room in Column 32, the overflow can be entered in Column 41, "Remarks."

10.2.19.10 Rainfall (Remarks)

10.2.19.10.1

Some stations, selected by their Regional Headquarters, will report the accumulated rainfall, since the time of the last main synoptic report, in the Remarks section of the hourly observation by means of a /Rrr/ group. The letter "R" identifies the precipitation as rain and "rr" the units in whole millimetres.

10.2.19.10.2

/Rrr/ is the accumulative rainfall, rounded off to the nearest whole millimetre. The measurement may be obtained from a recording rain gauge, the standard type-B rain gauge or the AWOS Fischer and Porter precipitation gauge.

10.2.19.10.3

The /Rrr/ group **shall** be recorded and transmitted only at the hours when the rainfall accumulated since the time of the last main synoptic report equals or exceeds 10 mm (rounded), or exceeds the previously reported value by 10 mm (rounded) or more.

Example:

Time (UTC)	Accumulated rainfall (mm)	Recorded rainfall (col. 41)
0700	3.2	-
0800	9.8	/R10/
0900	20.2	/R20/
1000	29.7	/R30/
1100	39.1	-
1200	43.4	/R43/
1300	10.1	/R10/

10.2.19.11 Snowfall (or rainfall) reporting procedures for part-time stations

10.2.19.11.1

Part-time stations are defined as operating daily but fewer than 24 hours.

10.2.19.11.2

When the station reopens, the first observation will indicate the reportable snowfall (or rainfall) amount, using the format /Sss AFT HH/ (or /Rrr AFT HH/), where HH is the hour (UTC) of the main synoptic at or prior to the time of closing.

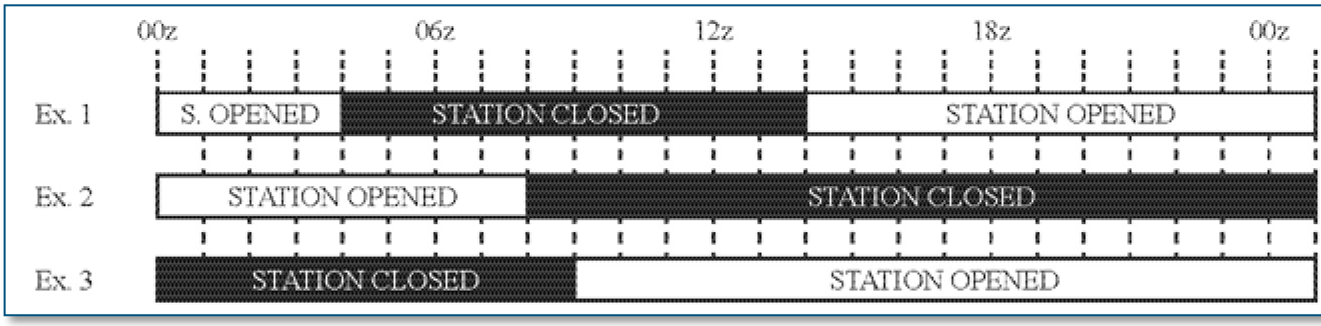
10.2.19.11.3

If the closed period includes a main synoptic hour, and if the reopening time is at a non-synoptic hour, the second and subsequent snow (or rain) reports will take the form /Ss_1s_1 AFT H_1H_1UTC/, where the flag indicates that H_1H_1UTC is the time the station reopened and s_1s_1 is the snowfall (or rainfall) amount since the station reopened.

Note: For rainfall, Ss_1s_1 is replaced by Rr_1r_1.

10.2.19.11.4

The following diagram shows three closing and opening situations. The reporting procedures for coding and reporting each situation is described below the diagrams.



Example (1): **Opening time 1400 UTC** (opening can be from 13 UTC to 17 UTC)
First report, use the format : /Sss AFT 00UTC/
Subsequent reports, up to and including 18UTC use format: /Ss$_1$s$_1$ AFT 14UTC/
Example (2): **Opening time 0000 UTC**
First report, use the format: /Sss AFT 06UTC/
Subsequent reports, use conventional format: /Sss/
Example (3): **Opening time 0900 UTC** (opening can be from 07 UTC to 11 UTC)
First report, use the format: /Sss AFT 00UTC/
Subsequent reports, up to and including 12 UTC, use format: /Ss$_1$s$_1$ AFT 09UTC

Note: For rainfall, Sss is replaced by Rrr.

10.2.19.12 Hail size (Remarks)

10.2.19.12.1

When hail is observed at the station, the average size of the hail **shall** be estimated in whole millimetres, recorded in Column 41, and transmitted in Remarks in the following format:
HAIL DIAM nn MM

Where "nn" is the average diameter in whole millimetres, e.g., HAIL DIAM 09 MM.

10.2.19.13 Runway Visual Range (RVR)

Where RVR data is displayed, it **shall** be included in hourly and SPECI observations. RVR **shall** be reported for the active or most-aligned into-the-wind runway(s) when the prevailing visibility is 1 SM or less and/or the RVR value for the designated runway(s) is 6,000 feet or less. Stations with the capability to display values for multiple RVRs may record and transmit a maximum of four RVR values and may include RVR data for runway(s) other than the active or most-aligned into-the-wind. All RVR values transmitted **shall** be representative of the touchdown zone of the active landing runway(s).

10.2.19.13.1

RVR is recorded and transmitted using the following format:

$RD_RD_R/V_RV_RV_RV_Ri$

or

$RD_RD_R/V_RV_RV_RV_RVV_RV_RV_RV_Ri$

10.2.19.13.2 Group $RD_RD_R/V_RV_RV_RV_Ri$

R: Indicator.

D_RD_R:The designator of each runway for which runway visual range is reported. Parallel runways should be distinguished by appending to D_RD_R letters L, C or R indicating the left, central or right parallel runway, respectively. A suitable combination of these letters is used for up to, and including, five parallel runways (i.e. LL, L, C, R, RR). The letter(s) **shall** be appended to D_RD_R as necessary in accordance with the standard practice for runway designation.

$V_RV_RV_RV_R$: Mean value of runway visual range over the 10-minute period immediately preceding the observation. However, when the 10-minute period includes a marked discontinuity in the RVR (for example, sudden advection of fog, rapid onset or cessation of an obscuring snow shower), only the data after the discontinuity **shall** be used for obtaining mean RVR values and variations thereof, hence the time interval in these circumstances **shall** be correspondingly reduced. FT **shall** be appended to the measurement to indicate that the measurement is in feet.

i: If the runway visual range values during the 10-minute period preceding the observation shows a distinct upward or downward tendency such that the mean during the first five minutes varies by 300 feet or more from the mean during the second five minutes of the period, this **shall** be indicated by i = U for upward and i = D for downward tendency of runway visual range values. When no distinct change in runway visual range is observed, i = N **shall** be used. When it is not possible to determine the tendency, i **shall** be omitted.

10.2.19.13.3 $RD_RD_R/V_RV_RV_RV_RVV_RV_RV_RV_Ri$ – significant variation of runway range

When the RVR at a runway varies significantly and when during the 10-minute period preceding the nominal observation time, the one-minute mean extreme values assessed vary from the mean value by more than 150 feet or more than 20% of the mean value, whichever is greater, the one-minute mean minimum and the one-minute mean maximum values **shall** be given in that order in the form $RD_RD_R/V_RV_RV_RV_RVV_RV_RV_RV_Ri$ instead of the 10-minute mean. The tendency **shall** also be included.

10.2.19.13.4

When actual RVR values are outside the measuring range of the observing system in use, the following procedure **shall** apply:

1) When the RVR is greater than the maximum value which can be assessed with the system in use, P **shall** be appended to the group $V_RV_RV_RV_R$: e.g. P6000.
2) When the RVR is below the minimum value which can assessed with the system in use, M **shall** be appended to the group $V_RV_RV_RV_R$: e.g. M0600.

10.2.19.13.5

Sites that are using RVR data based on a 10-minute mean **shall** enter the RVR data in the specified field of the input screen and record in Column 41.

10.2.19.13.6

Sites that are using the Remarks section to transmit RVR **shall** use only one value of RVR tendency and variations by this method **shall not** be reported in Remarks.

Example: RVR RWY 06R 1600FT

10.2.19.14 Late weather observations

In order that users of weather observations may have confidence in the observations and use them safely, it cannot be overstressed that hourly observations must be accurate and adhere to the schedules specified in Chapter 9, "Observing and reporting priorities." An occasion may arise, beyond the control of the observer, which would necessitate taking the observation either early or late. Since in an hourly observation the barometer is read exactly on the hour, the following procedures **shall** be used if a departure from the scheduled time is unavoidable.

10.2.19.14.1

The number of minutes before or after the hour that the barometer is read **shall** be recorded in Column 41 as the first of "General Weather Remarks" (see 10.2.19). The format of the remark **shall** be, "OBS TAKEN ±tt," where "+tt" indicates that the barometer was read (or the observation was made) "tt" minutes after the hour, and "-tt" indicates that the barometer was read (or the observation was made) "tt" minutes before the hour recorded in Column 29.

Example:
OBS TAKEN +18: the barometer reading was taken 18 minutes after the hour recorded in Column 29.
OBS TAKEN -12: the observation was taken 12 minutes before the hour.

10.2.19.15 Observational program status

In order that users of weather observations can determine if a station is staffed or when the next observation will be, Remarks indicating the status of operation are required.

10.2.19.15.1

At sites with less than a 24-hour observing program and observations not supplemented with an auto station, enter in the Remarks section for the last observation of the day, for example: LAST OBS/NEXT 241500 UTC

10.2.19.15.2

At sites with a 24-hour program and a staff/machine mix for observations, enter in the Remarks section for the last staffed observation of the day, for example:
LAST STFD OBS/NEXT 241500 UTC

10.2.19.16 Station pressure

Enter the last three digits of the station pressure (hectopascal and tenths in the column labeled Stn. Pres.).

10.2.20 Column 42 – tendency

Enter a tendency code group at the main and intermediate synoptic hours (0000, 0300, 0600, 0900, 1200, 1500, 1800, 2100 UTC). The tendency **shall** take the same form as in the synoptic code "appp" where "a" is the code figure for the tendency characteristic (see 4.4.2.2) and "ppp" is the amount of pressure change in hectopascals and tenths.

Example:

Amount of change (hPa)	Code ppp
0.0	000
0.3	003
1.1	011
10.2	102

10.2.21 Column 42a – additional data group

This group need not be recorded as the input screen has fields for total amount, total opacity and temperatures in degrees and tenths.

10.2.22 Column 43 – observer

The initials of the observer **shall** be printed legibly for each observation.

10.3 Types of observations

10.3.1

Observations are divided into two main types, i.e. "hourly" and "synoptic." Synoptic observations are discussed in Part C, "Synoptic observations." Observations are further subdivided and classified as "hourly" "SPECI", and "check." When two or more types of observation coincide, all elements observed for each type **shall** be included in the observation.

10.3.2 Hourly observations

Hourly observations are the observations taken to meet scheduled transmission times. The data listed below **shall** be included in the transmitted hourly observation unless otherwise authorized:

- Sky condition
- Visibility
- Weather and obstruction to vision
- Sea level pressure
- Temperature
- Dewpoint
- Wind
- Altimeter setting
- Clouds
- Remarks (if required)
- Runway Visual Range (RVR) (where available)
- Tendency*

***Note**: The tendency **shall** be included at 0000, 0300, 0600, 0900, 1200, 1500, 1800 and 2100 UTC.

10.3.3 Hourly observations

Even when an hourly observation reveals that one or more of the criteria specified as requirements for SPECI observations has occurred, (see 10.3.5), the observation **shall** be designated as an Hourly observation. If the criteria for a SPECI observation have been met during the period H-5 to H, the observer is not required to transmit a SPECI observation before the hour.

Note: Threatening severe weather (see "Priority of duties" in Introduction) **shall** require a SPECI observation with least possible delay.

10.3.4 SPECI

An observation **shall** be taken promptly to report changes which occur between scheduled transmission times. A SPECI observation **shall** include the following:

- Sky condition
- Visibility
- Weather and obstruction to vision
- Sea level pressure
- Temperature
- Dew point
- Wind
- Altimeter setting
- Clouds
- Remarks (if required)
- Runway Visual Range (RVR) (where available)

10.3.5 Criteria for taking SPECI

A SPECI observation **shall** be taken whenever one or more of the elements listed (see 10.3.5.1 to 10.3.5.9) have changed in the amount specified. The amount of change is with reference to the preceding hourly **or** SPECI observation.

10.3.5.1 Ceiling

Ceiling decreases to less than or, if below, increases to equal or exceed the following coded values of height (see 10.2.8.6).

- 15
- 10
- 5
- 4*
- 3
- 2*
- 1*
- The additional limits as specified in Appendix V, entitled "IFR approach and alternate limits."

***Note**: Criteria marked with an asterisk (*) are applicable only at aerodromes with precision approach equipment (i.e. ILS, MLS, GCA) and only down to and including the lowest published minima for these aerodromes.

10.3.5.2 Sky condition

A layer aloft is observed below:

1) 300 m (coded height 10) and no layer aloft were reported below this height in the report immediately previous.
2) The highest minimum for IFR straight-in landing or take-off, and no layer was reported below this height in the report immediately previous.

10.3.5.3 Visibility

Prevailing visibility decreases to less than or, if below, increases to equal or exceed:

- 3 miles
- 1 1/2 miles
- 1 mile
- 3/4 mile*
- 1/2 mile
- 1/4 mile*
- The additional limit as specified in Appendix V, entitled "IFR approach and alternate limits."

***Note (1)**: Criteria marked with an asterisk (*) are applicable only at aerodromes with precision approach equipment (i.e. ILS, MLS, GCA) and only down to and including the lowest published minima for these aerodromes.
Note (2): Under rapidly varying conditions of low ceiling and/or visibility, observers should, when possible, apply the provisions for the reporting of variation (see 10.2.8.10 and 10.2.9.2).

10.3.5.4 Tornado, waterspout or funnel cloud

- Is observed
- Disappears from sight
- Is reported by the public (from reliable sources) to have occurred within the preceding six hours

10.3.5.5 Thunderstorm

- Begins
- Ends (SPECI observation **shall** be made when 15 minutes have elapsed without the occurrence of thunderstorm activity [see 3.3.1])

Example: (See 10.4.2.3, “Three periods of thunder and the necessary entries in columns 2, 3 and 4”) SPECI would be required at 1210 for the beginning of the TS. SPECI at 1240 for ending the TS at 15 minutes past 1225. At 1250 another SPECI to begin another TS. At 1300, hourly observation. At 1345 another SPECI to end the TS.

10.3.5.6 Precipitation

When any of the following begin, end or change intensity:

- Freezing rain
- Freezing drizzle
- Ice pellets (showery and non-showery)
- Rain
- Rain showers
- Drizzle
- Snow
- Snow showers
- Snow grains
- Hail
- Snow pellets
- Ice crystals begin or end

SPECIs **shall** be taken as required to report the beginning and ending of each individual type of precipitation, regardless of simultaneous occurrences of other types. A leeway of up to 15 minutes is allowed after the ending of precipitation before a SPECI is mandatory.

Changes in character of precipitation do not require a SPECI if the break in precipitation does not exceed 15 minutes and there is no change to the intensity of the precipitation.

Example:
-RA begins or -RA ends: SPECI is required
-RA changes to RA: SPECI is required
-RA changes to SHRA: SPECI is required
-RA changes to -SHRA: SPECI is not required
-RA changes to -RA INMT: SPECI is not required

10.3.5.7 Obstruction to vision

SPECI **shall** be taken to report the beginning or ending of freezing fog.

10.3.5.8 Temperature

- The rounded temperature increases by 5 °C or more from the previous reported value and the previous reported value was 20 °C or higher.
- The temperature decreases to a reported value of 2 °C or lower.

Note: At sites designated by NAV CANADA as listed in Appendix II, entitled “Stations where SPECI reports are required for temperature changes.”

10.3.5.9 Wind

- Speed (two-minute mean) increases suddenly to at least double the previously reported value and exceeds 30 kts.
- Direction changes sufficiently to fulfill criteria required for a "Wind Shift,” (see 7.1.4.1).

10.3.5.10 Volcanic eruption

The occurrence of a volcanic eruption **shall** be reported by a SPECI observation when observed. The following data **shall** be included in Remarks when known:

- Name of the volcano.
- Direction (16 points, true, of the compass) and approximate distance (statute miles) of the volcano.
- Date/time (UTC) of eruption.
- Height and direction of movement of ash cloud
- Other pertinent data.

Example of Remarks: MT ST HELEN VOLCANO 60 MI WNW ERUPTED 091025 ASH CLOUD TO 300 MOVG RPDLY SE

Post eruption volcanic ash clouds should be included in Remarks of hourly and SPECI observations as long as significant. Volcanic ash may be reported as smoke, haze or dust in column 40. Dust is normally reserved for cases in which a deposit is being made.

10.3.5.11 Observer’s initiative

The criteria specified in the preceding paragraphs **shall** be regarded as the minimum requirements for taking SPECI observations. In addition, any weather condition that in the opinion of the observer, is important for the safety and efficiency of aircraft operations or otherwise significant, **shall** be reported by a SPECI observation.

10.3.5.12 Graphic reference guide for reporting a SPECI

Appendix I, Graphic reference guide, may be used to assist in the identification of criteria for the issuance of special (SPECI) weather observations. Note that temperature criteria are only to be applied at sites specified by NAV CANADA.

10.3.6 Check observations

Check observations are taken during the time between hourly observations to ensure that significant changes in weather do not remain unreported. If such an observation does not reveal a significant change, it is designated as a "check observation." If a significant change has occurred, the report is treated in every way as a "SPECI observation."

10.3.6.1

A check observation **shall** be taken whenever a pilot report is received from an aircraft within 1 1/2 miles of the boundary of an airfield, and the PIREP indicates that weather conditions as observed by the pilot differ significantly from those reported by the current observation, i.e., the PIREP indicated that a SPECI report may be required. This check observation may result in the transmission of a SPECI observation.

10.3.6.2

Check observations may be made on the observer's initiative.

10.3.6.2.1

The contents of check observations made at the request of a forecast office **shall** consist of sky condition, visibility, weather and obstruction to vision, wind, clouds and/or obscuring phenomena, and Remarks if applicable.

10.3.6.2.2

Requests for a check observation of a specific element may be limited to the item requested. For example, the control tower may request a check of the surface wind, or of the altimeter setting, and only the requested item need be observed and recorded.

10.3.7 Accident observation

Immediately upon learning of an aircraft accident, at or in the vicinity of the weather observing station, the observer **shall** make an accident observation unless a complete observation has been made subsequent to the accident. The accident observation **shall** be recorded on Form 63-2322 in Section II and it **shall** be as complete and accurate as possible, with particular care being taken to include in "Remarks" or under "Notes" any meteorological facts which might relate to the accident, or which might be of significance to the aircraft accident investigator.

10.3.7.1

Immediately upon completion of the accident observation or the complete observation (see 10.3.7), the original copy of Form 63-2322 containing the record of observations until that time for that day, **shall** be secured under lock and key to prevent any tampering, mutilation or destruction of the original record.

Note: If any of the observed elements warrant a SPECI as defined in 10.3.5, (Criteria for taking a SPECI) a full SPECI **shall** be transmitted and recorded on Form 63-2322.

10.3.7.2

The remaining observations for the day **shall** be recorded on a new Form 63-2322 and this form **shall** also contain an accurate transcription of the reports which have been secured under lock and key, in order that a complete record may be forwarded to Meteorological Service of Canada Headquarters at the end of the month. There **shall** also be a notation on each form indicating which observations were transcribed.

10.3.7.3

Requests for weather reports and forecasts normally transmitted on Meteorological Service of Canada circuits may be answered without question. Requests for professional advice or opinion or information other than that referred to above should be forwarded to the Chairman, Transportation Safety Board of Canada (TSB) for clearance with the board.

10.3.7.4

The original of Form 63-2322, containing the accident observation, **shall** be released only:

- To a TSB official, or
- As per the instructions from either the Regional Director General, Environment Canada, or the Chairman, TSB.

Note (1): If the original is removed, a receipt or equivalent should be placed on file.
Note (2): At stations where suitable photocopying equipment is available, the observer may substitute a clean, legible photocopy in place of the original copy of Form 63-2322 referred to in 10.3.7.1, 10.3.7.4, and 10.3.7.5. The photocopy would then be used for aircraft accident investigation purposes and it would be unnecessary to transcribe reports as detailed in 10.3.7.2.
Note (3): At Department of National Defence (DND) bases, the form **shall** be released according to local "SOPs."

10.3.7.5

After having been admitted as evidence and returned to the meteorological office, if not required as evidence within a three-month period, the original of Form 63-2322 **shall** be placed on a permanent aircraft accident file.

10.3.7.6

The officer-in-charge **shall** interview all meteorological personnel who were on duty at the time of the accident, and write down all relevant information as derived from the various personnel responsible to them, as soon as possible after the accident. Factual information **shall** be clearly separated from hearsay. Rumours or theories may be recorded, but should be so designated in the notes.

10.3.8 Transmission of hourly observations

10.3.8.1

Several different methods of data entry are used to transmit hourly observations on MSC meteorological circuits, referred to as the National Computer Communications System (NCCS). The following list shows some of the data entry systems:

- WinIDE (Windows Interactive Data Entry)
- MIDS (Multi-purpose Informative Display System)
- HWOS (Human Weather Observation System)

10.3.8.2

Requested check reports **shall** be forwarded immediately to the office making the request. Check reports taken on the observer's initiative **shall** be given such local distribution as the observer deems necessary.

10.4 Section I – observed data and computations

Stations which make synoptic observations **shall** complete the entire section (columns 1-14 and Lines 15-22) as part of the synoptic observation (see 13.3 for details). Stations which make hourly observations only, at any of the times of the main and intermediate synoptic hours, **shall** complete this section in part, omitting entries in columns 5 to 14.

10.4.1 Column 1 – notes

Notes on unusual weather, (see 3.12), local conditions affected by the weather etc., **shall** be entered in Column 1. This column **shall** also be used for the recording of any occurrences or events of meteorological significance, for example, damage to life or property by high winds, tornadoes or hail that cannot be recorded elsewhere on the form.

10.4.1.1 Column 1 – instrument defects and changes

Enter details of changes in thermometers and other instruments, the time at which instruments became or remained unserviceable, etc. For example: motor psychrometer unserviceable at 1800 UTC; wind equipment remained unserviceable due to freezing rain, max thermometer XC99-0421 replaced by XC96-0075 at 1155 UTC. Similar entries are required on Form 63-2325 (see 8.1.2).

10.4.2 Columns 2, 3 and 4 – duration of weather and/or obstruction to vision

10.4.2.1 Column 2

In Column 2 record each occurrence (see 10.4.2.4 to 10.4.2.7) of any of the weather phenomena listed in 10.2.10 (except VC codes, see 10.7.). The weather phenomena **shall** be designated by the appropriate symbols with separate entries to indicate different intensities. The symbols and possible variations in intensity are also shown in 10.2.10. These entries should be recorded in chronological order with respect to the time of beginning of the phenomenon.

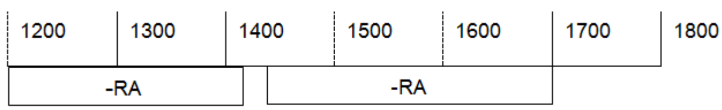
10.4.2.2 Columns 3 and 4

In columns 3 and 4 record the time (UTC) of beginning and ending for each entry in Column 2. If, due to the nature of the observing program, the time(s) is (are) not known, enter "M" for missing.

10.4.2.3

When recording the beginning and ending of thunder, intermittent precipitation or showery precipitation or obstruction to vision, the record in these columns need not show (unless there is a local need) intervals of less than 15 minutes between occurrences of thunder, precipitation or obstructions to vision. When 15 minutes have elapsed since the last occurrence of thunder, showery or intermittent precipitation or obstructions to vision, the phenomenon is considered to have ended 15 minutes ago, and the appropriate entry **shall** be made in Column 4.

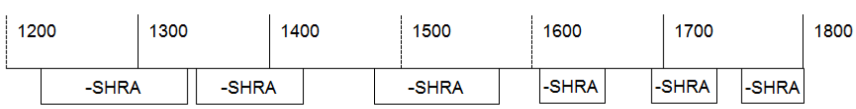
Example (1):



Duration of Weather and/or Obstructions to Vision					
(UTC)					(UTC)
Type 2	Bgn 3	End 4	Type 2	Bgn 3	End 4
-RA	1200	1408			
-RA	1430	1700			

Example (1) illustrates two periods of rain and the necessary entries in columns 2, 3 and 4.

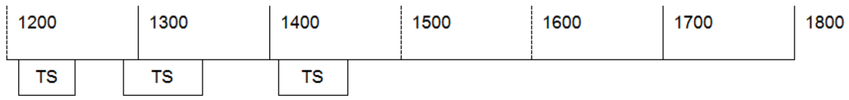
Example (2):



Duration of Weather and/or Obstructions to Vision					
(UTC)					(UTC)
Type 2	Bgn 3	End 4	Type 2	Bgn 3	End 4
-SHRA	1215	1418			
-SHRA	1445	1542			
-SHRA	1608	1635			
-SHRA	1651	1723			
-SHRA	1738	1800			

Example (2) illustrates five periods of rain showers and the necessary entries in columns 2, 3 and 4.

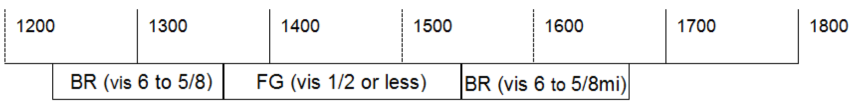
Example (3):



(UTC)	Duration of Weather and/or Obstructions to Vision				(UTC)
Type 2	Bgn 3	End 4	Type 2	Bgn 3	End 4
TS	1210	1225			
TS	1250	1330			
TS	1404	1438			

Example (3) illustrates three periods of thunder and the necessary entries in columns 2, 3 and 4.

Example (4):



(UTC)	Duration of Weather and/or Obstructions to Vision				(UTC)
Type 2	Bgn 3	End 4	Type 2	Bgn 3	End 4
BR	1215	1340			
FG	1340	1522			
BR	1522	1638			

Example (4) illustrates mist (BR) with visibility between six miles and five-eighths mile, changing to fog (FG) with visibility one-half mile or less and the necessary entries in columns 2, 3, and 4, then changing back to mist.

Note: A period of precipitation, thunder, etc., refers to the interval between the beginning and ending of the phenomenon, disregarding intervals of less than 15 minutes between occurrences. However, entries in columns 2, 3 and 4 are also required to show the duration of each intensity as illustrated (see 10.4.2.3 Example (2)).

10.4.2.4

Each occurrence of mist, haze, smoke, blowing snow, blowing sand, blowing dust, duststorm, sandstorm, dust haze, shallow fog patches, fog patches, fog covering part of aerodrome, dust/sand whirls or volcanic ash, alone or in combination with other phenomena, **shall** be recorded in these columns if observed with a prevailing visibility of six miles or less.

10.4.2.5

Each occurrence of fog or freezing fog, alone or in combination with other phenomena **shall** be recorded in these columns if observed with a prevailing visibility of 1/2 mile or less.

10.4.2.6

Each occurrence of volcanic ash, alone or in combination with other phenomena **shall** be recorded in these columns if observed regardless of the prevailing visibility.

10.4.2.7

Each occurrence of drifting dust, drifting sand, or drifting snow alone or in combination with other phenomena **shall** be recorded in these columns if observed regardless of the prevailing visibility.

10.4.2.8

If additional space is required for entries in columns 2, 3 and 4 use Column 1.

10.4.3 Hour (UTC)

No entries are required in this column; the times shown and the 24-hour. value indicator are guides for subsequent entries.

10.4.3.1

Columns 5 to 14 of Form 63-2322 are not filled in at stations that do not do synoptic reports.

10.4.4 Column 5 – corrected maximum

Record the corrected reading of the maximum thermometer in degrees and tenths Celsius in the space indicated, e.g. 1.4, 0.4 etc.. At the bottom of Column 5, enter the maximum temperature in degrees and tenths for the preceding 24 hours.

10.4.4.1

At stations which operate during part of the day, seven days a week but do not take an observation at 0600 UTC, the thermograph chart **shall** be used to obtain the maximum temperature to the nearest degree for the period between the previous reading of the maximum thermometer and 0600 UTC. Apply the appropriate correction (see 5.9.2 (3) (ii)) and record this 0600 UTC corrected value in degrees and tenths followed by the letter "E".

Example: 25.0E, -4.0E, etc.

Note: It is only at 0600 UTC that an entry is required for a time when no observation was taken.

10.4.4.1.1

When the 0600 UTC maximum temperature is obtained from the thermograph chart, the thermograph chart must also be used in conjunction with the maximum thermometer to obtain the next maximum temperature. For example:

- At 1200 UTC, the maximum thermometer reads 9.4 and it is obvious from the thermograph chart that this maximum temperature occurred between 0600 UTC and 1200 UTC. Record 9.4 as the maximum temperature at 1200 UTC.
- At 1200 UTC the maximum thermometer reads 9.4 and it is obvious from the thermograph chart that this maximum temperature occurred before 0600 UTC. From the thermograph chart obtain the highest temperature since 0600 UTC. Apply the appropriate correction (see 5.9.2 (3) (ii)), and record the corrected reading in degrees and tenths, followed by the letter "E" as the 1200 UTC maximum temperature. Example: 15.0E, -3.0E.

10.4.4.2

If during a given period, a dry-bulb thermometer registers a higher temperature than that indicated by the maximum thermometer for the same period, record the maximum thermometer reading in brackets and immediately above, record the dry-bulb temperature in the same space. In this case the dry-bulb temperature **shall** be considered for coding purposes and in determining the 24-hour maximum temperature. Further details **shall** be recorded under “Notes,” Column 1.

10.4.4.3

When the maximum thermometer is unserviceable for the entire period under consideration, and consecutive hourly dry-bulb temperatures are available, record the highest dry-bulb reading as the maximum temperature. Enclose this value in brackets and explain under “Instrument Defects and Changes,” Column 1.

Note: When a serviceable maximum thermometer is available for only a portion of the period, its reading **shall** be entered in Column 5 and considered in conjunction with the appropriate dry-bulb readings, to determine the maximum temperature.

10.4.4.4

At stations collocated with an automatic station, the maximum temperature may, if necessary, be obtained from the input message or from either the hourly or synoptic messages generated by the automatic station. Maximum temperatures derived from automatic stations **shall** be recorded in degrees and tenths. A note **shall** be entered in Column 1 to indicate that the maximum temperature is derived from the automatic station.

10.4.4.5 Column 6 – $T_XT_XT_X$ – maximum temperature in degrees and tenths Celsius

The small figure inserted in the upper left hand corner of each space indicates the period preceding the time of observation for which a maximum temperature is required, except at 1200 UTC the entry in Column 6 **shall** be the 24-hour maximum for the 24-hour period ending six hours ago. If, however, the 0600 UTC observation was not taken, record at 1200 UTC the maximum for the previous 24 hours.

10.4.4.6

The entry in Column 6 **shall** be selected, without rounding, from the appropriate entries in Column 5.

10.4.5 Column 7 – corrected minimum

Record the corrected reading of the minimum thermometer in degrees and tenths Celsius in the space indicated. At the bottom of Column 7 enter the minimum temperature in degrees and tenths for the preceding 24 hours.

10.4.5.1

At stations which operate during part of the day, seven days a week, but do not take an observation at 0600Z the thermograph chart **shall** be used to obtain the minimum temperature, to the nearest degree, for the period between the previous reading of the minimum thermometer and 0600 UTC. Apply the appropriate correction (see 5.9.2 (3) (ii)) and record this 0600 UTC corrected value in degrees and tenths followed by the letter "E".

Example: 15.0E, -2.0E

Note: It is only at 0600 UTC that an entry is required for a time when no observation was taken.

10.4.5.1.1

When the 0600 UTC minimum temperature is obtained from the thermograph chart, the thermograph chart must also be used in conjunction with the minimum thermometer to obtain the next minimum temperature.

Example:

- At 1200 UTC, the minimum thermometer reads 9.4 and it is obvious from the thermograph chart that the minimum temperature occurred between 0600 UTC and 1200 UTC. Record 9.4 as the minimum temperature at 1200 UTC.
- At 1200 UTC, the minimum thermometer reads 9.4 and it is obvious from the thermograph chart that this minimum temperature occurred before 0600 UTC. From the thermograph chart obtain the lowest temperature since 0600 UTC. Apply the appropriate correction (see 5.9.2 (3) (ii)) and record the corrected value in degrees and tenths followed by the letter "E", as the 1200 UTC minimum temperature.
  Example: 15.0E, -3.0E

10.4.5.2

If during a given period a dry-bulb thermometer registers a lower temperature than that indicated by the minimum thermometer for the same period, record the minimum thermometer reading in brackets and in the same space and immediately above, record the dry-bulb temperature. In this case the dry-bulb temperature **shall** be considered for coding purposes and in determining the 24-hour minimum temperature. Further details **shall** be recorded under “Notes”, Column 1.

10.4.5.3

When the minimum thermometer is unserviceable for the entire period under consideration and consecutive hourly dry-bulb readings are available, record the lowest dry-bulb reading as the minimum temperature. Enclose this value in brackets and explain under “Instrument Defects and Changes”, Column 1.

Note: When a serviceable minimum thermometer is available for only a portion of the period, its reading **shall** be entered in Column 7 and considered in conjunction with the appropriate dry-bulb readings, to determine the minimum temperature.

10.4.5.4

At stations collocated with an automatic station, the minimum temperature may, if necessary, be obtained from the input message or from either the hourly or synoptic messages generated by the automatic station. Minimum temperatures derived from automatic stations **shall** be recorded in degrees and tenths.

Example: -27.4, -23.0

A note **shall** be entered in Column 1 to indicate that the minimum temperature is derived from the automatic station.

10.4.6 Column 8 – $T_nT_nT_n$ - minimum temperature in degrees and tenths Celsius

The small figure inserted in the upper left-hand corner of each space indicates the period preceding the time of observation for which a minimum temperature is required. The entry in Column 8 **shall** be selected, without rounding, from the appropriate entries in Column 7.

Note: At 1200 and 1800 UTC, it is necessary to check the entries recorded in Column 7 of Form 63-2322 for the previous day, e.g., at 1200 UTC the six-hour minimum recorded at 0600 UTC of the previous day **shall** also be considered when determining the entry in Column 8.

10.4.7 Column 9 – snowfall

Enter the amount, (see 3.7.6 and 3.7.7) in centimetres and tenths (nearest 0.2 cm) in the space indicated. When there is less than a measurable amount, that is, less than 0.2 cm, record this as a "trace" by entering "TR". Enter "0" for none.

10.4.7.1

At the bottom of Column 9 enter the total amount of snowfall for the previous 24 hours. Enter "TR" for a trace; enter "0" for none.

Note: The addition of two or more "TR" amounts yields only a "TR".

10.4.7.2

Stations which operate during part of the day, seven days a week, but do not take the 0600 UTC observation, **shall** estimate the amount of snowfall for the period between the time of the previous snowfall measurement and 0600 UTC. Under these circumstances the value entered for 0600 UTC, if greater than a trace, **shall** be followed by the letter "E".

Note: It is only at 0600 UTC that an entry is required for a time when no observation was taken.

10.4.7.2.1

When the snowfall for 0600 UTC was determined by estimation (see 10.4.7.2), the snowfall amount for the next observation **shall** be the measured amount minus the amount assigned to the 0600 UTC observation.

10.4.8 Column 10 – snowfall (water equivalent)

Enter the amount, in millimetres and tenths, in the space indicated. When there is less than a measurable amount, that is, less than 0.2 mm, record this as a "trace" by entering "TR". Enter "0" for none. At the 0600 UTC observation, compute the total amount of snowfall water equivalent for the preceding 24-hour period and enter this value at the bottom of Column 10. Enter "TR" for a trace*. Enter "0" for none.

Note (1): At stations equipped with a snow gauge, this is the "measured" water equivalent. At stations not equipped with a snow gauge, it is the "estimated" (snowfall divided by ten and converted to mm) water equivalent.
***Note (2)**: The addition of two or more "TR" amounts yields only a "TR".

10.4.9 Column 11 – rainfall

Enter the amount in millimetres and tenths in the space indicated.

Example: 12.0, 0.4

When there is less than a measurable amount, that is, less than 0.2 mm, record this as a trace by entering "TR". Enter "0" for none.

10.4.9.1

When the observer is certain that the water measured in the rain gauge has resulted from the formation of dew alone, the word "dew" **shall** be written in brackets before the amount, e.g., (dew) 0.2

10.4.9.2

At the bottom of Column 11, enter the total amount of rainfall (less dew) for the preceding 24-hour period. Enter "TR" for a trace*. Enter "0" for none.

10.4.9.3

Stations which operate during part of the day, seven days a week, but do not take the 0600 UTC observation, **shall** determine from the recording rain gauge (or from the recording rain gauge of a collocated automatic station), or by estimation if necessary, the amount of rainfall for the period between the time of the previous standard gauge measurement and 0600 UTC. Under these conditions, the value entered at 0600 UTC, if greater than a trace, **shall** be followed by the letter "E".

Note: It is only at 0600 UTC that an entry is required for a time when no observation was taken.

10.4.9.3.1

When the rainfall for 0600 UTC was determined from a recorder chart, collocated automatic station, or by estimation, the rainfall amount for the next observation **shall** be the measured amount from the standard gauge **minus the amount assigned to the 0600 UTC observation**.

10.4.10 Column 12 – total precipitation

Enter the amount in millimetres and tenths in the space indicated. Example: 8.2, 0.4, etc. This value is the sum of the water equivalent and rainfall as entered in columns 10 and 11. When there is less than a measurable amount (less than 0.2 mm) record this as a trace by entering "TR". Enter "0" for none. At the bottom of Column 12 enter the total amount of precipitation for the preceding 24 hours.

***Note**: The addition of two or more "TR" amounts yields only a "TR".

10.4.10.1

When dew occurs alone, its amount **shall not** be included in the total precipitation recorded in Column 12.

10.4.10.2

The total amount of precipitation for the preceding 24 hours **shall** agree with the sum of the 24-hour snowfall water equivalent and the 24-hour rainfall as entered at the bottom of columns 10 and 11.

10.4.11 Column 13 – total 24-hour precipitation

Entries are made in this column only at those stations at which synoptic observations are transmitted (see 13.3.12).

10.4.12 Column 14 – depth of snow on ground

Enter the total depth of snow on the ground in whole centimetres. Enter "TR" for a trace (less than 0.5 cm) and enter "0" for none.

10.4.13 Time (UTC)

Lines 15 to 22 **shall** be completed whenever an observation is made at 0900, 1200, 1500, 1800, 2100, 0000, 0300 or 0600 UTC. Space has been left in these time blocks for observers to fill in the current dry-bulb temperature (T0) and the temperature of 12 hours ago (T-12). The small numbers beneath the 0900, 1200, etc., serve as reminders of the times to which temperatures of 12 hours ago apply.

Example: The temperature of 12 hours ago, which should be used at 0900 UTC, is the temperature from the previous day at 2100 UTC.

10.4.13.1

At sites equipped with data entry screens that compute pressure, entries to lines 15 to 17 and 19 to 22 of Form 63-2322 are not required. Line 18 **shall** be completed as per 10.4.16 and 10.4.17. Entries in Column 33 (sea-level pressure), Column 39 (altimeter setting), Column 41 (Remarks - reduction of pressure to sea level only when manually calculated, station pressure) and Column 42 (appp) are still required and will be obtained from the data entry screen.

10.4.13.1.1

If, for any reason, tables are used to do manual pressure calculations (at sites equipped with data entry screens that compute pressure), complete lines 15-22. Entries in Column 33 (sea level pressure), Column 39 (altimeter setting), Column 41 (reduction to sea level reported in accordance with 10.2.11.1), and Column 42 (appp), will be obtained from the calculated values in Lines 15-22. Appropriate entries are also required in Column 1, Notes, and on Form 63-2325 (“Monthly Summary of Instrument Malfunctions, Changes and New Installations”) indicating the hours that the tables were used for pressure computations.

10.4.13.1.2

At sites where an AWOS is used to report station pressure, the value will be entered on Line 20.

10.4.14 Line 15 – sum

Enter the sum of the dry-bulb temperature of 12 hours previously and the current dry-bulb temperature.

Note: When the temperature of 12 hours ago cannot be obtained from a dry-bulb reading, a collocated automatic station, or a thermograph, it **shall** be estimated (see 4.2.3.2).

10.4.15 Line 16 – mean

Divide the sum by two and round to one decimal place to obtain a temperature mean and record this value. This mean **shall** be used for computing the reduction to sea level (line 21) using the tables supplied for this purpose.

10.4.16 Line 17 – attached thermometer

Entry not required when digital barometer in use.

10.4.17 Line 18 – barometer as read

Enter the barometer as read (nearest tenth hPa). Example: 968.9

10.4.18 Line 19 – total correction

From the table for the reduction of the barometer reading to station pressure, determine the total correction and enter this value using the appropriate sign. Example: +1.2, -0.7, etc.

10.4.19 Line 20 – station pressure

Compute the station pressure from the barometer as read and the total correction. Record the station pressure (nearest tenth hPa).

10.4.20 Line 21 – reduction to sea level

Enter the reduction to sea level value as determined from the sea level reduction table (see 4.2.3).

10.4.21 Line 22 – sea level pressure

Add the reduction to sea level to the station pressure to obtain the sea level pressure. Record the sea level pressure (nearest tenth hPa). Example: 1018.9

10.5 Section IV

See 13.6 for the summary for the climatological day ending at 0600 UTC.

Note: See 13.6.13.1 to 13.6.13.6 for more detailed instructions about programs A, B, C, D, E, and F.

10.5.1 Column 69 – checked by

The Officer-in-Charge or a designated staff member **shall** check, preferably on a daily basis, the accuracy and legibility of all data recorded on Form 63-2322. Upon completion of this check, the reviewing officer **shall** record their name and their signature in Column 69 (Column 69 is found in the extreme upper left corner of the form).

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10.6 Typical Entries – Form 63-2322

10.6.1 Example 1 – Completed Form 63-2322

Environment Canada / Environnement Canada
Meteorological Service of Canada / Service météorologique du Canada

SURFACE WEATHER RECORD AT KARNWAY (YTT) PROVINCE ON F

STATION NAME AS IN METSTAT

69 CHECKED, CERTIFIED COMPLETE & CORRECT BY **M. ANOBS** *M. Anobs*

I OBSERVED DATA AND COMPUTATIONS

1 NOTES AND INSTRUMENT DEFECTS AND CHANGES
AIRCRAFT ACCIDENT REPORTED 10NM EAST OF AIRFIELD AT 1030
DEWCEL COMPARISON DONE AT 1630
D.B. -0.1 / D.P. +0.3
1800 MAX FM 1800 D.B.
0000 MIN FM 1800 D.B.

(UTC) Type 2	Duration of Weather and/or Obstructions to Vision Bgn 3	End 4	Type 2	Bgn 3	(UTC) End 4
BR	1115	1236			
FZFG	1236	1500			
BR	1500	1643			
-SN	2258	0559			
BLSN	0548	0559			
DRSN	0559	→			
SN	0559	→			

HOUR (UTC)	Corrected Max (tenths) 5	↓	$T_xT_xT_x$ 6	Corrected Min (tenths) 7		$T_nT_nT_n$ 8
12	-18.7	(24)	-21.1	-21.6	12	-23.1
18	-14.9 (-15.0)	12	-14.9	-19.0	24	-23.1
00	-6.9	12	-6.9	-14.9 (-14.7)	18	-21.6
06	-4.2	24	-4.2	-8.2	24	-21.6
24-HR	-4.2			-21.6		

HOUR (UTC)	Snowfall (cm & tenths) 9	Water equivalent (mm & tenths) 10	Rainfall (mm & tenths) 11	Total precip. (mm & tenths) 12	24-hour precip. (mm & tenths) 13	Depth snow on ground (whole cm) 14
12	0	0	0	0	0	17 *
18	0	0	0	0	0	17
00	TR	TR	0	TR	TR	17
06	3.2	3.0	0	3.0	3.0	20
24-HR	3.2	3.0	0	3.0		

II HOURLY OBSERVATIONS

Corrected wet bulb °C 23	Relative humidity 24	Total opacity 25	Total amount 26	Type 27	Date UTC 28	Hour (UTC) 29	Sky condition 30	Visibility (mi.) 31	Weather and obstructions to vision 32
		0	0	SA	09	0700	CLR	15+	
		0	1	SA	09	0800	240 -FEW	15+	
		1	2	SA	09	0900	240 -FEW	15+	
		2	4	SA	09	1000	240 -SCT	15+	
		2	3	C	09	1030	240 -FEW	12	
		4	6	SA	09	1100	240 -BKN	7	PRFG
		6	6	SP	09	1123	-X	2 1/2	BR
		8	8	SA	09	1200	-X	2	BR
		10	10	SP	09	1236	W2 X	1/4	FZFG
		10	10	SA	09	1300	W1 X	1/4	FZFG
		10	10	SP	09	1328	W0 X	1/8	FZFG
		10	10	SA	09	1400	W0 X	1/8	FZFG
		10	10	SP	09	1441	W7 X	1/4	FZFG
		10	10	SA	09	1500	A15 X	2	BR
		8	8	SP	09	1517	-X E240 BKN	3	BR
		7	9	SA	09	1600	-X E240 BKN	5	BR
		9	10	SA	09	1700	140 SCT E200 OVC	7	BCFG
		10	10	SA	09	1800	E140 BKN 200 OVC	15	
		10	10	SA	09	1900	E120 OVC	15	
		9	10	SA	09	2000	E120 OVC	20	
		10	10	SA	09	2100	E100 OVC	20	
		10	10	SA	09	2200	E90 OVC	12	
		10	10	SA	09	2300	E90 OVC	12	-SN
		10	10	SP	09	2332	E75 OVC	8	-SN
		10	10	SA	10	0000	E70 OVC	7	-SN
		10	10	SA	10	0100	E70 OVC	6	-SN
		10	10	SA	10	0200	9 FEW M70 OVC	4	-SN
		10	10	SA	10	0300	8 SCT M50 OVC	3	-SN
		10	10	SP	10	0311	M6 BKN 40 OVC	3	-SN
		10	10	SA	10	0400	M8 BKN 30 OVC	3	-SN
		10	10	SP	10	0429	M8 BKN 30 OVC	1	-SN
		10	10	SA	10	0500	M5 BKN 25 OVC	1	-SN
		10	10	SP	10	0539	5 SCT P8 X	3/4	-SN
		10	10	SP	10	0548	5 SCT P8 X	3/4	-SN BLSN
		10	10	SA	10	0600	5 SCT P8 X	1/2	SN DRSN

III CODED SYNOPTIC REPORTS

YY	GG	iw	IIiii	i_Ri_xhVV 31	Nddff 26 (00fff)	$1s_nTTT$ 34	$2s_nT_dT_dT_d$ 35	$3P_oP_oP_oP_o$ 20
09	12	4	71999	11932	03603	11189	21219	30040
	18	4	71999	11974	80610	11149	21178	39990
10	00	4	71999	11861	81012	11071	21086	39970
	06	4	71999	11208	91620	11044	21057	39873

TIME (UTC)	0900	1200	1500	1800	2100	0000	0300	0600
Temperature T_{-12}	21 -23.4	00 -21.9	03 -21.6	06 -21.3	09 -20.4	12 -18.9	15 -17.3	18 -14.9
Temperature T_o								
15 Sum (T_{-12} + T_o)								
16 Mean (Sum ÷ 2)								
17 Attached thermometer								
18 Barometer as read	1008.0	1007.7	1005.8	1003.0	1002.0	1000.8	997.1	991.0
19 Total correction								
20 Station pressure								
21 Reduction to sea level								
22 Sea level pressure								

IV SUMMARY FOR THE CLIMATOLOGICAL DAY E

Day (2 figures)	TEMPERATURE Maximum tenths	TEMPERATURE Minimum tenths	REL. HUMIDITY Maximum	REL. HUMIDITY Minimum	6 HOUR TO 1200 Z (mm & tenths)	6 HOUR TO 1800 Z (mm & tenths)
44	45	46	47	48	49	50
09	-4.2	-21.6	M	M	0	0

FROM 0601 09 FEB 20 06 TO 0600 10 FEB 20 06 LST = UTC - 5 HOURS

HOUR (UTC) DAY MONTH   HOUR (UTC) DAY MONTH

Sea level pressure (hPa)	Temperature °C (tenths) Dry-bulb	Dew-point	WIND Direction	Speed (kt)	Character	AT 06Z Altimeter setting (in.)	CLOUDS and/or OBSCURING PHENOMENA Type/Opacity	REMARKS (16.8)	(Stn. Pres.)	Tendency appp	TT_dOA	OBSERVER (Print)
33	34	35	36	37	38	39	40	41		42	42a	43
210	-21.2	-24.2	36	10		009			042			KM
211	-20.6	-23.6	36	07		010	CI		043			KM
213	-20.4	-24.4	35	08		010	CI1		045	2005		KM
210	-20.0	-23.8	36	06		009	CI2		042			KM
209	-20.0	-23.1	36	06		009	CI2		041			KM
208	-19.1	-22.6	01	04		009	CI4	VIS NE-SE 3 BR	040			KM
208	-19.0	-22.7	36	04		009	FG6		040			KM
205	-18.9	-21.9	01	04		008	FG8		040	6005		KM
203	-18.7	-20.1	01	03		008	FG10	CIG VRB 1-3	038			KM
202	-18.1	-19.4	00	00		008	FG10	RIME ON INDICATOR	037			KM
196	-18.0	-19.6	00	00		007	FG10		032			JD
193	-17.8	-20.1	00	00		005	FG10	RIME ON INDICATOR	028			JD
189	-17.5	-19.2	00	00		003	FG10		024			JD
185	-17.3	-18.4	02	04		002	FG10	VIS E 1 FROIN 350V050	020	8020		JD
180	-17.3	-18.4	04	05		000	FG7 CS1		015			JD
175	-16.2	-18.4	04	06		999	FG4 CS3		010			JD
169	-15.3	-19.7	05	08		998	AS4 CS5	VIS VRB 5-9	004			JD
155	-14.9	-17.8	06	10		993	AS7 CS3	SUN DIMLY VISBL	990	7030		JD
155	-13.7	-16.1	06	11		993	AS10		990			JD
147	-12.7	-14.9	09	15		991	AS9		982			JD
146	-11.5	-13.8	08	14		991	AS10	VIRGA SE	981	6009		JD
145	-9.9	-12.4	10	12		990	AS10		980			JD
143	-8.2	-9.7	11	12		990	AS10		978			LB
138	-7.8	-9.0	09	12		988	AS10		975			LB
133	-7.1	-8.6	10	11		987	AS10		970	8011		LB
123	-6.6	-8.0	11	15		984	AS10		960			LB
113	-5.9	-7.4	12	17		981	SF2 AS8	/S01/	950			LB
096	-5.6	-6.8	12	17		977	SF7 NS3		935	8035		LB
087	-5.5	-7.0	12	16		974	SF7 NS3		926			LB
079	-5.4	-7.1	14	15		972	SF7 NS3		918			LB
070	-5.1	-6.8	14	17		970	SF8 NS2		909			LB
061	-4.9	-6.3	14	18		967	SF8 NS2	/S02/	900			LB
047	-4.7	-6.0	15	15		964	SF5 SN5	VIS VRB 1/2 - 1 RVR RWY 15 3500FT	886			LB
040	-4.5	-5.8	15	32	G40	960	SF5 SN5	RVR RWY 15 3500FT	879			GL
034	-4.4	-5.7	16	20		959	SF5 SN5	PRESFR /S03/ RVR RWY 15 3500FT	873	8062		GL

4PPPP 33	5appp 42	$6RRRt_R$ 12	$7wwW_1W_2$ 32 2-4	$8N_hC_LC_MC_H$	333							
						11211	21231	44017	55			70000
40205	56005	60001	71011	8		909	931	(555	1	2	3	4)
40155	57030	60001	70341	86017	333	11149	21231	44017	5	70000	909	931
40133	58011	69901	77122	8802/	333	11069	21216	44017	79999	90921	931	
40034	58062	60031	77377	887XX	333	11042	21216	44020	70030	90973	93103	
						555	10032	20030	31540	40063		

ENDING AT 0600 UTC

AMOUNT OF PRECIPITATION — TOTAL AMOUNT: 0000 Z (mm & tenths)	0600 Z (mm & tenths)	24 HOUR AMOUNT: Rainfall (RA, SHRA, DZ, FZRA, FZDZ, SHGR) (mm & tenths)	Snowfall (SN, SHSN, PL, SHPL, SHGS, SG, IC) (cm & tenths)	Total Precipitation (mm & tenths)	DEPTH* of snow on the ground at 12Z (whole cm)	DAY WITH: Thunderstorms	Freezing Rain or Freezing Drizzle	Hail	Fog or Freezing Fog (Visibility less than 5/8 mi.)	Visibility 6 mi. or less: Smoke, Dust Haze, or Haze	Blowing Dust, Blowing Sand	Blowing Snow	Mean Wind of: 28 or more knots	34 or more knots	PEAK WIND SPEED GUST OR MEAN (leave blank if speed does not exceed 16 knots): Direction nearest 10 degrees (2 figures)	Speed	Time (UTC) (2 figures)
51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68
TR	3.0	0	3.2	3.0	17	0	0	0	1	0	0	1	1	0	15	40E	06

10.6.2 Example 2 – Completed Form 63-2322

Environment Canada Environnement Canada
Meteorological Service of Canada Service météorologique du Canada

SURFACE WEATHER RECORD AT KARNWAY (YTT) PROVINCE ON F
STATION NAME AS IN METSTAT

69 CHECKED, CERTIFIED COMPLETE & CORRECT BY **M. ANOBS** *M. Anobs*

I OBSERVED DATA AND COMPUTATIONS

1 NOTES AND INSTRUMENT DEFECTS AND CHANGES

POWER FAILURE 1355-1513
WIND DCTN ESTD AT 1400 AND 1500
DEWCEL UNSERVICEABLE 1355-1515 USED SLING PSYCHROMETER DURING THIS PERIOD
DEWCELL COMPARISONS:
1530 D.B. -0.1 D.P. +0.3
1545 D.B. -0.1 D.P. +0.1
1600 D.B. +0.1 D.P. +0.0
1615 D.B. -0.1 D.P. +0.1
PRESSURE CALCULATED FROM TABLES
AT 1400 AND 1500
1400, 1438 AND 1500 OBS SENT VIA YYZ

II HOURLY OBSERVATIONS

Corrected wet bulb °C 23	Relative humidity 24	Total opacity 25	Total amount 26	Type 27	Date UTC 28	Hour (UTC) 29	Sky condition 30	Visibility (mi.) 31	Weather and obstructions to vision 32
		10	10	SA	10	0700	P7 X	3/8	SN DRSN
		10	10	SA	10	0800	P6 X	1/4	SN BLSN
		10	10	SA	10	0900	6 FEW P9 X	3/8	SN BLSN
		10	10	SP	10	0915	-X 10 -SCT M30 OVC	3	-SN BLSN
		10	10	SA	10	1000	10 -BKN M30 OVC	4	-PL -SN
		10	10	SA	10	1100	10 -OVC E25 OVC	4	PL -SN
		10	10	SP	10	1137	10 -BKN E25 OVC	7	-FZRA
		10	10	SA	10	1200	10 -BKN E25 OVC	7	-FZRA
		10	10	SP	10	1222	10 SCT E25 OVC	6	FZRA
-0.1		10	10	SA	10	1300	10 SCT E25 OVC	7	-FZRA
		10	10	SA	9	1400	10 SCT E25 OVC	3	-FZRA BR
-0.1		10	10	SP	10	1438	-X B10 BKN 25 OVC	1 1/2	-RA BR
-0.1		10	10	SA	10	1500	-X B10 BKN 25 OVC	1/2	-RA BR
		10	10	SA	10	1600	-X E10 OVC	1 1/2	-RA BR
		10	10	SP	10	1700	-X E15 OVC	4	-RA BR
		10	10	SA	10	1726	E15 OVC	4	-RA BR
		10	10	SA	10	1800	E15 OVC	5	-RA BR
		9	9	SA	10	1900	15 FEW E20 BKN 280 BKN	10	
		8	9	SA	10	2000	15 FEW E20 BKN 120 BKN 280 BKN	20	
		9	9	SP	10	2100	E20 BKN 30 BKN	20	
		10	10	SA	10	2118	E20 BKN 30 OVC	2	-SHSN
		9	9	SP	10	2200	E20 BKN 30 BKN	1 3/4	-SHSN
		9	9	SA	10	2245	-X E20 BKN	3/8	SHSN
		9	9	SA	10	2300	-X E20 BKN	1/4	SHSN BLSN
		8	8	SP	10	2308	E20 BKN	3	-SHSN
		9	9	SA	11	0000	E20 BKN 100 BKN	4	-SHSN
		8	8	SA	11	0100	E20 BKN 100 BKN	5	VCSH
		6	6	SA	11	0200	20 SCT E100 BKN	10	-SHSN
		6	6	SP	11	0226	20 FEW M110 BKN	12	VCSH
		6	7	SA	11	0300	20 FEW M110 BKN	15+	VCSH
		5	6	SA	11	0400	20 FEW 110 -BKN	12	-SHSN
		3	3	SA	11	0500	110 FEW 250 FEW	15+	
		2	2	SP	11	0545	110 FEW 250 FEW	15	IC
		2	3	SA	11	0600	110 FEW 250 -FEW	6	IC

Duration of Weather and/or Obstructions to Vision

Type 2 (UTC)	Bgn 3	End 4	Type 2 (UTC)	Bgn 3	End 4
DRSN		0730	SHSN	2245	2308
SN		0915	BLSN	2255	2308
BLSN	0730	1000	-SHSN	2308	0450
-SN	0915	1137	IC	0545	
-PL	1000	1056			
PL	1056	1137			
-FZRA	1137	1222			
FZRA	1222	1257			
-FZRA	1257	1438			
BR	1315	1850			
-RA	1438	1857			
-SHSN	2118	2245			

HOUR (UTC)	Corrected Max (tenths) 5	$T_xT_xT_x$ 6	Corrected Min (tenths) 7	$T_nT_nT_n$ 8
12	-0.9	(24) -4.2	-4.5	12 -8.2
18	0.7	12 0.7	1.0	24 -14.9
00	3.4	12 3.4	-4.3	18 -4.5
06	-4.3	24 3.4	-14.8	24 -14.8
24-HR	3.4		-14.8	

III CODED SYNOPTIC REPORTS

HOUR (UTC)	Snowfall (cm & tenths) 9	Water equivalent (mm & tenths) 10	Rainfall (mm & tenths) 11	Total precip. (mm & tenths) 12	24-hour precip. (mm & tenths) 13	Depth snow on ground (whole cm) 14	YYGGiw (UTC)			IIiii	i_Ri_xhVV 31	Nddff 26 (00fff)	$1s_nTTT$ 34	$2s_nT_dT_dT_d$ 35	$3P_0P_0P_0P_0$ 20
12	11.4	11.2	0.8	12.0	15.0	27*	10	12	4	71999	11461	81921	11009	21011	39780
18	0	0	5.6	5.6	20.6	24		18	4	71999	11458	82224	10004	20004	39762
00	3.0	3.0	TR	3.0	23.6	23	11	00	4	71999	11556	73130	11043	21057	39813
06	0.8	0.8	0	0.8	21.4	23		06	4	71999	11974	23216	11148	21161	39913
24-HR	15.2	15.0	6.4	21.4											

TIME (UTC)	0900	1200	1500	1800	2100	0000	0300	0600
Temperature T_{-12}	21 -11.5	00 -7.1	03 -5.6	06 -4.4	09 -2.7	12 -0.9	15 -0.1	18 -0.4
Temperature T_0			0.1					
15 Sum (T_{-12} + T_0)			-5.5					
16 Mean (Sum ÷ 2)			-2.8					
17 Attached thermometer								
18 Barometer as read	966.7	961.8	980.1	980.1	979.6	985.0	990.0	994.9
19 Total correction			-3.8					
20 Station pressure			976.3					
21 Reduction to sea level			15.5					
22 Sea level pressure			991.8					

IV SUMMARY FOR THE CLIMATOLOGICAL DAY E

Day (2 figures)	TEMPERATURE Maximum tenths	TEMPERATURE Minimum tenths	REL. HUMIDITY Maximum	REL. HUMIDITY Minimum	6 HOUR TO 1200 Z (mm & tenths)	6 HOUR TO 1800 Z (mm & tenths)
44	45	46	47	48	49	50
10	3.4	-14.8	M	M	12.0	5.6

FROM 0601 10 FEB 20 06 TO 0600 11 FEB 20 06 LST = UTC - 5 HOURS

HOUR (UTC) DAY MONTH HOUR (UTC) DAY MONTH

Sea level pressure (hPa)	Temperature °C (tenths)		WIND			AT 06Z	CLOUDS and/or OBSCURING PHENOMENA	REMARKS				
	Dry-bulb	Dew-point	Direction	Speed (kt)	Character	Altimeter setting (in.)	Type/Opacity		(Stn. Pres.)	Tendency	TT_dOA	OBSERVER (Print)
33	34	35	36	37	38	39	40	41 (16.1)		appp 42	42a	43
031	-3.9	-4.5	17	23		955	SN10	/S02/ RVR RWY 15 1800FT	860			GL
012	-3.5	-4.0	16	25	G31	952	SN10	/S05/ RVR RWY 15 1200FT	851			GL
987	-2.7	-2.7	18	20	G26	946	SF2 SN8	/S08/ RVR RWY 15 1600FT	830	8043		GL
976	-2.5	-2.6	19	20		942	SN2 SF2 NS6		820			GL
965	-2.2	-2.3	19	17		939	SF5 NS5	/S10/	808			GL
949	-1.8	-2.3	19	20		934	SF3 NS7	/S11/	792			GL
943	-1.2	-1.7	18	20		932	SF5 NS5		786			GL
937	-0.9	-1.1	18	21		931	SF5 NS5		780	6050		GL
934	-0.9	-1.1	17	21		930	SF5 NS5		777			SW
930	-0.9	-1.1	19	22		929	SF5 NS5	CIG LWR SE	773			SW
925	0.0	-0.2	18	25E	G32	927	SF5 NS5	OBS TAKEN +07 CIG LWR S WND ESTD	768			SW
922	0.0	-0.2	19	26E		926	FG3 SF4 NS3	WND ESTD	765			SW
918	0.1	-0.1	18	28E	G	926	FG3 SF6 NS1	WND ESTD (15.5)	763	6017		SW
918	0.1	-0.2	18	25		926	FG7 SC3		763			SW
919	0.6	0.0	23	23		926	FG3 SC7	WSHFT 1655	764			SW
919	0.5	0.1	22	23		926	SC10		764			SW
917	0.4	0.4	22	25		925	SC10		762	7001		SW
915	2.6	1.6	24	27		925	CF2 SC5 CI2		760			SW
913	2.9	2.6	24	21		924	CU3 SC3 AC2 CI		758	6004		SW
913	0.6	0.0	25	26		924	TCU6 SC3	TCU E	758			SW
914	0.5	0.0	27	27		924	TCU7 SC3	VIS E 6	759			RR
915	0.4	0.0	27	23		925	TCU6 SC3		760			RR
926	-0.9	-1.1	30	30	G38	927	SN4 TCU5	VIS E 1 RVR RWY 33 2400FT	771			RR
937	-1.7	-2.2	29	40	G52	931	SN6 TCU3	/S02/ RVR RWY 33 2200FT	782			RR
950	-3.1	-4.2	29	31	G43	936	TCU8		795			RR
968	-4.3	-5.7	32	30	G35	941	TCU8 AC1	PRESRR /S03/	813	3055		RR
998	-6.3	-7.6	31	25		950	TCU6 AC2	OCNL -SHSN	843			RR
006	-7.4	-4.1	32	23		952	TCU4 AC2	/S01/	851			RR
014	-9.1	-8.7	32	21		954	TCU3 AC3	OCNL -SHSN	858			RR
022	-10.9	-13.2	32	20		956	TCU3 AC3	FROIN OCNL -SHSN	863	1050		RR
041	-11.8	-13.9	30	20		961	TCU2 AC3	FROIN	882			RR
057	-12.4	-14.5	32	18		966	AC1 CI2		898			RR
065	-13.6	-14.9	31	19		968	AC1 CI1	IC	906			RR
072	-14.8	-16.1	31	16		971	AC1 CI1		913	2050		RR

4PPPP 33	5appp 42	$6RRRt_R$ 12	$7wwW_1W_2$ 32 2-4	$8N_hC_LC_MC_H$	333	11042	21082	44027	55			70150
49937	56050	60121	76673	8572/		90983	93111	(555	1	2	3	4)
49917	57001	60061	76166	885//	333	10007	21149	44024	5	70206	90983	931
49968	53055	60031	78562	87230	333	10034	21045	44023	70236	90937	93103	
40072	52050	69981	77681	81031	333	10034	21148	44023	70214	90917	93101	
						555	10152	20150	3XXXX	4XXX3		

ENDING AT 0600 UTC

AMOUNT OF PRECIPITATION					DEPTH* of snow on the ground at 12Z (whole cm)	DAY WITH									PEAK WIND SPEED GUST OR MEAN (leave blank if speed does not exceed 16 knots)		
OTAL AMOUNT		24 HOUR AMOUNT								Visibility 6 mi. or less			Mean Wind of				
0000 Z (mm & tenths)	0600 Z (mm & tenths)	Rainfall (RA, SHRA, DZ, FZRA, FZDZ, SHGR) (mm & tenths)	Snowfall (SN, SHSN, PL, SHPL, SHGS, SG, IC) (cm & tenths)	Total Precipitation (mm & tenths)		Thunderstorms	Freezing Rain or Freezing Drizzle	Hail	Fog or Freezing Fog (Visibility less than 5/8 mi.)	Smoke, Dust Haze, or Haze	Blowing Dust, Blowing Sand	Blowing Snow	28 or more knots	34 or more knots	Direction nearest 10 degrees (2 figures)	Speed	Time (UTC) (2 figures)
51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68
3.0	0.8	6.4	15.2	21.4	27	0	1	0	0	0	0	1	1	1	M	M	M

10.7 Summary: surface weather record; acceptable entries for Column 2

Phenomena	Code
Tornado	+FC (TORNADO in Remarks)
Waterspout	+FC (WATERSPOUT in Remarks)
Funnel Cloud	FC (FUNNEL CLOUD in Remarks)
Thunderstorm	TS
Rain	-RA, RA, +RA
Rain Showers	-SHRA, SHRA, +SHRA
Drizzle	-DZ, DZ, +DZ
Freezing Rain	-FZRA, FZRA, +FZRA
Freezing Drizzle	-FZDZ, FZDZ, +FZDZ
Snow	-SN, SN, +SN
Snow Showers	-SHSN, SHSN, +SHSN
Snow Grains	-SG, SG, +SG
Ice Crystals	IC
Ice Pellets	-PL, PL, +PL
Ice Pellet Showers	-SHPL, SHPL, +SHPL
Hail (diameter of largest stone ≥5 mm)	-SHGR, SHGR, +SHGR
Hail (diameter of largest stone <5 mm)	-SHGS, SHGS, +SHGS
Snow Pellets	-SHGS, SHGS, +SHGS
Fog (prevailing visibility <5/8 mile)	FG
Freezing Fog (prevailing visibility <5/8 mi., temperature <0 °C and ≥ -30 °C)	FZFG
Shallow Fog	MIFG
Partial Fog	PRFG
Fog Patches	BCFG
Mist (visibility 5/8 to 6 mi.)	BR
Haze	HZ
Smoke	FU
Blowing Snow	BLSN, +BLSN
Blowing Sand	BLSA, +BLSA
Blowing Dust	BLDU, +BLDU

Phenomena	Code
Duststorm	DS, +DS
Sandstorm	SS, +SS
Dust/Sand whirls	PO
Dust Haze	DU
Drifting Dust	DRDU
Drifting Sand	DRSA
Drifting Snow	DRSN
Volcanic Ash	VA

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Part C
Synoptic observations

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Chapter 11 The synoptic code – general description

11.1 General

Weather recognizes no international boundaries. A precise synoptic picture of weather conditions over a vast area of the earth's surface is required in order to provide national and international forecasts and climatological data to satisfy the needs of aviation, agriculture, industry and the public. As a first step in meeting these requirements, surface weather reports are prepared and exchanged throughout the world in an international code developed and agreed upon by member states of the World Meteorological Organization (WMO). Such reports are made at least four times daily and a complete report may contain over 20 pieces of information which include measurements of atmospheric pressure, calculated from barometer readings taken at precisely the same time throughout the world, i.e., 0000 UTC, 0600 UTC, 1200 UTC and 1800 UTC. These observations are referred to as synoptic observations.

11.2 The synoptic code

The international meteorological code FM 12-IX SYNOP is used for reporting synoptic surface observations from a land station, either staffed or automatic. This code is called FM 13-IX SHIP when used for reporting similar observations from a staffed or automatic sea station. The common synoptic code comprises six sections numbered 0 to 5, each of which is primarily composed of five-figure code groups. Most groups in sections 0 to 5 begin with a numerical indicator and these indicators are numbered consecutively within each section. The numerical indicators identify a specific group which always contains the same weather elements. Thus the omission, whether accidental or deliberate, of any one group will not affect the identification of other groups. Indeed, provision is made within the code for omission of groups when their weather elements are either not present or cannot be observed. This also assures a code flexible enough for both staffed and automatic stations.

11.2.1

Section 0 contains, in the case of land stations (SYNOP report), the station identifier; in the case of sea stations (SHIP report), the ship's position and call sign (or buoy identifier number). It also contains a message type identifier group and a date-time-wind indicator group which is transmitted once at the beginning of a synoptic message bulletin.

11.2.2

Section 1 contains data for international as well as regional and national exchange. This section is included in both the SYNOP and the SHIP code form.

11.2.3

Section 2 contains maritime data pertaining to a sea station. Land stations do not use this section, except in the case of a coastal station that transmits maritime data.

11.2.4

Section 3 contains data for regional and national exchange only. It is always included in reports from Canadian land stations.

11.2.5

Section 4 is for use of designated mountain stations only, for reporting of clouds below station level and is not normally used in Canada.

11.2.6

Section 5 is used by land stations to transmit data for national exchange only.

11.2.7

Within a given five-figure code group, the relative position of each code figure, denoting a specific weather element, is constant, thus the synoptic code can be represented symbolically as depicted in section 11.3.

11.3 Symbolic form of the synoptic code

Section 0

(SYNOP) $M_iM_iM_jM_j$ $YYGGi_w$ IIiii

(SHIP) $M_iM_iM_jM_j$ D....D or $A_1b_wn_bn_bn_b$ $YYGGi_w$ $99L_aL_aL_a$ $Q_cL_oL_oL_oL_o$

Section 1

i_Ri_xhVV Nddff (00fff) $1s_nTTT$ $2s_nT_dT_dT_d$ $3P_0P_0P_0P_0$ 4PPPP 5appp $6RRRt_R$

$7wwW_1W_2$ $8N_hC_LC_MC_H$ 9GGgg

Section 2

$222D_sv_s$ $0s_sT_wT_wT_w$ $1P_{wa}P_{wa}P_{wa}P_{wa}$ $2P_wP_wH_wH_w$ $3d_{w1}d_{w1}d_{w2}d_{w2}$ $4P_{w1}P_{w1}H_{w1}H_{w1}$

$5P_{w2}P_{w2}H_{w2}H_{w2}$ $6I_sE_sE_sR_s$ ICE $c_iS_ib_iD_iz_i$

Section 3

333 [$0C_SD_LD_MD_H$] $1s_nT_xT_xT_x$ $2s_nT_nT_nT_n$ [3Ejjj] 4E'sss [$5EEEi_E$]

[$55SSS\ j_5F_{24}F_{24}F_{24}F_{24}$] $6RRRt_R$ $7R_{24}R_{24}R_{24}R_{24}$ [$8N_sCh_sh_s$] $9S_PS_Ps_ps_p$

Section 4

[444] [$N'C'H'H'C_t$]

Section 5

555 1ssss $2s_ws_ws_ws_w$ $3d_md_mf_mf_m$ $4f_hf_tf_tf_i$

A detailed explanation of these symbols and complete coding instructions for each group are given in Chapter 12, “The synoptic code – detailed description.”

Note: Groups enclosed in square brackets [ ] are not reported in Canada

11.4 Interpretation of the symbols

Groups enclosed in square brackets [ ] are not reported in Canada.

Symbol	Interpretation
Section 0 – land stations	
$M_iM_iM_jM_j$	Message type identifier in second line of SYNOP bulletins
$YYGGi_w$ (1)	
YY	Day of the month (UTC)
GG	Hour of observation (UTC)
i_w	Indicates units of wind speed, and whether measured or estimated. In Canada always coded as "4"
IIiii	International index number
II	Block number
iii	Station number
Section 0 – sea stations	
$M_iM_iM_jM_j$	Message type identifier in second line of SHIP bulletins
D....D or $A_1b_wn_bn_bn_b$	Ship's call sign or buoy identifier number
$YYGGi_w$	Same as for land stations, but included with every individual report and i_w may be coded "3" or "4"
$99L_aL_aL_a$	
99	Group identifier
$L_aL_aL_a$	Latitude of station in tenths of a degree
$Q_cL_oL_oL_oL_o$	
Q_c	Quadrant of globe
$L_oL_oL_oL_o$	Longitude of station in tenths of a degree

Symbol	Interpretation
Section 1	
$i_R i_X hVV$	
i_R	Identifier for inclusion or omission of precipitation data (group $6RRRt_R$)
i_X	Identifier for the type of station operation and for present and past weather data (group $7wwW_1W_2$)
h	Height, above ground, of the base of the lowest cloud
VV	Horizontal visibility
Nddff	
N	Fraction of the celestial dome covered by cloud
dd	True direction, in tens of degrees, from which the wind is blowing
ff	Wind speed in knots (kts)
(**00fff**) (2)	
00	Group identifier
fff	Wind speed when it is 99 kts or more
$1s_nTTT$	
1	Group identifier
s_n	Sign of temperature
TTT	Dewpoint temperature in tenths of a degree Celsius
$2s_nT_dT_dT_d$	
2	Group identifier
s_n	Sign of dewpoint temperature
$T_dT_dT_d$	Dewpoint temperature in tenths of a degree Celsius
$3P_0P_0P_0P_0$	
3	Group identifier
$P_0P_0P_0P_0$	Station pressure in tenths of a hectopascal

Symbol	Interpretation
4PPPP	
4	Group identifier
PPPP	MSL pressure in tenths of a hectopascal
5appp	
5	Group identifier
a	Characteristics of the pressure tendency during the three hours preceding the time of observation
ppp	Amount of pressure tendency during the three hours preceding the time of observation, in tenths of a hectopascal
6RRRt_R	
6	Group identifier
RRR	Amount of precipitation which has fallen during the period indicated by t_R
t_R	The coding for the period of reference ending at the time of the report, for RRR. (See 12.3.9.3, WMO code 4019.)
7wwW_1W_2	
7	Group identifier
ww	Present weather
W_1W_2	Past weather
8$N_hC_LC_MC_H$	
8	Group identifier
N_h	Total amount of all C_L clouds or, if no C_L clouds, total amount of all C_M Clouds
C_L	Clouds of SC, ST, CU and CB types
C_M	Clouds of AS, NS, and AC types
C_H	Clouds of CI, CS, and CC types
9GGgg	
9	Group identifier
GGgg	Actual time of observation at a data platform when it differs by more than 10 minutes from the standard time reported by GG in section 0)

Symbol	Interpretation
Section 2 (3)	
$222D_Sv_S$	
222	Section 2 identifier
D_S	Ship's course (true) made good during the three hours preceding the time of observation
v_S	Ship's average speed made good during the three hours preceding the time of observation
$0s_sT_wT_wT_w$	
0	Group identifier
s_s	Sign of sea surface temperature
$T_wT_wT_w$	Sea-surface temperature in tenths of a degree Celsius
$1P_{wa}P_{wa}H_{wa}H_{wa}$	
1	Group identifier
$P_{wa}P_{wa}$	Period in seconds, of sea waves, obtained by instrumental methods
$H_{wa}H_{wa}$	Height of sea waves, obtained by instrumental methods
$2P_wP_wH_wH_w$	
2	Group identifier
P_wP_w	Period in seconds, of sea waves (non-instrumental)
H_wH_w	Height of sea waves (non-instrumental)
$3d_{w1}d_{w1}d_{w2}d_{w2}$	
3	Group identifier
$d_{w1}d_{w1}$	True direction, in tens of degree, from which swell waves (first system) are coming
$d_{w2}d_{w2}$	True direction, in tens of degree, from which swell waves (second system) are coming

Symbol	Interpretation
$4P_{w1}P_{w1}H_{w1}H_{w1}$	
4	Group identifier
$P_{w1}P_{w1}$	Period, in seconds, of swell waves (first system)
$H_{w1}H_{w1}$	Height of swell waves (first system)
$5P_{w2}P_{w2}H_{w2}H_{w2}$	
5	Group identifier
$P_{w2}P_{w2}$	Period, in seconds, of swell waves (second system)
$H_{w2}H_{w2}$	Height of swell waves (second system)
$6I_SE_SE_SR_S$	
6	Group identifier
I_S	Type of ice accretion on ships
E_SE_S	Thickness of ice accretion on ships in centimetres
R_S	Rate of ice accretion on ships
ICE + $c_iS_ib_iD_iz_i$	
ICE	Symbolic word identifies ice group
c_i	Concentration or arrangement of sea ice
S_i	Stage of development of sea ice
b_i	Ice of land origin
D_i	Bearing of principal ice edge
z_i	Present ice situation and trend of conditions over preceding 3 hours

Symbol	Interpretation
Section 3	
333	Section 3 identifier
[**$0C_SD_LD_MD_H$**]	
0	Group identifier
C_S	State of sky in tropics
D_L	Direction from which C_L clouds are moving
D_M	Direction from which C_M clouds are moving
D_H	Direction from which C_H clouds are moving
$1s_nT_xT_xT_x$	
1	Group identifier
s_n	Sign of maximum temperature
$T_xT_xT_x$	Maximum temperature in tenths of a degree Celsius
$2s_nT_nT_nT_n$	
2	Group identifier
s_n	Sign of minimum temperature
$T_nT_nT_n$	Minimum temperature in tenths of a degree Celsius
[**3Ejjj**]	
3	Group identifier
E	State of ground without snow or measurable ice cover
jjj	Supplementary data on state of ground
4E'sss	
4	Group identifier
E’	State of ground with snow or measurable ice cover
sss	Total depth of snow in centimetres

Symbol	Interpretation
[**5EEEi$_E$**]	
5	Group identifier
EEE	Amount of evaporation or evapotranspiration, in tenths of a millimetre, for a 24-hour period
i_E	Type of instrumentation or crop (see WMO code 1806, 12.4.5.3)
[**55SSS $j_5F_{24}F_{24}F_{24}F_{24}$**]	
55	Group identifier
SSS	Duration of bright sunshine in tenths of an hour for 24 hours ending at midnight local apparent time (LAT)
j_5	Radiation field identifier
$F_{24}F_{24}F_{24}F_{24}$	Amount of radiation, in joules per square centimetre, for the 24-hour period ending at 1200 UTC (j_5 indicates whether radiation is global solar, or net; group may be repeated.)
6RRRt$_R$ (4)	
7$R_{24}R_{24}R_{24}R_{24}$	
7	Group identifier
$R_{24}R_{24}R_{24}R_{24}$	Total amount of precipitation during the 24-hour period ending at the time of observation, in tenths of a millimetre
[**8N_sCh_sh_s**]	
8	Group identifier
N_s	Summation amount of significant layer
C	Type of significant cloud
h_sh_s	Height above ground of the layer to which N_s refers
9$S_PS_Ps_ps_p$	
9	Group identifier
S_PS_P	Special phenomena, general description
s_ps_p	Special phenomena, detailed description
[80000]	Identifier to indicate additional regional groups to follow (not currently used in Region IV)

Symbol	Interpretation
Section 4 (5)	
[444]	Section 4 identifier
[**N'C'H'H'C_t**]	
N’	Amount of cloud whose base is below the level of the station
C'	Type of cloud whose base is below the level of the station
H'H'	Altitude of the upper surface of clouds reported by C’, in hundreds of metres
C_t	Description of the top of cloud whose base is below the level of the station
Section 5	
555	Section 5 identifier
1ssss	
1	Group identifier
ssss	Amount of snowfall in tenths of a centimetre, for the 24-hour period ending at 0600 UTC
$2s_ws_ws_ws_w$	
2	Group identifier
$s_ws_ws_ws_w$	Water equivalent, in tenths of a millimetre, of 24-hour snowfall ending at 0600 UTC
$3d_md_mf_mf_m$	
3	Group identifier
d_md_m	Direction, in tens of degrees, of maximum wind speed if in excess of 16 kts, for 24-hour period ending at 0600 UTC
f_mf_m	Maximum wind speed, in knots, if wind in excess of 16 kts, for 24-hour period ending at 0600 UTC

Symbol	Interpretation
$4f_hf_tf_tf_i$	
4	Group identifier
f_h	Hundreds digit of maximum wind speed reported in 3-group
f_tf_t	Time of occurrence of maximum wind speed reported in 3-group
f_i	Index identifies range of maximum two-minute mean wind speed in 24-hour period ending at 0600 UTC

Note (1): In second line of SYNOP bulletins; coded by a computer.

Note (2): Supplementary wind group.

Note (3): The groups of Section 2 are for the use of sea stations, or of land stations which are required to transmit marine data.

Note (4): In Canada, the 6-group is always transmitted in Section 1 of main synoptic reports when applicable. The 6-group, when applicable, is also included in Section 3 by stations which transmit intermediate synoptic reports.

Note (5): Section 4 is for use of designated mountain stations only.

11.5 Content of the coded synoptic message

Main synoptic messages from land stations will normally consist of sections 0, 1, and 3. While some groups are mandatory and must be reported in each synoptic message, other groups may be omitted, depending on specified conditions. At land stations, the communications computer will normally insert the first two groups of Section 0; the observer will code and transmit the remainder of the message. Mandatory and optional groups are briefly described below. Detailed coding instructions follow in Chapter 12, “The synoptic code – detailed description.”

Section 0

This section is mandatory for all synoptic reports. For land stations, $M_iM_iM_iM_i$ and $YYGGi_w$ will normally be coded and inserted by the communications computer, whereas IIiii will always be coded by the observer. Other groups in Section 0 are for the identification and location of sea stations, and are not used by land stations.

Section 1

Groups i_Ri_xhVV, Nddff, $1s_nTTT$, $2s_nT_dT_dT_d$, $3P_oP_oP_oP_o$, 4PPPP and 5appp **shall** always be included.

Group 00fff **shall** be included only if wind speed equals or exceeds 99 kts.

Group $6RRRt_R$ **shall** always be included in the message.

Group $7wwW_1W_2$ **shall** be included only if present or past weather of significance is observed.

Group $8N_hC_LC_MC_H$ **shall** be included only if clouds are observed.

Section 2

This section **shall not** be used by land stations except by those specifically instructed to do so by the ADM.

Section 3

In main synoptic, the indicator group, 333, and groups $1s_nT_xT_xT_x$, $2s_nT_nT_nT_n$ and $7R_{24}R_{24}R_{24}R_{24}$ are always included.

Groups with identifiers 0 and 3 are not used in Canada.

Group 4E’sss is included at certain times when there is snow or ice on the ground.

Groups $5EEEi_E$, 55SSS and $j_5F_{24}F_{24}F_{24}F_{24}$ are not used in Canada.

Group $8N_sCh_sh_s$ is not used in Canada.

Group $9S_PS_Ps_ps_p$ is included only if there are special phenomena to report. It is included if precipitation has occurred.

Section 4

This section **shall not** be used, except by mountain stations specifically so instructed by the ADM.

Section 5

The groups in this section pertain to summarized daily climatological data, thus each group is included no more than once daily and distribution is within Canada only.

11.5.1

Intermediate synoptic reports **shall** include sections 0 and 1, omitting groups $3P_0P_0P_0P_0$ and $6RRRt_R$. Group $7wwW_1W_2$ is included only if present or past weather of significance is observed. In Section 3, group $6RRRt_R$ is included if precipitation has occurred in the preceding three hours and if so, group $9S_PS_Ps_ps_p$ is also included; group $8N_sCh_sh_s$ is included only by stations which do not transmit an hourly observation for the same hour and have significant cloud data to report.

Note: If a tornado is at or within sight of a station at the time of observation or within the past hour, the plain language word “tornado” **shall** be recorded and transmitted as the last group of Section 3. A tornado may also be reported in the 7-group simultaneously if ww = 19 is the highest present weather code applicable at the time. This coding **shall** apply to both main and intermediate synoptic reports, if applicable.

11.5.2 "=" message separation signal

The message separation signal "=" **shall** be included as the last character of the last group of each transmitted synoptic message. The separation signal is always added to the last data group without a space intervening, thus the last group of the transmitted synoptic message will consist of 6 characters.

11.5.3 Missing data

Elements of missing data are recorded in Section III of the Surface Weather Record by means of an "X". When entering a synoptic report on a computer or communication system for transmission, replace any "X"s by a solidus, that is, a "/".

11.6 Observing schedule

The times of the main synoptic reports are 0000, 0600, 1200 and 1800 UTC. The times of the intermediate synoptic reports are 0300, 0900, 1500 and 2100 UTC. In all cases, the barometer **shall** be read at the hour. The observing, recording and coding of all elements, except the pressure and tendency, should be done in the 10 minutes preceding the hour. In difficult weather it may be necessary to begin 15 minutes before the hour in order to be ready to read the barometer at the hour. All stations **shall** conform to this schedule of observing, unless special permission to deviate is obtained from the ADM.

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Chapter 12 The synoptic code – detailed description

12.1 General

Detailed coding instructions for each element of each group of the synoptic code are given below. The instructions often include reference to entries on the Surface Weather Record Form 63-2322. In most cases, the observer will find that the preparation of the synoptic message is simplified if the appropriate entries for lines and columns 1 to 42a on Form 63-2322 are completed before preparing the coded message. Observers may find that “Form 63-9028, Tables for Synoptic Code,” will assist them in encoding the synoptic report.

12.1.1

Complete instructions for recording the observed data on Form 63-2322 are given in Chapter 13, “Recording the synoptic observation on Form 63-2322.”

12.2 Section 0

12.2.1 Group $M_iM_iM_jM_j$

This group is inserted by the communications computer in the message header for identification of synoptic bulletins and is encoded AAXX for synoptic reports from land stations. It is the first group of the second line of the message header. ($M_iM_iM_jM_j$ is encoded BBXX for synoptic reports from ship stations.)

12.2.2 Group $YYGGi_w$

This group is inserted by the communications computer as the second group of the second line of the message header of a synoptic bulletin originating from a land station.

12.2.2.1

YY – day of the month (UTC)

12.2.2.2

GG – hour of the observation (UTC)

12.2.2.3

i_w – wind indicator, showing the units of wind speed and whether the wind speed is measured or estimated. The communications computer will insert the code figure 4 for i_w at Canadian land stations. Observers on ships will have the option of specifying a 3 or 4, depending on whether or not the ships are equipped with anemometers. The following table for i_w is given for decoding purposes.

Code figure i_w	Wind indicator	
0	Wind speed estimated	Wind speed in metres per second
1	Wind speed obtained from anemometer	
3	Wind speed estimated	Wind speed in knots
4	Wind speed obtained from anemometer	

12.2.3 Group IIiii

12.2.3.1

II – block number. All Canadian land stations use 71.

12.2.3.2

iii – station number, as found in METSTAT.

12.3 Section 1

12.3.1 Group i_Ri_xhVV

12.3.1.1

i_R – this symbol is an indicator to show whether or not the precipitation group $6RRRt_R$ is included in the message and, if included, in what section of the message it appears. The following code table **shall** be used:

WMO code 1819

Code figure i_R	Precipitation data are reported	Group $6RRRt_R$ is:
0	In Sections 1 and 3	Not used in Canada
1	In Section 1	Included
2	In Section 3	Included
3	In none of the two Sections 1 and 3	Not used in Canada
4	In none of the two Sections 1 and 3	Omitted (precipitation amount not normally measured)

12.3.1.1.1

Code figures 0 and 3 are not used for i_R in Canada. At stations normally measuring precipitation, the group $6RRRt_R$ is always included in Section 1 with i_R being encoded 1 at main synoptic hours. At stations normally measuring precipitation, the group $6RRRt_R$ is always included in Section 3 with i_R being encoded 2 at intermediate synoptic hours.

12.3.1.2

i_X – this symbol indicates whether the synoptic message has originated from a staffed or an automatic station and secondly, whether or not the present and past weather group, $7wwW_1W_2$ is included. The WMO Code Table 1860 **shall** be used.

WMO code 1860

Code figure i_x	Type of station operation	Group $7wwW_1W_2$ or $7w_aw_aW_{a1}W_{a2}$
1	Staffed	Included
2	Staffed	Omitted (no significant phenomenon to report)
3	Staffed	Omitted (not observed, data not available)
4	Automatic	Included using code tables 4677 and 4561
5	Automatic	Omitted (no significant phenomenon to report)
6	Automatic	Omitted (not observed, data not available)
7	Automatic	Included using Code tables 4680 and 4531

Note: Current automatic stations do not use indicator i_x = 4; they normally use indicator i_x = 5, 6, or 7.

12.3.1.2.1

Insignificant weather phenomena referred to by code figure 2 are defined in 12.3.10.

12.3.1.3

h – Height above ground of the base of lowest cloud. When C_L clouds exist, the height of the base of the lowest layer is reported by h. When no C_L clouds exist, h is coded with reference to the height of the base of the lowest C_M cloud. The following code table **shall** be used.

WMO code 1600

Code figure h	Cloud height	Coded cloud heights (hourly reports)
0	0 to less than 50 m	0, 1
1	50 m to less than 100 m	2, 3
2	100 m to less than 200 m	4, 5, 6
3	200 m to less than 300 m	7, 8, 9
4	300 m to less than 600 m	10 to19
5	600 m to less than 1000 m	20 to 33
6	1000 m to less than 1500 m	34 to 49
7	1500 m to less than 2000 m	50 to 66
8	2000 m to less than 2500 m	67 to 83
9	Greater than 2500 m or no cloud	Greater than 83 or no cloud
/	Sky completely obscured, or no cloud visible	

Note (1): If coded cloud height in the hourly report does not fit within the adjacent range of metric heights because of rounding, give precedence to the actual cloud height in selecting the code for h, rather than the coded value of the hourly report.
Example: Cloud height 290 m: Code as 10 in hourly report; code h as 3 in synoptic report.

Note (2): When C_H clouds are observed without C_L or C_M clouds being present, h **shall** always be coded as 9.

12.3.1.3.1

If the sky is partially obscured by fog or other obscuring phenomena, h refers to the base of the lowest cloud observed, if any.

12.3.1.3.2

If the sky is completely obscured, h is recorded as /; however, if the sky is completely obscured and clouds are visible below the obscuration, h is reported as observed. Example: if the sky is completely obscured by snow in which the vertical visibility is 300 m and 1/10 of Stratus Fractus is observed at 150 m the coding for h would be 2.

12.3.1.4

VV – the horizontal visibility (Column 31) **shall** be coded using the following table.

WMO code 4377

Miles	Code figure VV	Miles	Code figure VV	Visibility	Code figure VV
0	00	8	62	Less than 55 yards	90
1/8	02	9	64	55 yards, but less than 220	91
1/4	04	10	66	220 yards, but less than 550	92
3/8	06	11	67	550 yards, but less than 1100	93
1/2	08	12	69	1100 yards, but less than 2200	94
5/8	10	13	70	2200 yards, but less than 4400 (2.2 naut. mi.)	95
3/4	12	14	72	4400 yards, but less than 11 000 (5.4 naut. mi)	96
1	16	15	74	5.4 naut. mi. but less than 11 naut. mi	97
1 1/4	20	19	80	11 naut. mi. but less than 27 naut. mi.	98
1 1/2	24	22	81	27 naut. mi. or greater	99
1 3/4	28	25	82		
2	32	28	83		
2 1/4	36	32	84		
2 1/2	40	35	85		
3	48	38	86	-	
4	56	41	87		
5	58	44	88		
6	59	More than 44	89		
7	61	-	-		

Note (1): Code figure 90 to 99 **shall** not be used except on special instructions from ADMA.
Note (2): When an hourly and a synoptic observation are taken at the same time and the entry in Column 31 is 15+, VV **shall** be reported as code 74.

12.3.1.4.1

If the visibility recorded in Column 31 falls between two code figures, use the lower code figure. Thus, 20 miles **shall** be coded as 80; 30 miles as 83, etc.

12.3.2 Group Nddff

12.3.2.1

N – This symbol gives the fraction of the celestial dome covered by clouds, irrespective of their type. The following code table **shall** be used.

WMO code 2700

Code figure	Tenths	Okta(s)
0	0	0
1	1/10 or less, but not zero	1 okta or less, but not zero
2	2/10 - 3/10	2 oktas
3	4/10	3 oktas
4	5/10	4 oktas
5	6/10	5 oktas
6	7/10 - 8/10	6 oktas
7	9/10 or more, but not 10/10	7 oktas or more, but not 8 oktas
8	10/10	8 oktas
9	Sky obscured by fog and/or other meteorological phenomena.	
/	Cloud cover is indiscernible for reasons other than fog or other meteorological phenomena, or observation is not made.	

12.3.2.1.1

Normally "N" **shall** be coded with reference to the entry in Column 26 (Total Amount). However, because of some differences in the procedures for coding hourly and synoptic observations some exceptions are necessary as indicated below:

- When blue sky or stars are seen through a layer of fog or other obscuring phenomenon without any trace of cloud above this layer, N is reported as 0.
- If clouds are seen through fog or other obscuring phenomenon their amount **shall** be evaluated as though the obscuration did not exist. In other words, partial obscurations may be disregarded and N is determined by considering that portion of the sky which is not obscured to be the entire sky. Examples follow:

Example (1): Refer to 0700 and 0800 UTC observations

The sky is partially concealed by fog. In the portion which is not concealed, there are equal parts of blue sky and cloud; the code for N would be 4 (4 oktas) in each case, i.e., in coding N the sky is considered to be half covered by cloud.

Example (2): Refer to 0900 UTC observation

The sky is partially concealed or obscured by snow. The observer notes that the remainder of the sky is 20% clear and 80% cloud covered. In coding N the sky is considered to be 80% covered by cloud, hence the code for N would be 6.

Example (3): Refer to 1100 and 1200 UTC observations

The observer reports only a trace of cloud. The entry in Column 26 is 0, but since cloud is present the code for N would be 1.

Example (4): Refer to 1300 UTC observation

The sky is partially concealed by blowing snow. In the portion which is not concealed, there is no cloud. The code for N would be 0, i.e., in coding N the sky is considered to be clear.

12.3.2.1.2 Code tables for N, N_h and N_s

If the sky is partially obscured by a surface-based layer, the code for N may be obtained from the following tables:

Total amount of cloud (eighths) \ Amount of sky obscured (Oktas)	-	1	2	3	4	5	6	7
	0	0	0	0	0	0	0	0
	1	1	1	2	2	3	4	8
	2	2	2	3	4	6	8	-
	3	3	3	4	5	8	-	-
	4	4	5	6	8	-	-	-
	5	6	7	8	-	-	-	-
	6	6	8	-	-	-	-	-
	7	8	-	-	-	-	-	-

Figure obtained is the code figure.

Total amount of cloud (tenths) \ Amount of sky obscured (tenths)	-	1	2	3	4	5	6	7	8	9
	0	0	0	0	0	0	0	0	0	0
	1	1	1	1	2	2	2	2	4	8
	2	2	2	2	2	3	4	6	8	-
	3	2	3	3	4	5	6	8	-	-
	4	3	4	5	6	6	8	-	-	-
	5	5	5	6	6	8	-	-	-	-
	6	6	6	7	8	-	-	-	-	-
	7	6	7	8	-	-	-	-	-	-
	8	7	8	-	-	-	-	-	-	-
	9	8	-	-	-	-	-	-	-	-

Figure obtained is the code figure.

12.3.2.1.3

With a mackerel sky (AC or SC perlucidus), breaks between the cloud elements always exist. Hence, even though these clouds extend over the whole celestial dome, the total amount **shall** be reported by N = 7 or less.

12.3.2.1.4

N = 9 **shall** be reported when the sky is completely concealed by an obscuring phenomenon either surface-based or aloft. This instruction also applies when:

1) Clouds cover part of the sky below the vertical visibility or below an obscuring layer aloft.
2) Clouds are present below the extent of vertical visibility in a surface-based layer which has a summation opacity of 10/10 or summation amount of 8/8.

Example:

Sky condition	Visibility (mi.)	Weather and obstructions to vision	Sea level pressure (hPa)	Temperature (°C) (tenths)		WIND				CLOUDS and/or OBSCURING PHENOMENA
				Dry-bulb	Dew-point	Direction	Speed (kt)	Character	Altimeter setting (in.)	Type/Opacity
30	31	32	33	34	35	36	37	38	39	40
5 SCT A15 OVC										**SF2 FU8**
5 SCT A15 X										**SF2 SN8**

12.3.2.1.5

Persistent condensation trails and cloud masses which have obviously developed from condensation trails **shall** be reported as cloud and considered when coding the cloud amount, N. Rapidly dissipating condensation trails **shall** not be considered in coding N.

12.3.2.2

dd – wind direction (true). The 10-minute mean wind direction **shall** be coded to the nearest ten degrees (01–36) using the following table:

WMO code 0877

Direction	Degrees	Code figure dd	Direction	Degrees	Code figure dd
CALM	Calm	00	SSW	195° - 204°	20
N	005° - 014°	01		205° - 214°	21
NNE	015° - 024°	02	SW	215° - 224°	22
	025° - 034°	03		225° - 234°	23
NE	035° - 044°	04	WSW	235° - 244°	24
	045° - 054°	05		245° - 254°	25
ENE	055° - 064°	06		255° - 264°	26
	065° - 074°	07	W	265° - 274°	27
	075° - 084°	08		275° - 284°	28
E	085° - 094°	09	WNW	285° - 294°	29
	095° - 104°	10		295° - 304°	30
ESE	105° - 114°	11	NW	305° - 314°	31
	115° - 124°	12		315° - 324°	32
SE	125° - 134°	13	NNW	325° - 334°	33
	135° - 144°	14		335° - 344°	34
SSE	145° - 154°	15	N	345° - 354°	35
	155° - 164°	16		355° - 004°	36
	165° - 174°	17	Variable	Wind direction variable	99
S	175° - 184°	18	-		
	185° - 194°	19			

Note: dd = 99 **shall** not be used.

12.3.2.3

ff – the wind speed in knots (10-minute mean). The following table is provided for conversion of miles per hour to knots. See 7.5.1.

Conversion of miles per hour to knots

Miles per hour	0	1	2	3	4	5	6	7	8	9
	Knots									
0	0	1	2	3	3	4	5	6	7	8
10	9	10	10	11	12	13	14	15	16	17
20	17	18	19	20	21	22	23	23	24	25
30	26	27	28	29	30	30	31	32	33	34
40	35	36	36	37	38	39	40	41	42	43
50	43	44	45	46	47	48	49	50	50	51
60	52	53	54	55	56	56	57	58	59	60
70	61	62	63	63	64	65	66	67	68	69
80	70	70	71	72	73	74	75	76	76	77
90	78	79	80	81	82	83	83	84	85	86
***100**	87	-	-	-	-	-	-	-	-	-

Note: This table is not reversible.

For example:

10 mph = 9 kts

11 mph = 10 kts

34 mph = 30 kts

35 mph = 30 kts

110 mph* = (87 kts + 9 kts) = 96 kts

12.3.3 Group 00fff – supplementary

00fff – this supplementary group is included in all synoptic reports when the wind speed, in the units indicated by i_w, is 99 or more. The group, when required, **shall** be included immediately following the Nddff group. Enter on Form 63-2322 in the same box as Nddff but underneath the Nddff entries.

12.3.3.1

When the synoptic speed is 99 kts or more, the fff of the 00fff group **shall** contain the actual wind speed and the ff of the Nddff group **shall** be coded as 99.

Example:
An east wind of 118 kts **shall** be coded N0999 00118.
A south wind of 99 kts **shall** be coded N1899 00099.

12.3.4 Group $1s_nTTT$

12.3.4.1

1 – indicator figure of the group.

12.3.4.2

s_n – sign of the temperature given by TTT. Use code figure 0 if the temperature is 0.0 °C or warmer; use code figure 1 if the temperature is colder than 0.0 °C.

12.3.4.3

TTT – dry-bulb temperature in tenths of a degree Celsius. Code the absolute value of the temperature for TTT as read, filling in a zero for the tens and units digit if required.

Example:

Temperature	s_n	TTT	$1s_nTTT$
15.3 °C	0	153	10153
-15.3 °C	1	153	11153
4.5 °C	0	045	10045
-0.9 °C	1	009	11009
0.0 °C	0	000	10000

12.3.5 Group $2s_nT_dT_dT_d$

12.3.5.1

2 – indicator figure of the group.

12.3.5.2

s_n – sign of the temperature given by $T_dT_dT_d$. Use code figure 0 if the dewpoint temperature is 0.0 °C or warmer; use code figure 1 if the dewpoint temperature is colder than 0.0 °C.

12.3.5.3

$T_dT_dT_d$ – dewpoint temperature in tenths of a degree Celsius. Code the absolute value of the dewpoint for $T_dT_dT_d$, filling in a zero for the tens and units digit as required.

Example:

Dewpoint temperature	s_n	$T_dT_dT_d$	$2s_nT_dT_dT_d$
12.1 °C	0	121	20121
-10.0 °C	1	100	21100
1.9 °C	0	019	20019
-0.1 °C	1	001	21001
0.0 °C	0	000	20000

12.3.6 Group $3P_0P_0P_0$

This group **shall** be included in main synoptic reports only.

12.3.6.1

3 – indicator figure of the group.

12.3.6.2

$3P_0P_0P_0$ – station pressure. Obtain the station pressure from Line 20 of Section 1 and code directly if the station pressure is less than 1000.0 hPa, omitting the decimal point.

Example:

Station pressure	$3P_0P_0P_0$
987.2	39872
964.3	39643
999.0	39990, etc.

12.3.6.2.1

If the station pressure is 1000.0 hPa or more, code $3P_0P_0P_0$ by omitting the thousands digit and record the hundreds, tens, units, and tenths digits directly, omitting the decimal point.

Example:

Station pressure	$3P_0P_0P_0$
1000.0	30000
1012.4	30124
1004.2	30042, etc.

12.3.7 Group 4PPPP

12.3.7.1

4 – indicator figure of the group.

12.3.7.2

PPPP – sea level pressure in tenths of a hectopascal. To obtain the code figure for PPPP, refer to the value recorded on Line 22, and use all four digits when sea level pressure is less than 1000 hPa. When sea level pressure is 1000 hPa or more, omit the thousands digit and record the hundreds, tens, units, and tenths digits directly. The decimal is always omitted.

Example:

Sea level pressure	4PPPP
996.2	49962
1015.4	40154

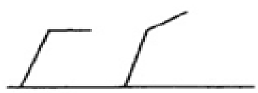
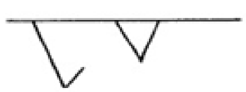
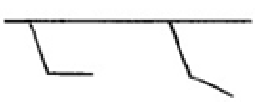
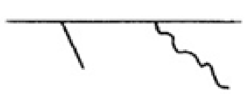
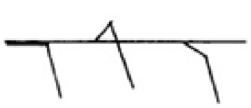
12.3.8 Group 5appp

12.3.8.1

5 – indicator figure of the group.

12.3.8.2

a – characteristic of pressure tendency during the three-hour period preceding the time of observation. The three-hour characteristic **shall** be obtained from the barograph chart and coded in accordance with the following table:

Code figure	Graphic representation	Characteristic	Atmospheric pressure
0		Increasing, then decreasing	Same as or higher than 3 hours ago
1		Increasing, then steady; or increasing then increasing more slowly	Higher than 3 hours ago
2		Increasing (steadily or unsteadily)	Higher than 3 hours ago
3		Decreasing or steady, then increasing; or increasing then increasing more rapidly	Higher than 3 hours ago
4		Steady	Same as 3 hours ago
5		Decreasing, then increasing	Same as or lower than 3 hours ago
6		Decreasing, then steady; or decreasing, then decreasing more slowly	Lower than 3 hours ago
7		Decreasing (steadily or unsteadily)	Lower than 3 hours ago
8		Steady or increasing, then decreasing; or decreasing, then decreasing more rapidly	Lower than 3 hours ago

12.3.8.2.1

Detailed instructions for coding “a” are given in 4.4.2.3.

12.3.8.3

ppp – amount of pressure tendency during the three hours preceding the time of observation, expressed in tenths of a hectopascal. Obtain the three-hour tendency amount, (see 4.4.1.1) and code directly for ppp inserting a zero in place of the tens digit if the amount is less than 10 hPa and two zeros in the places of the tens and units digits if the amount is less than 1 hPa. Always omit the decimal point.

Example:

Net three-hour pressure change	ppp
11.2 hPa	112
9.3 hPa	093
0.8 hPa	008

12.3.9 Group $6RRRt_R$

This group **shall** always be included in main and intermediate synoptic reports, unless otherwise directed by the Regional Director General (see 12.3.1.1 on the use of the symbol i_R).

12.3.9.1

6 – indicator figure of the group.

12.3.9.2

RRR – amount of precipitation which has fallen during the period preceding the time of observation, as indicated by t_R. Amounts are usually for a six-hour period at the main synoptic observation and a three-hour period at the intermediate observation. Six-hour amounts **shall** be obtained from Column 12; three-hour amounts **shall** be obtained from an intermediate reading of the standard rain gauge (see 12.4.8.2). Precipitation amounts are coded according to the following table.

WMO code 3590

Amount mm	Code RRR	Amount mm	Code RRR
Trace	990	0	000
0.1	991 (not used in Canada)	1	001
0.2	992	2	002
0.3	993	-	-
0.4	994	-	-
0.5	995	-	-
0.6	996	-	-
0.7	997	-	-
0.8	998	988	988
0.9	999	989 or more	989

Note: Precipitation amounts which are greater than 1.0 mm **shall** be rounded to the nearest whole millimetre prior to coding (see “Rounding of data” in the Introduction).

12.3.9.3

When precipitation amounts are normally measured but are not available for the current report, RRR will be coded as /// (three solidi).

12.3.9.4

WMO code 4019

Code figure	t_R – Duration of period of reference for amount of precipitation (RRR), ending at the time of report
1	Total precipitation during the 6 hours preceding the observation.
2	Total precipitation during the 12 hours preceding the observation.
3	Total precipitation during the 18 hours preceding the observation.
4	Total precipitation during the 24 hours preceding the observation.
5	Total precipitation during the 1 hour preceding the observation
6	Total precipitation during the 2 hours preceding the observation.
7	Total precipitation during the 3 hours preceding the observation.
8	Total precipitation during the 9 hours preceding the observation.
9	Total precipitation during the 15 hours preceding the observation.

At stations where main synoptic observations and precipitation measurements are made every six hours, t_R **shall** be coded as 1. At stations where fewer than four main synoptic observations are made daily, code figures 2 to 4 may be used for t_R. At stations where intermediate synoptic observations are taken and transmitted, the 6-group **shall** be included, using code figures 5 to 9 for t_R.

12.3.10 Group $7wwW_1W_2$

This group **shall** be included only if present and/or past weather phenomena of significance are observed. The 7-group is omitted when weather of no significance is observed; that is when ww may be coded 00, 01, 02, or 03 and past weather code figures 0, 1 or 2 apply.

12.3.10.1

7 – indicator figure of the group.

12.3.10.2

ww – present weather. The “Weather and Obstructions to Vision” (Column 32) **shall** usually be coded for “ww”, however consideration **shall** also be given to any related information that may be recorded under “Notes,” “Duration of Weather and Obstructions to Vision” and “Remarks.” Detailed instructions follow:

- ww codes 00–49 inclusive are used to code present weather when there is no precipitation at the station at the time of observation.
- ww codes 50–99 inclusive are used to code present weather when precipitation is occurring at the station at the time of observation.

12.3.10.2.1

ww codes 50–99 are used not only to indicate the type of precipitation but also the intensity (light, moderate or heavy), and the character (continuous, intermittent or showery). Detailed instructions regarding precipitation types, character and intensity are given in Part A, Chapter 3.

12.3.10.2.2

Proper usage of the present weather “ww” codes requires a complete knowledge of:

- “Definitions and Descriptions of Meteors” as given in the *International Cloud Atlas*; and
- “Atmospheric phenomena” instructions and definitions as given in Chapter 3, of this manual.

12.3.10.2.3

The first figure of the ww code corresponds to the ten principal categories of weather. Firstly, the decade most suitable to the general state of the weather is chosen; then, from that decade, the code figure is chosen which best describes the weather at the time of observation or (where specifically mentioned in the code) during the period of one hour immediately preceding it. In making the choice of the decade or in determining the complete code figure ww, one does not take into account meteorological phenomena which have been experienced more than one hour before the official time of observing the weather (with the one exception of thunder, which may have been heard up to 75 minutes before the official time of the weather observation - see ww codes 29 and 91–94).

12.3.10.2.4

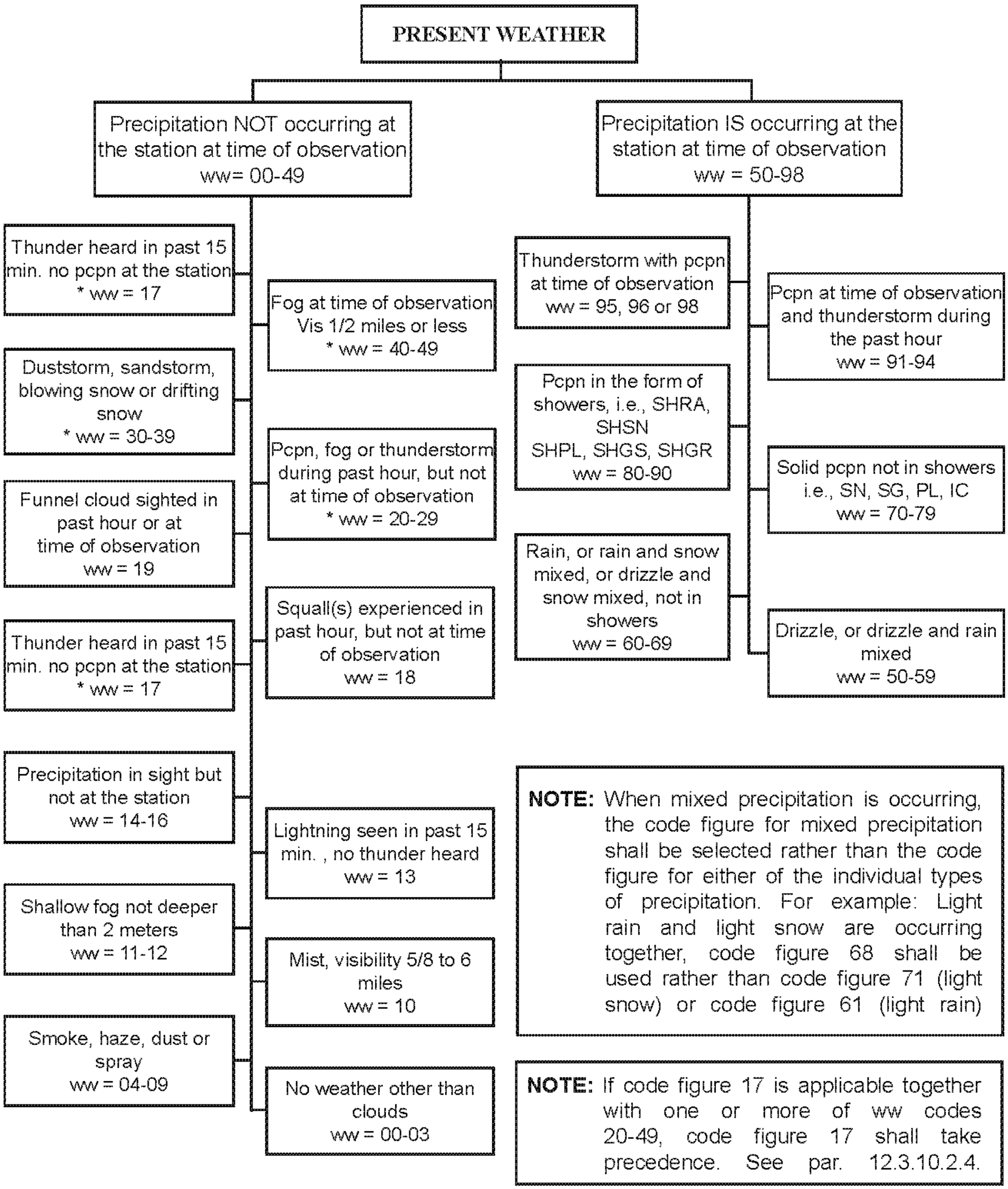
If more than one specification of the ww codes is applicable, the highest code figure is chosen, except that code 17 **shall** be given preference over codes 20–49.

Note: If a tornado is at or within sight of a station at the time of observation or within the past hour, the plain language word “tornado” **shall** be recorded and transmitted as the last group of Section 3. A tornado may also be reported in the $7wwW_1W_2$ group simultaneously if ww = 19 is the highest present weather code applicable at the time. This coding **shall** apply to both main and intermediate synoptic reports, if applicable.

12.3.10.2.5

The graphic guide in the next page, in which priority is indicated by the relative position of the block, may be used to assist in the selection for coding present weather. An abbreviated description of each of the code figures follows the chart.

Chart for assisting in the selection of the present weather code



12.3.10.2.6 Present weather codes – WMO code 4677 – detailed description

Note (1): Throughout these detailed descriptions, the term “slight” when referring to precipitation intensity, **shall** be considered to mean light as defined in Chapter 3, “Atmospheric phenomena.”

Note (2): Code figures 00, 01, 02, and 03 represent phenomena of little significance. When these code figures are applicable for ww, combined with a code figure of 2 or less for past weather (W_1W_2), then ww is neither recorded nor transmitted, see 12.3.10.

Note (3): Code figures 00, 01, 02 and 03 describe the general trend of changes in the state of the sky during the hour preceeding the time of observation. The development (shown by increasing vertical extent or thickening) or dissolution (shown by decreasing vertical extent or thinning) is the most important factor that must be considered when choosing the most suitable number. The variation in sky cover is less important and should be used as the criterion when there is no general development or dissolution observable; ww = 00, 01 and 02 can each be used when the sky is clear at the time of observation. In this case the following interpretation **shall** apply:

- 00 – when the preceding conditions are not known;
- 01 – when the clouds have dissolved during the past hour;
- 02 – when the sky has been continuously clear during the past hour.

Note (4): Present weather code figures normally refer to the weather occurring at the time of observation. The following present weather codes are applicable to the one-hour period preceding the official time of observation: ww = 00, 01, 02, 03, 18, 19, 20-28, 30-35, and 40-47. Codes 29 and 90-94 apply for a period of up to one hour and 15 minutes preceding the official time of observation.

Note (5): Although specifications for 04, 05 and 06 do not require visibility limits, smoke, haze and dust are usually associated with visibilities of 6 miles or less. Specifications for 07 and 10 require that the visibility be restricted to 6 miles or less.

Note (6): Code figures 20 to 29 **shall** never be used when precipitation is occurring at the station at the time of observation.

Note (7): Code figures 80 to 90 are used only when the precipitation is showery in character and is occurring at the station at the time of observation.

Note (8): The expressions “during the past hour” and “during the preceding hour” used in the ww code table refer to the full hour (60 minutes) preceding the official time at which the weather is observed for the synoptic observation.

Code figure 00 **shall** be used when the cloud development during the preceding hour is unknown or has not been observed.

Code figure 01 **shall** be used when the clouds have shown a tendency to dissolve or to decrease in vertical development during the preceding hour, e.g., code figure 01 is applicable to the decrease of fine weather Cumulus late in the day.

Code figure 02 **shall** be used when there has been no appreciable change in the state of the sky during the preceding hour.

Code figure 03 **shall** be used when the clouds have shown a tendency to form or develop during the preceding hour; e.g., this figure is applicable when cumulus clouds are forming and also when fair weather Cumulus is developing into Cumulus Congestus.

Code figure 04 **shall** be used when the prevailing visibility is restricted by smoke, e.g., forest fire, industrial smoke or volcanic ash.

Code figure 05 **shall** be used when the obstruction to vision consists of lithometeors, generally known as “haze.”

Code figure 06 **shall** be used when the prevailing visibility is restricted by dust suspended in the air, not raised by wind.

Code figure 07 **shall** be used when blowing dust or blowing sand is observed at or near the station at the time of observation and the prevailing visibility is observed to be not more than 6 miles, but no well-developed dust whirl(s) or sand whirl(s) and no duststorm or sandstorm seen, or in the case of ships, blowing spray at the station.

Code figure 08 **shall** be used when well developed dust whirls or sand whirls are seen at or near the station during the preceding hour or at the time of observation, but no duststorm or sandstorm.

Code figure 09 **shall** be used when a dust storm or sand storm is within sight at the time of observation or has occurred at the station during the preceding hour and the estimated or observed visibility in the dust storm or sandstorm is/was less than 5/8 mile.

Code figure 10 **shall** be used when fog or freezing fog is observed and the prevailing visibility is 6 miles or less but not less than 5/8 mile (more correctly referred to as mist).

Code figure 11 **shall** be used when patches of shallow fog or freezing fog are observed at the station at the time of observation. The depth of the fog **shall** not restrict visibility at eye level; however, the fog must be dense enough so that the apparent visibility in the fog is less than 5/8 mile.

Code figure 12 **shall** be used when more or less continuous shallow fog or freezing fog is observed at the station at the time of observation. The depth of the fog **shall** not restrict visibility at eye level; however, the fog must be dense enough so that the apparent visibility in the fog is less than 5/8 mile. Code figure 12 **shall** be used in preference to code figure 11 when shallow fog is observed to cover more than half of the ground normally visible.

Code figure 13 **shall** be used when lightning is seen at the time of observation or within 15 minutes preceding the time of observation, but no thunder is heard.

Code figure 14 **shall** be used to report VIRGA, i.e., precipitation within sight, but not reaching the ground or the surface of the sea.

Code figure 15 **shall** be used when precipitation is within sight and is reaching the ground or the surface of the sea, at an estimated distance of more than 3 miles from the station.

Code figure 16 **shall** be used when precipitation is within sight and is reaching the ground or the surface of the sea, at an estimated distance of 3 miles or less from the station, but not at the station.

Code figure 17 **shall** be used when thunder is heard at the time of observation, or within 15 minutes preceding the time of observation, and no precipitation is occurring at the station at the time of observation.

Note: Whenever ww can be coded 17, this code figure **shall** be given preference over code figures 20-49.

Code figure 18 **shall** be used when squalls occur at the time of observation, or have occurred within the preceding hour.

Code figure 19 **shall** be used when a funnel cloud, waterspout, or tornado is within sight of the station at the time of observation or was observed during the preceding hour. In the case of a tornado, the plain language word “tornado” **shall** be recorded and transmitted as the last group of Section 3, whether or not ww is encoded as 19.

Code figure 20 **shall** be used when drizzle or snow grains have occurred at the station during the preceding hour, but are not occurring at the time of observation. If freezing drizzle has occurred during the preceding hour, use code figure 24.

Code figure 21 **shall** be used when rain (not rain showers) has occurred at the station during the preceding hour, but is not occurring at the time of observation. If freezing rain has occurred during the preceding hour, use code figure 24.

Code figure 22 **shall** be used when snow (not snow showers) or ice crystals have occurred at the station during the preceding hour, but are not occurring at the time of observation.

Code figure 23 **shall** be used when mixed rain and snow, or ice pellets (non-showery) have occurred at the station during the preceding hour but are not occurring at the time of observation.

Code figure 24 **shall** be used when freezing rain (non-showery) or freezing drizzle has occurred at the station during the preceding hour, but is not occurring at the time of observation.

Code figure 25 **shall** be used when a rain shower has occurred at the station during the preceding hour, but is not occurring at the time of observation.

Code figure 26 **shall** be used when a snowshower or a shower of rain and snow has occurred at the station during the preceding hour, but is not occurring at the time of observation.

Code figure 27 **shall** be used when a shower of hail, or of hail and rain, has occurred at the station during the preceding hour, but is not occurring at the time of observation. For purposes of reporting code figure 27, hail may be considered to mean any one, or any combination of hail, snow pellets, or ice pellets.

Code figure 28 **shall** be used when fog or freezing fog, with visibility less than 5/8 mile has occurred at the station during the preceding hour, but is not occurring at the time of observation.

Code figure 29 **shall** be used when a thunderstorm with or without precipitation, has occurred at the station during the preceding hour, but neither thunder nor precipitation is occurring at the time of observation. This requires that the last thunder be heard 15 minutes or more before the time of observation. For purposes of reporting this code figure, the “preceding hour” is from 1 hour and 15 minutes ago to 15 minutes ago.

Code figure 30*** shall** be used when a duststorm or sandstorm is occurring at the station at the time of observation, the intensity of the phenomenon has decreased during the past hour, and the visibility is less than 5/8 mile but not less than 5/16 mile.

Code figure 31*** shall** be used when a duststorm or sandstorm is occurring at the station at the time of observation, the intensity has shown no appreciable change during the past hour, and the visibility is less than 5/8 mile but not less than 5/16 mile.

Code figure 32*** shall** be used when a duststorm or sandstorm is occurring at the station at the time of observation, the phenomenon has begun or increased in intensity during the past hour, and the visibility is less than 5/8 mile but not less than 5/16 mile.

Code figure 33*** shall** be used when a duststorm or sandstorm is occurring at the station at the time of observation, the intensity of the phenomenon has decreased during the past hour, and the visibility is less than 5/16 mile.

Code figure 34*** shall** be used when a duststorm or sandstorm is occurring at the station at the time of observation, the intensity has shown no appreciable change during the past hour, and the visibility is less than 5/16 mile.

Code figure 35* **shall** be used when a duststorm or sandstorm is occurring at the station at the time of observation, the phenomenon has begun or increased in intensity during the past hour, and the visibility is less than 5/16 mile.

Code figure 36 **shall** be used when drifting snow of light or moderate intensity is occurring at the station at the time of observation.

Code figure 37 **shall** be used when heavy drifting snow is occurring at the station at the time of observation.

Note: No quantitative criterion is given for determining the intensity of drifting snow. The observer **shall** use their own judgment in reporting ww = 36 or 37, keeping in mind that drifting snow does not affect visibility at eye level, regardless of intensity.

Code figure 38* **shall** be used when blowing snow is occurring at the station at the time of observation, and the visibility is 5/16 mile or more.

Code figure 39* **shall** be used when blowing snow is occurring at the station at the time of observation, and the visibility is less than 5/16 mile.

***Note**: In using codes 30-35 and 38 and 39, an observed visibility of 5/16 mile is used as a threshold value. A prevailing visibility of exactly 5/16 mile, because it is exactly half-way between two reportable values, would be coded as 1/4 mile, or VV = 04.

Code figure 40 **shall** be used when a bank of fog or freezing fog estimated to be more than 2 m in depth is observed at a distance from the station at the time of observation but not at the station during the preceding hour. The observer must estimate that the visibility appears to be restricted in the fog to less than 5/8 mile to justify the use of ww = 40.

Code figure 41 **shall** be used when fog or freezing fog, more than 2 m deep, is occurring in patches at the time of observation, and the prevailing visibility is restricted to less than 5/8 mile.

Code figure 42 **shall** be used when fog or freezing fog is occurring at the station at the time of observation, the visibility is less than 5/8 mile, the sky is visible, and the fog has become thinner during the past hour.

Code figure 43 **shall** be used when fog or freezing fog is occurring at the station at the time of observation, the visibility is less than 5/8 mile, the sky is not visible, and the fog has become thinner during the past hour.

Code figure 44 **shall** be used when fog or freezing fog is occurring at the station at the time of observation, the visibility is less than 5/8 mile, the sky is visible, and the fog has shown no appreciable change in intensity during the past hour.

Code figure 45 **shall** be used when fog or freezing fog is occurring at the station at the time of observation, the visibility is less than 5/8 mile, the sky is not visible, and the fog has shown no appreciable change in intensity during the past hour.

Code figure 46 **shall** be used when fog or freezing fog is occurring at the station at the time of observation, the visibility is less than 5/8 mile, the sky is visible, and the fog has begun or become thicker during the past hour.

Code figure 47 **shall** be used when fog or freezing fog is occurring at the station at the time of observation, the visibility is less than 5/8 mile, the sky is not visible, and the fog has begun or become thicker during the past hour.

Code figure 48 **shall** be used when fog is occurring at the station at the time of observation, the visibility is less than 5/8 mile, the sky is visible, and the fog is depositing rime.

Code figure 49 **shall** be used when fog is occurring at the station at the time of observation, the visibility is less than 5/8 mile, the sky is not visible, and the fog is depositing rime.

Code figure 50 **or** 51 **shall** be used when slight drizzle is occurring at the station at the time of observation:

- Code figure 50, when the drizzle is intermittent;
- Code figure 51, when the drizzle is continuous.

Code figure 52 **or** 53 **shall** be used when moderate drizzle is occurring at the station at the time of observation:

- Code figure 52, when the drizzle is intermittent;
- Code figure 53, when the drizzle is continuous.

Code figure 54 **or** 55 **shall** be used when heavy drizzle is occurring at the station at the time of observation:

- Code figure 54, when the drizzle is intermittent;
- Code figure 55, when the drizzle is continuous.

Code figure 56 **or** 57 **shall** be used when freezing drizzle is occurring at the station at the time of observation:

- Code figure 56, when the freezing drizzle is slight;
- Code figure 57, when the freezing drizzle is moderate or heavy.

Code figure 58 **shall** be used when drizzle and rain are occurring together at the station at the time of observation, and both types of precipitation are of slight intensity.

Code figure 59 **shall** be used when drizzle and rain are occurring together at the station at the time of observation, and either the rain, or the drizzle, or both, are of moderate or heavy intensity.

Code figure 60 **or** 61 **shall** be used when slight rain is occurring at the station at the time of observation:

- Code figure 60, when the rain is intermittent;
- Code figure 61, when the rain is continuous.

Code figure 62 **or** 63 **shall** be used when moderate rain is occurring at the station at the time of observation:

- Code figure 62, when the rain is intermittent;
- Code figure 63, when the rain is continuous.

Code figure 64 **or** 65 **shall** be used when heavy rain is occurring at the station at the time of observation:

- Code figure 64, when the rain is intermittent;
- Code figure 65, when the rain is continuous.

Code figure 66 **or** 67 **shall** be used when freezing rain is occurring at the station at the time of observation:

- Code figure 66, when the freezing rain is slight;
- Code figure 67, when the freezing rain is moderate or heavy.

Code figure 68 **shall** be used when snow accompanied by drizzle or freezing drizzle, or by rain or freezing rain, is occurring at the station at the time of observation and each of the precipitation types is of slight intensity.

Code figure 69 **shall** be used when snow accompanied by drizzle or freezing drizzle, or by rain or freezing rain, is occurring at the station at the time of observation and at least one of the precipitation types is of moderate or heavy intensity.

Note: For the purpose of reporting code figures 68 and 69, the term snow **shall** include ice pellets (non-showery).

Code figure 70 **or** 71 **shall** be used when slight snow, in flakes, is occurring at the station at the time of observation:

- Code figure 70, when the snow is intermittent;
- Code figure 71, when the snow is continuous.

Code figure 72 **or** 73 **shall** be used when moderate snow, in flakes, is occurring at the station at the time of observation:

- Code figure 72, when the snow is intermittent;
- Code figure 73, when the snow is continuous.

Code figure 74 **or** 75 **shall** be used when heavy snow, in flakes, is occurring at the station at the time of observation:

- Code figure 74, when the snow is intermittent;
- Code figure 75, when the snow is continuous.

Code figure 76 **shall** be used when ice crystals (diamond dust) are occurring at the station at the time of observation, whether or not fog or freezing fog is present at the same time.

Code figure 77 **shall** be used when snow grains are occurring at the station at the time of observation, whether or not fog or freezing fog is present at the same time.

Code figure 78 **shall** be used when isolated star-like snow crystals are occurring at the station at the time of observation, whether or not fog or freezing fog is present at the same time.

Code figure 79 **shall** be used when ice pellets (non-showery) are occurring at the station at the time of observation.

Code figure 80 **shall** be used when slight rain showers are occurring at the station at the time of observation.

Code figure 81 **shall** be used when moderate or heavy rain showers are occurring at the station at the time of observation.

Code figure 82 **shall** be used when exceptionally heavy or torrential rain showers are occurring at the station at the time of observation.

Note: Such showers occur only occasionally in temperate regions and the observer should use their own judgment in deciding whether the showers are heavy enough to justify the use of code figure 82.

Code figure 83 **shall** be used when showers of mixed rain and snow are occurring at the station at the time of observation, and both types are slight.

Code figure 84 **shall** be used when showers of mixed rain and snow are occurring at the station at the time of observation, and either one or both of the precipitation types are moderate or heavy.

Code figure 85 **shall** be used when showers of slight snow are occurring at the station at the time of observation.

Code figure 86 **shall** be used when showers of moderate or heavy snow are occurring at the station at the time of observation.

Code figure 87 **shall** be used when showers of slight snow pellets or slight ice pellets, with or without rain, or rain and snow mixed, are occurring at the station at the time of observation.

Code figure 88 **shall** be used when moderate or heavy showers of snow pellets or ice pellets, with or without rain, or rain and snow mixed, are occurring at the station at the time of observation.

Code figure 89 **shall** be used when showers of slight hail, with or without rain, or rain and snow mixed, not accompanied by thunder, are occurring at the station at the time of observation.

Code figure 90 **shall** be used when showers of moderate or heavy hail, with or without rain, or rain and snow mixed, not accompanied by thunder, are occurring at the station at the time of observation.

Thunderstorm during past hour, but not at time of observation

Code figure 91* **shall** be used when slight rain is occurring at the station at the time of observation, and a thunderstorm has occurred during the preceding hour, but is not occurring at the time of observation.

Code figure 92*** shall** be used when moderate or heavy rain is occurring at the station at the time of observation, and a thunderstorm has occurred during the preceding hour, but is not occurring at the time of observation.

Code figure 93*** shall** be used when snow, or rain and snow mixed, or hail, or snow pellets, or ice pellets are occurring at the station at the time of observation, and a thunderstorm has occurred during the preceding hour, but is not occurring at the time of observation. This code figure **shall** be used when the precipitation type or types are of slight intensity.

Code figure 94*** shall** be used when snow, or rain and snow mixed, or hail, or snow pellets, or ice pellets are occurring at the station at the time of observation, and a thunderstorm has occurred during the preceding hour, but is not occurring at the time of observation. This code figure **shall** be used when one or more of the precipitation types are of moderate or heavy intensity.

***Note**: Regarding codes 91 to 94 inclusive:

- The time of hearing the last thunder **shall** be at least 15 minutes, but not more than one hour and 15 minutes before the official time of observation.
- These codes refer to either showery or non-showery precipitation at time of observation.

Thunderstorm in progress at time of observation

Code figure 95*** shall** be used when a thunderstorm accompanied by rain or snow, is occurring at the station at the time of observation.

Code figure 96*** shall** be used when a thunderstorm accompanied by hail, snow pellets or ice pellets, is occurring at the station at the time of observation. Rain or snow may occur along with the hail, etc.

Code figure 97 no longer used in Canada.

Code figure 98*** shall** be used when a thunderstorm, accompanied by a duststorm or sandstorm, is occurring at the station at the time of observation (precipitation occurring). Under these circumstances, the precipitation may not be visible, and the observer must judge whether precipitation is actually occurring.

Code figure 99 no longer used in Canada.

***Note (1)**: Thunderstorm at the station is considered to be in progress when:

- Thunder is heard within the 15 minutes preceding the official time of observation, or
- Overhead lightning is observed within the 15 minutes preceding the official time of observation, and the local noise level is such as might prevent hearing thunder. In this case, hail may also be an indicator of a thunderstorm in progress.

Note (2): Codes 95 and 98 allow showery or non-showery precipitation at time of observation.

12.3.10.3 W_1W_2 – past weather

The past weather at the station, based on "Notes" (Column 1), duration of weather and obstructions to vision (columns 2, 3 and 4), and other items of previous observations, **shall** be coded using the following table. Two types of past weather may be selected. The highest applicable code figure is assigned to W_1 and the second highest to W_2.

WMO code 4561

Code figure	W_1W_2 past weather
0	Cloud covering 1/2 or less of the sky (N ≤ 4) throughout the appropriate period
1	Cloud covering more than 1/2 of the sky during part of the appropriate period and covering 1/2 or less during part of the period
2	Cloud covering more than 1/2 of the sky (N > 4) throughout the appropriate period
Types of significant past weather	
3	Sandstorm, duststorm or blowing snow (prevailing visibility less than 5/8 mile)
4	Fog, freezing fog or thick haze (prevailing visibility less than 5/8 mile)
5	Drizzle, or freezing drizzle
6	Rain, or freezing rain
7	Snow, or rain and snow mixed, i.e., SN, RASN, SG, PL, IC
8	Shower(s), i.e., SHRA, SHSN, SHPL, SHGS, SHGR
9	Thunderstorm(s) with or without precipitation

12.3.10.3.1

The period covered by W_1W_2 normally begins at the actual time of observation of the previous synoptic report and ends at the time the present weather (ww) began and so will cover a maximum of 3 hours for intermediate synoptics and 6 hours for main synoptics.

12.3.10.3.1.1

If during the period covered by W_1W_2 there has been a break in the weather watch exceeding 30 minutes which in the considered opinion of the observer makes a reasonable assessment of past weather impossible, W_1W_2 may be recorded as XX.

12.3.10.3.2

The code figures for W_1 and W_2 **shall** be selected in such a way that W_1W_2 and ww together give as complete a description as possible of the weather in the time interval concerned, based on their significance according to WMO code tables 4677 and 4561. If the type of weather undergoes a complete change during the time interval concerned, the code figures selected for W_1 and W_2 **shall** describe the weather prevailing before the type of weather indicated by ww began.

After selecting ww, select the most significant type of past weather, different from ww, though they may be occurring simultaneously. If only one type of weather has been occurring throughout the whole period, use that one type for ww, W_1, and W_2.

After selecting the first past weather type, select another past weather type, different, if possible, from the first past weather type that has occurred during the past weather period. If more than one code figure may be given to past weather, the highest figure **shall** be reported for W_1 and the second highest applicable code figure **shall** be reported for W_2. If only one type of past weather has occurred during the past weather period, encode W_1 and W_2 the same.

Note: If precipitation has been continuous at the station throughout the past weather period, do not use codes 0, 1, or 2 for either W_1 or W_2.

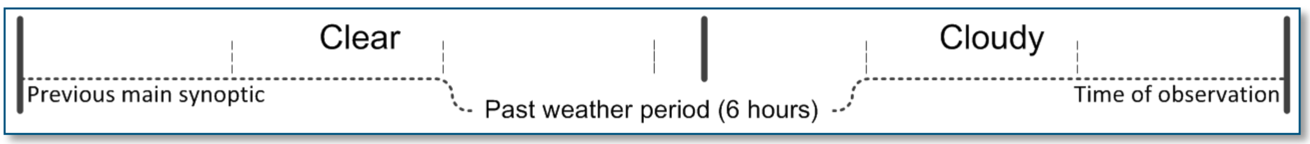
The 7-group gives a qualitative rather than quantitative picture of the weather during the past weather period. It generally does not give sequence or duration of weather events, unless ww, W_1 and W_2 are all coded the same, in which case only one type of weather has prevailed throughout the period.

Users of the code should be aware that decoding ambiguities are possible. In examples 5 and 6, different weather sequences give rise to similar code sequences. Note how W_1 in these examples differs with respect to duration of the snow and rain.

12.3.10.3.3

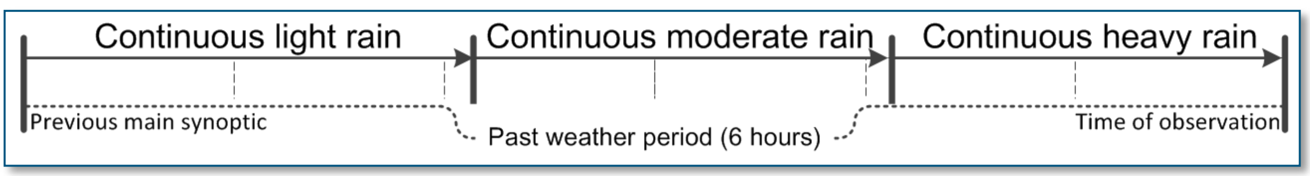
The following examples, shown graphically, of weather conditions during a “past weather” period of six hours, will illustrate how the rules are applied in coding W_1 and W_2. The proper coding of ww and W_1 and W_2 is given for each example. These examples, where appropriate, also illustrate the coding of the special phenomena group $909R_td_c$ in Section 3 of the code. (See 12.4.11.3.3 and 12.4.11.3.4)

Example (1):



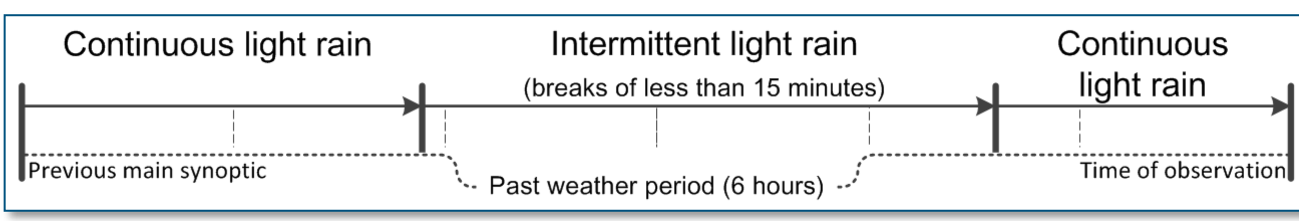
Group $7wwW_1W_2$ not included (no weather of significance).

Example (2): ww = 65; W_1 = 6; W_2 = 6



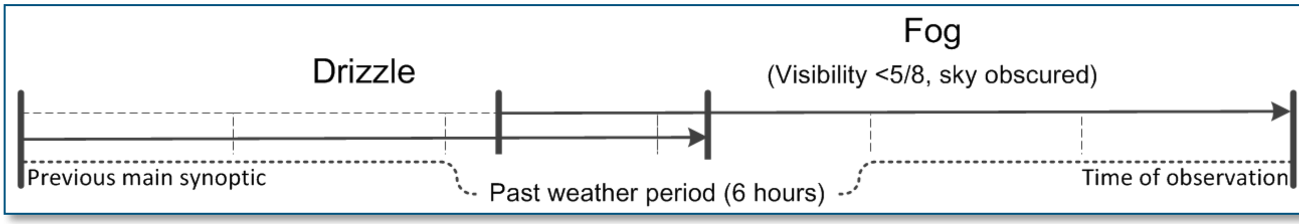
The report of rain in ww, W_1 and W_2, shows that rain has been continuous throughout the entire weather period and no other past weather type has occurred. Group $909R_td_c$ is coded 90973.

Example (3): ww = 61; W_1 = 6; W_2 = 6



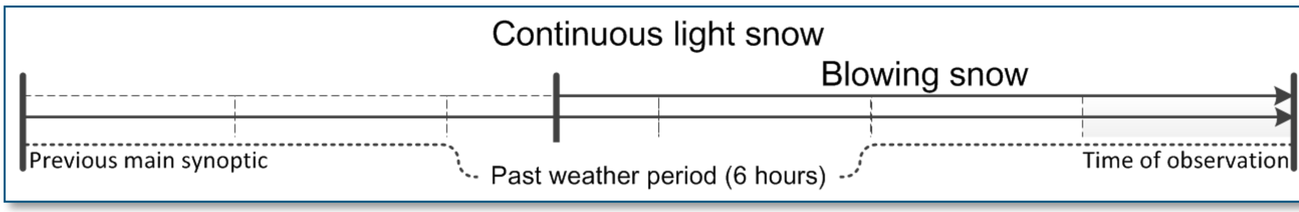
Group $909R_td_c$ is coded 90973.

Example (4): ww = 45; W_1 = 5; W_2 = 5



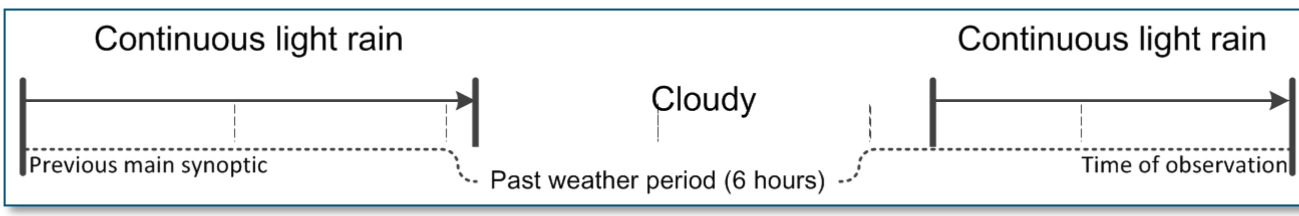
Present weather is sky obscured, visibility <5/8 in fog for the past hour or more, so ww is encoded 45. W_1 and W_2 are used to report the weather prevailing before ww (fog) began, i.e., drizzle, and are thus encoded 55. Group $909R_td_c$ is coded 90932.

Example (5): ww = 71; W_1 = 7; W_2 = 3



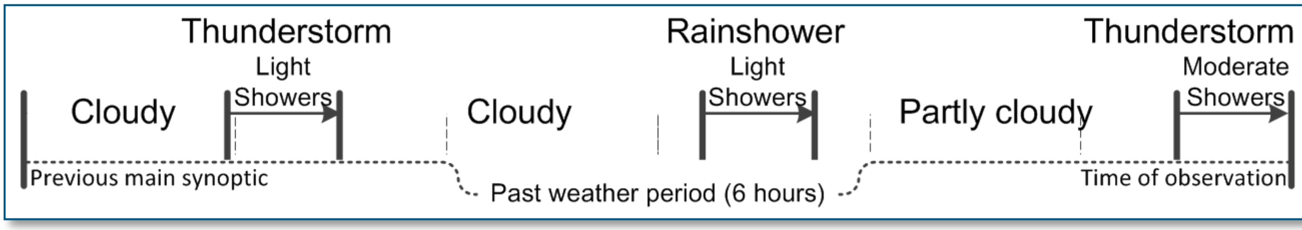
In addition to continuous light snow throughout the period, blowing snow is the only other reportable weather type. If the snowfall began at the time of the previous main synoptic hour, group $909R_td_c$ would be coded 90962.

Example (6): ww = 61; W_1 = 6; W_2 = 2



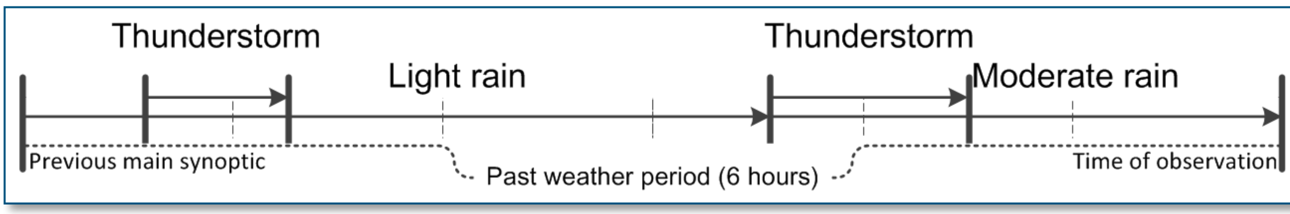
Group $909R_td_c$ is coded 90927 which indicates that the rain reported by ww and W_1 are separate occurrences.

Example (7): ww = 95; W_1 = 9; W_2 = 8



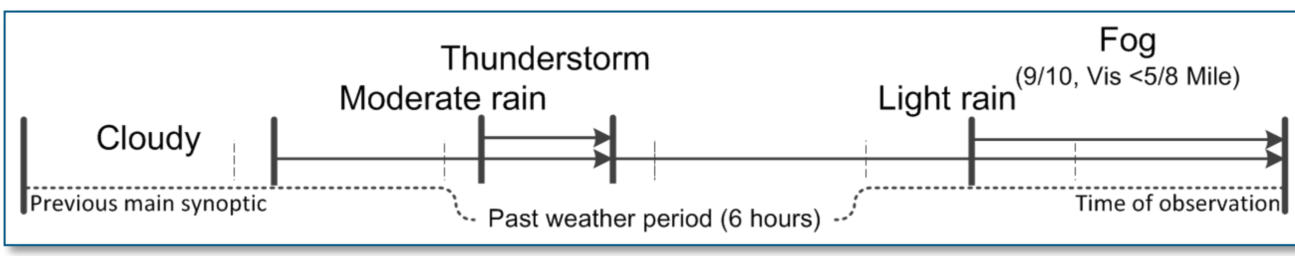
If only one type of past weather was encoded, it would be code 8. In selecting past weather in addition to the code 8, the earlier thunderstorm is the most significant event, and because of its priority in the code table it is encoded as W_1. Group $909R_td_c$ is coded 90916.

Example (8): ww = 63; W_1 = 9; W_2 = 6



The past weather consists of continuous rain and occasional thunderstorms. Because the highest past weather code figure is assigned to thunderstorms, W_1 is coded 9, and W_2 is coded 6. Group $909R_td_c$ is coded 90973.

Example (9): ww = 61; W_1 = 9; W_2 = 4

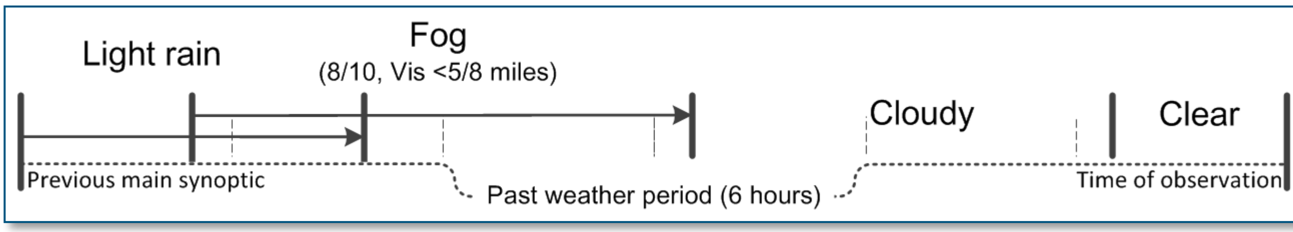


Group $909R_td_c$ is coded 90952.

Example (10): ww = 61; W_1 = 8; W_2 = 1

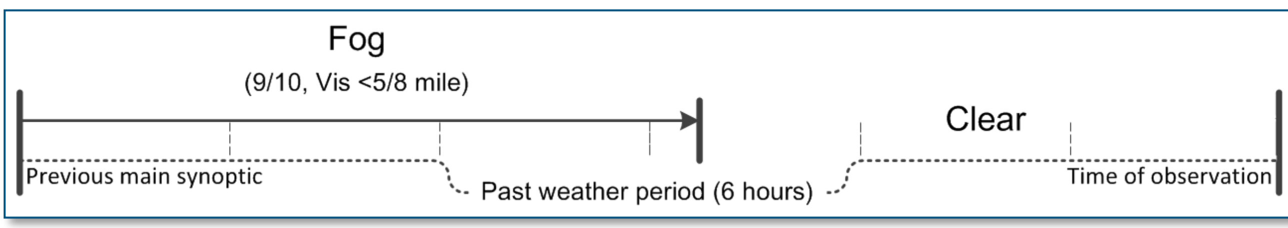
Group $909R_td_c$ is coded 90936.

Example (11): ww = 01; W_1 = 6; W_2 = 4



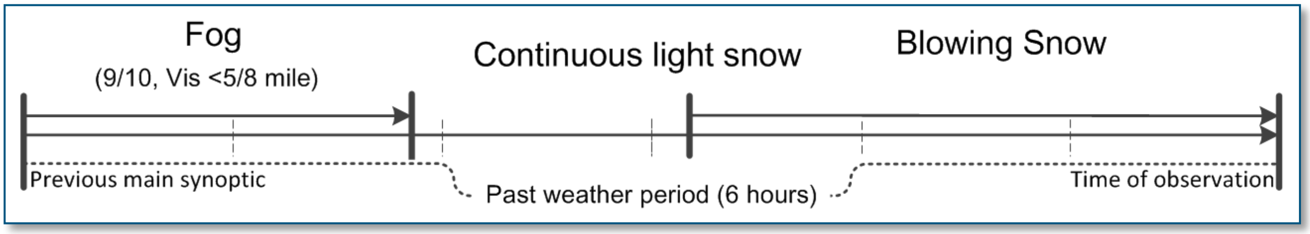
The clouds have generally dissolved in the past hour so ww is coded 01. In the past weather code, rain has a higher code figure than fog, therefore W_1 is coded 6 and W_2 is coded 4. Group $909R_td_c$ is coded 90951.

Example (12): ww = 02; W_1 = 4; W_2 = 4



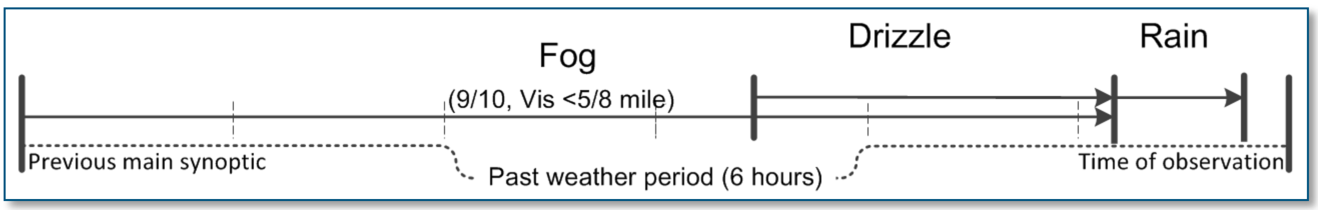
The clear skies during the hour preceding the time of observation are reported by ww = 02. The significant weather which necessitates the encoding of the 7-group is the fog in the past weather. Since fog was the only weather type prevailing before the weather reported by ww, both W_1 and W_2 are encoded 4.

Example (13): ww = 71; W_1 = 4; W_2 = 3



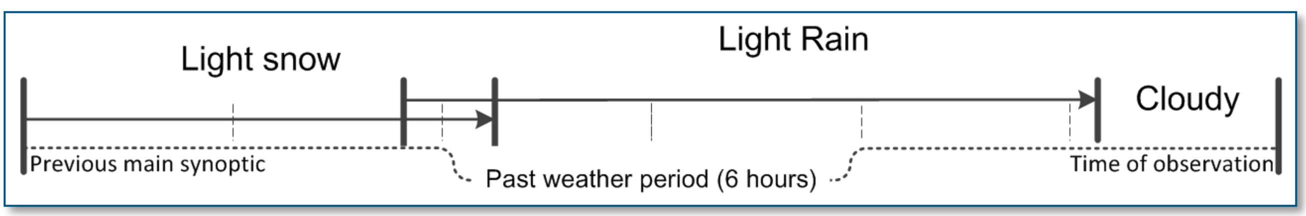
Although the light snow has been falling continuously throughout the period, it is not repeated in W_1 and W_2 because of the occurrence of two other weather types which are coded. Group $909R_td_c$ is coded 90973 and this indicates that the snow reported by ww has been continuous throughout the period.

Example (14): ww = 28; W_1 = 6; W_2 = 5



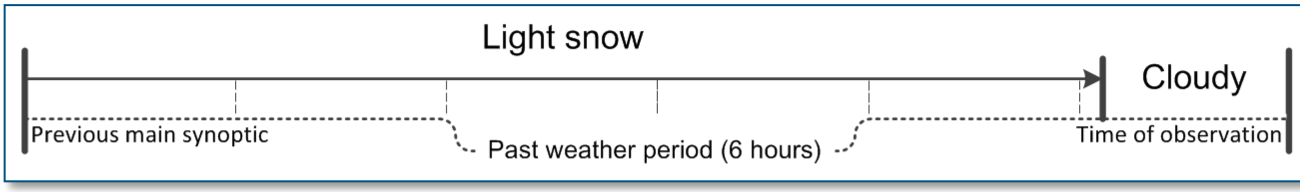
Fog ending in the past hour is the highest code figure that can be used for present weather, hence ww = 28. Although the fog has been continuous up to its description by ww, two other past weather types are coded for W_1 and W_2. Group $909R_td_c$ is coded 90911. (If the rain restarted during transmission of the report, the observer might well change the coding of the 7-group to 76054.)

Example (15): ww = 21; W_1 = 7; W_2 = 2



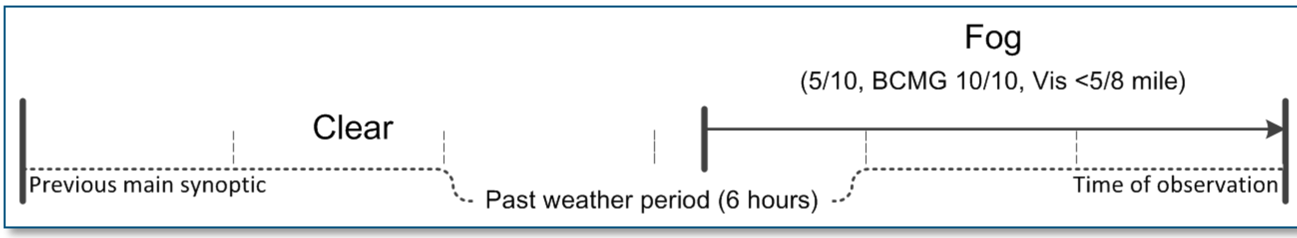
The light rain which ended in the past hour is the highest code figure applicable to present weather, so ww = 21. Other reportable weather consisted of snow and the cloudy skies which prevailed since the rain ended. Thus W_1 and W_2 are coded 7 and 2 respectively. Group $909R_td_c$ is coded 90972.

Example (16): ww = 22; W_1 = 7; W_2 = 2



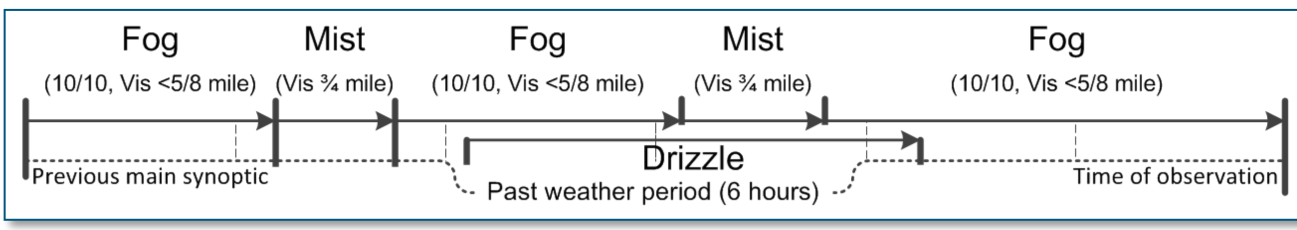
Group $909R_td_c$ is coded 90973. (The light snow was continuous for more than six hours).

Example (17): ww = 47; W_1 = 0; W_2 = 0



By the time of observation, the sky had become totally obscured by thickening fog, preceded only by clear skies.

Example (18): ww = 45; W_1 = 5; W_2 = 4



Reportable past weather consisted of drizzle and fog; therefore W_1 and W_2 are coded 5 and 4, respectively. Group $909R_td_c$ is coded 90921.

In the case of a six-hour period of mist, in which visibilities vary upward from 5/8 of a mile and during which there has been no significant past weather, encode the 7-group as follows:

- ww =10;
- W_1 and W_2 = 0, 1, or 2. (Select the most appropriate code figure even if the sky has been obscured.)

12.3.11 Group $8N_hC_LC_MC_H$

12.3.11.1

This group **shall** be omitted when the sky is clear (N = 0), or when the sky is totally obscured (N = 9) and no cloud is visible below the obscuration.

12.3.11.1.1

In general the basic data which are required in the coding of this group are recorded in columns 25, 26, 30, 40 and 41. However, the observer must keep in mind that the analysis of the sky condition by layers and individual cloud types is not always directly applicable to coding the clouds in this group of the synoptic code. For example, in coding clouds in the C_L category, if CB is present in any amount the coding must be 3 or 9 (see 12.3.11.4.1). Similarly, in coding clouds in the C_M category, if turreted or tufted Altocumulus is present it must be reported by code figure 8 (see 12.3.11.5.1), (unless code 9 applies) even though another type of Altocumulus or Altostratus covers a greater portion of the celestial dome. In the $8N_hC_LC_MC_H$ group, three categories of clouds can be coded along with the amount of one category.

12.3.11.2

8 – Indicator figure of the group.

12.3.11.3

N_h – amount of cloud. The amount coded for N_h **shall** be the total amount of all cloud in the C_L category, or in the absence of C_L cloud, it **shall** be the total amount of all cloud in the C_M category. If C_H clouds alone are present N_h **shall** be coded as 0.

12.3.11.3.1

When blue sky or stars are seen through a layer of fog or other obscuring phenomenon, without any trace of cloud above or within this layer, the group $8N_hC_LC_MC_H$ **shall** be omitted. If clouds are seen through the fog or other obscuring phenomenon, their amount **shall** be evaluated as though the obscuration did not exist. In other words, partial obscurations are not considered and N_h is evaluated in terms of the visible portion of the sky. The code table given in 12.3.11.3.7 may be helpful in determining N_h under partially obscured conditions.

Note: The synoptic code makes no provision for reporting partial obscurations aloft, such as smoke, except where authorized as “special phenomena” and so they should be treated as surface based layers.

12.3.11.3.2

If the sky is completely obscured, and no cloud is visible, the group $8N_hC_LC_MC_H$ **shall** be omitted. If the sky is completely obscured and clouds are visible below the obscuration or below the extent of vertical visibility in the obscuration, N_h is reported as observed. For example, if the sky is completely obscured and 1/10 of Stratus Fractus is observed, the cloud elements would be recorded as $N = 9$, $N_h = 1$, $C_L = 7$ and both C_M and $C_H = X$ unless the obscuration is a layer aloft based above the middle cloud level, in which case $C_M = 0$.

12.3.11.3.3

In the coding of N_h there are no height restrictions regarding clouds of the C_L or C_M categories, i.e., Cumulus cloud based at 3600 m would be reported as cloud of the C_L category.

12.3.11.3.4

Persistent condensation trails and cloud masses which have obviously developed from condensation trails **shall** be reported as cloud, using the appropriate C_H or C_M code figure. Rapidly dissipating condensation trails **shall not** be reported.

12.3.11.3.5

With a mackerel sky (AC or SC perlucidus), breaks between the cloud elements always exist. Hence, even though such a layer extends over the whole celestial dome, N_h **shall** be coded as 7 or less.

12.3.11.3.6

N_h **shall** be coded according to the following table:

WMO code 2700

Code figure	Tenths	Okta(s)
0	0	0
1	1/10 or less, but not zero	1 okta or less, but not zero
2	2/10 - 3/10	2 oktas
3	4/10	3 oktas
4	5/10	4 oktas
5	6/10	5 oktas
6	7/10 - 8/10	6 oktas
7	9/10 or more, but not 10/10	7 oktas or more, but not 8 oktas
8	10/10	8 oktas
9*	Sky obscured by fog and/or other meteorological phenomena.	
/	Cloud cover is indiscernible for reasons other than fog or other meteorological phenomena, or observation is not made.	

***Note**: Code 9 is not used in Canada.

12.3.11.3.7 Code tables for N, N_h and N_s

If the sky is partially obscured by a surface-based layer, the code for N_h may be obtained from the following tables:

Total amount of cloud (eighths)	Amount of sky obscured (oktas)							
	-	1	2	3	4	5	6	7
	0	0	0	0	0	0	0	0
	1	1	1	2	2	3	4	8
	2	2	2	3	4	6	8	-
	3	3	3	4	5	8	-	-
	4	4	5	6	8	-	-	-
	5	6	7	8	-	-	-	-
	6	6	8	-	-	-	-	-
	7	8	-	-	-	-	-	-

Figure obtained is the code figure.

Total amount of cloud (tenths)	Amount of sky obscured (tenths)									
	-	1	2	3	4	5	6	7	8	9
	0	0	0	0	0	0	0	0	0	0
	1	1	1	1	2	2	2	2	4	8
	2	2	2	2	2	3	4	6	8	-
	3	2	3	3	4	5	6	8	-	-
	4	3	4	5	6	6	8	-	-	-
	5	5	5	6	6	8	-	-	-	-
	6	6	6	7	8	-	-	-	-	-
	7	6	7	8	-	-	-	-	-	-
	8	7	8	-	-	-	-	-	-	-
	9	8	-	-	-	-	-	-	-	-

Figure obtained is the code figure.

12.3.11.4 C_L – clouds of types SC, ST, CU and CB (WMO code 0513)

12.3.11.4.1 Coding instructions for C_L – clouds

The coding instructions list the code figures in descending order of priority. A given code figure is used subject to the condition that all the code figures listed above it are not applicable, and irrespective of the presence of clouds corresponding to the code figures listed below it. More detailed descriptions of the cloud type coding can be found in the *International Cloud Atlas*.

C_L code figure – coding criteria

Cumulonimbus present, with or without other C_L-clouds

C_L = 9 – If the upper part of at least one of the Cumulonimbus clouds present is clearly fibrous or striated[1], use C_L = 9.

C_L = 3 – If the upperpart of none of the Cumulonimbus clouds present is clearly fibrous or striated, use C_L = 3.

No cumulonimbus present

C_L = 4 – If Stratocumulus formed by the spreading out of Cumulus is present, use C_L = 4.

C_L = 8 – If the C_L code figure 4 is not applicable and if Cumulus and Stratocumulus clouds with bases at different levels are present, use C_L = 8.

C_L = 2 – If the C_L code figures 4 and 8 are not applicable and if Cumulus clouds of moderate or strong vertical extent are present, use C_L = 2.

C_L = 1, 5, 6, 7 – If the C_L code figures 4, 8 and 2 are not applicable:

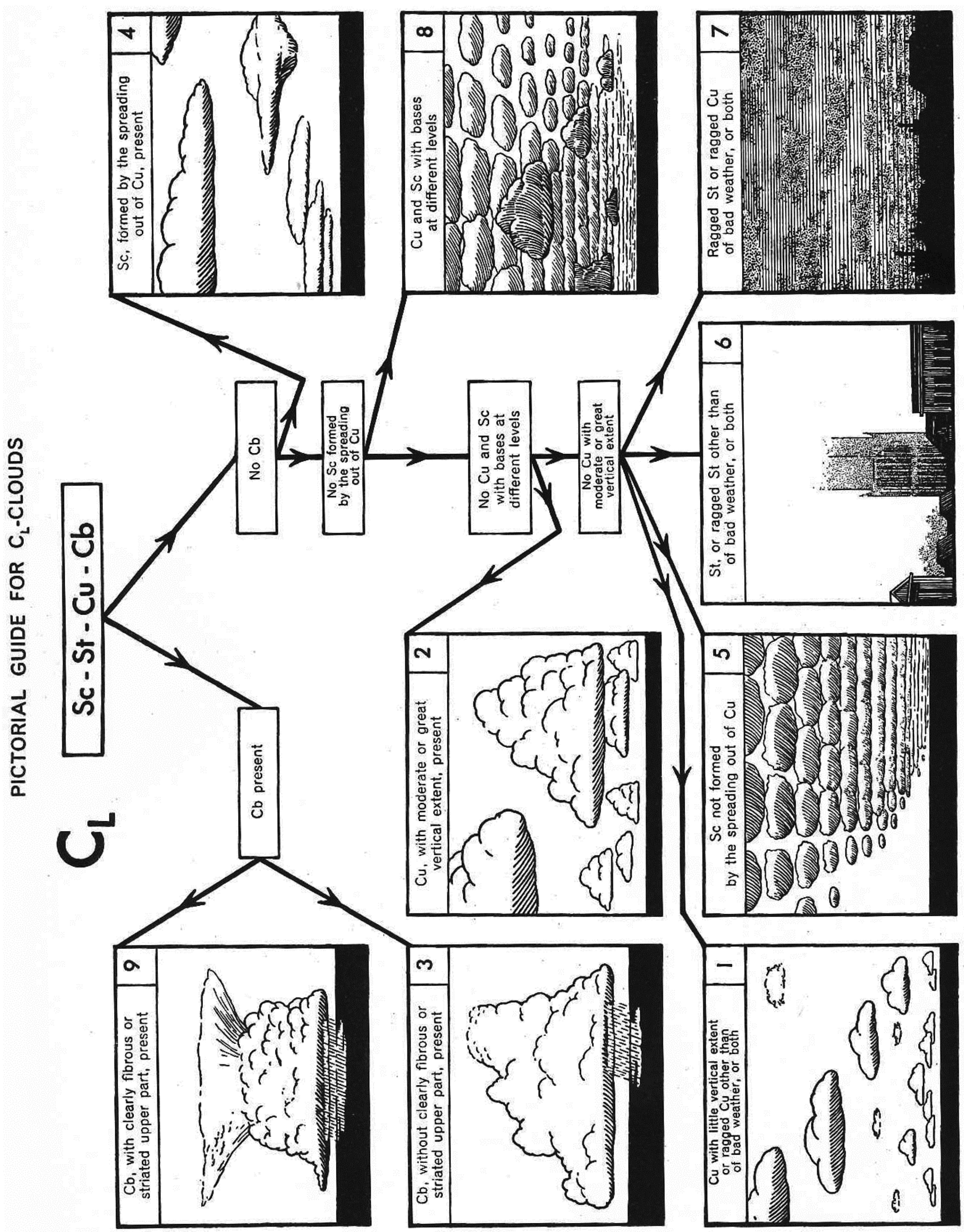
- use C_L = 1, if the C_L clouds present are predominantly[2] Cumulus with little vertical extent and seemingly flattened or ragged Cumulus other than of bad weather, or both;
- use C_L = 5, if among the C_L clouds present Stratocumulus other than that formed by the spreading out of cumulus is predominant[1];
- use C_L = 6, if the C_L clouds present are predominantly[2] Stratus in a more or less continuous sheet or layer, or in ragged shreds (other than ragged Stratus of bad weather), or both;
- use C_L = 7, if the C_L clouds present are predominantly[2] pannus (ragged shreds of Stratus of bad weather[3] or ragged Cumulus of bad weather, or both).

C_L = 0 – If no Stratocumulus, Stratus, Cumulus or Cumulonimbus.

Note (1): Consult WMO Cloud Atlas on the specification C_L = 9.

Note (2): In the present case, consideration of the predominance is restricted to the clouds corresponding to C_L code figures 1, 5, 6 and 7 which have the same priority. Clouds of any one of these four specifications are said to be predominant when their sky cover is greater than that of the clouds of any of the three other specifications.

Note (3): “Bad weather” denotes the conditions which generally exist during precipitation and a short time before and after.


PICTORIAL GUIDE FOR C_L-CLOUDS
C_L
Sc - St - Cu - Cb
Cb present
No Cb
Cb, with clearly fibrous or striated upper part, present
9
Cb, without clearly fibrous or striated upper part, present
3
Sc, formed by the spreading out of Cu, present
4
No Sc formed by the spreading out of Cu
Cu and Sc with bases at different levels
8
No Cu and Sc with bases at different levels
Cu, with moderate or great vertical extent, present
2
No Cu with moderate or great vertical extent
Ragged St or ragged Cu of bad weather, or both
7
St, or ragged St other than of bad weather, or both
6
Sc not formed by the spreading out of Cu
5
Cu with little vertical extent or ragged Cu other than of bad weather, or both
1

12.3.11.5 C_M – clouds of types AC, AS and NS (WMO code 0515)

12.3.11.5.1 Coding instructions for C_M-clouds

The coding instructions list the code figures in descending order of priority. A given code figure is used subject to the condition that all the code figures listed above it are not applicable, and irrespective of the presence of clouds corresponding to the code figures listed below it. More detailed descriptions of the cloud type coding can be found in the *International Cloud Atlas*.

C_M code figure – coding criteria

Altocumulus present

(Altostratus or Nimbostratus may be present)

C_M= 9 – If the sky is chaotic, use C_M= 9.

C_M= 8 – If the C_M code figure 9 is not applicable and if Altocumulus with sproutings in the form of turrets or battlements or Altocumulus having the appearance of small cumuliform tufts is present, use C_M= 8.

C_M= 7 – If the C_M code figures 9 and 8 are not applicable and if Altostratus or Nimbostratus is present together with Altocumulus, use C_M= 7.

(No Altostratus or Nimbostratus)

C_M= 6 – If the C_M code figures 9, 8 and 7 are not applicable and if Altocumulus formed by the spreading out of Cumulus or Cumulonimbus is present, use C_M= 6.

C_M= 5 – If the C_M code figures 9, 8, 7 and 6 are not applicable, and if the Altocumulus present is progressively invading the sky, use C_M= 5.

C_M= 4 – If the C_M code figures 9, 8, 7, 6 and 5 are not applicable and if the Altocumulus present is continually changing in appearance, use C_M= 4.

C_M= 7 – If the C_M code figures 9, 8, 6, 5 and 4 are not applicable and if the Altocumulus present occurs at two or more levels, use C_M= 7.

C_M= 7, 3 – If the C_M code figures 9, 8, 6, 5 and 4 are not applicable and if the Altocumulus present occurs at one level, use C_M= 7 or 3 depending on whether the greater part of the Altocumulus is respectively opaque or semi-transparent.

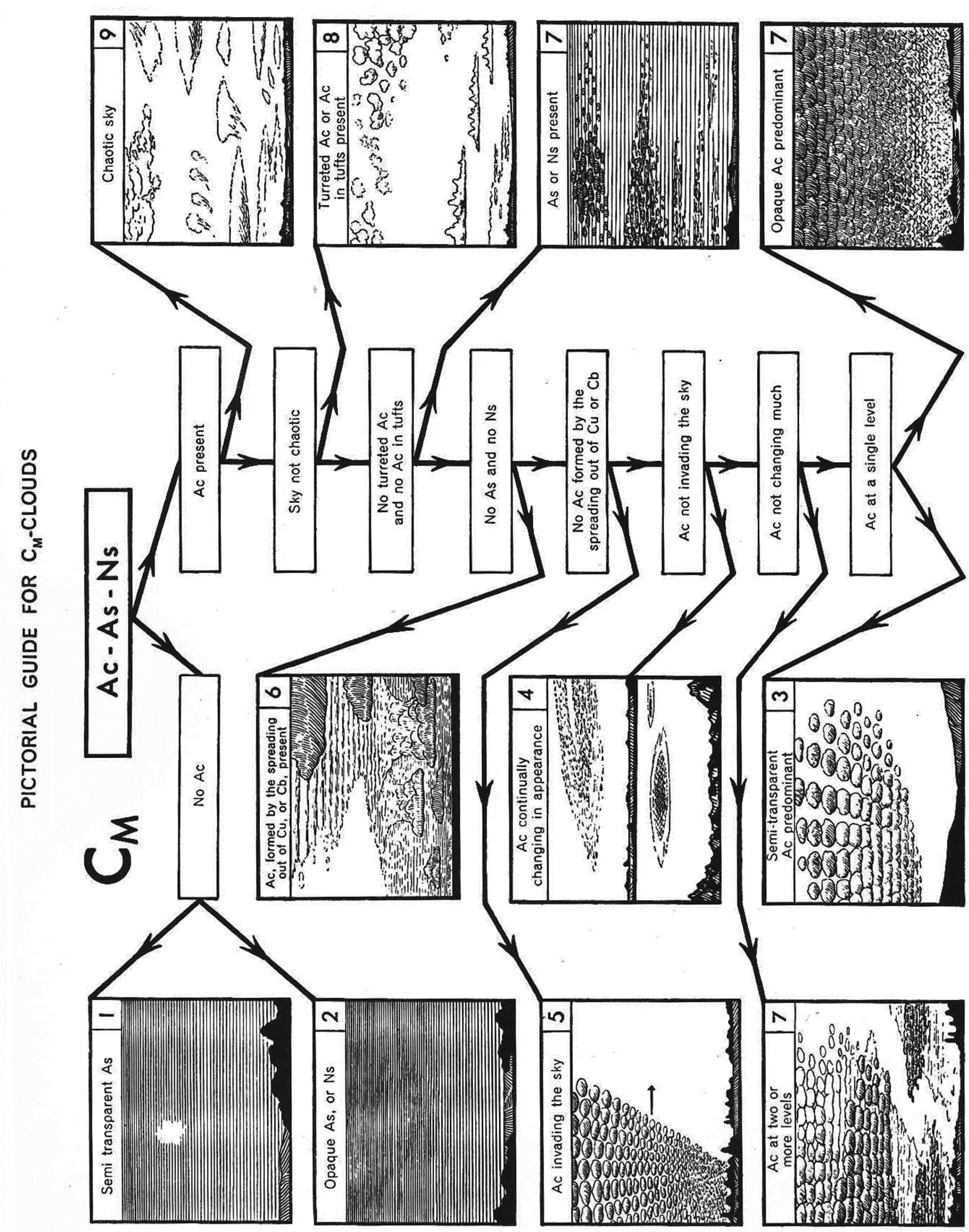
No Altocumulus Present

C_M= 2 – If Nimbostratus is present or if the greater part of the Altostratus present is opaque, use C_M= 2.

C_M= 1 – If there is no Nimbostratus and if the greater part of the Altostratus present is semi-transparent, use C_M= 1.

C_M= / – If C_M clouds invisible owing to continuous layer of lower clouds or because of fog, blowing dust or other similar phenomena.

C_M= 0 – If no Altocumulus, Altostratus or Nimbostratus.


PICTORIAL GUIDE FOR C_M-CLOUDS
C_M
Ac - As - Ns
No Ac
Ac present
Semi transparent As
1
Opaque As, or Ns
2
Sky not chaotic
Chaotic sky
9
No turreted Ac and no Ac in tufts
Turreted Ac or Ac in tufts present
8
No As and no Ns
As or Ns present
7
No Ac formed by the spreading out of Cu or Cb
Ac, formed by the spreading out of Cu, or Cb, present
6
Ac not invading the sky
Ac invading the sky
5
Ac not changing much
Ac continually changing in appearance
4
Ac at a single level
Ac at two or more levels
7
Semi-transparent Ac predominant
3
Opaque Ac predominant
7

12.3.11.6 C_H – clouds of the types Cirrus, Cirrostratus and Cirrocumulus (WMO code 0509)

12.3.11.6.1 Coding instructions for C_H-clouds

The coding instructions list the code figures in descending order of priority. A given code figure is used subject to the condition that all the code figures listed above it are not applicable, and irrespective of the presence of clouds corresponding to the code figures listed below it. More detailed descriptions of the cloud type coding can be found in the *International Cloud Atlas*.

C_H code figure – coding criteria

C_H= 9 – If Cirrocumulus is present alone or if the amount of the Cirrocumulus is more than the combined sky cover of any Cirrus and Cirrostratus present, use C_H= 9.

C_H= 9 not applicable and Cirrostratus present with or without Cirrus or Cirrocumulus

C_H= 7 – If the Cirrostratus covers the whole sky, use C_H= 7.

C_H= 8 – If the Cirrostratus does not cover the whole sky and is not invading the celestial dome, use C_H= 8.

C_H= 6 – If the Cirrostratus is progressively invading the sky and if the continuous veil extends more than 45 degrees above the horizon but does not cover the whole sky, use C_H= 6.

C_H= 5 – If the Cirrostratus is progressively invading the sky but if the continuous veil does not reach 45 degrees above the horizon, use C_H= 5.

C_H= 9 not applicable and no Cirrostratus present.

C_H= 4 – If the Cirrus clouds are invading the sky, use C_H= 4.

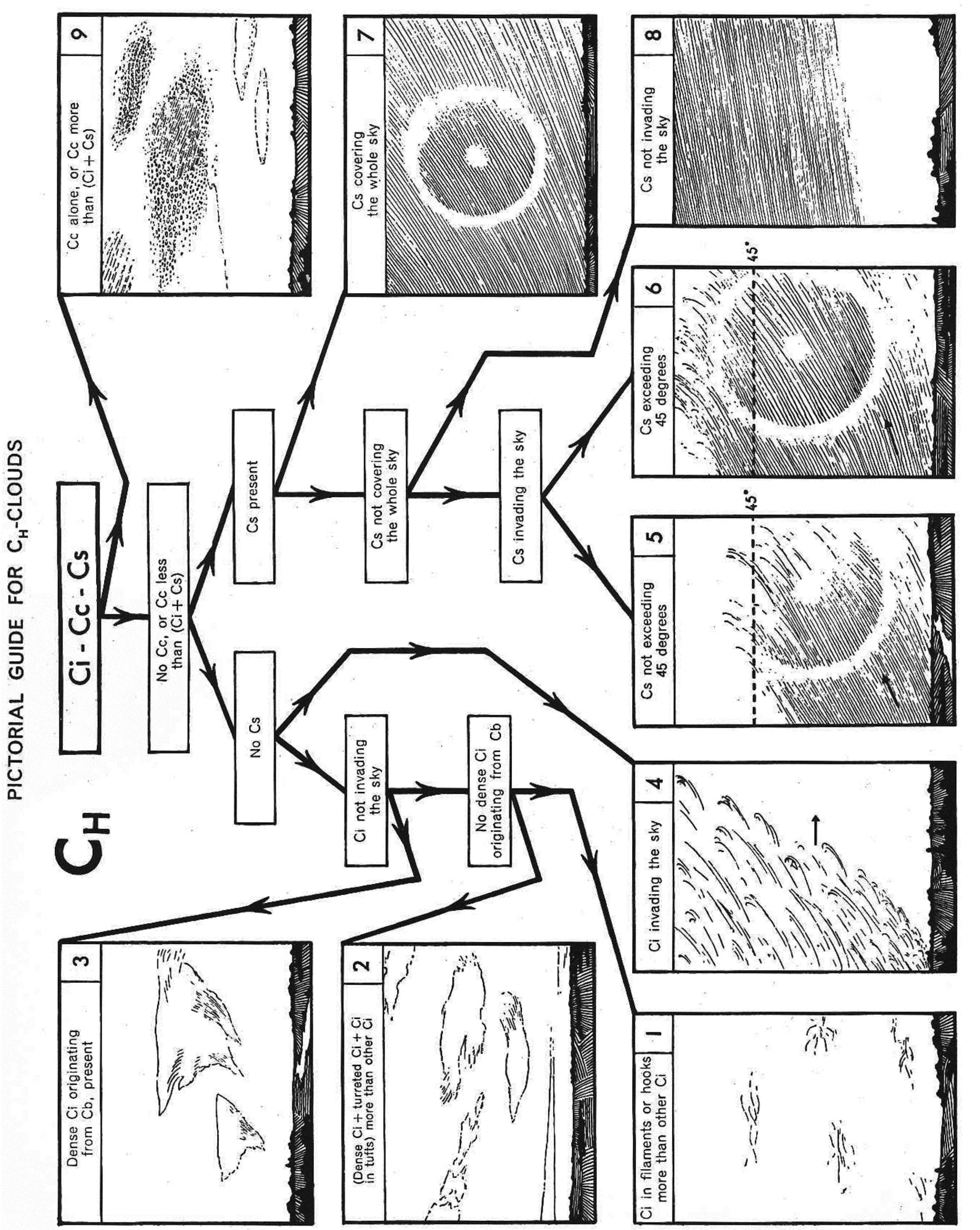
C_H= 3 – If the C_H code figure 4 is not applicable and if dense Cirrus which originated from Cumulonimbus is present in the sky, use C_H= 3.

C_H= 2, 1: If the C_H code figures 4 and 3 are not applicable,

- use C_H= 2 if the combined sky cover of dense Cirrus, of Cirrus with sproutings in the form of small turrets or battlements and of Cirrus in tufts is greater than the combined sky cover of Cirrus in the form of filaments, strands or hooks;
- use C_H= 1 if the combined sky cover of Cirrus in the form of filaments, strands or hooks is greater than the combined sky cover of dense Cirrus, of Cirrus with sproutings in the form of small turrets or battlements and of cirrus in tufts.

C_H= / – If C_H clouds invisible owing to continuous layer of lower clouds or because of fog, blowing dust or other similar phenomena.

C_H= 0 – If no Cirrus, Cirrostratus or Cirrocumulus.


PICTORIAL GUIDE FOR C_H-CLOUDS
C_H
Ci - Cc - Cs
No Cc, or Cc less than (Ci + Cs)
Cc alone, or Cc more than (Ci + Cs)
9
Cs present
No Cs
Cs not covering the whole sky
Cs covering the whole sky
7
Cs invading the sky
Cs not invading the sky
8
Cs exceeding 45 degrees
6
Cs not exceeding 45 degrees
5
45°
Ci not invading the sky
Ci invading the sky
4
No dense Ci originating from Cb
Dense Ci originating from Cb, present
3
(Dense Ci + turreted Ci + Ci in tufts) more than other Ci
2
Ci in filaments or hooks more than other Ci
1

12.4 Section 3

12.4.1

333 – indicator group to show beginning of Section 3. This three-figure group must precede the five-figure groups of Section 3 which follow.

12.4.2 Group $1s_nT_xT_xT_x$

12.4.2.1

1 – indicator figure of the group.

12.4.2.2

s_n – sign of the temperature given by $T_xT_xT_x$. Use code figure 0 if the temperature is 0.0 °C or warmer; use code figure 1 if the temperature is colder than 0.0 °C.

12.4.2.3

$T_xT_xT_x$ – maximum temperature in degrees and tenths Celsius **shall** be coded. See Column 6.

- At 1200 UTC – report the maximum temperature for the 24-hour period ending six hours ago, i.e. 0600 UTC.
- At 1800 UTC and 0000 UTC – report the maximum temperature for the previous 12 hours.
- At 0600 UTC – report the maximum temperature for the previous 24 hours. This is the same maximum temperature reported 6 hours later in the 1200 UTC synoptic report.

Example:

Temperature	s_n	$T_xT_xT_x$	$1s_nT_xT_xT_x$
25.3 °C	0	253	10253
4.5 °C	0	045	10045
0.0 °C	0	000	10000
-0.2 °C	1	002	11002
-5.0 °C	1	050	11050

12.4.3 Group $2s_nT_nT_nT_n$

12.4.3.1

2 – indicator figure of the group.

12.4.3.2

s_n – sign of the temperature given by $T_nT_nT_n$. Use code figure 0 if the temperature is 0.0 °C or warmer; use code figure 1 if the temperature is colder than 0.0 °C.

12.4.3.3

$T_nT_nT_n$ – minimum temperature in degrees and tenths Celsius **shall** be coded. See Column 8.

- At 1200 UTC – report the minimum temperature for the previous 12 hours.
- At 1800 UTC and 0600 UTC – report the minimum temperature for the previous 24 hours.
- At 0000 UTC – report the minimum temperature for the previous 18 hours.

The minimum temperature is coded in the same manner as exemplified in 12.4.2.3.

12.4.4 Group 4E'sss

This group **shall** be included in each main synoptic report when there is snow, ice, or any other form of solid precipitation such as hail, ice pellets, or snow pellets on the ground at the time of the observation and precipitation has occurred since the previous main synoptic observation. See Column 12. (An accumulation of ice which is the product of freezing precipitation only, is not included in this Group.) The group **shall** also be included in the 1200 UTC observation whenever there is solid precipitation on the ground at the time of observation, regardless of when it occurred. If the 1200 UTC synoptic observation is not taken, the group is included in the next main synoptic observation.

12.4.4.1

4 – indicator figure of the group.

12.4.4.2

E' – state of the ground with snow or measurable ice cover. E' **shall** be encoded according to code table 0975 and the following criteria:

- The highest applicable code figure is always reported.
- The definitions in the table apply to an open, representative area.
- The term "ice," as used in the table, also includes solid precipitation other than snow.

WMO code 0975

Code figure	E' – State of ground with snow or measurable ice cover
0	Ground predominately covered by ice (as opposed to snow)
1	Compact or wet snow (with or without ice) covering less than one-half of the ground
2	Compact or wet snow (with or without ice) covering at least one-half of the ground but ground not completely covered
3	Even layer of compact or wet snow covering ground completely
4	Uneven layer of compact or wet snow covering ground completely
5	Loose, dry snow covering less than one-half of the ground
6	Loose, dry snow covering at least one-half of the ground (but not completely)
7	Even layer of loose, dry snow covering ground completely
8	Uneven layer of loose, dry snow covering ground completely
9	Snow covering ground completely; deep drifts (50 cm or more above the general snow surface)

12.4.4.3

sss – total depth of snow (or ice) on the ground, in whole centimetres. The depth of snow **shall** be obtained from Column 14 and coded according to the following table:

Code figure	sss – depth of snow in centimetres
001	1 cm
996	996 cm
997	Trace (average depth less than 1/2 cm)

12.4.5 Group 5EEEi_E

This group **shall** be included in the 1800 UTC main synoptic report when measurable evaporation (or evapotranspiration) has occurred in the preceding evaporation day.

12.4.5.1

5 – indicator figure of the group.

12.4.5.2

EEE – total amount of evaporation (or evapotranspiration) during the evaporation day ending in the morning prior to the 1800 UTC observation. The evaporation amount **shall** be obtained from Column 4 of Form 0063-2270; EEE is coded in tenths of millimetres.

12.4.5.3

i_E – indicator of type of instrumentation for evaporation measurement, or type of crop for which evapotranspiration is reported.

WMO code 1806

i_E Code figure	Instrumentation or code type	Type of data
0	USA open pan evaporimeter (without cover)	Evaporation
1	USA open pan evaporimeter (mesh covered)	Evaporation
2	GGI-3000 evaporimeter (sunken)	Evaporation
3	20 m^2 tank	Evaporation
4	Others	Evaporation
5	Rice	Evapotranspiration
6	Wheat	Evapotranspiration
7	Maize	Evapotranspiration
8	Sorghum	Evapotranspiration
9	Other Crops	Evapotranspiration

Note: The code figure used for the AES Class A Evaporation pan is i_E = 0.

Coding examples:

Net water loss Col. 4, Form 0063-2270	Record EEE	Transmit group 5EEEi$_E$ as:
1.4	014	50140
12.6	126	51260
Unknown (due to overflow, etc.)	XXX	5///0
0.0	000	50000

12.4.6 Group 55SSS

This group **shall** be included in the 1200 UTC synoptic report to indicate the number of hours of bright sunshine received for the previous day, ending at midnight, local apparent time (LAT).

12.4.6.1

55 – indicator figure of the group.

12.4.6.2

SSS – duration of bright sunshine in tenths of an hour, for the 24-hour period ending at midnight, local apparent time. Sunshine values reported are those scaled from the sunshine recorder card, in accordance with the instructions given in the manual, *SUNSHINE*.

Example:

Duration of bright sunshine (hours and tenths)	Encoded value (hours and tenths) SSS
0.8	008
5.3	053
21.2	212
0.0	000

12.4.6.3

If equipment malfunction results in a partial or total loss of data, the group **shall** be recorded as 55XXX and transmitted as 55 / / /.

12.4.6.4

The group may be omitted by stations north of the Arctic Circle in winter during those extended periods when the sun is below the horizon, if the station does not transmit radiation data.

12.4.7 Group $j_5F_{24}F_{24}F_{24}F_{24}$

This supplementary group **shall** be included in the 1200 UTC synoptic report to indicate the amount of net radiation (RF4) and/or global solar radiation (RF1) recorded in the preceding 24-hour period. The radiation group(s) is (are) always preceded by the group 55SSS.

12.4.7.1

j_5 – indicator figure of the group, where:

- j_5 = 0 is the indicator for positive net radiation (RF4),
- j_5 = 1 is the indicator for negative net radiation (RF4), and
- j_5 = 2 is the indicator for global solar radiation (RF1).

12.4.7.2

$F_{24}F_{24}F_{24}F_{24}$ – absolute value of the amount of net radiation (RF4) or global solar radiation (RF1) for the 24 hours preceding the 1200 UTC observation. The amount of net or global solar radiation is printed out at 1200 UTC for the 24-hour period just ended. The units are joules per square centimetre with a floating decimal (see examples). The amount of net and/or global solar radiation **shall** be obtained from the printer, rounded to whole joules per square centimetre and encoded for $F_{24}F_{24}F_{24}F_{24}$ with sufficient leading zeros to produce a four-digit group.

Coding examples of sunshine, net radiation, and global solar radiation:

Sunshine	Encode SSS	Net radiation	Encode $F_{24}F_{24}F_{24}F_{24}$	Global solar	Encode $F_{24}F_{24}F_{24}F_{24}$
1.4	014	No RF4 sensor	-	02+31.85	0032
0.0	000	03-68.20	0068	02+244.0	0244
13.1	131	03+1472	1472	No RF1 sensor	-

Transmit groups:

55SSS $J_5F_{24}F_{24}F_{24}F_{24}$ $J_5F_{24}F_{24}F_{24}F_{24}$

as:

55014 20032
55000 10068 20244
55131 01472

Note: RF1 sensors operating during polar night may output a negative value. In such cases encode 0000 for the $F_{24}F_{24}F_{24}F_{24}$ associated with RF1.

Sample radiation printer output

01+0142	02+0091	03+0157	04+0600	05+09.72	06+0.844	07+0.000	08+2321	09+13.91
01+0209	02+0.045	03+0.076	04+0.066	05-1.894	06-0.320	07+09.79		
01+0209	02+0.389	03+0.326	04+0.140	05-1.125	06-0.373	07+08.73		
01+0155	02+1555	03+1387						
01+0209	02+1.141	03+0.571	04+0.333	05+0.933	06-0.317	07+08.73		
01+0209	02+4.617	03+0.883	04+1.389	05+08.51	06-0.360	07+12.09		
01+0209	02+6.761	03+2.140	04+1.857	05+13.77	06-0.447	07+16.09		
01+0209	02+5.280	03+3.502	04+1.372	05+11.63	06-0.284	07+17.94		
01+0140								
01+0142	02+0091	03+0157	04+1200	05+12.16	06+0.844	07+0.000	08+2321	09+13.92

The data on the printer output are arranged in columns. The example used in this case begins with a column of programming information followed by six columns of data, that is, RF1, RF2, RF3, RF4, RF9 and RF9 temperature. The first two digits of each column refer to the column number. The number of columns output at any radiation station will be dependent on the radiation program in place at the site. A summary line is printed every six hours (LST), followed by a line of data every hour. A three-column line summarizing daily energy data for RF1 and RF4 is printed at 1200 UTC each day. The station in the above example is equipped to measure both RF1 and RF4, and the daily energy data are printed in columns 2 and 3 respectively. The location of the daily energy data line will vary according to the time zone. In the example given, the 1200 UTC energy data line is printed immediately prior to the data for 0800 LST, which indicates that the data came from the Atlantic Region (where four hours are added to LST to obtain UTC). Note also that daily energy values greater than 1000 are already rounded prior to printing on the printer output. 24-hour values for net radiation (RF4) may be either positive or negative, as indicated on the output.

12.4.8 Group 6RRRt_R

This group **shall** be included in intermediate synoptic reports at stations which normally measure precipitation (see 12.3.1.1 on the use of the symbol i_R).

12.4.8.1

6 – indicator figure of the group. This group is included in Section 3 only in intermediate synoptic reports.

12.4.8.2

RRR – amount of precipitation which has fallen during the period preceding the time of observation, as indicated by t_R. Amounts are usually for a three-hour period at the intermediate observation. Precipitation amounts should be obtained from an intermediate reading of the standard rain gauge, without emptying its contents. In cold weather, if the contents of the gauge are frozen, it may be necessary to replace the funnel and graduate with a spare and measure the amount as instructed in 3.7.3.3. Precipitation amounts are coded according to WMO code 3590 (see 12.3.9.2).

Note: Precipitation amounts which are greater than 1.0 mm **shall** be rounded to the nearest whole millimetre prior to coding.

12.4.8.3

WMO code 4019 (abridged)

t_R Code Figure	Duration of period of reference for amount of precipitation (RRR), ending at the time of the report
5	Total precipitation during the 1 hour preceding the observation
6	Total precipitation during the 2 hours preceding the observation
7	Total precipitation during the 3 hours preceding the observation
8	Total precipitation during the 9 hours preceding the observation
9	Total precipitation during the 15 hours preceding the observation

12.4.9 Group $7R_{24}R_{24}R_{24}R_{24}$

This group **shall** be included in each main synoptic observation to report total amount of measurable precipitation during the preceding 24 hours.

12.4.9.1

7 – indicator figure of the group.

12.4.9.2

$R_{24}R_{24}R_{24}R_{24}$ – total amount of precipitation during the 24-hour period ending at the time of observation. The amount **shall** be obtained from Column 13 and coded in tenths of millimetres.

Example:

24-hour Precipitation	$7R_{24}R_{24}R_{24}R_{24}$
Nil	70000
Trace	79999
0.2 mm	70002
25.3 mm	70253
105.8 mm	71058
999.8 mm or more	79998

12.4.10 Group $8N_sCh_sh_s$

This group gives additional detailed information on the sky condition, but **shall** be included in the main and intermediate synoptic observations only if an hourly observation is not transmitted for the same hour as the synoptic. The group **shall** also be omitted when the sky is clear (N and N_s = 0). The 8-group may be repeated to report a number of layers aloft but normally the number of groups will not exceed three. Four groups may, however, be reported when cumulonimbus clouds are observed. The order of reporting layers **shall** be from low to high levels. This group **shall** be used to report:

1) The lowest layer aloft of any amount; (including smoke etc.);
2) the lowest layer aloft at which the summation amount is 4/10 or more; and
3) the lowest layer aloft at which the summation amount is 6/10 or more.

Note (1): When reporting a layer under requirement (1), (2) or (3) in which two or more cloud types are present at the same level, the type of cloud which is coded for C, in order of priority, **shall** be:

(i) Cumulonimbus, if present. If the amount of the remaining type(s) of cloud is less than required by (2) or (3) above, that amount **shall** be included in the group in which C is coded 9; another group **shall** be used to describe the remaining type(s) of cloud if their amount would satisfy the preceding criteria of (2) or (3).

(ii) The type of cloud which is predominant in amount at that level.

(iii) The type of cloud having the highest applicable code figure, if the amounts of cloud of each type are equal at that level.

4) Cumulonimbus, exclusively, whenever observed and not reported under requirement (1), (2), or (3).
5) The height of vertical visibility when a surface-based layer completely obscures the sky and the vertical visibility constitutes the ceiling (see 12.4.10.4.2, examples 9, 10 and 11).

Note (2): When blue sky or stars are seen through existing surface-based layers such as fog, smoke, etc., without any trace of cloud above the surface-based layer, the 8-group **shall not** be coded.

12.4.10.1

8 – indicator figure of the group.

12.4.10.2

N_s – the code figure for N_s **shall** be selected from the following table:

WMO code 2700

Code figure	Fraction of the celestial dome covered by clouds	Okta(s)
0	0	0
1	1/10 or less, but not zero	1 okta or less, but not zero
2	2/10 - 3/10	2 oktas
3	4/10	3 oktas
4	5/10	4 oktas
5	6/10	5 oktas
6	7/10 - 8/10	6 oktas
7	9/10 or more, but not 10/10	7 oktas or more, but not 8 oktas
8	10/10	8 oktas
9	Sky obscured by fog and/or other meteorological phenomena.	
/	Cloud cover is indiscernible for reasons other than fog or other meteorological phenomena, or observation is not made.	

12.4.10.2.1 Code tables for N, N_h and N_s

When clouds are seen through a surface-based layer (a partial obscuration), their amount **shall** be evaluated as though the obscuration did not exist and the code for N_s may be obtained from the following tables:

Total amount of cloud (eighths)	Amount of sky obscured (oktas)							
-	1	2	3	4	5	6	7	
0	0	0	0	0	0	0	0	
1	1	1	2	2	3	4	8	
2	2	2	3	4	6	8	-	
3	3	3	4	5	8	-	-	
4	4	5	6	8	-	-	-	
5	6	7	8	-	-	-	-	
6	6	8	-	-	-	-	-	
7	8	-	-	-	-	-	-	

Figure obtained is the code figure.

Total amount of cloud (tenths)	Amount of sky obscured (tenths)								
-	1	2	3	4	5	6	7	8	9
0	0	0	0	0	0	0	0	0	0
1	1	1	1	2	2	2	2	4	8
2	2	2	2	2	3	4	6	8	-
3	2	3	3	4	5	6	8	-	-
4	3	4	5	6	6	8	-	-	-
5	5	5	6	6	8	-	-	-	-
6	6	6	7	8	-	-	-	-	-
7	6	7	8	-	-	-	-	-	-
8	7	8	-	-	-	-	-	-	-
9	8	-	-	-	-	-	-	-	-

Figure obtained is the code figure.

12.4.10.3

C – type of significant cloud. The type **shall** be selected from the following code table:

WMO Code 0500

Code figure	Type of significant cloud
0	Cirrus
1	Cirrocumulus
2	Cirrostratus
3	Altocumulus or Altocumulus Castellanus
4	Altostratus
5	Nimbostratus
6	Stratocumulus
7	Stratus or Stratus Fractus
8	Cumulus, Towering Cumulus or Cumulus Fractus
9	Cumulonimbus
/	Non-cloud layer aloft, or sky totally obscured by surface-based layer.

12.4.10.4

h_sh_s – height above station of layer to which N_s refers. The height of the base of the significant cloud layer, or the vertical visibility if appropriate, **shall** be determined and coded using the following table:

WMO code 1677

h_sh_s – height of base of cloud layer or mass whose genus is indicated by “C”.

Meters	h_sh_s	Coded height
<30	0	-
30	1	1
60	2	2
90	3	3
120	4	4
150	5	5
180	6	6
210	7	7
240	8	8
270	9	9

Meters	h_sh_s	Coded height
300	10	10
330	11	11
360	12	12
390	13	13
420	14	14
450	15	15
480	16	16
510	17	17
540	18	18
570	19	19
600	20	20
630	21	21
660	22	22
690	23	23
720	24	24
750	25	25
780	26	26
810	27	27
840	28	28
870	29	29
900	30	30
930	31	31
960	32	32
990	33	33
1020	34	34
1050	35	35
1080	36	36
1110	37	37
1140	38	38
1170	39	39
1200	40	40
1230	41	41
1260	42	42
1290	43	43
1320	44	44

Meters	h_sh_s	Coded height
1350	45	45
1380	46	46
1410	47	47
1440	48	48
1470	49	49
1500	50	50
Not used	51	Not used
Not used	52	Not used
Not used	53	Not used
Not used	54	Not used
Not used	55	Not used
1800	56	60
2100	57	70
2400	58	80
2700	59	90
3000	60	100
3300	61	110
3600	62	120
3900	63	130
4200	64	140
4500	65	150
4800	66	160
5100	67	170
5400	68	180
5700	69	190
6000	70	200
6300	71	210
6600	72	220
6900	73	230
7200	74	240
7500	75	250
7800	76	260
8100	77	270
8400	78	280
8700	79	290

Meters	h_sh_s	Coded height
9000	80	300
10500	81	350
12000	82	400
13500	83	450
15000	84	500
16500	85	550
18000	86	600
19500	87	650
21000	88	-
>21000	89	-
<50	90	-
50 to 100	91	-
100 to 200	92	-
200 to 300	93	-
300 to 600	94	-
600 to 1000	95	-
1000 to 1500	96	-
1500 to 2000	97	-
2000 to 2500	98	-
2500 or more, or no clouds	99	-

Note (1): < means "less than"

Note (2): > means "greater than"

Note (3): Code figures 90–99 (h_sh_s) **shall not** be used except on special instructions from the ADM.

12.4.10.4.1

If the height recorded is not one of the values listed in the code table, select the code representing the next lower listed height.

Example: 1650 m **shall** be coded as 50; 10 000 m **shall** be coded as 80.

12.4.10.4.2

The following examples illustrate the application of the preceding instructions in coding the required "8" groups.

Example	Sky Condition	Necessary 8-Groups (8N_sC$h_s$$h_s$)
1	6/10 of SC at 600 m 1/10 of SC at 600 m	85620
2	6/10 of SC at 600 m 1/10 of CB at 1200 m	85620 86940 (See 12.4.10 (4))
3	1/10 of SC at 600 m 2/10 of AC at 2400 m 1/10 of AS at 3600 m 1/10 of CS at 9000 m	81620 83462
4	3/10 TCU at 600 m 1/10 CB at 600 m	81920 83820 (See 12.4.10, Note 1 (i))
5	2/10 TCU at 600 m 1/10 CB at 600 m	82820 (See 12.4.10, Note 1 (i))
6	6/10 of SC at 600 m 1/10 of CB at 900 m 2/10 of TCU at 900 m	85620 86930 (Requirements of 12.4.10 (1) to (3) are satisfied by first group, the second group satisfies requirement (4))
7	6/10 of sky obscured by fog 2/10 SC at 600 m 1/10 AC at 3000 m	84620 86360 (N_s was coded with the aid of the table in 12.4.10.2.1)
8	1/10 SC at 750 m 2/10 CB at 1050 m 2/10 AC at 3600 m 3/10 AC at 4800 m	81625 82935 84362 86366
9	10/10 of sky obscured by fog, vertical visibility 90 m	89X03
10	6/10 SF at 150 m 4/10 Snow, vertical visibility 360 m	85705
11	4/10 SF at 150 m 6/10 Snow, vertical visibility 360 m	83705 89X12
12	3/10 Smoke aloft, based at 120 m 6/10 SC at 450 m	82X04 87615
13	5/10 Smoke, (surface-based) 1/10 SC at 450 m	82615

Example	Sky Condition	Necessary 8-Groups ($8N_sCh_sh_s$)
14	1/10 of CF at 900 m 1/10 of AC at 3600 m 3/10 of AS at 3600 m	81830 84462
15	2/10 of TCU at 900 m 1/10 of CB at 900 m 2/10 of AC at 2700 m 3/10 of CI at 8400 m	82930 84359 86078

12.4.11 Group $9S_PS_Ps_ps_p$

This group is used to give detailed information on special phenomena. Although the codes make provision for the reporting of various special phenomena, unless special instructions are received from the ADM, two 9-groups only **shall** be used to report:

1) Time at which precipitation began or ended and duration and character of precipitation. This information **shall** be reported by means of the special phenomena group $909R_td_c$ whenever group $6RRRt_R$ is encoded and the RRR value of this group is not coded as 000. R_t **shall** be encoded in accordance with the table in 12.4.11.3.3 and d_c **shall** be encoded according to the table in 12.4.11.3.4.
2) Depth of newly fallen snow. The depth of newly fallen snow is the amount of snow that would have accumulated had it not been disturbed by the wind or melted. It is essentially the rounded value of the amount recorded in Column 9, Form 63-2322. The measurement is reported in the group 931ss, where ss is the measurement in whole centimetres, up to 55 cm. Measurements above 55 cm **shall** be encoded in accordance with the table in 12.4.11.3.5. The group **shall** be included at the discretion of the Regional Director General, but only by stations that take four staffed synoptic observations daily and when the rounded measurement is 1 cm or more.

12.4.11.1

9 – indicator figure of the 9-Group.

12.4.11.2

$S_PS_Ps_ps_p$ – supplementary information

WMO code 3778

$S_PS_Ps_ps_p$ Decile 00-09	Time of variability
900tt	Time of commencement of ww (in group $7wwW_1W_2$)
900zz	Variability, location or intensity of ww (in group $7wwW_1W_2$)
901u	Time of ending of ww (in group $7wwW_1W_2$)
902tt	Time of commencement of weather phenomenon reported in the following group $9S_PS_Ps_ps_p$
902zz	Variability, location or intensity of weather phenomenon reported in the following group $9S_PS_Ps_ps_p$
903tt	Time of ending of weather phenomenon reported in the preceding group $9S_PS_Ps_ps_p$
904tt	Time of occurrence of weather phenomenon reported in the following group $9S_PS_Ps_ps_p$
905tt	Duration of non-persistent weather or time of commencement of persistent weather reported by ww in group $7wwW_1W_2$
906tt	Duration of non-persistent weather or time of commencement of persistent weather phenomenon reported in the following group $9S_PS_Ps_ps_p$
907tt	Duration of period of reference, ending at the time of observation, of weather phenomenon reported in the following group $9S_PS_Ps_ps_p$
908	Not used
$909R_td_c$	Time at which precipitation given by RRR began or ended and duration and character of precipitation

Decile 10-19	Wind and squall
910ff	Highest gust during the 10-minute period immediately preceding the observation
911ff	Highest gust (3)
912ff	Highest mean wind speed (3)
913ff	Mean wind speed (3)
914ff	Lowest mean wind speed (3)
915dd	Wind direction
916tt	Pronounced clockwise shift in wind direction (veering)

Decile 10-19	Wind and squall
917tt	Pronounced anticlockwise shift in wind direction (backing)
918s_qD_p	Nature and/or type of squall, and direction from which it approaches the station
919M_wD_a	Water spout(s), tornadoes, whirlwinds, dust devils

Note (1): When wind speed reaches or exceeds 99 units, two groups **shall** be used in the same manner as in Section 1 (see 12.3.3).

Note (2): The mean wind speed referred to in groups 912ff and 914ff is defined as time averaged instantaneous wind speed over a 10-minute interval throughout the period covered by W_1W_2 or as indicated by a preceding time group.

Note (3): During the period covered by W_1W_2 in group 7wwW_1W_2 unless a different period of reference is indicated by group 907tt, or during the 10-minute period immediately preceding the time of observation indicated by group 904tt.

Decile 20-29	State of the Sea, Icing Phenomena and Snow Cover
920SF_x	State of the sea and maximum wind force (F_x ≤9 Beaufort)
921SF_x	State of the sea and maximum wind force (F_x >9 Beaufort)
922S'V'_s	State of the water surface and visibility at a seaplane alighting area
923S'S	State of the water surface in the alighting area and state of the sea in the open sea
924SVS	State of the sea and visibility seawards (from a coastal station)
925T_wT_w	Water temperature at resorts during the bathing season
926S_0i_0	Hoar frost or coloured precipitation
927S_6T_w	Frozen deposit
928$S_7S'_7$	Character and regularity of snow cover
929$S_8S'_8$	Drift snow

Decile 30-39	Amount of precipitation or deposit	
930RR	Amount of Precipitation	During the period by W_1W_2 in group $7wwW_1W_2$ unless a different period of reference is indicated by group 907tt.
931ss	Depth of newly fallen snow	During the period by W_1W_2 in group $7wwW_1W_2$ unless a different period of reference is indicated by group 907tt.
932RR	Maximum diameter of hailstones	During the period by W_1W_2 in group $7wwW_1W_2$ unless a different period of reference is indicated by group 907tt.
933RR	Water equivalent of solid precipitation on ground	At time of observation
934RR	Diameter of glaze deposit	At time of observation
935RR	Diameter of rime deposit	At time of observation
936RR	Diameter of compound deposit	At time of observation
937RR	Diameter of wet snow deposit	At time of observation
938nn	Rate of glaze accrual on a surface, in mm h^{-1}	
$939h_gh_g$	Height above ground, in metres, at which diameter of deposit reported in the preceding group $9S_PS_Ps_ps_p$ is observed	
939nn	Maximum diameter of hailstones, in millimetres	

Decile 40-49	Clouds
$940Cn_3$	Evolution of clouds
$941CD_p$	Direction from which clouds are moving
$942CD_a$	Location of maximum concentration of clouds
$943C_LD_p$	Direction from which low-level clouds are moving
$944C_LD_a$	Location of maximum concentration of low-level clouds
$945h_th_t$	Height of the tops of the lowest clouds or height of the lowest cloud layer or fog
$946C_cD_a$	Direction of colouration and/or convergence of clouds associated with a tropical disturbance
947Ce'	Elevation of clouds
$948C_0D_a$	Orographic clouds
$949C_aD_a$	Clouds of vertical development

Decile 50-59	Cloud conditions over mountains and passes, or in valleys or plains observed from a higher level	
$950N_mn_3$	Cloud conditions over mountains and passes	
$951N_vn_4$	Fog, mist or low cloud in valleys or plains, observed from a station at a higher level	
952	Not used	
953	Not used	
954	Not used	
955	Not used	
956	Not used	
957	Not used	
$958E_hD_a$	Location of maximum concentration of clouds	Reported in the preceding group $9S_PS_Ps_ps_p$
$959v_pD_p$	Forward speed and direction from which clouds are moving	Reported in the preceding group $9S_PS_Ps_ps_p$

Decile 60-69	Present weather and past weather
960ww	Present weather phenomenon observed simultaneously with and/or in addition to weather phenomenon reported by ww in group $7wwW_1W_2$
$961w_1w_1$	Present weather phenomenon observed and/or in addition to weather phenomenon reported by ww in group $7wwW_1W_2$ or amplification of present phenomenon reported by ww in group $7wwW_1W_2$
962ww $963w_1w_1$	Amplification of weather phenomenon during preceding hour but not at time of the observation and reported by ww = 20-29 in group $7wwW_1W_2$
964ww $965w_1w_1$	Amplification of weather phenomenon during the period covered by W_1W_2 and reported by W_1 and/or W_2 in group $7wwW_1W_2$
966ww $967w_1w_1$	Weather phenomenon occurring at the time or during the period indicated by associated $9S_PS_Ps_ps_p$ groups
968	Not used
$9696D_a$	Rain at the station not associated with thunderstorm in distance, direction D_a
$9697D_a$	Snow at the station not associated with thunderstorm in distance, direction D_a

Decile 60-69	Present weather and past weather
$9698D_a$	Shower at the station not associated with thunderstorm in distance, direction D_a

Decile 70-79	Location and movement of phenomena	
$970E_hD_a$	Location of maximum concentration of phenomenon reported by	ww in group $7wwW_1W_2$
$971E_hD_a$		ww in group 960ww
$972E_hD_a$		w_1w_1 in group $961w_1w_1$
$973E_hD_a$		W_1 in group $7wwW_1W_2$
$974E_hD_a$		W_2 in group $7wwW_1W_2$
$975V_pD_p$	Forward speed and direction from which it is moving, phenomenon reported by	ww in group $7wwW_1W_2$
$976V_pD_p$		ww in group 960ww
$977V_pD_p$		w_1w_1 in group $961w_1w_1$
$978V_pD_p$		W_1 in group $7wwW_1W_2$
$979V_pD_p$		W_2 in group $7wwW_1W_2$

Decile 80-89	Visibility
$980V_sV_s$	Visibility towards the sea
981VV	Visibility to NE
982VV	Visibility to E
983VV	Visibility to SE
984VV	Visibility to S
985VV	Visibility to SW
986VV	Visibility to W
987VV	Visibility to NW
988VV	Visibility to N
$989V_bD_a$	Variation of visibility during the hour preceding the time of observation and the direction in which this variation has been observed.

Decile 90-99	Optical phenomena and miscellaneous
$990Z_0i_0$	Optical phenomena
$991AD_a$	Mirage
99190	St. Elmo's fire
$992N_tt_w$	Condensation trails
$993C_SD_a$	Special clouds
$994A_3D_a$	Day darkness
995nn	Lowest atmospheric pressure reduced to mean sea level during the period covered by W_1W_2 unless otherwise indicated by associated $9S_PS_Ps_ps_p$ time group(s), in tens and units of hectopascals
$996T_vT_v$	Sudden rise in air temperature, in whole degrees Celsius
$997T_vT_v$	Sudden fall in air temperature, in whole degrees Celsius
$998U_vU_v$	Sudden rise in relative humidity, in per cent
$999U_vU_v$	Sudden fall in relative humidity, in per cent

Note: Groups $996T_vT_v$, $997T_vT_v$, $998U_vU_v$ and $999U_vU_v$ should not be used to report normal diurnal changes in temperature or humidity.

12.4.11.3 s_ps_p – Special phenomena, detailed description

Several selected code tables for reporting s_ps_p are listed below with their corresponding paragraph numbers in *MANOBS*, or reference in the *WMO Manual on Codes*:

dd – Wind direction table (see 12.4.11.3.1)

ff – Wind speed table (see 12.4.11.3.2)

R_t – Time of precipitation table (see 12.4.11.3.3)

d_c – Duration and character of precipitation (see 12.4.11.3.4)

tt – Time or duration of phenomena (see WMO code 4077, Vol.1)

zz – Variation, location, or intensity of phenomena (see WMO code 4077, Vol.1)

RR – Amount of precipitation (see WMO code 3570, Vol.1)

ss – Depth of newly fallen snow (see WMO code 3870, Vol.1)

12.4.11.3.1 Direction of Wind in Tens of Degrees – dd

Code Figure	Degrees
00	Calm
01	5° - 14°
02	15° - 24°
03	25° - 34°
04	35° - 44°
05	45° - 54°
06	55° - 64°
07	65° - 74°
08	75° - 84°
09	85° - 94°
10	95° - 104°
11	105° - 114°
12	115° - 124°
13	125° - 134°
14	135° - 144°
15	145° - 154°
16	155° - 164°
17	165° - 174°
18	175° - 184°
19	185° - 194°
20	195° - 204°
21	205° - 214°
22	215° - 224°
23	225° - 234°
24	235° - 244°
25	245° - 254°
26	255° - 264°
27	265° - 274°
28	275° - 284°
29	285° - 294°
30	295° - 304°
31	305° - 314°
32	315° - 324°

Code Figure	Degrees
33	325° - 334°
34	335° - 344°
35	345° - 354°
36	355° - 4°

12.4.11.3.2 Wind Speed Table, ff – Wind Speed in Knots (00-99)

Code Figure	Wind speed	Code Figure	Wind speed
00	Calm or unknown	95	95 kts
01	1 kts	96	96 kts
02	2 kts	97	97 kts
03	3 kts	98	98 kts
etc.	etc.	99	99 kts or greater*

***Note**: When the wind speed is 99 kts or greater, two special phenomena groups are required to report the speed, as in Section 1 of the code. For example, to report a gust of 135 kts during the 10-minute period preceding the observation, the two groups would be coded 91099 00135.

12.4.11.3.3 Time of Precipitation Table

R_t –time at which precipitation given by RRR began or ended. This information **shall** be obtained from columns 3 and 4 and coded according to the following table:

WMO Code 3552

Code Figure	Time at which precipitation given by RRR began or ended
0	Not used
1	Less than 1 hour ago
2	1 to 2 hours ago
3	2 to 3 hours ago
4	3 to 4 hours ago
5	4 to 5 hours ago
6	5 to 6 hours ago
7	6 to 12 hours ago
8	More than 12 hours ago
9	Unknown

Note (1): If there is a choice, use the smaller code figure. For example: if rain ended exactly four hours ago, use code figure 4.

Note (2): When a station has not been continuously staffed and a recording rain gauge was not in operation throughout the period, it may be necessary to code R_t as 9.

Note (3): R_t **shall** be coded with reference to the official time of observation. When precipitation is occurring at the time of observation, R_t **shall** refer to the “time precipitation began.” When precipitation is not occurring at the time of observation, R_t **shall** refer to the “time precipitation ended,” except:

1) If the coding of ww indicates that precipitation has ended during the preceding hour (ww codes 20–27 and 29), R_t **shall** be coded to indicate the “time precipitation began.”
2) When two or more periods of precipitation occur during a six-hour period preceding the observation, the time (beginning or ending) of the last period of precipitation **shall** be reported by R_t. Occurrences of precipitation **shall** be considered as separate periods of precipitation when separated by 15 minutes or more.

12.4.11.3.4 Duration and character of precipitation table

WMO code 0833

Code Figure	d_c – duration and character of precipitation given by RRR	
0	Last less than one hour	Only one period of precipitation has occurred during the past 6 hours.
1	Lasted 1–3 hours	
2	Lasted 3–6 hours	
3	Lasted more than 6 hours	
4	Lasted less than 1 hour	Two or more periods of precipitation have occurred during the past 6 hours.
5	Lasted 1–3 hours	
6	Lasted 3–6 hours	
7	Lasted more than 6 hours	
8	Not used	
9	Unknown	

Note (1): If there is a choice, use the smaller code figure. For example, if a single period of precipitation lasted exactly three hours, use code figure 1.

Note (2): Occurrences of precipitation **shall** be considered as separate periods of precipitation when separated by intervals of 15 minutes or more.

Note (3): If only one period of precipitation has occurred during the past six hours, and is still occurring at the time of observation, the duration is defined as the time elapsed from the beginning of precipitation until the time of observation. If precipitation is not occurring at the time of observation, the duration is the interval from beginning to end of the precipitation (See 12.3.10.3.3, examples 2 to 5, 8, 9, 11, 13 to 16, and 18).

Note (4): If two or more periods of precipitation have occurred during the past six hours, and precipitation is occurring at the time of observation, the duration is defined as the time elapsed from the beginning of the first period of precipitation, all or part of which occurred during the past six hours, until the time of observation. If precipitation is not occurring at the time of observation, the duration is defined as the interval from the beginning of the first period of precipitation to the end of the last period of precipitation (see 12.3.10.3.3, examples 6, 7, and 10).

12.4.11.3.5 Depth of newly fallen snow table

WMO code 3870 – ss – depth of newly fallen snow

Code Figure	cm	Code Figure	cm	Code Figure	cm
00	Not used	34	34	68	180
01	1	35	35	69	190
02	2	36	36	70	200
03	3	37	37	71	210
04	4	38	38	72	220
05	5	39	39	73	230
06	6	40	40	74	240
07	7	41	41	75	250
08	8	42	42	76	260
09	9	43	43	77	270
10	10	44	44	78	280
11	11	45	45	79	290
12	12	46	46	80	300
13	13	47	47	81	310
14	14	48	48	82	320
15	15	49	49	83	330
16	16	50	50	84	340
17	17	51	51	85	350
18	18	52	52	86	360
19	19	53	53	87	370
20	20	54	54	88	380
21	21	55	55	89	390
22	22	56	60	90	400
23	23	57	70	91	Not used
24	24	58	80	92	Not used
25	25	59	90	93	Not used
26	26	60	100	94	Not used
27	27	61	110	95	Not used
28	28	62	120	96	Not used
29	29	63	130	97	Not used
30	30	64	140	98	More than 400
31	31	65	150	99	Not used
32	32	66	160	-	
33	33	67	170		

Note: For 56 cm and 57 cm use code 55, for values over 57 cm round to nearest 10 cm to encode.

12.5 Section 5

12.5.1

555 – indicator group to show beginning of Section 5. This 3-figure group must always precede the 5-figure groups of Section 5 which follow.

12.5.1.1

Data of Section 5 **shall** be transmitted once daily as the last section of the 0600 UTC synoptic message by all stations at which some or all of columns 53-55 and 64-68 of Form 63-2322 are completed. If data are not normally available, the group is omitted. At stations where the data for Section 5 are available at 1200 UTC, but not at 0600 UTC, they should be transmitted at 1200 UTC. In either case, the data themselves **shall** always pertain to the same 24-hour period ending at the most recent 0600 UTC time.

12.5.2 Group 1ssss

12.5.2.1

1 – indicator figure of the group.

12.5.2.2

ssss – amount of snowfall, in tenths of a centimetre, for the 24-hour period ending at 0600 UTC. The amount of the snowfall transmitted **shall** be the total amount recorded at the bottom of Column 9, omitting the decimal. A "trace" **shall** be encoded as 19999. If there has been no snowfall in the 24-hour period, the group **shall** be coded 10000. If snowfall could not be measured the group **shall** be coded as 1////.

Examples:

Snowfall amount (Col. 9)	Encoded value
0.6 cm	10006
43.8 cm	10438
120.8 cm	11208
0.0 cm	10000
Unable to measure	1////

12.5.3 Group $2s_ws_ws_ws_w$

12.5.3.1

2 – indicator figure of the group.

12.5.3.2

$s_ws_ws_ws_w$ – amount of water equivalent, in tenths of a millimetre, of the 24-hour snowfall ending at 0600 UTC. The amount of the water equivalent **shall** be the total amount recorded at the bottom of Column 10, omitting the decimal. A "trace" **shall** be encoded as 29999. If there has been no snowfall in the 24-hour period, the group **shall** be coded as 20000. If snowfall water equivalent could not be measured the group **shall** be coded as 2////.

Examples:

Water equivalent (Col. 10)	Encoded Value
0.8 mm	20008
30.2 mm	20302
110.8 mm	21108
0.0 mm	20000
Unable to measure	2////

12.5.4 Group $3d_md_mf_mf_m$

12.5.4.1

3 – indicator figure of the group. The group is reported only when f_mf_m exceeds 16 kts. If a station has no serviceable wind speed detector for any period during the climatological day, data for columns 66–68 must be reported as missing, and the group **shall** be recorded as 3xxxx. A case of wind direction missing, but wind speed available would be recorded as $3xxf_mf_m$.

12.5.4.2

d_md_m – direction, in tens of degrees, of the maximum wind for the 24-hour period ending at 0600 UTC. The direction encoded is the direction associated with the maximum wind speed for the period. The value recorded in Column 66 **shall** be the value encoded for d_md_m.

12.5.4.3

f_mf_m – maximum wind speed, in knots, for the 24-hour period ending at 0600 UTC. The speed may be either a mean or gust speed, but f_mf_m is encoded only when the maximum speed for the period exceeds 16 kts. The units and tens values recorded in Column 67 **shall** be the value encoded for f_mf_m.

12.5.5 Group $4f_hf_tf_tf_i$

12.5.5.1

4 – indicator figure of the group. This group is reported whenever group $3d_md_mf_mf_m$ is reported. At stations equipped to record entries in columns 64 and 65, but not 66–68, or at stations where there has been a period of wind equipment unserviceability, the group $4f_hf_tf_tf_i$ **shall** be reported only when f_i can be coded as a 2 or 3, i.e., recorded in the format $4xxxf_i$.

12.5.5.2

f_h – hundreds digit of the maximum wind speed for the 24-hour period ending at 0600 UTC. Normally f_h is encoded “0”, however if, for example, a gust of 108 kts was observed, f_h would then be encoded “1”.

12.5.5.3

f_tf_t – time of occurrence, UTC, of the maximum wind speed reported by group $3d_md_mf_mf_m$. The time encoded **shall** be derived directly from Column 68.

12.5.5.4

f_i – index to identify the speed range of the maximum two-minute mean wind speed for the 24-hour period ending at 0600 UTC. The speed range is identified in columns 64 and 65 or 37 (or should be obtained from the wind recorder at stations so equipped). The following table **shall** be used for encoding f_i:

Speed range of maximum two-minute mean wind	f_i – Encoded value
16 kts or less	0
17-27 kts	1
28-33 kts	2
34 kts or more	3

Note: The highest code possible is always selected for f_i. The use of code 2 is indicated by an entry in Column 64 and code 3 by entries in both columns 64 and 65.

12.6 Groups Not Reported by Canadian Land Stations

12.6.1

As mentioned in 11.1 and 11.2, the synoptic code is flexible enough to allow the omission of some groups. Further references or details on groups omitted by Canadian land stations are given in the following paragraphs to facilitate the decoding of these groups when encountered in transmitted messages.

12.6.2

All of the groups of Section 2 of the synoptic code, outlined in 11.3, are omitted by Canadian land stations. In the same reference, station identification data in Section 0 pertaining to a sea station (ship, buoy, drilling rig, oil or gas production platform) are also omitted. Complete details on encoding/decoding these groups of Section 0 and Section 2 are provided in the *Manual of Marine Weather Observing* (MANMAR), Sixth Edition.

12.6.3 Section 3

12.6.3.1

Group $0C_sD_LD_MD_H$, omitted by Canada, is included only by stations in the southern part of WMO Region IV which are below 1000 m elevation and within 500 km of the shore, and then only during the part of the year in which tropical weather is observed.

12.6.3.1.1

C_s, which refers to the state of sky in the tropics, is decoded according to WMO Code 430 (*WMO Manual on Codes*, Vol. II).

12.6.3.1.2

D_L, D_M and D_H refer to the direction from which clouds of type C_L, C_M, and C_H respectively, are moving. They are decoded according to WMO Code 0700 (*WMO Manual on Codes*, Vol. I).

12.6.3.2

Group 3Ejjj describes the state of the ground without snow or measurable ice cover. No decision has yet been made regarding the use of the symbolic letters jjj, so they **shall** be encoded as solidi (///) whenever this group is included. E is decoded according to WMO Code 0901 (*WMO Manual on Codes*, Vol. I).

12.6.3.3

Group $5j_1j_2j_3j_4$ (WMO Code 2061, *WMO Manual on Codes*, Vol. I) is used to report:

1) A temperature change of 5 °C or more in less than 30 minutes during the period covered by W_1W_2.
2) Data on direction of cloud drift.
3) Data on direction and elevation of cloud.
4) Positive or zero change of surface pressure over the last 24 hours.
5) Negative change of surface pressure over the last 24 hours.

Note (1): The use of the 5-group in case (1) is restricted to islands or other widely separated stations.
Note (2): The use of the 5-group, in cases (2) and (3), is required from land and fixed ship stations mainly in the tropics.
Note (3): The inclusion of the 5-group, in cases (4) and (5), **shall** be mainly in that part of Region IV comprising the Caribbean Islands, Central America, Mexico, and the Bahamas.
Note (4): Other WMO Codes which apply to the data reportable in this group are 0822, 0500, 0700, 1004, and 3845 (*WMO Manual on Codes*, Vol. I).

12.6.3.4

Provision has been made in the code for inclusion of additional regional groups, which **shall** be identified by the Group 80000. Region IV has not yet adopted any additional data groups for Section 3 of the code.

12.6.4 Section 4

This section would be used in Canada only by mountain stations specifically instructed to do so by the ADM.

12.6.4.1

444 – indicator group to show beginning of Section 4. This three-figure group must always precede the five-figure groups of Section 4 which follow.

12.6.4.2 Group N'C'H'H'C_t

This group refers to the amount (N'), type (C'), altitude of the upper surface (ASL) in hundreds of metres (H'H'), and description of the cloud top (C_t) of cloud whose base is below the level of the station. The following WMO Codes apply:

Parameter	WMO Code No.	Reference
N'	2700	See 12.3.11.3.6
C'	0500	See 12.4.10.3
H'H'	-	Altitude (ASL), hundreds of metres. For altitudes of 9900 m or higher, H'H' is coded 99
C_t	0552	*WMO Manual on Codes, Vol. I*

Note: This group will be repeated when two or more cloud layers with their bases below station level occur at different levels.

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Chapter 13 Recording the synoptic observation on Form 63-2322

13.1 General

The Surface Weather Record, Form 63-2322, is provided for the recording of surface weather observations both in the hourly and synoptic codes. General instructions regarding the purpose, completion, retention and disposal of this form have already been given in Chapter 8 of this manual.

13.1.1

The record of synoptic observations and the summary for the climatological day derived from these observations **shall** be maintained on Form 63-2322 in Sections I, II, III and IV in accordance with the following detailed instructions.

13.2 Headings

A new sheet (Form 63-2322) **shall** be used for the record of each day's weather beginning at 0601 UTC. The headings for each new sheet **shall** include:

1) Station name as listed in METSTAT, followed by the three-character identifier in brackets.
2) The province, encoded as follows: British Columbia – BC, Alberta – AB, Saskatchewan – SK, Manitoba – MB, Ontario – ON, Quebec – QC, New Brunswick – NB, Nova Scotia – NS, Prince Edward Island – PE, Newfoundland and Labrador – NL, Nunavut – NU, Yukon Territory – YT, and Northwest Territories – NT (compatible with the MSC computerized Station Information System (SIS)).
3) A four-figure group for the hour, two figures for the date (UTC in both cases), and the first three letters of the month, indicating the beginning of the period for which observations are recorded on that sheet.
4) A four-figure group for the hour, two figures for the date (UTC in both cases), and the first three letters of the month, indicating the end of the period for which observations are recorded on that sheet.

13.2.1

When the entire 24-hour observing period can be recorded on one sheet, the four-figure hour groups **shall** be 0601 and 0600 respectively.

13.2.2

When two or more sheets are required for a 24-hour period the following procedures apply:

1) The four-figure hour groups for each additional sheet **shall** be determined by adding one minute to the time of the last observation on the previous sheet to obtain the beginning of the period.
2) The four-figure hour group for the end of the period of observations **shall** be the time of the last observation as recorded in Column 29.
3) See 8.2.2.2.

13.3 Section I – observed data and computations

Stations which make synoptic observations **shall** complete the entire section (columns 1–14 and Lines 15–22) as part of the synoptic observation. Stations which make hourly observations only, at any of the times of the main and intermediate synoptic hours, **shall** complete this section in part, omitting entries in columns 6, 8 and 13, except where needed for local or regional requirements.

13.3.1 Column 1 – notes

Notes on unusual weather (see 3.12), local conditions affected by the weather, etc., **shall** be entered in Column 1. This column **shall** also be used for the recording of any occurrences or events of meteorological significance.

Example: Damage to life or property by high winds, tornadoes or hail that cannot be recorded elsewhere on the form.

Column 1 – instrument defects and changes

Enter details of changes in thermometers and other instruments, the time at which instruments became or remained unserviceable, etc. For example: Motor Psychrometer unserviceable at 1800 UTC; wind equipment remained unserviceable due to freezing rain. Similar entries are required on Form 63-2325 (see 8.1.2).

13.3.2 Columns 2, 3 and 4 – duration of weather and/or obstruction to vision

13.3.2.1 Column 2

In Column 2 record each occurrence (as specified in 13.3.2.4 to 13.3.2.7) of any of the weather phenomena listed in 10.2.10 (except VC codes). The weather phenomena **shall** be designated by the appropriate symbols with separate entries to indicate different intensities. The symbols and possible variations in intensity are also shown in 10.2.10. These entries should be recorded in chronological order with respect to the time of beginning of the phenomenon.

13.3.2.2 Columns 3 and 4

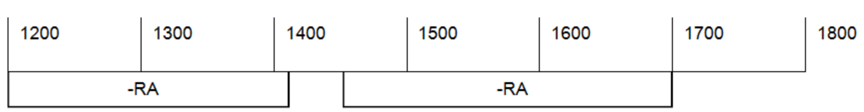
In columns 3 and 4 record the time (UTC) of beginning and ending for each entry in Column 2. If due to the nature of the observing program the time(s) is (are) not known, enter "M" for missing.

13.3.2.3

When recording the beginning and ending of thunder, intermittent precipitation or showery precipitation or obstruction to vision, the record in these columns need not show, (unless there is a local need) intervals of less than 15 minutes between occurrences of thunder, precipitation or obstructions to vision. When 15 minutes have elapsed since the last occurrence of thunder, showery or intermittent precipitation or obstructions to vision, the phenomenon is considered to have ended 15 minutes ago, and the appropriate entry **shall** be made in Column 4.

The following examples illustrate the above:

Example (1):

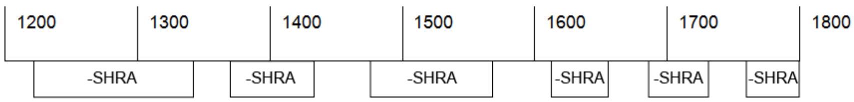


Duration of Weather and/or Obstructions to Vision

(UTC)					(UTC)
Type 2	Bgn 3	End 4	Type 2	Bgn 3	End 4
-RA	1200	1408			
-RA	1430	1700			

Example (1) illustrates two periods of rain and the necessary entries in columns 2, 3 and 4.

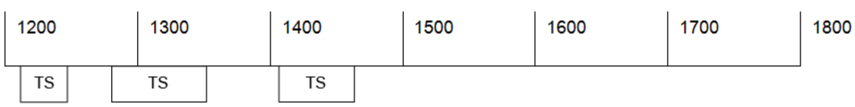
Example (2):



Duration of Weather and/or Obstructions to Vision					
(UTC)					(UTC)
Type 2	Bgn 3	End 4	Type 2	Bgn 3	End 4
-SHRA	1215	1418			
-SHRA	1445	1542			
-SHRA	1608	1635			
-SHRA	1651	1723			
-SHRA	1738	1800			

Example (2) illustrates five periods of rain showers and the necessary entries in columns 2, 3 and 4.

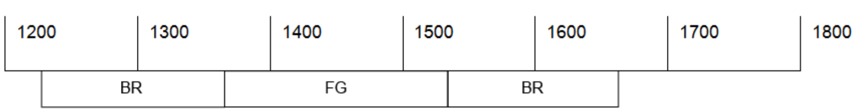
Example (3):



Duration of Weather and/or Obstructions to Vision					
(UTC)					(UTC)
Type 2	Bgn 3	End 4	Type 2	Bgn 3	End 4
TS	1210	1225			
TS	1250	1330			
TS	1404	1438			

Example (3) illustrates three periods of thunder and the necessary entries in columns 2, 3 and 4.

Example (4):



Duration of Weather and/or Obstructions to Vision					
(UTC)					(UTC)
Type 2	Bgn 3	End 4	Type 2	Bgn 3	End 4
BR	1215	1340			
FG	1340	1522			
BR	1522	1638			

Example (4) illustrates mist (BR) with visibility less than 7 mi. to greater than 1/2 mi., changing to fog (FG), with visibility 1/2 mi. or less and the necessary entries in columns 2, 3 and 4.

Note: A period of precipitation, thunder, etc., refers to the interval between the beginning and ending of the phenomenon, disregarding intervals of less than fifteen minutes between occurrences. However entries in columns 2, 3 and 4 are also required to show the duration of each intensity as illustrated in example (2).

13.3.2.4

Each occurrence of haze, smoke, blowing snow, blowing sand, blowing dust, dust haze, sandstorm or duststorm, alone or in combination with other phenomena, **shall** be recorded in these columns if observed with a prevailing visibility of 6 mi. or less.

13.3.2.5

Each occurrence of fog or freezing fog, alone or in combination with other phenomena, **shall** be recorded in these columns if observed with a prevailing visibility of 1/2 mi. or less.

13.3.2.6

Each occurrence of volcanic ash, alone or in combination with other phenomena, **shall** be recorded in these columns if observed regardless of the prevailing visibility.

13.3.2.7

Each occurrence of drifting dust, drifting sand, or drifting snow, alone or in combination with other phenomena, **shall** be recorded in these columns if observed regardless of the prevailing visibility.

13.3.2.8

If additional space is required for entries in columns 2, 3 and 4, use Column 1.

13.3.2.9

Examples of typical entries are also shown in 13.8 and 13.8.1. Note the examples which illustrate precipitation going on at the end of the day and continuing into the next day.

13.3.3 Hour (UTC)

No entries are required in this column. The times shown and the 24-hour value indicator are guides for subsequent entries.

13.3.4 Column 5 – corrected maximum

Record the corrected reading of the maximum thermometer in degrees and tenths Celsius in the space indicated, e.g. 1.4, 0.4 etc. At the bottom of Column 5, enter the maximum temperature in degrees and tenths for the preceding 24 hours.

13.3.4.1

At stations which operate during part of the day, seven days a week but do not take an observation at 0600 UTC, the thermograph chart **shall** be used to obtain the maximum temperature to the nearest degree for the period between the previous reading of the maximum thermometer and 0600 UTC. Apply the appropriate correction, see. 5.9.2 (3) (ii), and record this 0600 UTC corrected value in degrees and tenths followed by the letter “E”. Examples: 25.0E, -4.0E

Note: It is only at 0600 UTC that an entry is required for a time when no observation was made.

13.3.4.1.1

When the 0600 UTC maximum temperature is obtained from the thermograph chart, the thermograph chart must also be used in conjunction with the maximum thermometer to obtain the next maximum temperature.

Example (1): At 1200 UTC, the maximum thermometer reads 9.4 and it is obvious from the thermograph chart that this maximum temperature occurred between 0600 UTC and 1200 UTC. Record 9.4 as the maximum temperature at 1200 UTC.

Example (2): At 1200 UTC the maximum thermometer reads 9.4 and it is obvious from the thermograph chart that this maximum temperature occurred before 0600 UTC. From the thermograph chart obtain the highest temperature since 0600 UTC. Apply the appropriate correction, par. 5.9.2 (3) (ii), and record the corrected reading in degrees and tenths, followed by the letter “E” as the 1200 UTC maximum temperature.

13.3.4.2

If during a given period, a dry-bulb thermometer registers a higher temperature than that indicated by the maximum thermometer for the same period, record the maximum thermometer reading in brackets and in the same space and immediately above, record the dry-bulb temperature. In this case, the dry-bulb temperature **shall** be considered for coding purposes and in determining the 24-hour maximum temperature. Further details **shall** be recorded under notes, Column 1. See example in 13.8.

13.3.4.3

When the maximum thermometer is unserviceable for the entire period under consideration, and consecutive hourly dry-bulb temperatures are available, record the highest dry-bulb reading as the maximum temperature. Enclose this value in brackets and explain under “Instrument defects and changes,” Column 1.

Note: When a serviceable maximum thermometer is available for only a portion of the period, its reading **shall** be entered in Column 5 and considered in conjunction with the appropriate dry-bulb readings, to determine the maximum temperature.

13.3.4.4

At stations collocated with an automatic station, the maximum temperature may, if necessary, be obtained from the input message or from either the hourly or synoptic messages generated by the automatic station. Maximum temperatures derived from automatic stations **shall** be recorded in degrees and tenths, e.g. 23.8, 21.0. A note **shall** be entered in Column 1 to indicate that the maximum temperature is derived from the automatic station.

13.3.5 Column 6 – $T_xT_xT_x$ – maximum temperature in degrees and tenths Celsius

The small figure inserted in the upper left hand corner of each space indicates the period preceding the time of observation for which a maximum temperature is required, except at 1200 UTC the entry in Column 6 **shall** be the 24-hour maximum for the 24-hour period ending six hours ago. If, however, the 0600 UTC observation was not taken, record at 1200 UTC the maximum for the previous 24 hours.

13.3.5.1

The entry in Column 6 **shall** be selected, without rounding, from the appropriate entries in Column 5.

13.3.6 Column 7 – corrected minimum

Record the corrected reading of the minimum thermometer in degrees and tenths Celsius, e.g. 1.4, 0.4, etc. At the bottom of Column 7 enter the minimum temperature in degrees and tenths for the preceding 24 hours.

13.3.6.1

At stations which operate during part of the day, seven days a week, but do not take an observation at 0600 UTC the thermograph chart **shall** be used to obtain the minimum temperature, to the nearest degree, for the period between the previous reading of the minimum thermometer and 0600 UTC. Apply the appropriate correction, par. 5.9.2 (3) (ii), and record this 0600 UTC corrected value in degrees and tenths followed by the letter "E." Examples: 15.0E, -2.0E

Note: It is only at 0600 UTC that an entry is required for a time when no observation was made.

13.3.6.1.1

When the 0600 UTC minimum temperature is obtained from the thermograph chart, the thermograph chart must also be used in conjunction with the minimum thermometer to obtain the next minimum temperature.

Example:

- At 1200 UTC, the minimum thermometer reads 9.4 and it is obvious from the thermograph chart that the minimum temperature occurred between 0600 UTC and 1200 UTC. Record 9.4 as the minimum temperature at 1200 UTC.
- At 1200 UTC, the minimum thermometer reads 9.4 and it is obvious from the thermograph chart that this minimum temperature occurred before 0600 UTC. From the thermograph chart obtain the lowest temperature since 0600 UTC. Apply the appropriate correction (see 5.9.2 (3) (ii)) and record the corrected value in degrees and tenths followed by the letter "E", as the 1200 UTC minimum temperature.

13.3.6.2

If during a given period, a dry-bulb thermometer registers a lower temperature than that indicated by the minimum thermometer for the same period, record the minimum thermometer reading in brackets and in the same space and immediately above, record the dry-bulb temperature. In this case, the dry-bulb temperature **shall** be considered for coding purposes and in determining the 24-hour minimum temperature. Further details **shall** be recorded under Notes, Column 1. See example in 13.8.

13.3.6.3

When the minimum thermometer is unserviceable for the entire period under consideration and consecutive hourly dry-bulb readings are available, record the lowest dry-bulb reading as the minimum temperature. Enclose this value in brackets and explain under “Instrument Defects and Changes,” Column 1.

Note: When a serviceable minimum thermometer is available for only a portion of the period, its reading **shall** be entered and considered in conjunction with the appropriate dry-bulb readings, to determine the minimum temperature.

13.3.6.4

At stations collocated with an automatic station, the minimum temperature may, if necessary, be obtained from the input message or from either the hourly or synoptic messages generated by the automatic station. Minimum temperatures derived from automatic stations **shall** be recorded in degrees and tenths, e.g. -27.4, -23.0. A note **shall** be entered in Column 1 to indicate that the minimum temperature is derived from the automatic station.

13.3.7 Column 8 – $T_nT_nT_n$ – minimum temperature in degrees and tenths Celsius

The small figure inserted in the upper left-hand corner of each space indicates the period preceding the time of observation for which a minimum temperature is required. The entry in Column 8 **shall** be selected, without rounding, from the appropriate entries in Column 7.

Note: At 1200 and 1800 UTC, it is necessary to check the entries recorded in Column 7 of Form 63-2322 for the previous day, e.g., at 1200 UTC the six-hour minimum recorded at 0600 UTC of the previous day **shall** also be considered when determining the entry in Column 8.

13.3.8 Column 9 – snowfall

Enter the amount, (see 3.7.6 and 3.7.7) in centimetres and tenths (nearest 0.2 cm) in the space indicated. When there is less than a measurable amount, that is, less than 0.2 cm, record this as a "trace" by entering "TR". Enter "0" for none.

13.3.8.1

At the bottom of Column 9 enter the total amount of snowfall for the previous 24 hours. *Enter "TR" for a trace; enter "0" for none.

13.3.8.2

Stations which operate during part of the day, seven days a week, but do not take the 0600 UTC observation, **shall** estimate the amount of snowfall for the period between the time of the previous snowfall measurement and 0600 UTC. Under these circumstances the value entered for 0600 UTC, if greater than a trace, **shall** be followed by the letter "E".

Note: It is only at 0600 UTC that an entry is required for a time when no observation was made.

13.3.8.2.1

When the snowfall for 0600 UTC was determined by estimation (see 13.3.8.2) the snowfall amount for the next observation **shall** be the measured amount minus the amount assigned to the 0600 UTC observation.

13.3.9 Column 10 – water equivalent (snowfall)

Enter the amount, in millimetres and tenths, in the space indicated. When there is less than a measurable amount, that is, less than 0.2 mm, record this as a "trace" by entering "TR". Enter "0" for none. At the 0600 UTC observation, compute the total amount of snowfall water equivalent for the preceding 24-hour period and enter this value at the bottom of Column 10. Enter "TR" for a trace*. Enter "0" for none.

***Note (1)**: The addition of two or more "TR" amounts yields only a "TR".
Note (2): At stations equipped with a snow gauge, the snow gauge measurement is the "measured" water equivalent. At stations not equipped with a snow gauge the water equivalent is "estimated", i.e., snowfall divided by ten.

13.3.10 Column 11 – rainfall

Enter the amount in millimetres and tenths in the space indicated, e.g. 12.0, 0.4, etc. When there is less than a measurable amount (less than 0.2 mm), record this as a “trace” by entering “TR”. Enter “0” for none.

13.3.10.1

When the observer is certain that the water measured in the rain gauge has resulted from the formation of dew alone, the word “dew” **shall** be written in brackets before the amount, e.g. (dew) 0.2.

13.3.10.2

At the bottom of Column 11, enter the total amount of rainfall (less dew) for the preceding 24-hour period. Enter “TR” for a trace*. Enter “0” for none.

13.3.10.3

Stations which operate during part of the day, seven days a week, but do not take the 0600 UTC observation **shall** determine from the recording rain gauge (or from the recording rain gauge of a collocated automatic station), or by estimation if necessary, the amount of rainfall for the period between the time of the previous standard gauge measurement and 0600 UTC. Under these conditions, the value entered at 0600 UTC, if greater than a trace, **shall** be followed by the letter “E”.

Note: It is only at 0600 UTC that an entry is required for a time when no observation was made

13.3.10.3.1

When the rainfall for 0600 UTC was determined from a recorder chart, collocated automatic station, or by estimation, the rainfall amount for the next observation **shall** be the measured amount from the standard gauge minus the amount assigned to the 0600 UTC observation.

13.3.11 Column 12 – total precipitation

Enter the amount in millimetres and tenths in the space indicated, e.g. 8.2, 0.4 etc. This value is the sum of the water equivalent and rainfall as entered in columns 10 and 11. When there is less than a measurable amount (less than 0.2 mm) record this as a “trace” by entering “TR”. Enter “0” for none. At the bottom of Column 12 enter the total amount of precipitation for the preceding 24 hours. Enter “TR” for a trace*. Enter “0” for none.*

***Note**: The addition of two or more “TR” amounts yields only a “TR”.

13.3.11.1

When dew occurs alone its amount **shall not** be included in the total precipitation recorded in Column 12.

13.3.11.2

The total amount of precipitation for the preceding 24 hours **shall** agree with the sum of the 24-hour snowfall water equivalent and the 24-hour rainfall as entered at the bottom of columns 10 and 11.

13.3.12 Column 13 – 24-hour precipitation

At 0600, 1200, 1800 and 0000 UTC, enter the total amount of precipitation, which has been measured during the preceding 24-hour period. Enter “TR” for a trace and “0” for none. The amount **shall** be obtained from the appropriate entries in Column 12. For coding these data in synoptic reports see 12.4.9.

13.3.13 Column 14 – depth of snow on ground

Enter the total depth of snow on the ground in whole centimetres. Enter “TR” for a trace (less than 0.5 cm) and enter “0” for none.

13.3.14 Time (UTC)

Lines 15 to 22 **shall** be completed whenever an observation is made at 0900, 1200, 1500, 1800, 2100, 0000, 0300 or 0600 UTC. Space has been left in these time blocks for observers to fill in the temperature of 12 hours ago (T-12), and the current temperature, (T0). The small numbers beneath the 0900, 1200, etc., serve as reminders of the times to which temperatures of 12 hours ago apply. For example, with the above in mind, the 0900 UTC space allows for the addition of the previous day's 2100 UTC temperature.

13.3.14.1

At sites equipped with data entry screens that compute pressure, entries to Lines 15 and 17, and 19 to 22 of Form 63-2322 are not required. Line 18 **shall** be completed as per 10.4.16 and 10.4.17. Entries in Column 33 (sea level pressure), Column 39 (altimeter setting), and Column 42 (Appp) are still required and will be obtained from the data entry screen.

13.3.14.1.1

If for any reason tables are used to do manual pressure calculations (at sites equipped with data entry screens that compute pressure), complete lines 15–22. Entries in Column 33 (sea-level pressure), Column 39 (altimeter setting), Column 41 (reduction to sea level, reported in accordance with Section 10.2.11.1), and Column 42 (Appp), will be obtained from the calculated values in Lines 15–22. Appropriate entries are also required in Column 1 (Notes) and on Form 63-2325, Monthly Summary of Instrument Malfunctions, Changes and New Installations, indicating the hours that the tables were used for pressure computations.

13.3.14.1.2

At sites where an AWOS is used to report station pressure, the value will be entered on Line 20.

13.3.15 Line 15 – sum

Enter the sum obtained from the addition of the temperature 12 hours ago and of the current dry-bulb temperature.

Note: When the temperature of 12 hours ago cannot be obtained from a dry-bulb reading, a collocated automatic station, or a thermograph, it **shall** be estimated (see 4.2.3.2).

13.3.16 Line 16 – mean

Divide the sum by two to obtain a temperature mean and record this value. This mean **shall** be used for computing the Reduction to Sea Level (21) using the tables supplied for this purpose.

13.3.17 Line 17 – attached thermometer

Leave blank if using digital or AWOS barometer.

13.3.18 Line 18 – barometer as read

Enter the barometer as read (nearest tenth hPa) e.g., 968.9.

13.3.19 Line 19 – total correction

From the table for the “Reduction of the barometer reading to station pressure,” determine the total correction and enter this value using the appropriate sign, e.g., +1.2, -0.7 etc.

13.3.20 Line 20 – Station Pressure

Compute the station pressure from the barometer as read and the total correction. Record the station pressure (nearest tenth hPa).

13.3.21 Line 21 – Reduction to Sea Level

Enter the reduction to sea level value as determined from the sea level reduction table. See 4.2.3.

13.3.22 Line 22 – Sea level pressure

Add the reduction to sea level to the station pressure to obtain the sea level pressure. Record the sea level pressure (nearest tenth hPa), e.g., 1018.9.

13.4 Section II – hourly observations

13.4.1

The instructions for entries in Section II are contained in Chapter 10, these instructions **shall** be followed for the synoptic hour observation at stations which transmit synoptic observations but do not transmit hourly observations.

13.4.1.1

Stations which transmit hourly observations at any of the synoptic times **shall** complete this section in accordance with the instructions in Chapter 10.

13.5 Section III – coded synoptic reports

13.5.1

In Section III of Form 63-2322 spaces are provided for the recording of four coded synoptic reports.

13.5.2

In the first column headed YY, enter, using two figures, the dates in Coordinated Universal Time, applicable to the 1200 UTC and 0000 UTC observations.

13.5.3

To assist in the preparation and recording of the synoptic message, Section III contains pre-printed values as follows:

- Coordinated Universal Times 12, 18, 00, and 06, to indicate the appropriate line on which each synoptic message should be recorded.
- Each of the vertical columns of Section 1 is headed by the symbolic form of one of the groups in the synoptic message. Each coded group of the message, up to and including the 8-group of Section 1, should be recorded below its symbolic form.
- Figures are shown immediately below the symbolic form of the groups in Section 1 to indicate the lines or columns on Form 63-2322 where observed data, required in coding the message, may be located.
- The first figure of most groups is pre-printed where the initial figure is used to identify groups of sections 1, 3, and 5.
- Appropriate entries **shall** be overwritten on the screened areas of symbolic language in sections 3 and 5. In the event that data are recorded for the supplementary wind group, 00fff, it will be necessary to record data for both Nddff and 00fff in the same block.

13.5.4

The letter “X” **shall** be used in Section III of Form 63-2322 to indicate that information on a certain meteorological element was missing when the report was made. However, to facilitate communications, on the copy of the coded synoptic message prepared for the communicator (i.e., on Form 61-9406), the letter “X” **shall** be replaced by the solidus "/". Care should be taken that the solidus “/” is legible.

13.5.5

Transmission of synoptic reports on meteorological communication circuits **shall** be in conformity with the time schedule specified in Chapter 9. The filing times of synoptic reports **shall** be laid down by the Officer-in-Charge at each station to provide sufficient time to meet scheduled transmission times.

13.6 Section IV – summary for the climatological day ending at 0600 UTC

The climatological day which is summarized in Section IV is the 24-hour period ending at 0600 UTC. At stations which operate during part of the day, seven days a week, but do not take the 0600Z observation, the temperature and precipitation data, which apply to the period between the time at which these parameters were previously measured and 0600 UTC, **shall** be determined from recording instruments and/or by estimation. See 13.3.4.1, 13.3.4.4, 13.3.6.1, 13.3.6.4, 13.3.8.2, 13.3.10.3. The following stations are not required to complete this portion of the record:

- Stations which operate on fewer than seven days a week.
- Stations which operate during part of the day seven days a week but do not take the 0600 UTC observation, and have neither a thermograph nor are collocated with an automatic station.

13.6.1 Column 44 – day

Using a two-figure group, enter the first date which appears in the heading of Form 63-2322; i.e., the date (UTC) of the beginning of the 24-hour period for which a “summary” is being prepared.

13.6.2 Column 45 – maximum temperature

The 24-hour maximum (from Column 5) **shall** be entered here in degrees and tenths Celsius.

13.6.3 Column 46 – minimum temperature

The 24-hour minimum (from Column 7) **shall** be entered here in degrees and tenths Celsius.

13.6.4 Columns 47 and 48 – relative humidity

When 24 hourly observations are taken per day and each observation contains the relative humidity (recorded in Column 24), enter in these columns the maximum and minimum relative humidity. Otherwise enter “M”.

13.6.5 Columns 49 to 52 – six-hour total amount

Enter the 6-hour amount of precipitation as recorded in Column 12 for each of the times indicated. Enter "0" if no precipitation has occurred. Enter "TR" for trace.

13.6.5.1

Enter "M" in each column for which a six-hour total amount has not been determined. For example, if the total amount of precipitation recorded in Column 12 at 0000 UTC is for a period greater than six hours, enter "M" in Column 51; also enter "M" in columns 50 or 49 for each of the previous missing six-hour amounts.

13.6.6 Column 53 – 24-hour amount – rainfall

Enter the amount of rainfall in millimetres and tenths as recorded at the bottom of Column 11. Enter "TR" for a trace. Enter "0" if no rainfall has occurred.

Note: The water equivalent of hail and freezing precipitation is included in this amount.

13.6.7 Column 54 – 24-hour amount – snowfall

Enter the amount of snowfall in centimetres and tenths as recorded at the bottom of Column 9. Enter "TR" for a trace. Enter "0" if no snowfall has occurred.

13.6.8 Column 55 – 24-hour amount – total precipitation

Enter the total amount of precipitation in millimetres and tenths as recorded at the bottom of Column 12. Enter "TR" for a trace. Enter "0" if no precipitation has occurred.

13.6.9 Column 56 – depth of snow on the ground

Enter the depth of snow on the ground in whole centimetres as recorded at the 1200 UTC observation (Column 14). Enter "TR" for a trace (less than 0.5 cm). When there is no snow or ice on the ground, a "0" entry **shall** be made in Column 56 at all seasons of the year.

13.6.9.1

When the 1200 UTC observation is not taken, enter the depth of snow on the ground measured at the next main synoptic observation e.g., at 1800 UTC or 0000 UTC etc.

13.6.10 Columns 57 to 65 – day with

Occurrences of thunderstorms, precipitation, obstructions to vision, and strong winds **shall** be recorded in these columns. The occurrence of a phenomenon **shall** be indicated by entering "1" in the appropriate column. The non-occurrence of a phenomenon **shall** be indicated by entering "0" in the appropriate column.

13.6.11 Columns 57 to 63

Thunderstorms, freezing rain or freezing drizzle, hail, fog, freezing fog and obstructions to vision. The information recorded under Duration of Weather and Obstructions to Vision (columns 2 to 4) **shall** be used to determine entries in columns 57 to 63.

Note: At stations which operate during part of the day, seven days per week, the entry in these columns **shall** be either “0” or “1” based on the best information available to the observer, see 13.6.10.

13.6.11.1

An “M” **shall** be entered in these columns only if it is impossible for the observer to tell whether there has been an occurrence or non-occurrence.

13.6.11.2

Any amount, even a trace, of freezing rain, freezing drizzle, or hail requires a “1” entry in Column 58 or 59.

13.6.12 Columns 64, 65, 66, 67 and 68 – general instructions

13.6.12.1

The reference and priority for values recorded in columns 64 and 65 are as follows:

1) Mean wind speeds for a period of two minutes or more derived from a wind recorder chart.
2) Two-minute mean wind speeds, as recorded on Form 63-2322 when the observing program includes 24 hourly observations per day and the station is not equipped with a recording wind instrument.
3) Mean wind speed obtained from a collocated automatic station.

13.6.12.2

The reference and priority for values recorded in columns 66, 67 and 68 are as follows:

1) The greatest peak speed, derived from a wind recorder chart which has gust information.
2) The greatest speed, gust or mean, obtained from the record of 24 hourly observations (SPECIs and Checks included), provided the wind data were obtained from dial or digital type wind equipment with gust information.
3) The greatest peak speed obtained from a collocated automatic station.

13.6.12.3

At stations which do not take hourly observations and are not equipped with serviceable recording wind equipment, and are not collocated with an automatic station, “M” **shall** be entered in each of the columns 64, 65, 66, 67 and 68.

13.6.12.4

If a station has no serviceable wind speed detector for any period during the “climatological day,” “M” **shall** be entered in each of the columns 66, 67 and 68 for that day. A “1” entry is required in columns 64 and/or 65 if winds of 28 or more knots and/or 34 or more knots occurred during the period in which the wind equipment was serviceable.

13.6.12.4.1

If the greatest speed, (peak) occurred more than once in a day or in an hour, the entries in columns 66, 67 and 68 **shall** refer to the earliest occurrence.

13.6.13 Columns 64, 65, 66, 67 and 68

Detailed instructions as appropriate for various observing programs are listed in the following pages.

13.6.13.1 Program A

Program A	Columns	Procedure
24 hourly observations +		(1) Determine from the recorder chart the greatest mean wind speed for a period of two minutes or more.
Recording wind equipment which records gust information	64	(2) Enter 1 to indicate an occurrence of 28 kts or more; 0 for non-occurrence.
	65	(3) Enter 1 to indicate an occurrence of 34 kts or more; 0 for non-occurrence. Example: Mean speed 35 kts: Enter 1 in each of columns 64 and 65.
i.e.,		(4) Determine the greatest (peak) wind speed, from the recorder chart.
	66-67-68	(5) If the greatest speed is 16 kts or less, leave these columns blank.
U2A recorder		(6) If the greatest speed is 17 kts or more:
or other analog recorder	66	Enter two figures to indicate the direction of the greatest wind to the nearest ten degrees. If the recorder chart does not indicate the direction of the greatest wind speed, enter M.
	67	Enter the greatest speed in knots.
	68*	Enter two figures to indicate the time of the greatest wind speed in hours UTC, e.g: If the greatest speed occurred at 0600 UTC, enter 06. If the greatest speed occurred at 1500 UTC, enter 15. If the greatest speed occurred at 1505 UTC, enter 16. If the greatest speed occurred at 1620 UTC, enter 17.

Example: Greatest mean speed 35 kts; Greatest (peak) speed NW 60 kts at 1405 UTC.

Mean Wind of		PEAK WIND SPEED GUST OR MEAN (leave blank if speed does not exceed 16 knots)		
28 or more knots	34 or more knots	Direction nearest 10 degrees (2 figures)	Speed	Time (UTC) (2 figures)
64	65	66	67	68
1	1	32	60	15

***Note**: When an entry is made in Column 68, record also in Column 1 the time of the greatest wind speed to the nearest minute, as determined from the recorder chart.

13.6.13.2 Program B

Program B	Columns	Procedure
24 hourly observations +		(1) Determine from all observations, including SPECIs and Checks recorded on Form 63-2322, the greatest mean two-minute wind speed.
	64	(2) Enter 1 to indicate an occurrence of 28 kts or more; 0 for non-occurrence.
Dial or digital type wind gust information (but no serviceable recorder)	65	(3) Enter 1 to indicate an occurrence of 34 kts or more; 0 for non-occurrence. Example: Greatest mean two-minute speed 35 kts: Enter 1 in each Column 64 and 65.
i.e U2A (dial only) 78D or		(4) Determine from all observations, Including specials and checks recorded on Form 63-2322, the greatest wind speed, gust or mean.
Collocated automatic station	66-67-68	(5) If the greatest speed is 16 kts or less leave these columns blank.
		(6) If the greatest speed is 17 kts or more:
	66	Enter two figures to indicate the direction of the greatest wind to the nearest ten degrees. If the direction of the greatest wind was estimated, enter M.
	67	Enter the greatest speed in knots followed by the letter E.
	68	Enter two figures to indicate the time of the greatest wind speed in hours UTC, e.g., If the greatest speed occurred at 0600 UTC, enter 06 If the greatest speed occurred at 1500 UTC, enter 15 If the greatest speed occurred at 1505 UTC, enter 16 If the greatest speed occurred at 1620 UTC, enter 17

Example: Greatest mean speed 29 kts; Greatest (peak) speed SW 52 kts at 1320 UTC.

Mean Wind of		PEAK WIND SPEED GUST OR MEAN (leave blank if speed does not exceed 16 knots)		
28 or more knots 64	34 or more knots 65	Direction nearest 10 degrees (2 figures) 66	Speed 67	Time (UTC) (2 figures) 68
1	**0**	**23**	**52E**	**14**

13.6.13.3 Program C

Program C	Columns	Procedure
24 hourly observations +		(1) Determine from all observations, including SPECIs and Checks recorded on Form 63-2322 and from the recorder chart the greatest mean wind speed for a period of two minutes or more.
	64	(2) Enter 1 to indicate an occurrence of 28 kts or more; 0 for non-occurrence.
Recording wind equipment without recorded gust information	65	(3) Enter 1 to indicate an occurrence of 34 kts or more; 0 for non-occurrence. Example: Mean two-minute speed 35 kts: Enter 1 in each of columns 64 and 65.
i.e., MSC 45B	66-67-68	(4) Enter M in each column, e.g. greatest mean speed 29 kts.

Example:

Mean Wind of		PEAK WIND SPEED GUST OR MEAN (leave blank if speed does not exceed 16 knots)		
28 or more knots 64	34 or more knots 65	Direction nearest 10 degrees (2 figures) 66	Speed 67	Time (UTC) (2 figures) 68
1	**0**	**M**	**M**	**M**

13.6.13.4 Program D

Program D	Columns	Procedure
Fewer than 24 hourly observations +	64-65	(1) Enter M in each column.
Dial or digital type wind equipment with gust information but no recorder, i.e., U2A (Dial only) or 78D.	66-67-68	(2) Enter M in each column.

Example:

Mean Wind of		PEAK WIND SPEED GUST OR MEAN (leave blank if speed does not exceed 16 knots)		
28 or more knots	34 or more knots	Direction nearest 10 degrees (2 figures)	Speed	Time (UTC) (2 figures)
64	65	66	67	68
M	**M**	**M**	**M**	**M**

13.6.13.5 Program E

Program E	Columns	Procedure
Less than 24 hourly observations +		(1) Determine (see 13.6.12.1) the greatest mean wind speed for a period of two minutes or more.
	64	(2) Enter 1 to indicate an occurrence of 28 kts or more; 0 for non-occurrence.
	65	(3) Enter 1 to indicate an occurrence of 34 kts or more; 0 for non- occurrence. Example: Mean speed 35 kts: Enter 1 in each of columns 64 and 65.
Recording wind equipment with recorded gust information, i.e.		(4) Determine the greatest (peak) wind speed (see 13.6.12.2).
U2A recorder or other analog recorder	66-67-68	(5) If the greatest speed is 16 kts or less, leave these columns blank.
or	66	(6) If the greatest speed is 17 kts or more:
Collocated automatic station	67	Enter two figures to indicate the direction of the greatest wind to the nearest ten degrees. If the recorder chart does not indicate the direction of the greatest wind speed, enter M.
	68	Enter the greatest speed in knots. Enter two figures to indicate the time of the greatest wind speed in hours UTC*, e.g., If the greatest speed occurred at 0600 UTC, enter 06. If the greatest speed occurred at 1500 UTC, enter 15. If the greatest speed occurred at 1505 UTC, enter 16. If the greatest speed occurred at 1620 UTC, enter 17.

Example: Greatest mean Hourly speed 36 kts. Greatest (peak) speed SW 49 kts at 0315 UTC.

Mean Wind of		PEAK WIND SPEED GUST OR MEAN (leave blank if speed does not exceed 16 knots)		
28 or more knots	34 or more knots	Direction nearest 10 degrees (2 figures)	Speed	Time (UTC) (2 figures)
64	65	66	67	68
1	**1**	**23**	**49**	**04**

***Note**: When an entry is made in Column 68, record also in Column 1 the time of the greatest wind speed to the nearest minute, if determined from a recorder chart.

13.6.13.6 Program F

Program F	Columns	Procedure
Less than 24 hourly observations +		(1) Determine from the recorder chart the greatest mean speed for a period of 10 minutes or more.
Recording wind equipment but no recorded gust information	64	(2) Enter 1 to indicate an occurrence of 28 kts or more; 0 for non-occurrence.
i.e.	65	(3) Enter 1 to indicate an occurrence of 34 kts or more; 0 for non-occurrence.
MSC 45B	66-67-68	Enter M in each column.

Example: Greatest mean speed 29 kts

Mean Wind of		PEAK WIND SPEED GUST OR MEAN (leave blank if speed does not exceed 16 knots)		
28 or more knots	34 or more knots	Direction nearest 10 degrees (2 figures)	Speed	Time (UTC) (2 figures)
64	65	66	67	68
1	0	M	M	M

13.7 Column 69 – checked by

The Officer-in-Charge or a designated staff member **shall** check, preferably on a daily basis, the accuracy and legibility of all data recorded on Form 63-2322. Upon completion of this check, the reviewing officer **shall** record their name and their signature in Column 69. (Column 69 is found in the extreme upper left corner of the form.)

13.8 Typical entries – Form 63-2322

13.8.1 Example 1 – Completed Form 63-2322

Environment Canada / Environnement Canada — Meteorological Service of Canada / Service météorologique du Canada

SURFACE WEATHER RECORD AT KARNWAY (YTT) PROVINCE ON

STATION NAME AS IN METSTAT

69 CHECKED, CERTIFIED COMPLETE & CORRECT BY *M. Anobs*

I OBSERVED DATA AND COMPUTATIONS

1 NOTES AND INSTRUMENT DEFECTS AND CHANGES

AIRCRAFT ACCIDENT REPORTED 10NM
EAST OF AIRFIELD AT 1030

DEWCEL COMPARISON DONE AT 1630
D.B. -0.1 / D.P. +0.3

1800 MAX FM 1800 D.B.
0000 MIN FM 1800 D.B.

(UTC) Type 2	Bgn 3	End 4	Type 2	Bgn 3	End 4 (UTC)
BR	1115	1236			
FZFG	1236	1500			
BR	1500	1643			
-SN	2258	0559			
BLSN	0548	0559			
DRSN	0559	→			
SN	0559	→			

Duration of Weather and/or Obstructions to Vision

HOUR (UTC)	Corrected Max (tenths) 5	↓	$T_xT_xT_x$ 6	Corrected Min (tenths) 7		$T_nT_nT_n$ 8
12	-18.7	(24)	-21.1	-21.6	12	-23.1
18	-14.9 (-15.0)	12	-14.9	-19.0	24	-23.1
00	-6.9	12	-6.9	-14.9 (-14.7)	18	-21.6
06	-4.2	24	-4.2	-8.2	24	-21.6
24-HR	-4.2			-21.6		

HOUR (UTC)	Snowfall (cm & tenths) 9	Water equivalent (mm & tenths) 10	Rainfall (mm & tenths) 11	Total precip. (mm & tenths) 12	24-hour precip. (mm & tenths) 13	Depth snow on ground (whole cm) 14
12	0	0	0	0	0	17 *
18	0	0	0	0	0	17
00	TR	TR	0	TR	TR	17
06	3.2	3.0	0	3.0	3.0	20
24-HR	3.2	3.0	0	3.0		

TIME (UTC)	0900	1200	1500	1800	2100	0000	0300	0600
Temperature T_{-12}	21 -23.4	00 -21.9	03 -21.6	06 -21.3	09 -20.4	12 -18.9	15 -17.3	18 -14.9
Temperature T_0								
15 Sum (T_{-12} + T_0)								
16 Mean (Sum ÷ 2)								
17 Attached thermometer								
18 Barometer as read	1008.0	1007.7	1005.8	1003.0	1002.0	1000.8	997.1	991.0
19 Total correction								
20 Station pressure								
21 Reduction to sea level								
22 Sea level pressure								

II HOURLY OBSERVATIONS

Corrected wet bulb °C 23	Relative humidity 24	Total opacity 25	Total amount 26	Type 27	Date UTC 28	Hour (UTC) 29	Sky condition 30	Visibility (mi.) 31	Weather and obstructions to vision 32
		1	2	SA	09	0900	240 -FEW	15+	
		8	8	SA	09	1200	-X	2	BR
		10	10	SA	09	1500	A15 X	2	BR
		10	10	SA	09	1800	E140 BKN 200 OVC	15	
		10	10	SA	09	2100	E100 OVC	20	
		10	10	SA	10	0000	E70 OVC	7	-SN
		10	10	SA	10	0300	8 SCT M50 OVC	3	-SN
		10	10	SA	10	0600	5 SCT P8 X	1/2	SN DRSN

III CODED SYNOPTIC REPORTS

YYGGiw (UTC)			IIiii	i_Ri_xhVV 31	Nddff 26 (00fff)	$1s_nTTT$ 34	$2s_nT_dT_dT_d$ 35	$3P_0P_0P_0P_0$ 20
09	12	4	71999	11932	03603	11189	21219	30040
	18	4	71999	11974	80610	11149	21178	39990
10	00	4	71999	11861	81012	11071	21086	39970
	06	4	71999	11208	91620	11044	21057	39873

IV SUMMARY FOR THE CLIMATOLOGICAL DAY E

Day (2 figures) 44	TEMPERATURE Maximum tenths 45	TEMPERATURE Minimum tenths 46	REL. HUMIDITY Maximum 47	REL. HUMIDITY Minimum 48	6 HOUR TOT 1200 Z (mm & tenths) 49	6 HOUR TOT 1800 Z (mm & tenths) 50
09	-4.2	-21.6	M	M	0	0

FROM 0601 09 FEB 20 06 TO 0600 10 FEB 20 06 LST = UTC - 5 HOURS

HOUR (UTC) DAY MONTH HOUR (UTC) DAY MONTH

Sea level pressure (hPa) 33	Temperature °C (tenths) Dry-bulb 34	Dew-point 35	WIND Direction 36	Speed (kt) 37	Character 38	AT 06Z Altimeter setting (in.) 39	CLOUDS and/or OBSCURING PHENOMENA Type/Opacity 40	REMARKS 41	(Stn. Pres.)	Tendency appp 42	TT_dOA 42a	OBSERVER (Print) 43
213	-20.4	-24.4	35	08		010	CI1		045	2005		KM
205	-18.9	-21.9	01	04		008	FG8		040	6005		KM
185	-17.3	-18.4	02	04		002	FG10	VIS E 1 FROIN 350V050	020	8020		JD
155	-14.9	-17.8	06	10		993	AS7 CS3	SUN DIMLY VISBL	990	7030		JD
146	-11.5	-13.8	08	14		991	AS10	VIRGA SE	981	6009		JD
133	-7.1	-8.6	10	11		987	AS10		970	8011		LB
096	-5.6	-6.8	12	17		977	SF7 NS3		935	8035		LB
034	-4.4	-5.7	16	20		959	SF5 SN5	PRESFR /S03/ RVR RWY 15 3500FT	873	8062		GL

o	4PPPP 33	5appp 42	6RRRt$_R$ 12	7wwW$_1$W$_2$ 32 2-4	8N$_h$C$_L$C$_M$C$_H$	333							
							11211	21231	44017	55			70000
	40205	56005	60001	71011	8		909	931	(555	1	2	3	4)
	40155	57030	60001	70341	86017	333	11149	21231	44017	5	70000	909	931
	40133	58011	69901	77122	8802/	333	11069	21216	44017	79999	90921	931	
	40034	58062	60031	77377	8^{87XX}	333	11042	21216	44020	70030	90973	931 03	
							555	10032	20030	31540	40063		

ENDING AT 0600 UTC

AMOUNT OF PRECIPITATION						DAY WITH									PEAK WIND SPEED GUST OR MEAN (leave blank if speed does not exceed 16 knots)		
TAL AMOUNT		24 HOUR AMOUNT								Visibility 6 mi. or less			Mean Wind of				
0000 Z (mm & tenths)	0600 Z (mm & tenths)	Rainfall (RA, SHRA, DZ, FZRA, FZDZ, SHGR) (mm & tenths)	Snowfall (SN, SHSN, PL, SHPL, SHGS, SG, IC) (cm & tenths)	Total Precipitation (mm & tenths)	DEPTH* of snow on the ground at 12Z (whole cm)	Thunderstorms	Freezing Rain or Freezing Drizzle	Hail	Fog or Freezing Fog (Visibility less than 5/8 mi.)	Smoke, Dust Haze, or Haze	Blowing Dust, Blowing Sand	Blowing Snow	28 or more knots	34 or more knots	Direction nearest 10 degrees (2 figures)	Speed	Time (UTC) (2 figures)
51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68
TR	3.0	0	3.2	3.0	17	0	0	0	1	0	0	1	1	0	15	40E	06

13.8.2 Example 2 – Completed Form 63-2322

Environment Canada Meteorological Service of Canada / Environnement Canada Service météorologique du Canada

SURFACE WEATHER RECORD AT KARNWAY (YTT) PROVINCE ON F

STATION NAME AS IN METSTAT

69 CHECKED, CERTIFIED COMPLETE & CORRECT BY *M. Anobs*

I OBSERVED DATA AND COMPUTATIONS

1 NOTES AND INSTRUMENT DEFECTS AND CHANGES

POWER FAILURE 1355-1513
WIND DCTN ESTD AT 1400 AND 1500
DEWCEL UNSERVICEABLE 1355-1515 USED SLING PSYCHROMETER DURING THIS PERIOD
DEWCELL COMPARISONS:
1530 D.B. -0.1 D.P. +0.3
1545 D.B. -0.1 D.P. +0.1
1600 D.B. +0.1 D.P. +0.0
1615 D.B. -0.1 D.P. +0.1
PRESSURE CALCULATED FROM TABLES
AT 1400 AND 1500
1400, 1438 AND 1500 OBS SENT VIA YYZ

Duration of Weather and/or Obstructions to Vision (UTC)

Type 2	Bgn 3	End 4	Type 2	Bgn 3	End 4
DRSN	→	0730	SHSN	2245	2308
SN	→	0915	BLSN	2255	2308
BLSN	0730	1000	-SHSN	2308	0450
-SN	0915	1137	IC	0545	→
-PL	1000	1056			
PL	1056	1137			
-FZRA	1137	1222			
FZRA	1222	1257			
-FZRA	1257	1438			
BR	1315	1850			
-RA	1438	1857			
-SHSN	2118	2245			

HOUR (UTC)	Corrected Max (tenths) 5	$T_xT_xT_x$ 6	Corrected Min (tenths) 7	$T_nT_nT_n$ 8
12	-0.9	(24) -4.2	-4.5	12 -8.2
18	0.7	12 0.7	1.0	24 -14.9
00	3.4	12 3.4	-4.3	18 -4.5
06	-4.3	24 3.4	-14.8	24 -14.8
24-HR	3.4		-14.8	

HOUR (UTC)	Snowfall (cm & tenths) 9	Water equivalent (mm & tenths) 10	Rainfall (mm & tenths) 11	Total precip. (mm & tenths) 12	24-hour precip. (mm & tenths) 13	Depth snow on ground (whole cm) 14
12	11.4	11.2	0.8	12.0	15.0	27 *
18	0	0	5.6	5.6	20.6	24
00	3.0	3.0	TR	3.0	23.6	23
06	0.8	0.8	0	0.8	21.4	23
24-HR	15.2	15.0	6.4	21.4		

TIME (UTC)	0900	1200	1500	1800	2100	0000	0300	0600
Temperature T_{-12}	21 -11.5	00 -7.1	03 -5.6	06 -4.4	09 -2.7	12 -0.9	15 -0.1	18 -0.4
Temperature T_0			0.1					
15 Sum (T_{-12} + T_0)			-5.5					
16 Mean (Sum ÷ 2)			-2.8					
17 Attached thermometer								
18 Barometer as read	966.7	961.8	980.1	980.1	979.6	985.0	990.0	994.9
19 Total correction			-3.8					
20 Station pressure			976.3					
21 Reduction to sea level			15.5					
22 Sea level pressure			991.8					

II HOURLY OBSERVATIONS

Corrected wet bulb °C 23	Relative humidity 24	Total opacity 25	Total amount 26	Type 27	Date UTC 28	Hour (UTC) 29	Sky condition 30	Visibility (mi) 31	Weather and obstructions to vision 32
		10	10	SA	10	0900	6 FEW P9 X	3/8	SN BLSN
		10	10	SA	10	1200	10 -BKN E25 OVC	7	-FZRA
-0.1		10	10	SA	10	1500	-X B10 BKN 25 OVC	1/2	-RA BR
		10	10	SA	10	1800	E15 OVC	5	-RA BR
		9	9	SP	10	2100	E20 BKN 30 BKN	20	
		9	9	SA	11	0000	E20 BKN 100 BKN	4	-SHSN
		6	7	SA	11	0300	20 FEW M110 BKN	15+	VCSH
		2	3	SA	11	0600	110 FEW 250 -FEW	6	IC

III CODED SYNOPTIC REPORTS

YYGGiw (UTC)			IIiii	i_Ri_xhVV 31	Nddff 26 (00fff)	$1s_nTTT$ 34	$2s_nT_dT_dT_d$ 35	$3P_oP_oP_oP_o$ 20
09	12	4	71999	11461	81921	11009	21011	39780
	18	4	71999	11458	82224	10004	20004	39762
10	00	4	71999	11556	73130	11043	21057	39813
	06	4	71999	11974	23216	11148	21161	39913

IV SUMMARY FOR THE CLIMATOLOGICAL DAY E

Day (2 figures) 44	TEMPERATURE Maximum tenths 45	TEMPERATURE Minimum tenths 46	REL. HUMIDITY Maximum 47	REL. HUMIDITY Minimum 48	6 HOUR TO 1200 Z (mm & tenths) 49	6 HOUR TO 1800 Z (mm & tenths) 50
10	3.4	-14,8	M	M	12.0	5.6

FROM 0601 10 FEB 20 06 TO 0600 11 FEB 20 06 LST = UTC - 5 HOURS

HOUR (UTC) DAY MONTH — HOUR (UTC) DAY MONTH

Sea level pressure (hPa)	Temperature °C (tenths) Dry-bulb	Dew-point	WIND Direction	Speed (kt)	Character	AT 06Z Altimeter setting (in.)	CLOUDS and/or OBSCURING PHENOMENA Type/Opacity	REMARKS	(Stn. Pres.)	Tendency	TT_dOA	OBSERVER (Print)
33	34	35	36	37	38	39	40	41		appp 42	42a	43
987	-2.7	-2.7	18	20	G26	946	SF2 SN8	/S08/ RVR RWY 15 1600FT	830	8043		GL
937	-0.9	-1.1	18	21		931	SF5 NS5		780	6050		GL
918	0.1	-0.1	18	28E	G	926	FG3 SF6 NS1	WND ESTD (15.5)	763	6017		SW
917	0.4	0.4	22	25		925	SC10		762	7001		SW
913	0.6	0.0	25	26		924	CU6 SC3	TCU ASOCTD	758			SW
968	-4.3	-5.7	32	30	G35	941	TCU8 AC1	PRESRR /S03/	813	3055		RR
022	-10.9	-13.2	32	20		956	TCU3 AC3	FROIN OCNL -SHSN	863	1050		RR
072	-14.8	-16.1	31	16		971	AC1 CI1		913	2050		RR

4PPPP 33	5appp 42	$6RRRt_R$ 12	$7wwW_1W_2$ 32 2-4	$8N_hC_LC_MC_H$	333	11042	21082	44027	55			70150
49937	56050	60121	76673	8572/		90983	93111	(555	1	2	3	4)
49917	57001	60061	76166	885//	333	10007	21149	4024	5	70206	90983	931
49968	53055	60031	78562	87230	333	10034	21045	4023	70236	90937	93103	
40072	52050	69981	77681	81031	333	10034	21148	4023	70214	90917	93101	
						555	10152	20150	3XXXX	4XXX3		

ENDING AT 0600 UTC

AMOUNT OF PRECIPITATION TOTAL AMOUNT 0000 Z (mm & tenths)	0600 Z (mm & tenths)	24 HOUR AMOUNT Rainfall (RA, SHRA, DZ, FZRA, FZDZ, SHGR) (mm & tenths)	Snowfall (SN, SHSN, PL, SHPL, SHGS, SG, IC) (cm & tenths)	Total Precipitation (mm & tenths)	DEPTH* of snow on the ground at 12Z (whole cm)	DAY WITH Thunderstorms	Freezing Rain or Freezing Drizzle	Hail	Fog or Freezing Fog (Visibility less than 5/8 mi.)	Visibility 6 mi. or less: Smoke, Dust Haze, or Haze	Blowing Dust, Blowing Sand	Blowing Snow	Mean Wind of: 28 or more knots	34 or more knots	PEAK WIND SPEED GUST OR MEAN (leave blank if speed does not exceed 16 knots) Direction nearest 10 degrees (2 figures)	Speed	Time (UTC) (2 figures)
51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68
3.0	0.8	6.4	15.2	21.4	27	0	1	0	0	0	0	1	1	1	M	M	M

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Part D
Pilot Reports (PIREP)

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Chapter 14 Pilot Reports (PIREP)

14.1 General

Pilot Reports (PIREP) are reports of weather conditions encountered by aircraft during flight. This information is extremely useful to other pilots, aircraft operators, weather briefers and forecasters for supplementing the information received from meteorological observing stations. Pilots are encouraged to file brief reports of weather conditions when giving position reports. Also, any important atmospheric phenomenon encountered between reporting points should be reported, either immediately or appended to the position report given over the next reporting point. Pilot reports received by flight service personnel are relayed on meteorological communications circuits to weather offices and other air traffic service units.

14.1.1 Description and criteria

In order to provide standard methods of observing and reporting meteorological phenomena encountered during flight, PIREPs must be encoded in accordance with prescribed standards and criteria. The order in which the elements are discussed is the same as the order in which the meteorological information appears on the encoded PIREP.

The encoded PIREP message consists of a series of meteorological fields, each preceded by a specific field indicator. Message length may vary due to the omission of some fields, however, as a minimum; PIREP messages must include the message header, aircraft location, time, flight level, aircraft type and at least one other field. The indicators used in the PIREP message are as follows:

- UA – identifies the message as a routine PIREP
- UUA – identifies the message as an urgent PIREP
- /OV – location of the PIREP
- /TM – time (UTC) that PIREP is received from the pilot
- /FL – flight level or altitude above sea level of the aircraft when PIREP is filed
- /TP – type of aircraft
- /SK – sky cover
- /TA – ambient temperature
- /WV – wind velocity
- /TB – turbulence
- /IC – icing
- /RM – Remarks

14.1.2 PIREP format rules

All PIREP messages must conform to a basic set of format rules as follows:

1) Fields up to and including the /TP field are considered mandatory. Other PIREP fields for which no data are reported may be omitted from the message.
2) A space and a solidus precede all field indicators.
3) All field indicators are followed by a space except the /FL field indicator. There is no space following the /FL field indicator.
4) If turbulence and/or icing is reported at the same altitude as that given in the location field, then no altitude is required following /TB or /IC.
5) A single altitude may be reported, or a layer can be defined by encoding both top and bottom altitudes.
6) Hyphens are used to show variation in intensity, lower and upper limits of a layer, or to indicate negative temperatures. Hyphens may also be used to indicate route segments in the Remarks section of the PIREP.
7) Zeros are inserted in a field when the number of digits of the reported value is less than the minimum number required by the format. For example, an aircraft location report of "45 miles from the London VOR on the 005 degree radial at 00:30 UTC at 5000 feet ASL" would be encoded as per the following example.

Example: /OV YXU 005045 /TM 0030 /FL050

14.2 Symbolic form of PIREP messages

The following provides a coded description of the PIREP message format, including field indicators, spacing, interpretation, and content of each field:

UACN10 or **UACN01** SSSS DDTTTT

FI_R (FI_R)

(**U**)**UA** **/OV** $N_aN_aN_a$ $R_LR_LR_LD_nD_nD_n$ or (**/OV** $A_pA_pA_pA_p$ $R_LR_LR_LD_nD_nD_n$)

or (**/OV** $L_TL_T(I_tI_t)NL_GL_GL_G(I_gI_g)W$) **/TM** $T_HT_Ht_mt_m$ **/FL**$F_LF_LF_L$ or (**/FL**$F_AF_AF_AF_A$)

/TP AAAA **/SK** $B_1B_1B_1N_1N_1N_1T_1T_1T_1$ ($B_2B_2B_2N_2N_2N_2T_2T_2T_2$) **/TA** (-)TT

/WV $D_rD_rD_rS_pS_pS_p$ **/TB** $N_tN_tN_t$(-$N_tN_tN_t$) (CAT) $A_bA_bA_b$-$A_tA_tA_t$

/IC $N_tN_tN_t$(-$N_tN_tN_t$) $T_iT_iT_i$ $A_bA_bA_b$-$A_tA_tA_t$ **/RM** (*general remarks*)

Symbols shown in bold in the symbolic form above are included verbatim as part of the message, whenever the relevant group is included in the message. All other symbols are replaced by appropriate data as applicable.

14.3 PIREP header

The PIREP message header includes the message identifier, originating station, date and time of issue, and one or more flight information regions.

Example:

UACN01 CYGK 121510

YZ UL

14.3.1 Message identifier (UACN10 or UACN01)

Every PIREP is assigned either a routine message identifier (UACN10) or an urgent message identifier (UACN01). A routine PIREP message is issued to describe non-hazardous weather conditions. An urgent PIREP message is issued when a pilot reports hazardous or potentially hazardous weather conditions. Reports of any of the following conditions **shall** be transmitted as an urgent PIREP:

1) Volcanic ash
2) Tornado, funnel cloud, waterspout
3) Severe turbulence
4) Severe icing
5) Hail
6) Low-level wind shear 1500 feet AGL and below
7) Any other reported phenomena considered to be hazardous or potentially hazardous to flight operations

14.3.2 Originating station (SSSS)

The originating station is the four-letter ICAO designator of the station inputting the PIREP. Normally, this will be a NAV CANADA Flight Service Station (FSS) or Flight Information Centre (FIC).

14.3.3 Date/time of issue (DDTTTT)

The date/time group indicates when the PIREP was transmitted by the receiving station and may be different from the time of the actual PIREP. The date is coded as a two-digit number indicating the day of the month. The time is coded as a four-digit number indicating the time based on a 24-hour clock (UTC). Leading zeros are used as required.

14.3.4 Flight Information Region (FIR)

The FIR **shall** be the two-letter identifier for the flight information region where the PIREP has been reported. A maximum of two FIRs may be reported if the PIREP location is near a FIR boundary. The FIR identifier **shall** be chosen from the following list:

1) VR – Vancouver FIR
2) EG – Edmonton FIR
3) WG – Winnipeg FIR
4) YZ – Toronto FIR
5) UL – Montreal FIR
6) QM – Moncton FIR
7) QX – Gander FIR

14.4 PIREP body

14.4.1 Location (/OV)

Location **shall** be reported as the position of the aircraft at the time that the PIREP is being reported. Location **shall** be reported in one of the following ways:

1) As direction and distance from a Canadian navigation radio aid (NAVAID).
2) As direction and distance from a Canadian aerodrome.
3) As a geographic coordinate (latitude/longitude) without direction and distance.

A valid location format must be used to report the location of a PIREP. All NAVAIDs (VOR or NDB) **shall** have a three-letter identifier; aerodromes **shall** have a four-character (alphanumeric) identifier. Geographic coordinates **shall** be reported as latitude and longitude. Latitude **shall** be formatted as either two digits (degrees) or four digits (degrees and minutes) followed by the letter N (north). Longitude **shall** be formatted as either three digits (degrees) or five digits (degrees and minutes) followed by the letter W (west). Identifiers for Canadian NAVAIDs and aerodrome are published in the *Canada Flight Supplement*. Each station is encouraged to develop an on-site list of frequently used geographic locations and corresponding radial/distance to the closest aerodrome or NAVAID.

Direction of the aircraft from a NAVAID or aerodrome **shall** be reported in whole degrees magnetic in southern domestic airspace and whole degrees true in northern domestic airspace as a three-digit group. Distance **shall** be reported in nautical miles as a three-digit group. If the aircraft is overhead the NAVAID or aerodrome, direction and distance are omitted from the report. Leading zeros **shall** be used to complete location fields where the reported digits are less than the allotted field width.

14.4.2 Time (/TM)

The time of occurrence **shall** be the time that the pilot reports the PIREP. Pilot reports of historical weather events, not occurring at the time of the report, may be included in the Remarks section of the PIREP only if they are temporally pertinent.

14.4.3 Flight Level (/FL)

The flight level **shall** be reported as either a three-digit value indicating the aircraft altitude above sea level in hundreds of feet, based on readings taken from aircraft altimeter, or one of the following approved four-letter text abbreviations:

1) DURD – during descent / on approach
2) DURC – during climb / after takeoff
3) UNKN – unknown

14.4.4 Aircraft Type (/TP)

Aircraft type **shall** be encoded in accordance with the list of designators contained in ICAO DOC 8643 – *Aircraft Type Designators*. If the type of aircraft is unknown, the abbreviation UNKN is to be used.

14.4.5 Sky Cover (/SK)

Sky cover **shall** be used to report the cloud layer amount and height of cloud bases and/or tops. One or more layers may be reported. The altitudes of cloud bases and/or tops are based on aircraft altimeter measurement and **shall** be encoded in hundreds of feet above sea level as a three-digit group. The following abbreviations **shall** be used to report cloud layer amount:

- CLR – clear
- FEW – few
- SCT – scattered
- BKN – broken
- OVC – overcast

14.4.6 Temperature (/TA)

The ambient air temperature, reported by the pilot, **shall** be recorded in whole degrees Celsius as a two-digit value. Negative temperatures **shall** be preceded with a minus (-) sign.

14.4.7 Wind Velocity (/WV)

Wind velocity comprises both wind speed and direction. Wind direction **shall** be reported in whole degrees true as a three-digit value. Wind speed **shall** be reported in knots as a three-digit group.

Pilots may give the wind direction in degrees magnetic. In such cases, specialists must convert the wind direction to degrees true. The following will serve as guidance when converting wind direction from degrees magnetic to degrees true.

If the magnetic variation is West:

- True Direction = Magnetic direction minus magnetic variation

If the magnetic variation is East:

- True Direction = Magnetic direction plus magnetic variation

14.4.8 Turbulence (/TB)

The occurrence and intensity of turbulence reported in a PIREP is usually based on the aircraft and occupant reactions to the event. The altitude of the turbulence, if different from the altitude indicated in the flight level field (/FL), **shall** be reported by the use of one or two, three-digit groups. The symbol, BLO (below) or ABV (above) may be used in conjunction with a flight level when the base or top of the turbulence area is undefined, e.g. ABV 290.

Turbulence **shall** be reported by first giving the intensity or variation of intensity (light – LGT, moderate – MDT or severe – SEV). Clear air turbulence **shall** also include the type CAT. The following descriptions will serve as guidance when reporting turbulence:

- **Light Turbulence** – momentarily causes slight, erratic changes in altitude and/or attitude (pitch, roll, yaw).
- **Light Chop** – causes slight, rapid and somewhat rhythmic bumpiness without appreciable changes in altitude or attitude.
- **Moderate Turbulence** – increased intensity causes changes in altitude and/or attitude but the aircraft remains in positive control at all times. Changes in indicated airspeed may occur.
- **Moderate Chop** – more intense chop that causes rapid bumps or jolts without appreciable changes in aircraft altitude or attitude.
- **Severe Turbulence** – causes large abrupt changes in altitude and/or attitude with large variations in indicated airspeed. Aircraft may be momentarily out of control.

14.4.9 Airframe Icing (/IC)

Airframe icing **shall** be reported according to type and intensity or rate of accretion. The intensity is determined with reference to de-icing equipment and, to some extent, the characteristics of the aircraft. Icing is reported using the same format as turbulence, so the sequence is intensity, type, and altitude or layer. The altitude of the icing area, if different from the altitude indicated in the flight level field (/FL), **shall** be reported by the use of one or two three-digit groups. The symbol, BLO (below) or ABV (above) may be used in conjunction with a flight level when the base or top of the icing area is undefined, e.g. ABV 290.

If it is impossible to determine from the cockpit, the exact structure of the ice, any ice that spreads back from the leading edges should be reported as clear ice. The following descriptions will serve as guidance for reporting the type of icing:

- **Rime** – reported as "RIME" – rime is ice (other than frost) which is rough, milky and opaque in appearance and is formed by the instantaneous freezing of small super-cooled water droplets. It will usually form only on the leading edges of airfoils and tends to build forward into the air stream, forming fingers and ridges. If it is impossible to determine from the cockpit of an aircraft whether the structure of an ice formation is granular, any ice accretion which is confined to the leading edges should be reported as rime. Because of the low adhesive properties of rime, it is generally readily removed by de-icing equipment.
- **Clear** – reported as "CLR" – clear ice has high adhesive and cohesive properties. Unlike rime, it can spread form the leading edges, and in severe cases may cover the whole surface of the aircraft. Its physical appearance can vary all the way from a transparent, glass-like structure to a very tough opaque surface. Clear ice is formed when large, super-cooled water droplets collide with the air frame and freeze slowly after impact, the free water flowing back over the surface as it freezes at temperatures not far below freezing. Clear ice builds back from leading edges as well as forward and may develop large irregular protuberances into the air stream.
- **Mixed –** reported as "MXD" – mixed ice is a mixture of white and transparent ice, which has characteristics of rime and clear ice. If the ice is clear in some spots and white in others, and is spread irregularly over the wings, it is described as mixed ice.

The intensity or rate of ice accretion is reported as trace, light, moderate or severe. As there is no satisfactory instrument installed on commercial aircraft for measuring directly the rate of ice accretion on an airframe, these terms must be interpreted qualitatively and measured by the effect of the ice formation on the flying characteristics of the aircraft. The following describes the various ice accretion intensities:

- **Trace –** reported as "TR" – ice becomes perceptible. The rate of accumulation is slightly greater than rate of sublimation. It is not hazardous even though de-icing or anti-icing equipment is not used, unless encountered for an extended period of time (over 1 hour).
- **Light –** reported as "LGT" – the rate of accretion may create a problem if flight is prolonged in this environment (over one hour). Occasional use of deicing/anti-icing equipment removes/prevents accretion. It does not present a problem if the deicing/anti-icing equipment is used.
- **Moderate** – reported as "MDT" – the rate of accretion is such that even short encounters become potentially hazardous and the use of deicing/anti-icing equipment, or diversion, is necessary.
- **Severe** – reported as "SEV" – the rate of accretion is such that deicing/anti-icing equipment fails to reduce or control the hazard. Immediate diversion is necessary.

14.4.10 Remarks (/RM)

Remarks are used to report weather conditions not previously reported in the PIREP, or to clarify information reported in the PIREP. Although no specific format must be followed in the Remarks field, weather elements such as tornadoes, thunderstorms, low-level wind shear (LLWS), other forms of severe weather and explanatory information **shall** be reported in descending order of importance. Wording may be a combination of plain language and abbreviations. Abbreviations when used must conform to MANAB (*Manual of Word Abbreviations*). Remarks reported in the PIREP are intended to convey information of a meteorological nature that may be of concern to a pilot. Information such as runway surface condition reports is not to be included in the PIREP.

14.4.11 Icing in precipitation

When icing is experienced in precipitation, this fact should be reported because of its operational and meteorological significance. Icing in precipitation may range from freezing rain, a very dangerous type of icing condition, to slightly wet snow, which might cling for a short time to the leading edges of a wing, dislodging automatically at short intervals when it has accreted to appreciable proportions.

14.4.12 Thunderstorms

Reports of thunderstorm activity may only consist of observed lightning, as the pilot is often unable to hear thunder. The direction in which the lightning was observed should be reported as well as the type of lightning, e.g., “cloud to ground”, “cloud to cloud”, “within cloud”, “below horizon”, etc.

14.4.13 St. Elmo’s Fire

Pilots will occasionally report a “brush discharge” commonly known as “St. Elmo’s Fire.” When this is reported, it will be recorded and transmitted in Remarks so that other pilots may be warned of conditions favourable for such discharges.

14.4.14 Frontal conditions

Pilots are encouraged to report geographical location, phenomena encountered and time of passage through fronts. This information will be recorded and reported in the Remarks field in the PIREP.

14.4.15 Low-level wind shear

A pilot report of low-level wind shear 1500 feet AGL and below will be recorded in the Remarks (/RM) field of the PIREP and will be transmitted as an Urgent PIREP.

14.4.16 No turbulence or icing encountered

A pilot report of no turbulence or icing encountered will be recorded in the /RM field in the PIREP.

14.5 PIREP examples

Example (1): A complete PIREP

UACN10 CYQT 192128
YZ WG
UA /OV YSP 090025 /TM 2120 /FL050 /TP BE99 /SK 020BKN040 110OVC /TA -14 /WV 030045 /TB MDT CAT 060-080 /IC LGT RIME 020-040 /RM NIL TURB YAM-YXZ

Example (2): Pilot report 10 miles east of the London VOR (filed with London FIC)

UACN10 CYXU 032133
YZ
UA /OV YXU 090010 /TM 2120 /FL030 /TP C172 /TB MDT /RM MDT TURB BLO 050 CYKF-CYXU

Example (3): Pilot report after landing at Haines Junction aerodrome (filed with Whitehorse FIC)

UACN10 CYXY 281544
EG
UA /OV CYHT /TM 1538 /FLDURD /TP P28B /TA -07 /RM SHSN VC ARPT VIS LWR W

Example (4): Pilot report after departure from Nanaimo aerodrome (filed with Nanaimo FSS)

UACN10 CYCD 111822
VR
UA /OV CYCD /TM 1815 /FLDURC /TP C172 /TB MDT BLO 007

Example (5): Pilot report along the south shore of Baffin Island (filed with Iqaluit FSS)

UACN10 CYFB 192055
UL EG
UA /OV 6251N06953W /TM 2050 /FL090 /TP DHC6 /SK OVC070 /TA 04

Example (6): Pilot report west of Attawapiskat, of previously encountered weather conditions (filed with Timmins FSS)

UACN10 CYTS 021413
YZ WG
UA /OV YAT 260035 /TM 1405 /FL065 /TP BE9L /RM OVC050 CYMO-CYFA

Example (7): Pilot report east of Brandon (filed with Winnipeg FIC)

UACN10 CYWG 201345

WG

UA /OV CYBR 080030 /TM 1337 /FL045 /TP BE90 /SK BKN030 /RM CLRG TO W

Example (8): Pilot report of low-level wind shear during departure from London (filed with London FIC)

UACN01 CYXU 201545

YZ

UUA /OV CYXU /TM 1537 /FLDURC /TP C172 /RM WS RWY 18

Example (9): Pilot report of no turbulence or icing during departure from Port Hardy (filed with Kamloops FIC)

UACN10 CYKA 221536

VR

UA /OV CYZT /TM 1535 /FLDURC /TP PA31 /SK 008OVC050 /RM NIL TURB NIL ICG

Part E
Rate-of-rainfall and METAR

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Chapter 15 Rate-of-rainfall – tipping bucket rain gauge

15.1 General

The standard instrument for measuring rate-of-rainfall is the MSC tipping bucket rain gauge, provided with a daily or weekly chart recorder. The instrument is described in *Technical Manual TM 04-01-03*, (English and French versions). These publications deal with the installation, care and maintenance of the equipment. The following instructions cover the abstracting of recorded precipitation data for processing for climatological purposes.

15.1.1 Daily Chart

The MSC tipping bucket rain gauge (daily chart) **shall** be operated in conjunction with an MSC standard rain gauge.

15.1.2

The processing system established for correcting the amounts of rainfall recorded by the tipping bucket rain gauge to the amounts measured by the standard gauge requires that the time of chart change coincide with the time of reading of the MSC standard rain gauge.

15.1.3

General instructions on the care and maintenance of the tipping bucket rain gauge are given in *Technical Manual TM 04-01-03*. However, the instructions in *TM 04-01-03* regarding the operation of the recording gauge during the winter months are superseded by those which follow here. These detailed procedures are provided in order that reliable rate-of-rainfall data may be calculated for occurrences of rain or drizzle, during the winter, at observing sites where a continuous weather watch is maintained. In the following instructions the term “liquid precipitation” does not include freezing rain or freezing drizzle.

15.1.3.1

Stations equipped with a tipping bucket rain gauge and which take fewer than 24 hourly observations per day (including climatological stations), **shall** measure rate-of-rainfall (operate the tipping bucket rain gauge and recorder) only during that period of the year when liquid precipitation is the predominant form. For the remainder of the year (the period to be specified by the region) the recording gauge **shall** be taken out of service. During this period, no charts would be used on the recorder. The period of operation should begin on the first day of a month and end on the last day of a month.

Note: When the recording rain gauge is being withdrawn from service, the last chart for the season **shall** be annotated “closed for season.” Similarly, when the recording rain gauge is placed in service, the first chart **shall** be annotated “reopened for season.”

15.1.3.2

Stations equipped with a tipping bucket rain gauge and which take 24 hourly observations per day **shall** measure the rate-of-rainfall throughout the year. However, from the beginning of the snowfall season and continuing until a date specified by the regional headquarters or supervising office, the tipping bucket rain gauge **shall** be in service during periods of liquid precipitation only; recorder charts (Chart 99) **shall** be required for these periods only. The following routine **shall** be maintained:

1) At the first occurrence of snow in the autumn, cover the tipping bucket rain gauge with a suitable lid, plastic bag, etc. After the chart, which is then on the recorder drum has been removed at the normal time of chart change, record on that chart: “Tipping Bucket Rain Gauge taken out of continuous operation”. Further recorder charts (Chart 99) are not required until the next occurrence of measurable liquid precipitation.
2) When liquid precipitation (not accompanied by freezing or frozen precipitation) begins after a cover has been put on the tipping bucket rain gauge, remove the lid, cover, etc., while preparing the special observation which reports the beginning of the precipitation and activate the recorder. The recorder pen should be positioned on the chart to indicate the elapsed time since normal time of chart change, for example:
   - (i) Normal time of chart change is 0700 Local Standard Time (LST).
   - (ii) Rain begins at 12:30 LST (winter operation).
   - (iii) The cover is removed from the tipping bucket rain gauge as soon as possible after the rain starts.
   - (iv) Activate or read the standard gauge. (It may be convenient to install a spare funnel and graduate during the period of liquid precipitation).
   - (v) The recorder is activated.
   - (vi) The recorder pen is positioned on the chart at “5 1/2 hours after normal time of chart change,” and that chart should remain on the recorder until normal time of chart change.

If liquid precipitation begins again before normal time of chart change, the same chart may contain data for two or more periods of liquid precipitation. The time of chart change must coincide with the normal time of reading of the standard gauge, thus the amount of rain recorded on the chart can be readily compared with the corresponding amount measured by the standard gauge.

Note: The above procedure, on occasion, may require that a chart be removed from the recorder only a few minutes after the recorder is activated; i.e. when liquid precipitation begins only a few minutes prior to normal time of chart change.

3) If liquid precipitation (not accompanied by freezing or frozen precipitation) is occurring at the time of chart change, a new chart is of course put on the recorder immediately.
4) When liquid precipitations ends (during winter months) or if frozen precipitation starts while liquid precipitation is still occurring, replace the lid on the tipping bucket rain gauge. (The chart should not be removed from the recorder until normal time of chart change and the recorder pen need not be removed from the chart. Thus if liquid precipitation begins again before chart change, rate-of-fall data may be recorded as a continuation of the trace already on that chart. If freezing or frozen precipitation begins, an intermediate standard gauge reading should be made so that the rainfall amount collected by both gauges can be compared).
5) At these stations, Regional direction or the Station OIC will determine when the operation of the tipping bucket rain gauge should change from “winter operation” to continuous operation.
6) Stations in continuous operation may experience freezing or frozen precipitation events during early autumn or late spring. In these circumstances, the tipping bucket rain gauge must be covered for the duration of the freezing or frozen precipitation event and an intermediate reading of the standard gauge made so that any rainfall amount collected by both gauges can be compared.
7) Charts on which the recorded standard rain gauge amount is less than 0.2 mm (i.e. a trace) need not be sent to the Regional Data Processor.

15.1.3.2.1

Station programs regarding the operation of the tipping bucket rain gauge should be available to MSC Downsview, on request, to indicate the following:

- Which stations do not operate the tipping bucket rain gauge during the winter, and for what period each of these stations measures rate-of-rainfall.
- The period of “winter operation” at each of the observing stations where 24 hourly observations are taken daily.

15.1.3.3

Implementation of the preceding procedures will produce data on Chart 99 from which more accurate rate-of-rainfall data may be determined and will result in the following advantages:

- Only liquid precipitation (not accompanied by freezing or frozen precipitation) should be recorded on Chart 99.
- A more realistic correction factor can be directly determined from data on the chart, i.e., from the total rainfall recorded on the chart in relation to the total amount of liquid precipitation as measured by the standard gauge.
- Data Processors will not be obliged to abstract useless data, i.e., hourly amounts resulting from melting snow or ice.

15.1.3.4

At each station where rate-of-rainfall is measured throughout the year, the Officer-in-Charge **shall** be responsible for establishing a local maintenance routine, which will ensure that the tipping bucket rain gauge system is always ready for immediate service; for example, by checking regularly to ensure that:

- The recorder clock is in working order.
- The recorder pen has ink and is not clogged.
- The recorder has Chart 99 installed (not dated) but otherwise ready for service.
- The necessary removal of snow in the area of both the standard gauge and the tipping bucket rain gauge is done in advance, so that these instruments, when required, can be immediately exposed without digging to locate them beneath snow cover.

15.1.3.5

When in the opinion of the Regional or Supervising Office, the above instructions for measuring rate-of-rainfall throughout the year are not feasible, the tipping bucket rain gauge **shall** be taken out of service for such period as considered necessary; an appropriate note should be recorded on Form 63-2325 and the Regional or Supervising Office **shall** advise the ADMA by letter accordingly. (See note following 15.1.3.1.)

Note: The standard rain gauge however should not be taken out of service.

15.2 Form 63-9686 – MSC Tipping Bucket Gauge Daily Chart 99

15.2.1 Time of chart change

1) At each station, a normal time for changing the chart on the MSC tipping bucket gauge **shall** be selected, and this normal time of chart change **shall** coincide with the reading of the standard rain gauge. On occasion, it may be necessary to read the standard gauge and change the chart slightly before or after the normal time of chart change; however, the time of chart change must coincide with the reading of the standard gauge.
2) The time selected for the changing of the chart and the reading of the standard gauge **shall** be as nearly as possible on the hour.
3) The chart **shall** be changed each day, whether precipitation has occurred or not, except during “winter operation.” See 15.1.3.1 and 15.1.3.2.
4) The recorder pen should normally be positioned on each new chart on the line which indicates “0 hours after normal time of chart change.” However, if the chart is changed slightly before or after “normal time of chart change,” the pen should be positioned on the chart to indicate the time interval between actual time of chart change and normal time of chart change, e.g.:
   (i) Normal time of chart change is 0700 LST.
   (ii) The reading of the standard gauge and the changing of the chart are done 30 minutes later than “normal time of chart change”: i.e., at 0730 LST.
   (iii) The pen should be positioned on the chart half-way between “0” hours after “normal time of chart change” and “one hour after normal time of chart change.”

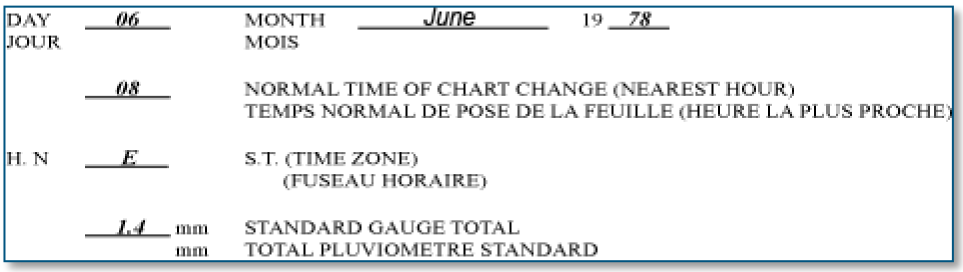
Note: The design of Chart 99 is such that an abstract of data, suitable for processing, can be obtained even though, on occasion, the time of chart change may vary by as much as an hour from the normal time.

15.2.2 Entries on Chart 99

15.2.2.1

Before placing Chart 99 on the recorder, enter the following:

1) Station name and province (as in METSTAT). On the first chart for a new month, affix a pre-printed label to the chart immediately above the space provided for the station name and province;
2) Day (two figures), month, year;
3) Normal time of chart change: Enter to the nearest hour the normal time of chart change and indicate the time zone. Do not use daylight saving time.


DAY / JOUR 06 MONTH / MOIS June 19 78

08 NORMAL TIME OF CHART CHANGE (NEAREST HOUR)
TEMPS NORMAL DE POSE DE LA FEUILLE (HEURE LA PLUS PROCHE)

H. N E S.T. (TIME ZONE)
(FUSEAU HORAIRE)

1.4 mm / mm STANDARD GAUGE TOTAL
TOTAL PLUVIOMETRE STANDARD

Note: This entry (to the nearest hour) should not vary from day to day or from month to month, unless for some reason it becomes necessary to establish a different "normal time of chart change," and if so, the change should be made at the beginning of a month.

The following examples illustrate the procedures which apply when the actual time of chart change departs from the normal time of chart change:

Normal time of chart change	Actual time of chart change	Chart change entry	Pen position on chart at
0750	0750	08	0 hours
0050	0040	01	0 hours minus 10 minutes
1250	1310	13	0 hours plus 20 minutes
0950	1050	10	1 hour after normal time of chart change
0150	0850(1)	02	7 hours after normal time of chart change
0800	1230(2)	08	4 hours and 30 minutes after normal time of chart change

Note (1): Winter operation

Note (2): Chart overrun – late change. Data from the last 4 1/2 hours on the chart being replaced should be placed in the appropriate boxes on the new chart.

15.2.2.2

After removing Chart 99 from the recorder, complete the following entries on the chart:

Standard Gauge Total. Enter the amount of rain as measured by the standard rain gauge to the nearest tenth of a millimetre, i.e., 29.2, 4.6, 0.8, for the period of the chart. Enter “0” for none; enter “M” for missing. Mark this amount with an asterisk if it includes any freezing precipitation. See 15.1.3.2 (2) (iv) and 15.1.3.2 (4) for special procedures during winter operation. (See 15.1.3.2 (6) for procedures during freezing and frozen precipitation events).

Greatest Fall of Rain in 5 minutes, 10 minutes, etc. In the boxes provided, enter in millimetres and tenths, the greatest fall of rain as determined from the chart, (see 15.2.2.4) for the various durations, i.e., the greatest recorded amounts for durations of 5 minutes, 10 minutes, 15 minutes, 30 minutes, 1 hour, 2 hours, 6 hours, and 12 hours. Enter “M” if there was rain during the period of the chart but the gauge was unserviceable. Leave blank if there was no rain.

Note (1): While lines have been provided on the chart for recording corrected amounts of greatest rainfall for various durations, and for corrected hourly amounts, entries in these lines are not required except where there is a regional need for the completion of Form 63-9687.

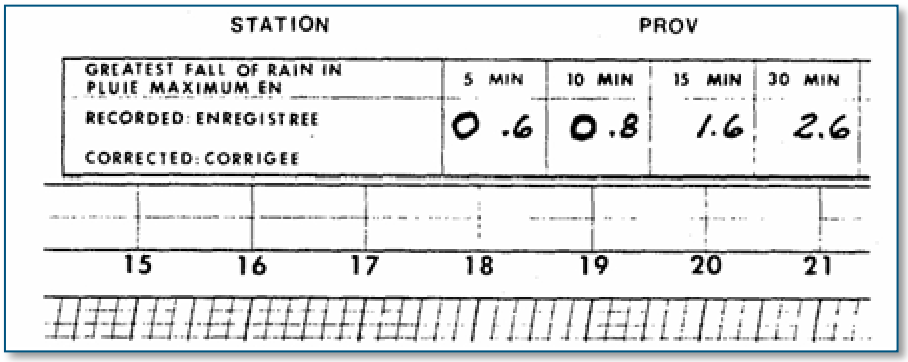
Note (2): A plastic Rainfall Intensity Scale No. 50, Stock No. 6675-21-904-3703 and a magnifying glass with case, Stock No. 6650-00-346-9106 are available from MSC Downsview Stores and are most useful aids when abstracting data from Chart 99.

Note (3): A series of control checks should be applied to the values recorded on Chart 99 for “Greatest Rainfall in 5 minutes, 10 minutes, 15 minutes, 30 minutes, 1 hour, 2 hours, 6 hours, 12 hours,” viz:

The amount assigned to any duration period up to one hour must not exceed twice the preceding amount, nor should it exceed the sum of the previous amounts.

- The 30-minute amount must not exceed three times the 10 minute amount.
- The 6-hour amount must not exceed three times the 2-hour amount.
- The 12-hour amount must not exceed twice the 6-hour amount.

Example (of incorrect data):



STATION PROV

GREATEST FALL OF RAIN IN / PLUIE MAXIMUM EN	5 MIN	10 MIN	15 MIN	30 MIN
RECORDED: ENREGISTREE	0.6	0.8	1.6	2.6
CORRECTED: CORRIGEE				

15 16 17 18 19 20 21

The entries shown above for the 5, 10, 15, and 30 minute intervals are not in keeping with the preceding rules, and are therefore not acceptable because the amount for 15 minutes is greater than the sum of the two previous amounts, and the amount for 30 minutes (2.6) is more than three times the amount for 10 minutes (0.8).

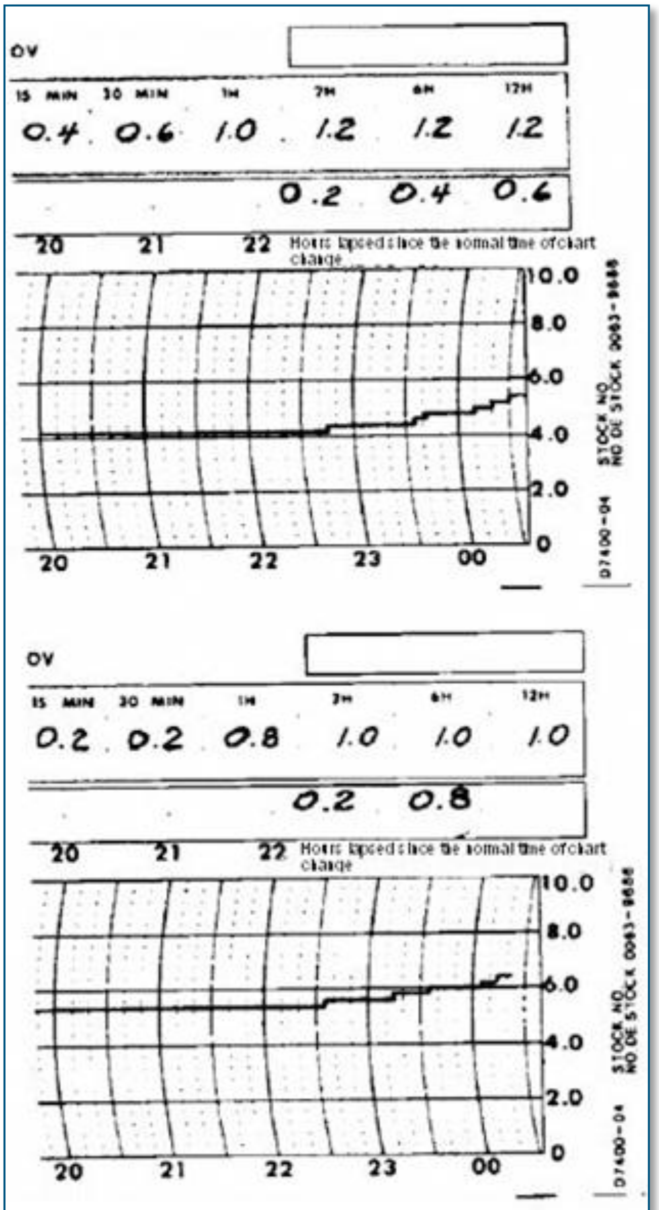
Recorded hourly amounts:

1) Enter the recorded hourly amounts to the nearest 0.2 mm as determined from the chart, (see 15.2.2.3).
2) No entries are required for hours with no rainfall.
3) Enter "M" for hours when there was malfunctioning of equipment during periods of rainfall.

15.2.2.3 How to determine hourly amounts from Chart 99

The recorded hourly amounts of rain **shall** be determined to the nearest 0.2 mm by counting the number of 0.2 mm steps on the chart. A step that occurs on the line separating two hours **shall** be credited to the first of these hours.

Note: One step = 0.2 mm of rain. Normally, there are two steps (0.4 mm of rain) made in the space between two horizontal lines. However, the observer is cautioned that occasionally, due to malfunctioning of the instrument, one step may extend over a full space or more. This double step **shall** be considered as 0.2 mm of rain.



15.2.2.3.1

When the chart has been changed slightly before or after the normal time of chart change, the trace on the recorder chart will not end exactly on the line indicating "24 hours after change." In such cases, the last hourly amount **shall** be determined as follows:

- When the last portion of the recorder trace extending beyond the "00" line (i.e. the last complete hour on the chart) represents a period of 30 minutes or more, count the 0.2 mm steps in this portion of the trace and record this amount in the appropriate box as the last hourly amount.
- When the last portion of the recorder trace extending beyond the "00" line represents a period of less than 30 minutes, count the 0.2 mm steps in this portion, add them to the amount recorded in the previous hour and record the total as the hourly amount for the last full hour recorded on the chart.

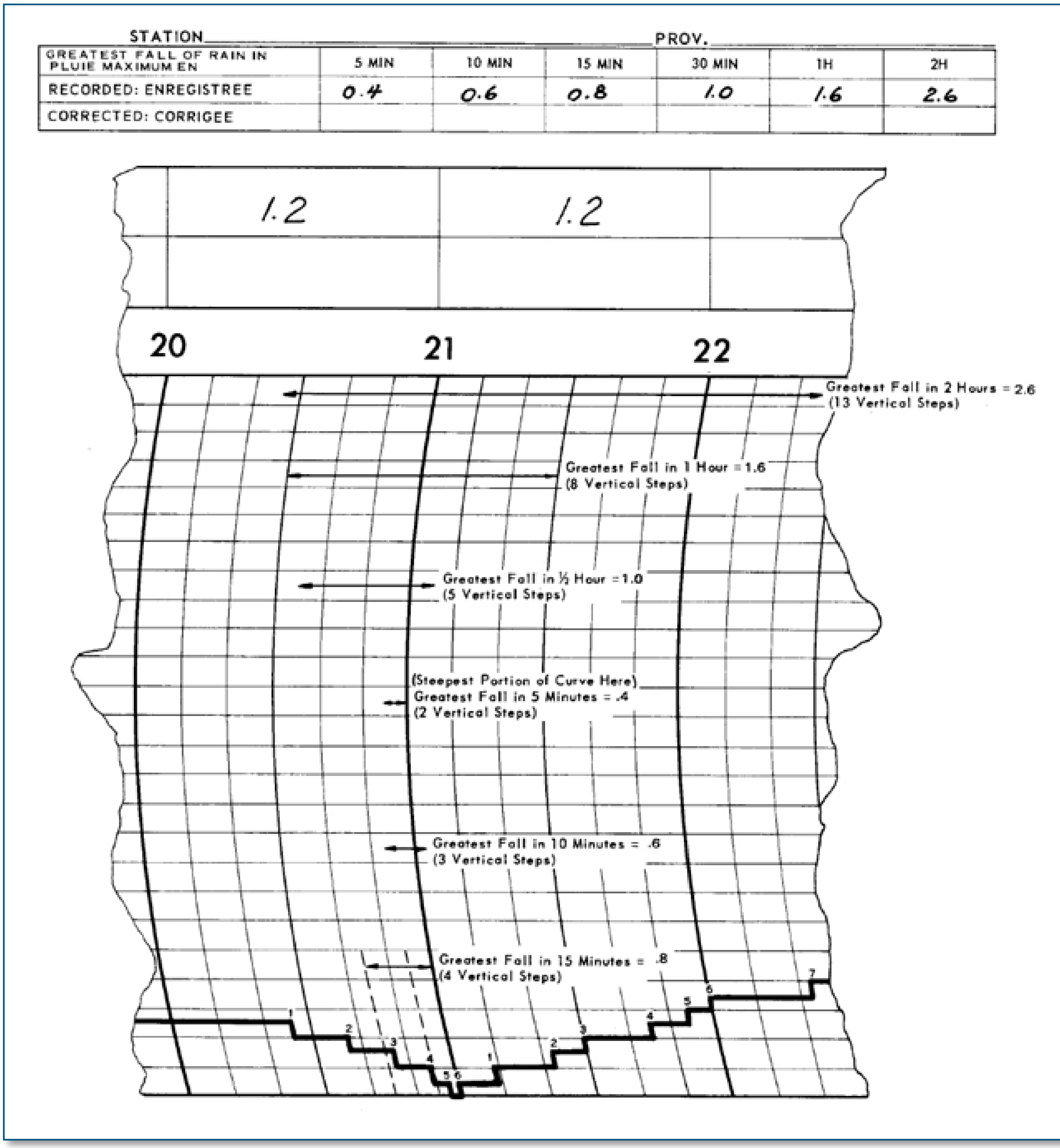
15.2.2.3.2

If a chart is changed more than an hour after the normal time of chart change and the pen overwrites on the beginning end of the chart, because of the chart overlap, the vertical lines on the body of the chart will no longer correctly represent the time. It will be necessary to scale off the time as well as abstracting the rainfall on the overrun portion of the chart. In such a case, the data abstracted following hour 24 **shall** be placed in the appropriate boxes at the beginning of the chart for the next day.

15.2.2.4 How to determine the greatest fall of rain in short duration

The greatest fall of rain for the various durations indicated on the chart will be determined by examination of the chart. The durations for which data are required, are 5 minutes, 10 minutes, 15 minutes, 30 minutes, 1 hour, 2 hours, 6 hours and 12 hours. These durations are not bound by clock hours. For example, the greatest fall in a 10-minute period may begin at 13 hours and 52 minutes after chart change and end at 14 hours and 2 minutes after chart change. For the shorter durations it may be necessary to scan several different periods to find the steepest slope of the curve representing the greatest fall of rain. See example on next page.

Example of greatest fall in 5 min, 10 min, etc. (Section of MSC Chart no. 99)



STATION ______ PROV. ______

GREATEST FALL OF RAIN IN / PLUIE MAXIMUM EN	5 MIN	10 MIN	15 MIN	30 MIN	1H	2H
RECORDED: ENREGISTREE	0.4	0.6	0.8	1.0	1.6	2.6
CORRECTED: CORRIGEE						

15.2.3 Distribution

The following instructions regarding the disposition of tipping bucket rain gauge charts **shall** be followed by all stations so equipped, except where these directions are modified by the Regional Director. At the beginning of each month, the completed charts for the previous month **shall** be forwarded to the Regional Data Processing Centre, for checking and forwarding to MSC Downsview. The charts, one for each day of the month (except during “winter operation,” see 15.1.3.2), **shall** be arranged in chronological order, the top chart being the one which was put on the recorder on the first day of the month, and the bottom chart being the one which was put on the recorder on the last day of the month, based on local standard time. The charts should be bound by two rubber bands and **shall not** be stapled.

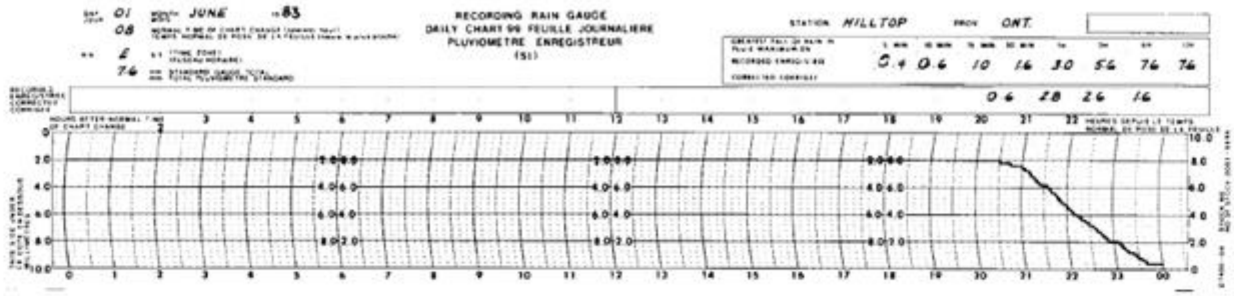
15.2.3.1

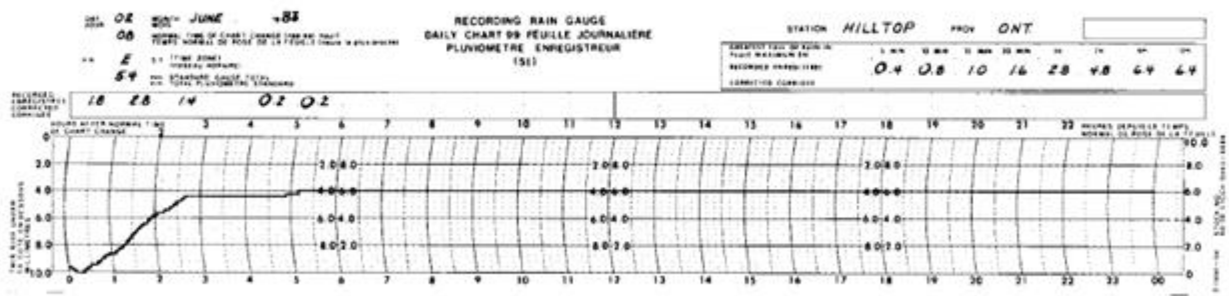
During “winter operation” when charts are not forwarded for every day of the month, it will be assumed that there was no rainfall on those days for which charts are missing. However if rainfall did occur and for some reason was not recorded on Chart 99, include a chart(s) with the following entries:

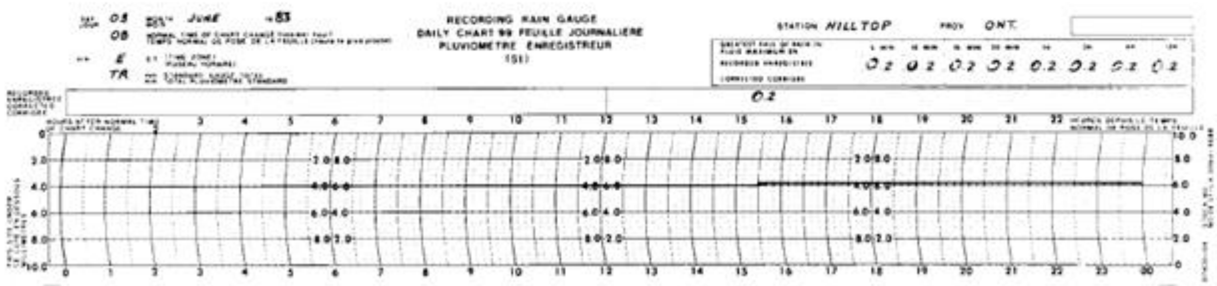
- Station name, date, etc.
- Standard gauge total rainfall (millimetres and tenths).
- Explanatory note that rain was not recorded on Chart 99.

15.2.4 Typical entries on Form 63-9686

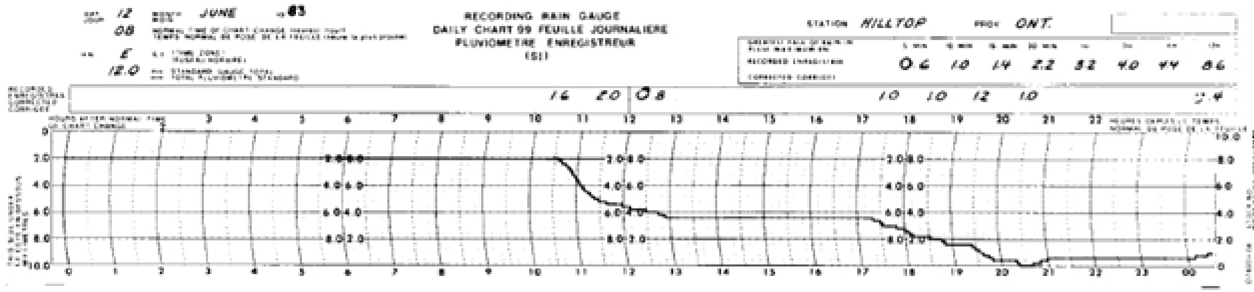
15.2.4.1 Example 1 – Completed Form 63-9686

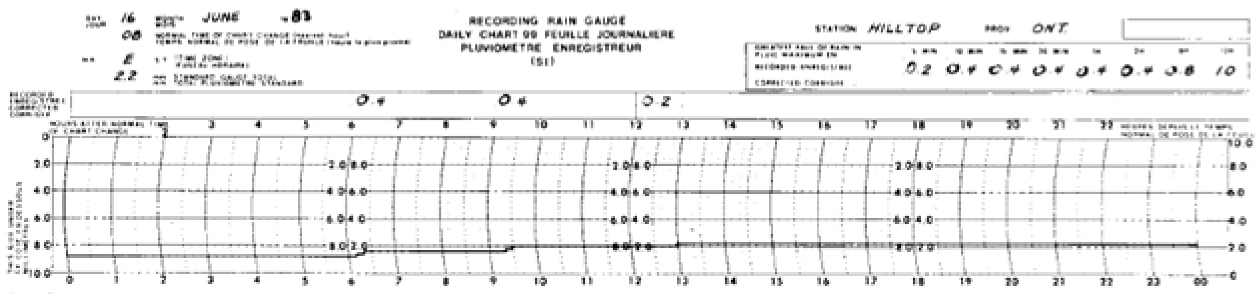


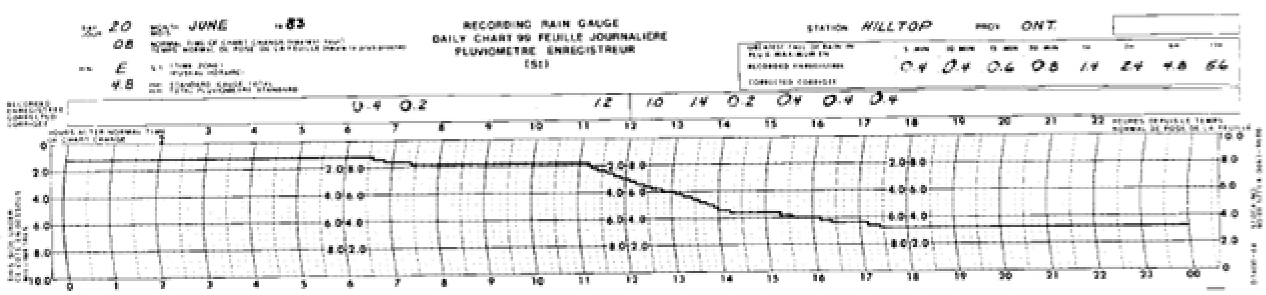




15.2.4.2 Example 2 – Completed Form 63-9686







15.3 Non-standard recording gauges

When data are to be processed from recording gauges other than the standard MSC tipping bucket, e.g., Bendix-Friez weighing type gauge, it will be necessary to forward the charts and Form 63-9689 completed as far as possible, in the manner as described for the weekly tipping bucket data. Where special instructions are required for submitting data from non-standard gauges, they will be supplied on request from MSC Downsview.

Chapter 16 METAR – Aviation routine weather report

16.1 General

Detailed coding instructions for each element of each group of the METAR code are given below, although not necessarily in the order in which elements are observed or that entries will be made by the observer. The type of report is usually determined after all other data have been observed. The observer may find that some weather elements are automatically encoded; however, the observer will need to possess a basic understanding of how these weather elements are observed.

16.2 Symbolic form of the Canadian METAR code

METAR or **SPECI** CCCC YYGGgg**Z** AUTO BBB dddff**G**f_mf_m**KT**

$d_nd_nd_n$**V**$d_xd_xd_x$ VVVV**SM** (**R**D_RD_R/$V_RV_RV_RV_R$**FT**/i or

RD_RD_R/$V_RV_RV_RV_R$**V**$V_RV_RV_RV_R$**FT**/i) w'w' ($N_sN_sN_sh_sh_sh_s$ and/or **VV**$h_sh_sh_s$)

T'T'/T'$_d$T'$_d$ **A**$P_HP_HP_HP_H$ **WS** **RWY**D_RD_R or **WS ALL RWY**

RMK (*Layer type and amount general remarks*) **SLP**ppp

Symbols shown in bold in the symbolic form above are included verbatim as part of the message, whenever the relevant group is included in the message. All other symbols are replaced by appropriate data as applicable.

16.3 The METAR code – detailed description and coding instructions

16.3.1 Type of report (METAR or SPECI)

The code name METAR or SPECI **shall** be included at the beginning of an individual report.

METAR is the name of the international meteorological code for an Aviation Routine Weather Report. METAR observations are normally taken and disseminated on the hour.

SPECI is a report issued when selected changes in weather conditions significant to aviation occur off the hour. (See 16.4.4 for detailed SPECI criteria.)

16.3.1.1

When an hourly observation (during the period H-5 to H) reveals that one or more of the criteria specified as requirements for SPECI observations has occurred, the observation **shall** be designated as a METAR and released on the hour. By exception, threatening severe weather (see Introduction – Priority of Duties) **shall** require the immediate dissemination of a SPECI observation.

Note: Segments in examples of coded messages are bolded to highlight the section described.

16.3.2 ICAO station identifier (CCCC)

Four-letter identifier beginning with the letter "C", which identifies it as a Canadian station.

Example: Weather observation from Toronto Lester B. Pearson International Airport.
METAR **CYYZ** 040600Z 35006KT 15SM BKN250 12/M01 A3013 RMK CI5 SLP208

16.3.3 Date/time of observation and other indicators (YYGGggZ AUTO BBB)

The date/time of observation (YYGGgg**Z**) **shall** be included in all reports. The date and time of observation on the hour is used for all METAR reports. In SPECI reports the time refers to the time of occurrence (hour and minutes) of the change(s) in observed elements that required the issue of the SPECI report. The exception is with reporting the end of thunderstorms and precipitation. (See 16.4.4.6 and 16.4.4.7.)

YY: Day of month.

GG: Hour of the day.

gg: Minute of the hour.

Z: Indicates UTC.

AUTO: Automatic Station Indicator. Indicates the report is from an auto station.

BBB: Correction indicator. Formed by the letters CC preceding an incremented letter to indicate the corrected observation. Use CCA for first correction, CCB for second correction, and so on.

Example (1): An automated aviation report taken at Moosonee (CYMO) airport on the 4th day at 0600Z.

METAR CYMO **040600Z AUTO** 30002KT 9SM FEW014 BKN024 OVC085 01/01 A2976 RMK SLP078

Example (2): A special aviation observation taken at Quebec City Jean Lesage International (CYQB) Airport on the 10th day at 1211Z.

SPECI CYQB **101211Z** 25007KT 4SM –SHRA BR BKN020TCU 13/12 A3003 RMK TCU6 SLP171

Example (3): Weather observation taken at Calgary International (CYYC) Airport on the 5th day at 1200Z. This is the **second** correction to the 1200Z METAR.

METAR CYYC **051200Z CCB** 31009KT 40SM FEW050 BKN160 OVC240 07/M03 A2980 RMK CU1AC5CI2 SLP098

16.3.4 Wind velocity (dddffG$f_m f_m$KT)

ddd: The two-minute mean wind direction from which the surface wind is blowing and is always three digits, given in degrees true but rounded off to the nearest 10 degrees.

ff: The two-minute mean wind speed; two digits if under 100, three digits if over 100 (see 7.1.2.).

G$f_m f_m$: Gust information will be included if gust speeds exceed the two-minute mean wind speed (ff) by 5 kts or more and the highest peak is at least 15 kts in the 10-minute period preceding the observation. If this condition is not met, this group **shall not** be reported. G indicates gust and $f_m f_m$ is the peak gust speed reported, using two or three digits as required.

KT: Indicates the units are knots.

Note (1): When suitable wind instruments are lacking, or when the wind instruments are not in operating condition, the wind direction and speed **shall be estimated** (see 7.4) and remarks entered. (See 16.3.13.2.1.) Use the Beaufort scale knots average for the speed.

Example: Wind estimated 230 degrees true at 9 kts.
METAR CYYC 051200Z **23009KT** 15SM FEW050 BKN160 OVC240 07/M03 A2980 RMK CU1AC5CI2 WND ESTD SLP098

Note (2): CALM wind is reported for mean wind speeds of less than 2 kts.

Example: Calm wind.
SPECI CYQB 101211Z **00000KT** 4SM BR FEW020 13/12 A3003 RMK FG1SC1 SLP171

Note (3): When squalls are observed, the peak wind speed **shall** be reported as a gust and "SQ" **shall** be reported in present weather. (See 7.1.3.2.)

Example: Squall with a peak wind speed of 36 kts.
METAR CYYT 241400Z **25015G36KT** 10SM **SQ** OVC009 17/13 A2979 RMK SF8 VIS LWR N SLP089

Note (4): In the case of variable wind direction, ddd **shall** be coded as VRB when the wind speed is less than 3 kts. A variable wind at higher speeds **shall** be reported only when the variation of wind direction is 180° or more or when it is impossible to determine a single wind direction.

Example (1): Wind direction is varying from 030 degrees to 140 degrees and the mean wind direction is 080 degrees but the mean wind speed is 2 kts.

METAR CYQB 041500Z **VRB02KT** 30SM FEW040 18/10 A3003 RMK SC2 SLP169

Example (2): Wind direction is varying from 030 degrees to 240 degrees and the mean wind direction is undeterminable. The mean wind speed is 4 kts.

METAR CYQB 041500Z **VRB04KT** 30SM FEW040 18/10 A3003 RMK SC2 SLP169

16.3.5 Variation in wind direction ($d_nd_nd_nVd_xd_xd_x$)

$d_nd_nd_n$: First counter-clockwise wind direction from the mean wind direction.

V: Variable indicator that is mandatory when this group is reported.

$d_xd_xd_x$: Last clockwise wind direction from the mean wind direction.

If, during the 10-minute period preceding the observation, the total variation in wind direction is 60° or more and less than 180° and the mean wind speed is 3 kts or greater, the observed two extreme directions between which the wind has varied **shall** be given for $d_nd_nd_n\mathbf{V}d_xd_xd_x$ in clockwise order. Otherwise the group **shall not** be included.

Example: Wind direction is varying from 060 degrees to 133 degrees. The mean wind direction is 100 degrees. The mean wind speed is 9 kts.

METAR CYQB 041300Z 10009KT **060V130** 30SM FEW040 BKN070 16/09 A3003 RMK SC2AC4 SLP169

16.3.6 Prevailing visibility (VVVVSM)

The prevailing visibility **shall** be reported in statute miles and fractions of statute miles followed by the letters "SM" to indicate units. If the observed prevailing visibility is between two reportable values, the "lower" value **shall** be used (see 2.3).

VVVV: Prevailing visibility.

SM: Indicates the units are statute miles.

16.3.6.1 Reportable visibility values

The following values (in statute miles) **shall** be used for reporting visibility:

Increments of 1/8 SM	0	1/8	1/4	3/8	1/2	5/8	3/4
Increments of 1/4 SM	1	1 1/4	1 1/2	1 3/4	2	2 1/4	2 1/2
Increments of 1 SM	3	4	5	6	7	8	up to 15
Increments of 5 SM	20	25	30	35	etc. – **shall** be used only if suitable markers are available.		

Note: If suitable markers beyond 15 mi. are lacking, 15 SM is the maximum reportable value.

Example: Prevailing visibility is observed as 3/4 SM.

METAR CYVR 241600Z 29005KT **3/4SM** BR SCT015 SCT230 15/15 A3018 RMK FG2SF1CI1 SLP219

16.3.6.2

Sector Visibilities that are half or less, or double or more of the prevailing visibility **shall** be reported in Remarks.

Example (1): The prevailing visibility is 15 SM; visibility to the north quadrant is observed to be 3 SM.

METAR CYTH 241800Z 13017KT **15SM** FEW020 FEW220 15/07 A3011 RMK SF1CI1 **VIS N 3** SLP205

Example (2): The prevailing visibility is 3 SM; visibility to the south quadrant is observed to be 6 SM.

METAR CYGK 201600Z 11003KT **3SM** BR FEW020 08/07 A2948 RMK FG1SC1 **VIS S 6** SLP980

16.3.6.3 Variable visibility

If the prevailing visibility is observed to be fluctuating rapidly and increasing and decreasing from a mean value by 1/4 or more of the mean value, the range of variation **shall** be entered in Remarks beginning with the lowest visibility value. The mean value **shall** be entered as the prevailing visibility.

Example (1): Prevailing visibility of 1 SM is varying between 3/4 and 1 1/4 SM.
METAR CYHZ 241800Z 35009KT **1SM** BR OVC008 16/14 A2986 RMK SF8 **VIS VRB 3/4-1 1/4** SLP112

Example (2): Prevailing visibility of 3 SM is varying between 1 SM and 5 SM.
METAR CYTS 251800Z 06010G25KT **3SM BLSN** SKC M12/M15 A3041 RMK **VIS VRB 1-5** SLP311

16.3.6.4 Point of observation

When observing visibility from elevated positions, such as a control tower or roof (see 2.6.1) and the visibility differs by a reportable value or more from the prevailing visibility observed on the ground (at eye level), the visibility from the elevated position and the identification of that position **shall** be reported in Remarks.

Example: Prevailing visibility is 3 SM in blowing snow; however, visibility from the roof is observed to be 10 SM.
METAR CYXU 251100Z 06015G25KT **3SM BLSN** BKN025 M09/M10 A3026 RMK SC6 **ROOF VIS 10** SLP248

16.3.6.4.1

With “blowing snow” conditions, the reporting of roof-top visibility is particularly important. Frequently, visibility is much better a short distance above ground level. Ground-level visibility alone in such circumstances does not give a full description of the visibility that would be experienced by the pilot of an aircraft.

16.3.6.4.2

Low-lying “fog” usually occurs with a clear sky or high thin cloud conditions. The observer should provide an estimate of the depth of the fog as well as the roof-top visibility.

Example: Prevailing visibility is 1/4 SM in fog; visibility from the roof is 10 SM. The fog is estimated by the observer to be 30 feet thick.
METAR CYSJ 081300Z 15012KT **1/4SM FG** OVC230 08/08 A3003 RMK FG6CI2 **ROOF VIS 10 FG 30FT THK** SLP170

16.3.7 Runway visual range (RD_RD_R/$V_RV_RV_RV_R$FT/i)

Where RVR data are displayed, they **shall** be included in the METAR and SPECI observations for the active – or most aligned into the wind – runway(s) when the prevailing visibility is 1 SM or less and/or the RVR value for the designated runway(s) is 6000 feet or less. RVR data for runway(s) other than the active or most-aligned into-the-wind may be included. Stations with the capability to display values for multiple RVRs may record and transmit a maximum of four RVR values. All RVR values transmitted **shall** be representative of the touchdown zone of the active landing runway(s).

R: Group indicator that precedes the runway visual range information.

D_RD_R: Designator of each runway for which runway visual range is reported. Parallel runways should be distinguished by appending to D_RD_R the letters L, C or R indicating the left, central or right parallel runway, respectively. A suitable combination of these letters is used for up to, and including, five parallel runways (i.e. LL, L, C, R, RR). The letter(s) **shall** be appended to D_RD_R as necessary in accordance with the standard practice for runway designation.

$V_RV_RV_RV_R$FT: The 10-minute average runway visual range immediately preceding the observation. However, when the 10-minute period includes a marked discontinuity in the RVR (for example, sudden advection of fog, rapid onset or cessation of an obscuring snow shower), only the data after the discontinuity **shall** be used for obtaining mean RVR values and variations thereof, hence the time interval in these circumstances **shall** be correspondingly reduced. FT **shall** be appended to the measurement to indicate that the measurement is in feet.

i: Indicates the RVR trend. If the runway visual range values during the 10-minute period preceding the observation show a distinct upward or downward tendency such that the mean during the first five minutes varies by 300 feet or more from the mean during the second five minutes of the period, this **shall** be indicated by i = U for upward and i = D for downward tendency of runway visual range values. When no distinct change in runway visual range is observed, i = N **shall** be used. When it is not possible to determine the tendency, i **shall** be omitted. When the tendency is not displayed, i **shall** be omitted.

Example: The RVR for runway 33 is 4000 feet and the observed trend is down.
METAR CYXE 292000Z 30015G25KT 3/4SM **R33/4000FT/D** -SN BLSN BKN008 OVC040 M05/M08 A2992 RMK SF5SC3 SLP170

16.3.7.1 Variations in runway visual range ($RD_RD_R/V_RV_RV_RV_RVV_RV_RV_RV_R$FT/i)

When the RVR at a runway varies significantly and when during the 10-minute period preceding the nominal observation time, the one-minute mean extreme values assessed vary from the mean value by more than 150 feet or more than 20% of the mean value, whichever is greater, the one-minute mean minimum and the one-minute mean maximum values **shall** be given in that order in the form $RD_RD_R/V_RV_RV_RV_RVV_RV_RV_RV_R$**FT**/i instead of the 10-minute mean. The tendency **shall** also be indicated.

R: see 16.3.7

D_RD_R: see 16.3.7

$V_RV_RV_RV_R$**V**$V_RV_RV_RV_R$: The minimum one-minute mean RVR value followed by the maximum one-minute mean RVR value during the 10-minute period preceding the observation. These two values will be separated by the letter "V" indicating variable conditions.

i: see 16.3.7

Example: The RVR for runway 33 is varying between 1000 feet and 2400 feet; the trend is upward.
METAR CYXE 081200Z 30010KT 3/8SM **R33/1000V2400FT/U** SN VV004 M05/M06 A3002 RMK SN8 SLP170

16.3.7.2

When actual RVR values are outside the measuring range of the observing system in use, the following procedure **shall** apply:

- When the RVR is greater than the maximum value that can be assessed with the system in use, a P **shall** be appended to the group $V_RV_RV_RV_R$, i.e., P6000. The METAR encoder will convert this to the ICAO standard.
- When the RVR is below the minimum value that can be assessed with the system in use, an M **shall** be appended to the group $V_RV_RV_RV_R$, i.e., M0600. The METAR encoder will convert this to the ICAO standard.

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16.3.8 Present weather (w'w')

One or more w'w' groups **shall** be used to report all present weather phenomena observed at or near the aerodrome and of significance to aeronautical operations in accordance with WMO Code table 4678 (see 16.3.8.1).

16.3.8.1 WMO Code Table 4678

Significant present and forecast weather codes. The w'w' groups **shall** be constructed by considering columns 1 to 5 in the following table in sequence; that is intensity, followed by description, followed by weather phenomena. An example could be: +SHRA (heavy shower(s) of rain).

Qualifier		**Weather phenomena**		
1 Intensity or proximity	**2 Descriptor**	**3 Precipitation**	**4 Obscuration**	**5 Other**
- **Light**	**MI** Shallow	**DZ** Drizzle	**BR** Mist	**PO** Dust/Sand Whirls (dust devils)
Moderate (no qualifier)	**BC** Patches	**RA** Rain	**FG** Fog	**SQ** Squalls
+ **Heavy** (well-developed in the case of dust/sand whirls, dust devils and funnel clouds)	**PR** Partial (covering part of the aerodrome)	**SN** Snow	**FU** Smoke	**FC** Funnel Cloud(s) (tornado or water-spout)
VC In the Vicinity	**DR** Low Drifting	**SG** Snow Grains	**VA** Volcanic Ash	**SS** Sandstorm
	BL Blowing	**IC** Ice Crystals (diamond dust)	**DU** Widespread Dust	**DS** Duststorm
	SH Shower(s)	**PL** Ice Pellets	**SA** Sand	
	TS Thunderstorm	**GR** Hail	**HZ** Haze	
	FZ Freezing (supercooled)	**GS** Small Hail and/or Snow Pellets		
		UP Unknown Precipitation (AWOS only)		

16.3.8.2 Qualifiers

Weather phenomena are preceded by one or two qualifiers, one of which describes either the intensity or proximity to the station of the phenomena, the other of which describes the phenomena in some other manner.

16.3.8.3 Intensity

If the intensity of the phenomena being reported in a group is either light "-" or heavy "+", this is indicated by the appropriate sign. No sign is included if the intensity is moderate, or when intensity is not relevant. (See 3.9, "Intensity of precipitation.")

1) Intensity **shall** be indicated for the following:
    - precipitation (light, moderate, heavy)

      Note: Not applicable to ice crystals
    - showers (light, moderate, heavy)
    - precipitation associated with thunderstorms (light, moderate, heavy)
    - blowing dust, blowing sand or blowing snow (moderate, heavy)
    - dust storm or sandstorm (moderate, heavy)
    - tornadoes or waterspouts **shall** be reported as heavy (+FC)
2) If multiple precipitation types are observed, the intensity assigned to the group will be that of the predominant precipitation type as determined by the greater intensity. The predominant precipitation **shall** be reported first within the combined report. Freezing precipitation **shall** be reported as a separate group (see 16.3.8.6.).
3) Intensity **shall not** be applied to precipitation associated with the proximity qualifier "VC".

Example (1): Light rain and mist.
METAR CYFC 251300Z CCA 36011KT 6SM **-RA BR** FEW009 OVC031 07/06 A3012 RMK SF2SC6 SLP199

Example (2): Moderate rain and light snow are occurring at the same time.
METAR CYHZ 231700Z 10006KT 6SM **RASN** OVC008 01/01 A2980 RMK SC8 SLP098

16.3.8.4 Vicinity

The vicinity qualifier VC **shall** be used when specific weather phenomena are observed within 5 SM, but are not occurring at the point of observation. Tornadoes, funnel clouds and waterspouts **shall** be reported as occurring “at the station” when within sight (at any distance). VC **shall** be used with the following weather phenomena:

- VCSH (showers)
- VCFG (fog)
- VCBLSN (blowing snow)
- VCBLDU (blowing dust)
- VCBLSA (blowing sand)
- VCPO (dust/sand whirls)
- VCDS (duststorm)
- VCSS (sandstorm)
- VCVA (volcanic ash)

Example: Light snow showers are observed in the vicinity; drifting snow is occurring at the site.
METAR CYXE 231700Z 31012G17KT 12SM **VCSH DRSN** BKN028 M15/M18 A3019 RMK SC6 SLP269

16.3.8.5 Descriptors

Descriptors provide further clarification to the weather phenomena that are being observed. This becomes critical when observing obstructions to vision. The only exception is when widespread dust, volcanic ash or other weather phenomenon is observed. The present weather w’w’ group **shall** have no more than one descriptor.

The descriptors MI (shallow), BC (patches) and PR (partial) **shall** be used only in combination with fog (FG). (See 3.5.2.5, 3.5.2.6 and 3.6.2.)

Example: Shallow fog is observed.
METAR CYVR 231900Z 10004KT 7SM **MIFG** OVC047 03/03 A3050 RMK SC8 SLP328

The descriptors DR (drifting) and BL (blowing) **shall** be used only in combination with snow (SN), dust (DU) and sand (SA). (See 3.5.4, 3.5.8 and 3.6.1.)

Example: Drifting snow is observed.
METAR CYBG 301200Z 26009KT 8SM -SN **DRSN** SCT030 M18/M21 A3017 RMK SC4 SLP234

When blowing snow (BLSN) is observed with snow (SN), both phenomena **shall** be reported. When the observer cannot determine whether or not snow is also falling due to heavy blowing snow then only +BLSN **shall** be reported. (See 3.5.4.)

Example: Blowing snow is observed.
METAR CYMU 301300Z 23020KT 3/4SM -SN **BLSN** OVC020 M17/M19 A2982 RMK SN1SC7 SLP109

SH (shower) **shall** be used in combination with one or more of the precipitation types rain (RA), snow (SN), ice pellets (PL), hail (GR) and snow pellets (GS). (See 3.4.3.2 for SHGS and 3.4.3.5 for SHGR.)

Example: Rain showers are observed.
METAR CYXX 301300Z 06003KT 7SM **-SHRA** BKN018 OVC035 01/M02 A2992 RMK SC6SC2 CVCTV CLD EMBD SLP 134

TS (thunderstorm) (see 3.3) **shall** be reported alone or in combination with one or more of the precipitation types rain (RA), snow (SN), ice pellets (PL), hail (GR) and snow pellets (GS).

Example: Thunderstorms and heavy rain showers are observed.
METAR CYXU 301500Z 15012KT 10SM **+TSRA** BKN024CB 27/19 A2993 RMK CB6 SLP134

FZ (freezing) **shall** be used only in combination with the weather types drizzle (DZ), rain (RA) and fog (FG) (see 3.4.2 and 3.5.3.1).

Example: Freezing fog is observed.
METAR CYAM 301300Z 00000KT 1/4SM R12/1200FT/N **FZFG** VV001 M13/M13 A3011 RMK FG8 SLP211

16.3.8.6 Weather phenomena

16.3.8.6.1 Precipitation

See Appendix III. If different types of precipitation are combined in one group, the predominant type as determined by intensity **shall** be reported first. The intensity qualifier selected represents the overall intensity of the entire group, not just one component of the group. The one exception is freezing precipitation (FZRA and FZDZ), which **shall** always be reported as a separate w'w' group. Ice crystals **shall** be reported regardless of the prevailing visibility.

16.3.8.6.2 Ice Crystals

To meet Canadian standards, when ice crystals (IC) are observed it **shall** be reported in the METAR/SPECI with any visibility.

16.3.8.6.3 Obstruction to vision

See Appendix III. An obstruction to vision is generally reported if the prevailing visibility is 6 mi. or less. If an obstruction to vision is reported when the prevailing visibility is greater than 6 mi., the weather phenomena **shall** be reported with a descriptor, except when widespread dust (DU) or volcanic ash (VA) is observed.

16.3.8.6.4 Other

See Chapter 3. When one of these weather phenomena is observed, no descriptor **shall** be included. In the case of FC being reported the observer **shall** report in Remarks if it is a funnel cloud, tornado or water spout (see 16.3.13.2.3.) The letter abbreviation SQ **shall** be used to report squalls when a sudden increase in wind speed is observed of at least 16 kts, the speed rising to 22 kts or more and lasting for at least one minute.

Example: Squall is observed.
METAR CYGR 051800Z 27025G35KT 8SM **SQ** BKN005 OVC010 05/02 A2923 RMK SF5SF3 SLP897

16.3.8.7 Present weather

Present weather (w'w') groups **shall** be in the following order:

1) The qualifier for intensity or for proximity (if appropriate),
   …followed without a space by…
2) The abbreviation for the descriptor (if appropriate),
   …followed without a space by…
3) The abbreviation for the observed weather phenomenon or combinations thereof.

16.3.8.8

When more than one weather phenomenon other than a precipitation combination is observed, each weather phenomenon **shall** be reported in a separate w'w' group in the order of the columns from WMO Code table 4678; Precipitation, Obscuration, and Other (see 16.3.8.1).

Example (1): Light rain and light snow are observed.
SPECI CYDP 051916Z 03017KT 6SM **-RASN** OVC004 01/00 A2945 RMK ST8 SLP974

Example (2): Fog observed; temperature minus 1.0 °C; visibility less than 5/8 SM. FZFG **shall** be reported whether or not evidence of rime ice deposit exists.
METAR CYSL 051800Z 30004KT 1/2SM **FZFG** OVC005 M01/M01 A2937 RMK FG5SC3 SLP956

Example (3): A thunderstorm with moderate rain shower is observed.
SPECI CYGQ 082346Z 23012KT 8SM **TSRA** FEW008 BKN015CB 18/17 A2962 RMK SF1CB6 SLP072

Example (4): A rain shower is observed in the vicinity of the station but is not occurring at the station.
METAR CYQK 082200Z 28012G22KT 15SM **VCSH** BKN030 OVC120 16/10 A2976 RMK CU6AC2 SLP080

Example (5): Light snow and blowing snow are observed.
METAR CYYZ 301800Z 26013G22KT 5SM **-SN BLSN** BKN030 OVC070 M05/M11 A2976 RMK SC6AC2 SLP088

Example (6): A thunderstorm with moderate rain shower, hail and a tornado are observed at the station at 2012Z.
SPECI CYGK 312012Z 27022G28KT 3SM **TSRAGR+FC** SCT010 OVC030CB 25/23 A2977 RMK SF4CB4 TORNADO S MOVG E FRQ LTGCG ALQDS HAIL DIAM 12 MM SLP080

16.3.9 Sky condition

All layers of cloud or weather phenomena that are observed **shall** be reported as a layer aloft and entered in Remarks (see examples in 16.3.9.8). Only significant convective clouds, whose base is observed, **shall** be identified by appending the letter abbreviations CB (cumulonimbus) or TCU (towering cumulus), as appropriate, to the cloud group without a space. When a layer consists of two or more cloud types, e.g., CU (cumulus) and SC (stratocumulus), the predominating type by amount **shall** be recorded. If a cloud layer consists of any amount of TCU or CB, the TCU or CB **shall** be reported as the predominant type. When an individual layer of cloud is composed of CB and TCU with a common cloud base, the type **shall** be reported as CB only.

When observing a surface-based layer, the amount of this phenomenon is added to the amount of the first layer aloft and then reported in accordance with 16.3.9.3. The surface-based layer that is observed **shall** then be reported in Remarks with the appropriate weather abbreviation (refer to Appendix III for abbreviations) and amount observed. This will then be followed by any types of layers aloft observed with the appropriate abbreviations and the amount of each layer aloft type. The sequence of reporting will be by the lowest level to the highest level with no spaces in between.

16.3.9.1 Layers aloft ($N_SN_SN_Sh_Sh_Sh_S$)

This group is used to report sky condition for layers aloft. This includes clouds and any amount of weather phenomena that is aloft. The amount of any surface-based obscuration **shall** be added to the coverage amount of any layers aloft to calculate the summation amount.

$N_SN_SN_S$: The amount of each layer **shall** be determined using the summation amount principle and reported using the three-letter symbol abbreviations (see 16.3.9.2) followed, without a space, by the height of the base of the layer $h_Sh_Sh_S$.

$h_Sh_Sh_S$: The height of layers aloft **shall** be reported to the nearest:

- 100 feet from the surface up to 10 000 feet
- 1000 feet above 10 000 feet

The layers aloft group **shall** be repeated to report each layer aloft starting with the lowest layer. If there are no clouds, the abbreviation SKC **shall** be used alone.

Note: If the actual observed height is halfway between any two values that satisfy the increments in paragraph 16.3.9.1, the lower value **shall** be used.

16.3.9.2 Cloud amount

Layer amount is the amount in oktas of the whole sky that is observed to be covered (not necessarily concealed) by a layer aloft or concealed by a surface-based layer.

Three-letter symbol abbreviation	Terminology	Layer as defined by summation amount
SKC	sky clear	No cloud or layer present
FEW	few	Less than 1/8 to 2/8 summation amount
SCT	scattered	3/8 to 4/8 summation amount
BKN	broken	5/8 to less than 8/8 summation amount
OVC	overcast	8/8 summation amount

16.3.9.3 Determining layer height

When determining the height of a layer aloft or vertical visibility the following order of priority **shall** apply:

1) Measured
2) Aircraft
3) Balloon* (daylight hours, ceiling 1000 ft or less)
4) Estimated

***Note**: It is not required to release a ceiling balloon if there is a laser ceilometer in operation.

16.3.9.4 Vertical visibility (VV$h_s h_s h_s$)

Vertical visibility (**VV**) **shall** be reported when the sky is obscured and information on vertical visibility is available. The existence of a vertical visibility will constitute an obscured ceiling.

VV: Group indicator that precedes the vertical visibility information.

$h_s h_s h_s$: Vertical visibility **shall** be reported to the nearest:

- 100 feet from the surface up to 10 000 feet
- 1000 feet above 10 000 feet

Note: If the actual observed height is between any two values that satisfy the increments in 16.3.9.4 ($h_s h_s h_s$), the lower value **shall** be used.

Example (1): Sky obscured by snow.
METAR CYDF 182100Z 25005KT 1/4SM +SN **VV002** M02/M02 A2926 RMK SN8 SLP911

Example (2): The vertical visibility is observed as 250 feet in fog.
METAR CYGK 241800Z 23005KT 1/4SM FG **VV002** 09/09 A2936 RMK FG8 SLP963

16.3.9.5 Variable heights

When the height of a layer aloft or into a vertical visibility is observed to be “variable,” i.e., increasing and decreasing from the mean value by 1/4 or more of the mean value, the range of variation **shall** be indicated in Remarks.

Example: The vertical visibility into a surface-based obscuration is observed as variable between 200 and 400 feet, with a mean value of 300 feet.
METAR CYYR 121100Z 29013KT 1SM -SN DRSN **VV003** M09/M11 A2945 RMK SN8 CIG VRB 2-4 SLP976

16.3.9.6 Ceiling

Ceiling is the lesser of the height above ground or water of the base of the lowest layer of cloud where the summation amount exceeds half the sky (more than 4/8); or the vertical visibility in a surface-based layer that completely obscures the whole sky.

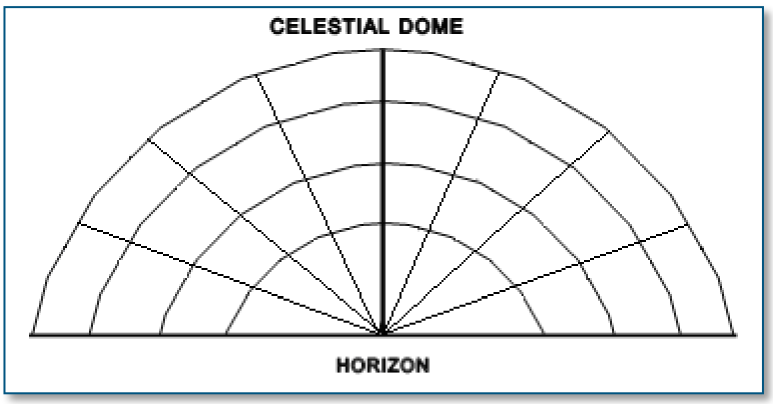
16.3.9.7 Variable Ceiling

When the ceiling is 3000 feet or less and is observed to be "variable," i.e., rising and falling from the mean value by 1/4 or more of the mean value (see 1.6.5), the range of variation shall be indicated in Remarks.

Example: Overcast ceiling (700 ft) varies between 500 and 900 feet.
METAR CYYT 071800Z 26004KT 1 1/2SM BR **OVC007**00/00 A2926 RMK SC8 **CIG VRB 5-9** SLP910

16.3.9.8 Sky condition examples

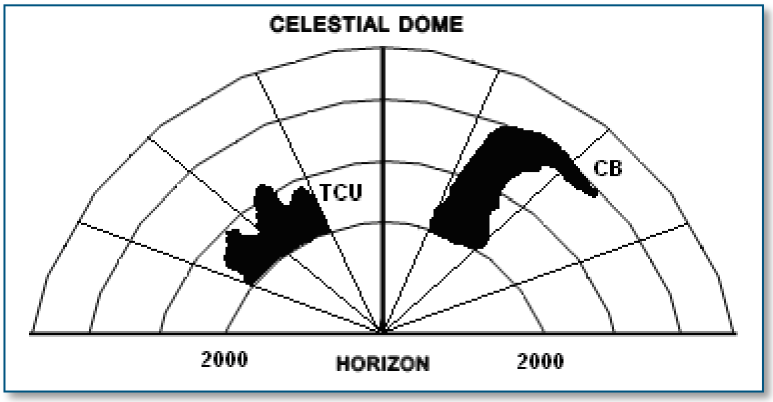
Example (1):



Observed: No cloud or surface-based obscuration.

Reported: METAR CYOW 061800Z 30015KT 15SM **SKC** M07/M10 A2974 RMK SLP079

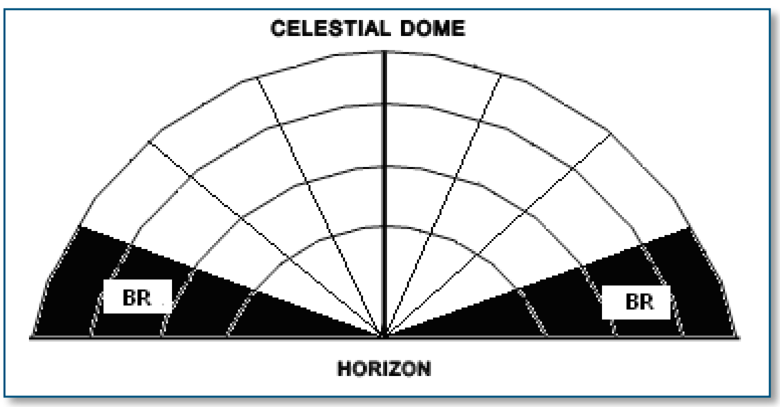
Example (2):



Observed: TCU (2/8) and CB (1/8) based at 2000 feet.

Reported: METAR CYPQ 311800Z 30015KT 15SM **SCT020CB** 24/18 A2947 RMK **CB3 CB NW** SLP979

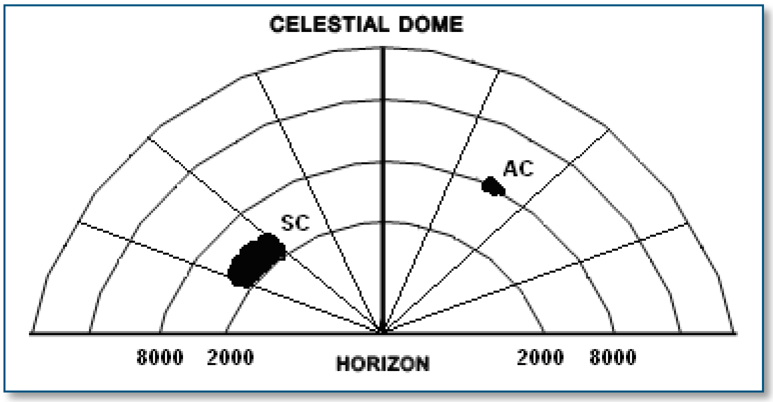
Example (3):



Observed: No cloud, Mist (2/8), visibility 2 SM.

Reported: METAR CYSN 061700Z 30004KT **2SM BR SKC** 09/08 A2994 RMK **FG2** SLP140

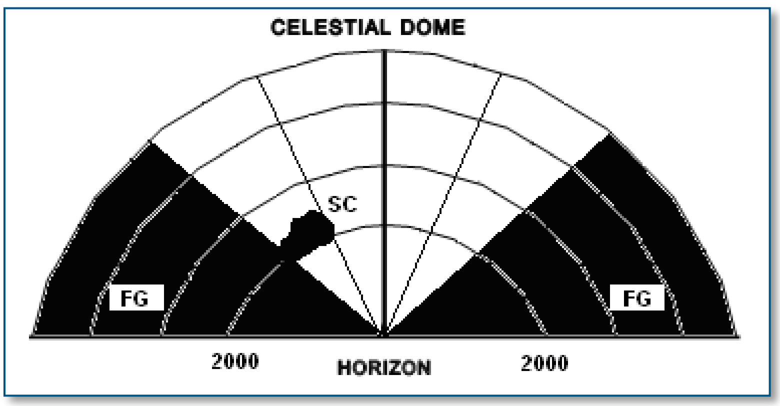
Example (4):



Observed: SC (1/8) based at 2000 feet, AC (trace) based at 8000 feet.

Reported: METAR CYTS 061800Z 30010G15KT 15SM DRSN **FEW020 FEW080** M13/M15 A3001 RMK **SC1AC1** SLP190

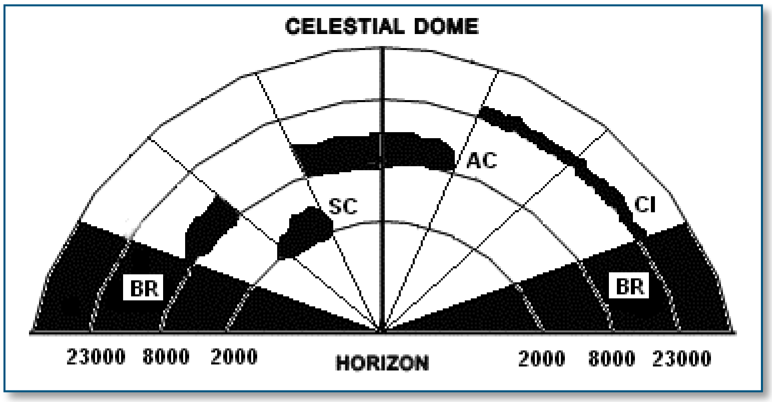
Example (5):



Observed: FG (4/8), SC (1/8) based at 2000 feet.

Reported: METAR CYMX 062000Z 26003KT **1/2SM FG BKN020** 05/05 A2965 RMK **FG4SC1** SLP045

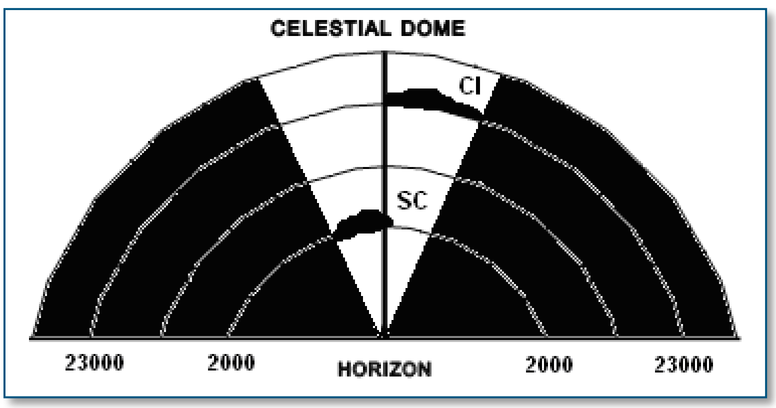
Example (6):



Observed: BR (2/8), SC (1/8) based at 2000 feet, AC (3/8 visible) based at 8000 feet, CI (2/8 visible) based at 23 000 feet.

Reported: METAR CYXX 071400Z 07008KT 4SM **BR SCT020 BKN080 OVC230** 07/07 A3020 RMK **FG2SC1AC3CI2** SLP230

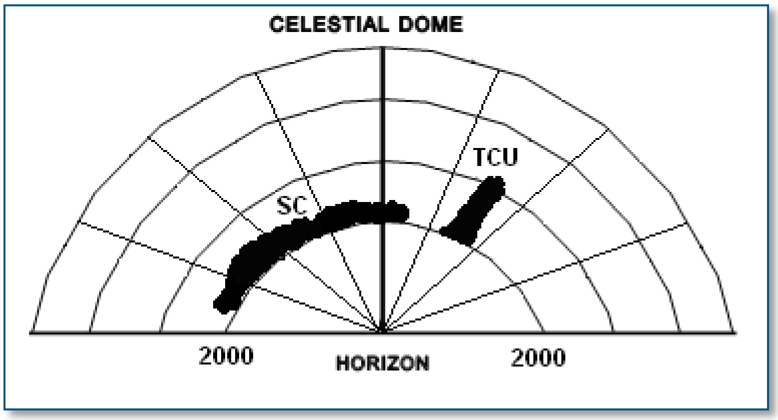
Example (7):



Observed: FG (6/8), SC (1/8) based at 2000 feet, CI (1/8) based at 23 000 feet.

Reported: METAR CWCA 071500Z 32005KT **3/8SM FG BKN020 OVC230** 07/07 A2930 RMK **FG6SC1CI1** SLP922

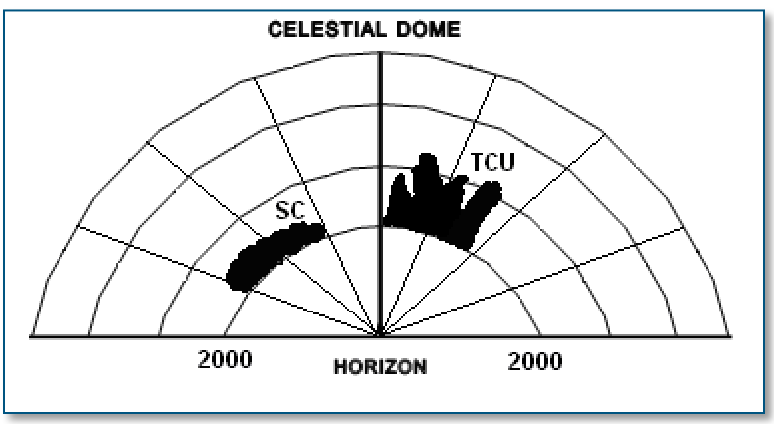
Example (8):



Observed: SC (4/8) based at 2000 feet, TCU (1/8) based at 2000 feet.

Reported: METAR CYOJ 012100Z 11012KT 15SM BKN020**TCU** 24/18 A3010 RMK TCU5 **TCU** NE SLP197

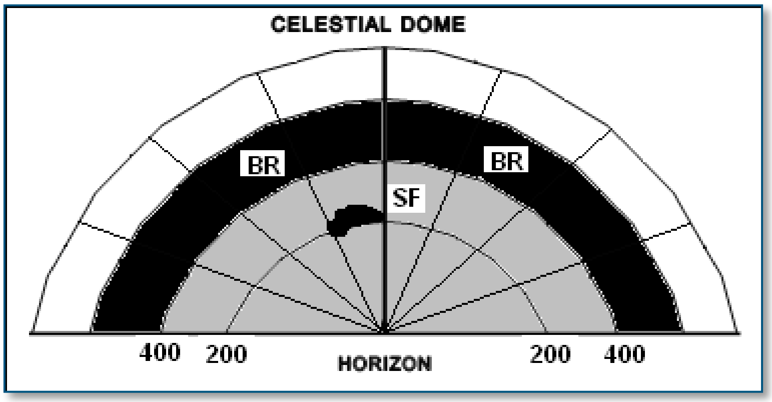
Example (9):



Observed: SC (2/8) based at 2000 feet, TCU (2/8) based at 2000 feet.

Reported: METAR CYXU 012000Z 21010KT 15SM SCT020TCU 27/22 A3008 RMK **TCU4** SLP178

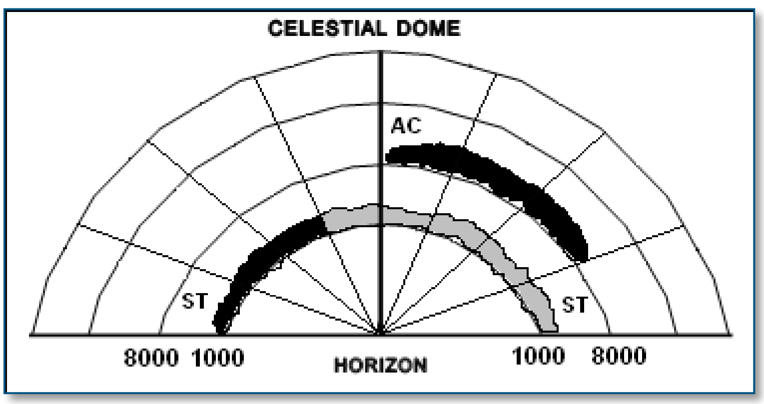
Example (10):



Observed: SF (1/8) based at 200 feet, BR (7/8) vertical visibility 400 feet.

Reported: METAR CYGK 051700Z 10005KT 1SM BR FEW002 **VV004** 09/09 A3010 RMK SF1FG7 SLP197

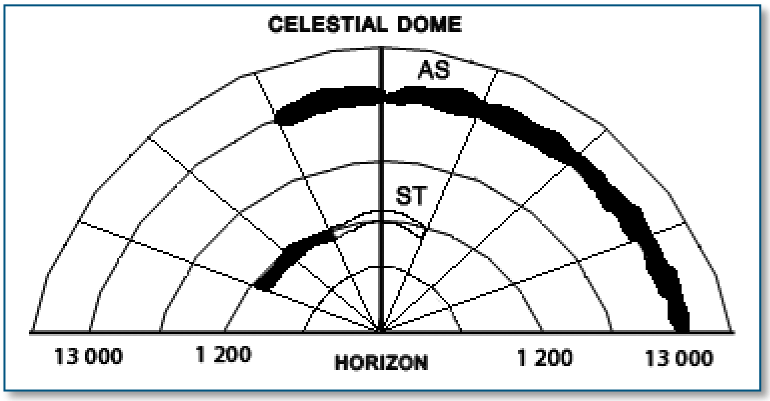
Example (11):



Observed: ST (8/8) based at 1000 feet, AC (3/8) based at 8000 feet.

Reported: METAR CYOW 141800Z 18010KT 15SM OVC010 OVC080 22/20 A3010 RMK **ST8AC3** SLP197

Example (12):



Observed: ST (4/8) based at 1200 feet, AS (5/8) based at 13 000 feet.

Reported: METAR CYZT 251300Z 14017KT 15SM SCT012 BKN130 07/06 A3012 RMK ST4AS5 SLP199

16.3.10 Temperature/dewpoint temperature ($T'T'/T'_dT'_d$)

The dry-bulb temperature and the dewpoint temperature **shall** be observed to the nearest tenth of a degree Celsius.

The air temperature and dewpoint temperature in the METAR **shall** be rounded to the nearest whole degree Celsius. Observed values involving 0.5 °C **shall** be rounded up to the next highest (warmer) Celsius degree.

$T'T'$: Dry-bulb temperature

$T'_dT'_d$: Dewpoint temperature

Example (1): Observed temperature of -9.5 °C will be rounded to M09 in the METAR.

Example (2): Observed temperature of -0.1 °C to -0.5 °C will be rounded to M00 in the METAR.

16.3.11 Altimeter setting ($AP_HP_HP_HP_H$)

A: Group indicator that precedes the altimeter settings information.

$P_HP_HP_HP_H$: The altimeter setting in hundredths of inches of mercury using four digits.

Example: A3012 would represent an altimeter setting of 30.12 inches of mercury.

16.3.12 Wind shear in the lower layers (WS RWY$D_R D_R$ or WS ALL RWY)

Information on the existence of low-level wind shear along the runway takeoff or approach path 1500 feet AGL and below that is considered significant to aircraft operations **shall** be reported.

WS: Group indicator that precedes the wind shear information

RWY$D_R D_R$: RWY is the standard indicator followed by $D_R D_R$ which represents the runway designators. As in the case of RVR reporting (see 16.3.7), the letters “L”, “C”, or “R” may be appended indicating the left, central or right parallel runway, respectively.

ALL RWY: Is used if the existence of wind shear applies to all runways.

16.3.13 Remarks (RMK)

The Remarks portion of the METAR observation is used to describe meteorological information of importance. Entries in Remarks are by no means restricted to the examples shown in this document. Directions in Remarks **shall** be recorded in a clockwise order.

Example: Prevailing visibility is 7 mi. in light rain. Visibility to the east-southeast is reduced to 2 mi. in mist.
METAR CYBX 111300Z 29008KT 7SM -RA OVC020 13/12 A2904 **RMK** SC8 **VIS 2 E-SE BR** SLP836

Remarks **shall** appear in the following order:

1) Layer type and amount.
2) General aviation remarks.
3) MSL pressure (SLPppp).

16.3.13.1 Layer type and amount (oktas)

For each layer reported in the layer aloft section (see 16.3.9), a corresponding cloud (from the list below) and amount **shall** be recorded. When vertical visibility is observed, the obscuring phenomenon abbreviation and amount **shall** be recorded. The amount will be a single digit.

When surface-based layers (see 1.2.5) are observed to obscure portions of the celestial dome, the obscuring phenomenon abbreviation and amount **shall** be recorded.

Clouds	Abbreviations
Altocumulus	AC
Altocumulus Castellanus	ACC
Altostratus	AS
Cirrocumulus	CC
Cirrostratus	CS
Cirrus	CI
Cumulonimbus	CB
Cumulus	CU
Cumulus Fractus	CF
Towering Cumulus	TCU
Nimbostratus	NS
Stratocumulus	SC
Stratus	ST
Stratus Fractus	SF

Note: The cloud type described in the *International Cloud Atlas* as “Cumulus Congestus” is listed above as “Towering Cumulus.(TCU)”

Obscuring Phenomena	Abbreviations
Rain (any form including SHRA and FZRA)	RA
Hail	GR
Ice Pellets (including Ice Pellet Showers)	PL
Drizzle (including Freezing Drizzle)	DZ
Ice Crystals	IC
Snow (Snow Showers, Snow Pellets, Snow Grains)	SN
Blowing Snow	BLSN
Fog (any form)	FG
Blowing Dust	BLDU
Dust Storm	DS
Haze	HZ
Blowing Sand	BLSA
Sandstorm	SS
Smoke	FU
Volcanic Ash	VA

16.3.13.2 General Aviation remarks

General aviation Remarks will include remarks that are significant to aircraft operations. The observer should note that these remarks will be disseminated globally and discretion should be used as to the content of the remarks. MANAB (*Manual of Word Abbreviations*) abbreviations are to be used. Observers are encouraged to use the Remarks section and are not restricted to the examples over the next few pages.

16.3.13.2.1 Wind remarks

METAR…27040G55	…RMK… WSHFT 0850
METAR…05009	…RMK… WND ESTD DUE ICE ACCRETION
METAR…14014	…RMK… WND ESTD

If winds are estimated due to ice accretion, the remark **shall** be included in the report.

If winds are estimated for reasons other than ice accretion, the remark **shall** be included in the report.

16.3.13.2.2 Visibility Remarks

METAR...1/2SM FG	...RMK... VIS VRB 1/4-3/4
METAR...4SM BR	...RMK... VIS VRB 2-6
METAR...10SM PRFG	...RMK... FG BANK W VIS 2
METAR...3/4SM BR	...RMK... VIS IMPRG RPDLY
METAR...1/2SM BLSN	...RMK... TOWER VIS 2
METAR... 0SM FG	...RMK... VIS 100 FT
METAR...3/4SM BR	...RMK... FG DSIPTG RPDLY
METAR...1/4SM FG	...RMK... FG 45 FT THK ROOF VIS 2
METAR...10SM	...RMK... FU DRFTG OVR FLD VIS N 1
METAR…3/8SM	…RMK… RVR RWY 06R 1600FT
METAR...6SM -RA BR	…RMK... BCFG SE VIS 1/4
METAR...1/2SM FG	...RMK... PRFG SE-N
METAR...10SM BCFG	...RMK... BCFG SE QUAD VIS 1/2
METAR...10SM MIFG	...RMK... MIFG OVER APCH RWY 27
METAR…6SM	…RMK… SF8 FG BANK ALQDS

16.3.13.2.3 Weather Remarks

METAR...OVC030CB 7SM +FC	...RMK... TORNADO SW MOVG E
METAR...BKN035TCU 8SM –SHRA	...RMK... FUNNEL CLOUD REPD 1435Z 15 S MOVG NE (1)
METAR...BKN045CB 10SM TS	...RMK... CB W MOVG N (2)
METAR...OVC040 8SM –RA	...RMK... -RA INTMT
METAR...OVC040 8SM	...RMK... INTMT –RA (3)
METAR...SCT035 10SM	...RMK... CB TOPS SW OCNL LTGIC SW (4)
METAR...SCT035 15SM	...RMK... OCNL -SHRA (5)
METAR...VV007 1/2SM SN	...RMK... SN WET
METAR...BKN030 15SM	...RMK... VIRGA N
METAR...BKN025CB 4SM TSRAGR	...RMK... HAIL DIAM nn MM (6)
METAR...SKC 25SM	...RMK... FROIN (7)

Note (1): If a tornado, waterspout or funnel cloud is reported by the public, indicate:

(i) the location with respect to the station, city or town;

(ii) the direction towards which it is moving; and

(iii) the time the phenomenon was observed.

Note (2): Observed cloud layer is combination of TCU and CB.

Note (3): Intermittent rain was not occurring at the time but was active within 15 minutes preceding the time of the observation.

Note (4): When lightning is observed, indicate frequency (OCNL, FRQ, CONTUS), type (LTGCG, LTGIC and LTGCC) and direction from station. CB not reported since base of observed CB clouds not visible. The following may be used as a guide for the frequency of lightning:

(i) OCNL less than one flash per minute

(ii) FRQ one to six flashes per minute

(iii) CONTUS more than six flashes/minute

Note (5): Rain showers were not occurring at the time but were active within 15 minutes preceding the time of the observation.

Note (6): When hail is observed at the station, the average size of the hail **shall** be estimated in whole millimetres, and recorded in Remarks. Where “nn” is the average diameter in whole millimetres.

Note (7): FROIN is used to report frost on the ice accretion indicator.

16.3.13.2.4 Sky condition Remarks

Sky cover

METAR…BKN070	…RMK… AC XTNDG RPDLY FM SW
METAR…OVC007	…RMK… OVC TPG HILLS NE
METAR…FEW250	…RMK… CONTRAILS (*)

***Note**: Shall be used when middle (CM) or high (CH) cloud consists in whole or in part of persistent (15 minutes or more) condensation trails. Rapidly dissipating condensation trails **shall not** be reported.

Ceiling

METAR…BKN008	…RMK… ACFT REPD CIG
METAR…OVC006	…RMK… CIG LWR SE
METAR…OVC003	…RMK… CIG DFUS VERT VIS 5
METAR…OVC000	…RMK… CIG 35 FT
METAR…OVC004	…RMK… BLN DSAPRD 550 FT
METAR…OVC007	…RMK… CIG VRB 5-9
METAR…VV002	…RMK… CIG VRB 1-3

Convective clouds

If clouds which indicate unstable conditions (CB, TCU or ACC) are observed they **shall** be reported in Remarks.

METAR …BKN100	…RMK… AC6 ACC W
METAR …FEW040	…RMK…SC1 CB TOPS NW (*)
METAR …SCT030CB	…RMK… CB4 CB MOVG RPDLY FM SE

***Note**: If TCU or CB clouds base are not observed and not reported in the sky condition, they **shall** be reported in Remarks.

Orographic clouds

When observed, orographic clouds, also known as standing wave clouds, **shall** be reported in Remarks whether or not the clouds are predominant. These clouds sometimes indicate severe turbulence aloft and are normally seen in areas up to 350 km to the leeward of mountains or hills and may occur for a period of 5 or 6 hours or longer.

METAR …SCT040 SCT090	…RMK… SC3AC1 ACSL OVR RDG NW (*)
METAR …SCT060TCU	…RMK… TCU3 ROTOR CLDS NW

***Note**: ACSL indicates standing lenticular altocumulus.

16.3.13.2.5 Pressure change Remarks

METAR ...SCT040 ...RMK... PRESRR (1)

METAR ...BKN100 ...RMK... PRESFR (2)

Note (1): PRESRR is used when the barograph trace indicates that the station pressure is rising at the rate of 2.0 hPa or more per hour.
Note (2): PRESFR is used when the barograph trace indicates that the station pressure is falling at the rate of 2.0 hPa or more per hour.

Note: If the barograph trace shows a steady increase of 0.5 hPa during the last 15 minutes, the rate of increase would be 2.0 hPa per hour and the remark PRESRR would be appropriate. If the barograph trace shows a steady decrease of 0.5 hPa during the last 15 minutes, the rate of decrease would be 2.0 hPa per hour and the remark PRESFR would be appropriate.

16.3.13.2.6 Snowfall Remarks

The increasing depth of newly fallen snow, since the time of the last main synoptic report, **shall** be reported in the Remarks section of a METAR report by means of a /Sss/ group. The letter “S” identifies the precipitation as snow and “ss” the units as whole centimetres.

The accumulating depth of newly fallen snow, since the last main synoptic report, is normally obtained by ruler and rounded off to whole centimetres.

/Sss/ **shall** be reported only at the hours when the accumulated (rounded) value increases to equal or exceed 1 cm, or exceeds the previously reported value by 1 cm or more.

Time (UTC)	Accumulated snowfall (cm)	Recorded snowfall
0700	0.2	-
0800	1.4	/S01/
0900	3.2	/S03/
1000	3.8	/S04/
1100	4.4	-
1200	5.8	/S06/
1300	1.4	/S01/

Example: Observer reports 1 cm of newly fallen snow since the last main synoptic report.
METAR CYYQ 121500Z 30006KT 15SM -SN OVC007 M12/M14 A2956 RMK SC8 **/S01/** SLP012

Note: If all the snow melts as it hits the ground, /Sss/ would not be reported.

16.3.13.2.7 Rainfall Remarks

All sites equipped with a recording rain gauge, the standard type B rain gauge or the AWOS precipitation gauge **shall** report the accumulated rainfall, since the time of the last main synoptic report, in the Remarks section of the METAR observation by means of an /Rrr/ group.

The letter "R" identifies the precipitation as rain and the "rr" the units in whole millimetres. /Rrr/ is the accumulative rainfall, rounded off to the nearest whole millimetre.

The /Rrr/ group **shall** be recorded and transmitted only at the hours when the rainfall accumulated since the time of the last main synoptic report equals or exceeds 10 mm (rounded), or exceeds the previously reported value by 10 mm (rounded) or more.

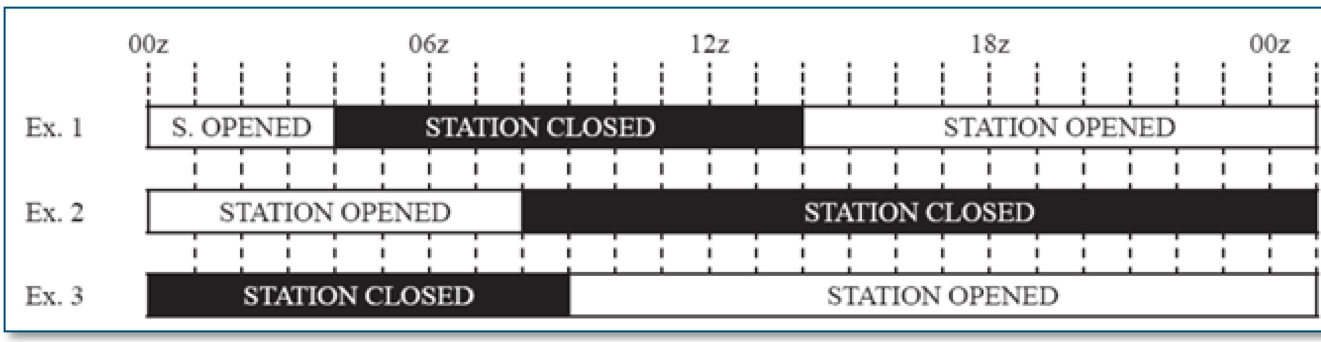
Time (UTC)	Accumulated rainfall (mm)	Recorded rainfall
0700	3.2	-
0800	9.8	/R10/
0900	20.2	/R20/
1000	29.7	/R30/
1100	39.1	-
1200	43.4	/R43/
1300	10.1	/R10/

16.3.13.2.8 Snowfall (or rainfall) reporting procedures for part-time stations

Part-time stations are defined as operating daily but fewer than 24 hours. When the station reopens, the first observation will indicate the reportable snowfall (or rainfall) amount, using the format /Sss AFT HH/ (or /Rrr AFT HH/), where HH is the hour (UTC) of the main synoptic at or prior to the time of closing.

If the closed period includes a main synoptic hour, and if the reopening time is at a non-synoptic hour, the second and subsequent snow (or rain) reports will take the form /Ss_1s_1 AFT H_1H_1UTC/, where the flag indicates that H_1H_1UTC is the time the station reopened and s_1s_1 is the snowfall (or rainfall) amount since the station reopened. Note that for rainfall, Ss_1s_1 is replaced by Rr_1r_1.

The following diagram shows three closing and opening situations. The reporting procedures for coding and reporting each situation is described below the diagrams.



Example (1):
Opening time 1400 UTC (opening can be from 13 UTC to 17 UTC)
First report, use the format: /Sss AFT 00UTC/
Subsequent reports, up to and including 18 UTC, use format: /Ss_1s_1 AFT 14UTC/

Example (2):
Opening time 0000 UTC
First report, use the format: /Sss AFT 06UTC/
Subsequent reports, use conventional format: /Sss/

Example (3):
Opening time 0900 UTC (opening can be from 07 UTC to 11 UTC)
First report, use the format: /Sss AFT 00UTC/
Subsequent reports, up to and including 12 UTC, use format:/Ss_1s_1 AFT 09UTC/

Note: For rainfall, Sss is replaced by Rrr.

16.3.13.3 Late weather observations

In order that users of weather observations may have confidence in the observations and use them safely, it cannot be overstressed that hourly observations must be accurate and adhere to the schedules specified in Chapter 9. Every effort must be made to ensure that weather observations are taken on time. However, should an occasion arise, beyond the control of the observer, that necessitates taking the observation late (see 9.2.1 and 9.2.2), the following **shall** apply.

The number of minutes after the hour that the observation has been taken **shall** be entered as the first of the general weather Remarks. The format of the remark **shall** be, "OBS TAKEN +tt", where "+tt" indicates the number of minutes the observation was taken after the hour.

Example: The observation was taken 18 minutes after the hour (barometric values and other direct-ingest weather data are from the hour).
METAR CYAM 121300Z 00000KT 15SM FEW012 FEW220 M20/M22 A3039 RMK SC1CI1 **OBS TAKEN +18** SLP308

16.3.13.4 Observational program status

In order that users of weather observations can determine if a station is staffed or when the next observation will be, Remarks indicating the status of operation are required.

At sites with less than a 24-hour observing program and observations not supplemented with an auto station, enter in the Remarks section for the last observation of the day.

Example: The last daily weather observation is issued at 03Z; the next weather observation will be issued at 10Z.
METAR CYGK 010300Z 20005KT 15SM SCT090 BKN110 21/17 A2994 RMK AC3AC2 **LAST OBS/NEXT 011000UTC** SLP138

At sites with a 24-hour program and a staff/machine mix for observations, enter in the Remarks section for the last staffed observation of the day.

Example: The last daily staffed weather observation is issued at 03Z; the next staffed weather observation will be issued at 13Z.
METAR CYXH 100300Z 28015G21KT 15SM FEW270 03/M02 A3001 RMK CI2 **LAST STFD OBS/NEXT 101300Z** SLP187

16.3.13.5 Sea level pressure (SLP$_{ppp}$)

SLP: Group indicator that precedes the sea level pressure.

$_{ppp}$: Sea level pressure in hectopascals. The recorded values are the last three digits including the tenths of the measured pressure.

Example: The MSL pressure is observed as 1002.9 hPa.
METAR CYWH 121500Z 00000KT 15SM FEW008 FEW020 BKN050 OVC120 09/08 A2962 RMK SF1SC2SC4AC2 **SLP029**

16.4 Types of observations

16.4.1

Observations are divided into two main types: METAR and SPECI. Synoptic observations are discussed in Part C.

16.4.2 Hourly observation

METAR observations are the observations taken to meet scheduled transmission times at the hour “H” during the period H-5 to H.

16.4.3 SPECI observation

A SPECI observation **shall** be taken and transmitted whenever one or more of the elements listed in 16.4.4 have changed in the amount specified. A SPECI should be transmitted within Time of SPECI +5 minutes. The amount of change is with reference to the preceding METAR or SPECI observation.

16.4.4 Criteria for taking SPECI

16.4.4.1 Ceiling

Ceiling decreases to less than or if below, increases to equal or exceed the following coded values of height:

1) 15
2) 10
3) 5
4) 4*
5) 3
6) 2*
7) 1*
8) The additional limit as specified in Appendix V entitled "IFR Approach and alternate limits for Canadian aerodromes."

***Note**: Criteria marked with an asterisk (*) are applicable only at aerodromes with approved precision approaches and only down to and including the lowest published minima for these aerodromes.

16.4.4.2 Obstruction to vision

SPECI **shall** be taken to report the beginning and ending of freezing fog.

16.4.4.3 Sky condition

A layer aloft is observed below:

1) 1000 feet and no layer aloft was reported below this height in the report immediately previous; or
2) the highest minimum for IFR straight-in landing or take-off, and no layer was reported below this height in the report immediately previous.

Note: Under rapidly varying conditions of low ceiling and/or visibility, observers should, when possible, apply the provisions of 16.3.9.7 for the reporting of variation.

16.4.4.4 Visibility

Prevailing visibility decreases to less than or if below, increases to equal or exceed the following values:

1) 3 mi.
2) 1 1/2 mi.
3) 1 mi.
4) 3/4 mi.*
5) 1/2 mi.
6) 1/4 mi.*
7) The additional limit as specified in Appendix V entitled “IFR Approach and alternate limits for Canadian aerodromes.”

Note: Criteria marked with an asterisk (*) are applicable only at aerodromes with approved precision approaches and only down to and including the lowest published minima for these aerodromes.

16.4.4.5 Tornado, waterspout or funnel cloud

1) Is observed
2) Disappears from sight

16.4.4.6 Thunderstorm

1) Begins
2) Ends (SPECI observation **shall** be made when 15 minutes have elapsed without the occurrence of thunderstorm activity; see 3.3.3).

16.4.4.7 Precipitation

When any of the following begin, end or change intensity:

- freezing rain
- freezing drizzle
- ice pellets (showery and non-showery)
- rain
- rain showers
- drizzle
- snow
- snow showers
- snow grains
- hail
- snow pellets
- ice crystals

A SPECI **shall** be taken as required to report the beginning and ending of each individual type of precipitation, regardless of simultaneous occurrences of other types. A leeway of up to 15 minutes is allowed after the ending of precipitation before a SPECI is mandatory.

Changes in character of precipitation do not require a SPECI if the break in precipitation does not exceed 15 minutes and there is no change to the intensity of the precipitation.

Example:
-RA begins or -RA ends: SPECI is required
-RA changes to RA: SPECI is required
-RA changes to SHRA: SPECI is required
-RA changes to -SHRA: SPECI is not required
-RA changes to -RA INTMT: SPECI is not required

16.4.4.8 Temperature

1) The rounded temperature increases by 5 °C or more from the previous reported value and the previous reported value was 20 °C or higher.
2) The temperature decreases to a reported value of 2 °C or lower.

Note: Stations where SPECI are required for temperature changes, as designated by NAV CANADA, are listed in Appendix II.

16.4.4.9 Wind

1) Speed (two-minute mean) increases suddenly to at least double the previously reported value and exceeds 30 kts.
2) Direction changes sufficiently to fulfill criteria required for a “wind shift” (see 7.1.4.1).

16.4.4.10 Volcanic eruption

The occurrence of a volcanic eruption **shall** be reported by a SPECI observation when observed. The following data **shall** be included in Remarks when known:

1) Name of the volcano
2) Direction (16 points, true, of the compass) and approximate distance (statute miles) of the volcano
3) Date/Time (UTC) of eruption
4) Height and direction of movement of ash cloud
5) Other pertinent data

Example:

METAR … **RMK MT ST HELEN VOLCANO 60 MI WNW ERUPTED 091025 ASH CLOUD TO 300 MOVG RPDLY SE**

Post-eruption volcanic ash clouds should be included in Remarks of METAR and SPECI observations as long as significant.

16.4.4.11 Additional observations

The criteria specified in the preceding paragraphs **shall** be regarded as the minimum requirements for taking SPECI observations. Observers are encouraged to exercise initiative to take additional observations when any weather condition exists that may impact the safety and efficiency of aircraft operations or is considered to be otherwise significant. This is to ensure that significant changes in weather are reported. Additional observations will be transmitted as a SPECI.

- A pilot report is received from an aircraft within 1 1/2 SM of the boundary of an airfield, and the PIREP indicates that weather conditions as observed by the pilot differ significantly from those reported by the current observation and when a pilot reports wind shear in the lower layers (see 16.3.12).
- On request of a forecast centre, Air Traffic Controller (ATC).
- Immediately upon learning of an aircraft accident, at or in the vicinity of the weather observing station. The observer **shall** issue an Accident Observation unless a complete METAR has been issued subsequent to the accident. The Accident Observation **shall** be as complete and accurate as possible, with particular care being taken to include in “Remarks” any meteorological facts that might relate to the accident, or which might be of significance to the aircraft accident investigator.
- Observer’s initiative.

16.4.4.12 Graphic reference guide for reporting a SPECI

Appendix I, graphic reference guide, may be used to assist in the identification of criteria for the issuance of special (SPECI) weather observations. Note that temperature criteria are only to be applied at sites specified by NAV CANADA.

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MANOBS Appendices

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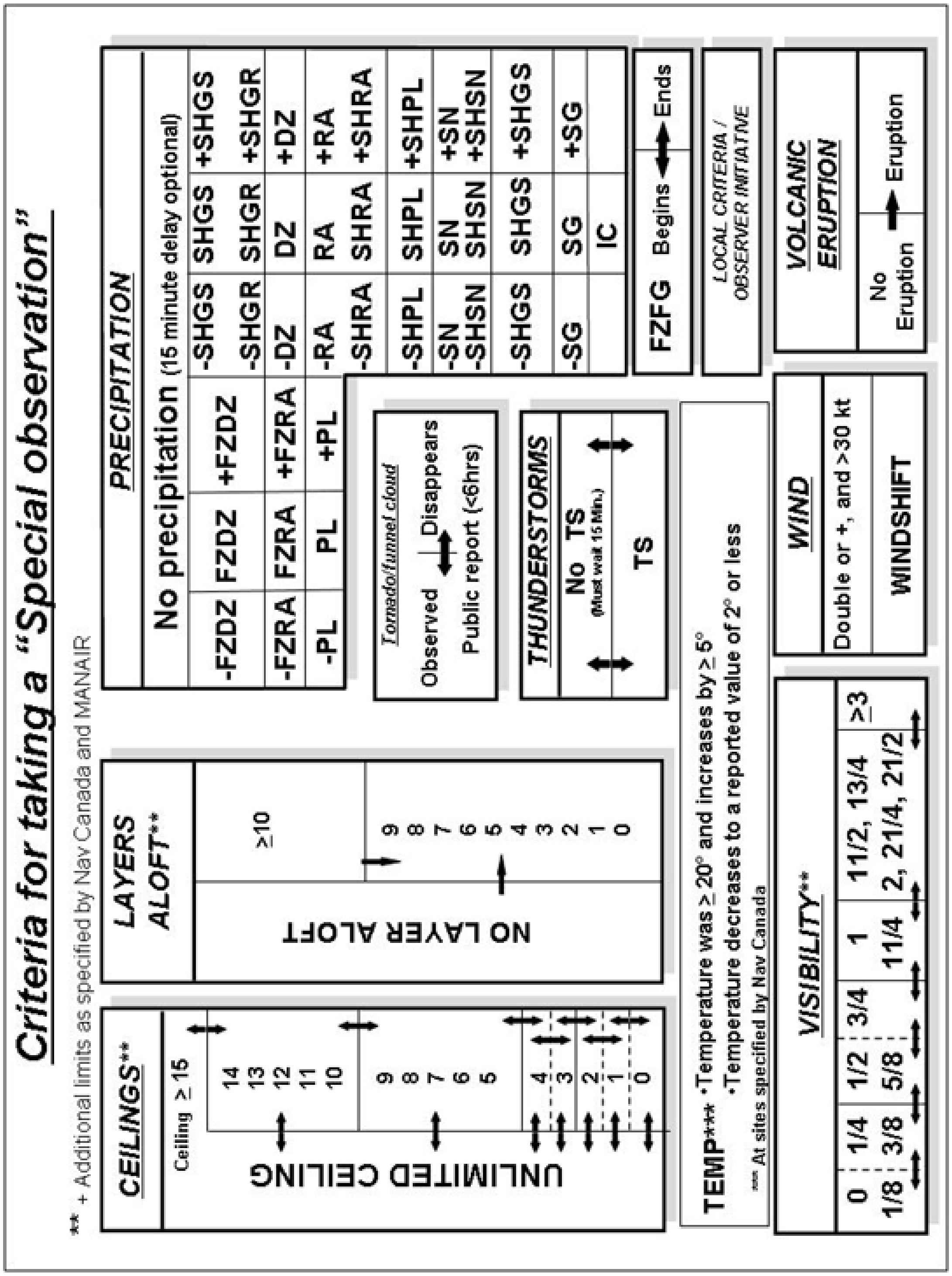
Appendix I: Criteria for reporting a SPECI



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Appendix II: Stations where SPECI reports are required for temperature changes

List of NAV CANADA designated sites required to issue SPECI reports when temperature changes occur as per 10.3.5.8 and 16.4.4.8.

Purpose in accordance with ICAO (International Civil Aviation Organization) Annex 3, Appendix 3, Section 2.3, designated sites are required to issue special (SPECI) reports when temperature changes occur which are of concern to aviation operations.

Affected stations: Application of the temperature criteria for taking SPECI is required at the "National Airports System" airports as identified by NAV CANADA.

Airport Name:

- Calgary Intl., AB
- Edmonton Intl., AB
- Gander Intl., NL
- Moncton/Greater Moncton Intl., NB
- Montréal/Pierre Elliot Trudeau Intl., QC
- Montréal Intl (Mirabel), QC
- Ottawa/Macdonald-Cartier Intl., ON
- St. John's Intl., NL
- Toronto/Lester B. Pearson Intl., ON
- Vancouver, BC
- Victoria Intl., BC
- Halifax Intl., NS
- London, ON
- Québec/Jean Lesage Intl., QC
- Whitehorse Intl., YK
- Winnipeg Intl., MB
- Yellowknife, NT
- Charlottetown, PE
- Fredericton, NB
- Prince George, BC
- Regina Intl., SK
- Saint John, NB
- Saskatoon/John G. Diefenbaker Intl., SK
- Thunder Bay, ON

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Appendix III: METAR Weather Phenomena

Tornadoes, Thunderstorms and Precipitation

Tornado	+FC (TORNADO in Remarks)
Waterspout	+FC (WATERSPOUT in Remarks)
Funnel Cloud	FC (FUNNEL CLOUD in Remarks)
Thunderstorm	TS
Rain	-RA, RA, +RA
Rain Showers	-SHRA, SHRA, +SHRA
Drizzle	-DZ, DZ, +DZ
Freezing Rain	-FZRA, FZRA, +FZRA
Freezing Drizzle	-FZDZ, FZDZ, +FZDZ
Snow	-SN, SN, +SN
Snow Showers	-SHSN, SHSN, +SHSN
Snow Grains	-SG, SG, +SG
Ice Crystals	IC
Ice Pellets	-PL, PL, +PL
Ice Pellet Showers	-SHPL, SHPL, +SHPL
Hail (diameter of largest stone ≥ 5 mm)	-SHGR, SHGR, +SHGR
Hail (diameter of largest stone < 5 mm)	-SHGS, SHGS, +SHGS
Snow Pellets	-SHGS, SHGS, +SHGS

Obstructions to Vision (Visibility 6 mi. or less)

Fog (visibility <5/8 mile)	FG
Freezing Fog (vis. <5/8, temp < 0 °C to -30 °C)	FZFG
Mist (vis. 5/8 mi. to 6 mi.)	BR
Haze	HZ
Smoke	FU
Blowing Snow	BLSN, +BLSN
Blowing Sand	BLSA, +BLSA
Blowing Dust	BLDU, +BLDU
Duststorm	DS, +DS
Sandstorm	SS, +SS
Dust haze	DU
Volcanic Ash	VA

Additional Phenomena (Visibility greater than 6 mi.)

Shallow Fog Patches	MIFG
Fog Patches	BCFG
Fog covering part of aerodrome	PRFG
Drifting Dust	DRDU
Drifting Sand	DRSA
Drifting Snow	DRSN
Dust/Sand Whirls	PO
Volcanic Ash	VA

In the Vicinity Phenomena

Showers in the Vicinity	VCSH
Duststorm in the Vicinity	VCDS
Sandstorm in the Vicinity	VCSS
Fog in the Vicinity	VCFG
Dust/Sand whirls in the Vicinity	VCPO
Blowing Dust in the Vicinity	VCBLDU
Blowing Sand in the Vicinity	VCBLSA
Blowing Snow in the Vicinity	VCBLSN
Volcanic Ash in the Vicinity	VCVA

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Appendix V: IFR Approach and alternate limits for Canadian aerodromes

ID	Aerodrome Name	Pr.	FIR	IFR Approach		Alternative		Notes
				CIG	VIS	CIG	VIS	
CYXX	Abbotsford	BC	CZVR	300	¾	600	2	1 ILS RVR
CYLT	Alert	NU	CZEG	400	1	800	2	NPA
CYAB	Arctic Bay	NU	CZEG	1400	3	1700	3	RNAV only
CYEK	Arviat	NU	CZEG	500	1 ½	800	2 ½	NPA (RNAV)
CYBG	Bagotville	QC	CZUL	500	1	700	1 ½	2 ILS 1 RVR
CYBC	Baie-Comeau	QC	CZUL	200	½	600	2	1 ILS RVR
CYBK	Baker Lake	NU	CZEG	500	1 ½	800	2 ½	NPA (RNAV)
CZBF	Bathurst	NB	CZQM	300	1	800	2	NPA (RNAV)
CBBC	Bella Bella (Campbell Island)	BC	CZVR	1200	3	1500	3	NPA (RNAV)
CYTL	Big Trout Lake	ON	CZWG	400	1 ¼	800	2 ¼	NPA (RNAV)
CYBN	Borden (Heli)	ON	CZYZ	500	1	800	2	A
CYBR	Brandon Muni	MB	CZWG	300	¾	600	2	1 ILS
CYVT	Buffalo Narrows	SK	CZEG	500	1 ½	800	2 ½	NPA (RNAV)
CYDB	Burwash	YT	CZEG	3100	3	3400	3	NPA
CYYC	Calgary Intl	AB	CZEG	200	½	600	2	5 ILS 5 RVR
CYBW	Calgary/Springbank	AB	CZEG	300	¾	400	1	1 ILS RVR
CYCB	Cambridge Bay	NU	CZEG	300	1	800	2	NPA (RNAV)
CYBL	Campbell River	BC	CZVR	300	½	600	2	1 ILS RVR
CYTE	Cape Dorset	NU	CZEG	700	2	1000	3	NPA (RNAV)
CYCA	Cartwright	NL	CZQX	600	1 ¾	900	2 ¾	NPA (RNAV)
CYCG	Castlegar/West Kootenay Regional	BC	CZVR	2900	3	3200	3	NPA (RNAV)
CYLD	Chapleau	ON	CZYZ	600	1 ¾	900	2 ¾	NPA
CYYG	Charlottetown	PE	CZQM	200	½	600	2	1 ILS RVR
CYMT	Chibougamau/Chapais	QC	CZUL	300	1	800	2	NPA (RNAV)
CZUM	Chuchill Falls	NL	CZQX	500	1 ½	800	2 ½	NPA (RNAV)
CYYQ	Churchill	MB	CZWG	300	¾	600	2	1 ILS RVR
CYCY	Clyde River	NU	CZEG	400	1 ¼	800	2 ¼	NPA (RNAV)
CYOD	Cold Lake/Group Captain R.W. McNair	AB	CZEG	200	½	600	2	1 ILS RVR
CYQQ	Comox	BC	CZVR	300	¾	500	1 ¼	2 ILS 2 RVR
CYZS	Coral Harbour	NU	CZEG	400	1 ¼	800	2 ¼	NPA

ID	Aerodrome Name	Pr.	FIR	IFR Approach		Alternative		Notes
				CIG	VIS	CIG	VIS	
CYXC	Cranbrook/Canadian Rockies Intl	BC	CZVR	200	½	600	2	1 ILS
CYDN	Dauphin (Lt. Col W.G. (Billy) Barker VC)	MB	CZWG	400	1 ¼	800	2 ¼	NPA (RNAV)
CYDA	Dawson City	YT	CZEG	1700	3	2000	3	NPA (RNAV)
CYDQ	Dawson Creek	BC	CZEG	300	1	800	2	NPA (RNAV)
CYDL	Dease Lake	BC	CZEG	1800	3	2100	3	NPA (RNAV)
CYDF	Deer Lake	NL	CZQX	200	½	600	2	1 ILS
CYWJ	Déline	NT	CZEG	500	1 ½	800	2 ½	NPA
CYHD	Dryden Regional	ON	CZWG	300	¾	600	2	1 ILS RVR
CYXR	Earlton (Timiscaming Regional)	ON	CZYZ	500	1 ½	800	2 ½	NPA (RNAV)
CYEG	Edmonton Intl	AB	CZEG	200	½	400	1	3 ILS 3 RVR
CYED	Edmonton/Namao (Heli)	AB	CZEG	600	2	900	3	NPA
CZVL	Edmonton/Villeneuve	AB	CZEG	200	½	600	2	1 ILS RVR
CYOA	Ekati	NT	CZEG	300	1	800	2	NPA (RNAV)
CYEN	Estevan Regional	SK	CZEG	400	1 ¼	800	2 ¼	NPA (RNAV)
CYEU	Eureka	NU	CZEG	500	1 ½	800	2 ½	NPA (RNAV)
CZFA	Faro	YT	CZEG	2400	3	2700	3	NPA
CYPY	Fort Chipewyan	AB	CZEG	500	1 ½	800	2 ½	NPA (RNAV)
CYGH	Fort Good Hope	NT	CZEG	400	1 ¼	800	2 ¼	NPA (RNAV)
CYMM	Fort McMurray	AB	CZEG	200	½	600	2	1 ILS
CZFM	Fort McPherson	NT	CZEG	500	1 ½	800	2 ½	NPA (RNAV)
CYYE	Fort Nelson	BC	CZEG	200	½	600	2	1 ILS
CYFS	Fort Simpson	NT	CZEG	400	1 ¼	800	2 ¼	NPA (RNAV)
CYSM	Fort Smith	NT	CZEG	300	1	800	2	NPA (RNAV)
CYXJ	Fort St. John	BC	CZEG	200	½	600	2	1 ILS RVR
CYFC	Fredericton Intl	NB	CZQM	300	¾	600	2	1 ILS RVR
CYCX	Gagetown (Heli)	NB	CZQM	500	½	-	-	A
CYRA	Gamèti/Rae Lakes	NT	CZEG	500	1 ½	800	2 ½	RNAV only
CYQX	Gander Intl	NL	CZQX	200	½	400	1	2 ILS 2 RVR
CYGP	Gaspé (Michel-Pouliot)	QC	CZUL	400	1 ¼	800	2 ¼	NPA (RNAV)
CYGQ	Geraldton (Greenstone Regional)	ON	CZWG	400	1 ¼	800	2 ¼	NPA
CYGX	Gillam	MB	CZWG	500	1	800	2	NPA
CYHK	Gjoa Haven	NU	CZEG	500	1 ½	800	2 ½	NPA (RNAV)
CYYR	Goose Bay	NL	CZQX	200	½	600	2	1 ILS RVR

ID	Aerodrome Name	Pr.	FIR	IFR Approach		Alternative		Notes
				CIG	VIS	CIG	VIS	
CYZE	Gore Bay-Manitoulin	ON	CZYZ	400	1 ¼	800	2 ¼	NPA (RNAV)
CYQU	Grande Prairie	AB	CZEG	200	½	600	2	1 ILS
CYZX	Greenwood	NS	CZQM	200	½	600	2	1 ILS RVR
CYAW	Halifax/Shearwater (Heli)	NS	CZQM	200	½	600	2	A
CYHZ	Halifax/Stanfield Intl	NS	CZQM	100	¼	400	1	2 ILS 2 RVR /CAT II
CYUX	Hall Beach	NU	CZEG	400	1 ¼	800	2 ¼	NPA
CYHM	Hamilton	ON	CZYZ	100	¼	600	2	1 ILS RVR /CAT II
CYGV	Havre St-Pierre	QC	CZUL	300	1	800	2	NPA (RNAV)
CYHY	Hay River / Merlin Carter Airport	NT	CZEG	300	¾	600	2	1 ILS
CYOJ	High Level	AB	CZEG	400	1 ¼	800	2 ¼	NPA (RNAV)
CYGT	Igloolik	NU	CZEG	500	1 ½	800	2 ½	NPA
CYGR	Îles-de-la-Madeleine	QC	CZQM	400	1 ¼	800	2 ¼	NPA (RNAV)
CYPH	Inukjuak	QC	CZUL	400	1 ¼	800	2 ¼	NPA (RNAV)
CYEV	Inuvik (Mike Zubko)	NT	CZEG	200	½	600	2	1 ILS RVR
CYFB	Iqaluit	NU	CZUL	200	¾	600	2	1 ILS RVR
CYIV	Island Lake	MB	CZWG	500	1 ½	800	2 ½	NPA (RNAV)
CYIK	Ivujivik	QC	CZUL	500	1 ½	800	2 ½	NPA (RNAV)
CYKA	Kamloops	BC	CZVR	2200	3	2500	3	NPA (RNAV)
CYYU	Kapuskasing	ON	CZYZ	400	1 ¼	800	2 ¼	NPA (RNAV)
CYLW	Kelowna	BC	CZVR	700	1 ½	1000	3	1 ILS
CYQK	Kenora	ON	CZWG	400	1 ¼	800	2 ¼	NPA (RNAV)
CYKJ	Key Lake	SK	CZEG	300	1	800	2	NPA (RNAV)
CYGK	Kingston	ON	CYZY	300	1	600	2	1 ILS
CYKF	Kitchener/Waterloo	ON	CYZY	200	½	600	2	1 ILS
CYBB	Kugaaruk	NU	CZEG	600	1 ¾	900	2 ¾	NPA (RNAV)
CYCO	Kugluktuk	NU	CZEG	500	1 ½	800	2 ½	NPA (RNAV)
CYVP	Kuujjuaq	QC	CZUL	200	½	600	2	1 ILS RVR
CYGW	Kuujjuarapik	QC	CZUL	600	1 ¾	900	2 ¾	NPA (RNAV)
CYGL	La Grande Riviere	QC	CZUL	300	1	800	2	NPA (RNAV)
CYAH	La Grande-4	QC	CZUL	600	1 ¾	800	2 ¾	NPA (RNAV)
CYVC	La Ronge (Barber Field)	SK	CZWG	500	1 ½	800	2 ½	NPA (RNAV)
CYQL	Lethbridge County	AB	CZEG	200	½	600	2	1 ILS
CYLL	Lloydminster	AB	CZEG	400	1	800	2	NPA (RNAV)

ID	Aerodrome Name	Pr.	FIR	IFR Approach		Alternative		Notes
				CIG	VIS	CIG	VIS	
CYXU	London	ON	CYZY	200	½	600	2	1 ILS RVR
CYBX	Lourdes-de-Blanc-Sablon	QC	CZUL	300	1	800	2	NPA (RNAV)
CYLK	Lutselk'e	NT	CZEG	600	1 ¾	900	2 ¾	RNAV only
CYYL	Lynn Lake	MB	CZWG	500	1 ½	800	2 ½	NPA (RNAV)
CYZY	MacKenzie	BC	CZVR	500	1 ½	800	2 ½	RNAV only
CYSP	Marathon	ON	CZYZ	700	2	1000	3	NPA
CYMH	Mary's Harbour	NL	CZQX	600	1 ¾	900	2 ¾	NPA (RNAV)
CZMT	Masset	BC	CZVR	500	1 ½	800	2 ½	NPA (RNAV)
CYMA	Mayo	YT	CZEG	2700	3	3000	3	NPA
CYXH	Medicine Hat	AB	CZEG	400	1 ¼	800	2 ¼	NPA (RNAV)
CYQM	Moncton/Greater Moncton Intl	NB	CZQM	200	½	400	1	2 ILS 2 RVR
CYYY	Mont-Joli	QC	CZUL	300	1	800	2	NPA (RNAV)
CYMX	Montréal Intl (Mirabel)	QC	CZUL	100	¼	400	1	2 ILS 2 RVR /CAT II
CYUL	Montreal Pierre Elliot Trudeau Intl	QC	CZUL	100	¼	400	1	5 ILS 4 RVR /CAT II
CYHU	Montréal/St-Hubert	QC	CZUL	200	½	600	2	1 ILS RVR
CYMJ	Moose Jaw/R Vice Marshal C.M. McEwen	SK	CZWG	200	½	400	1	2 ILS 1 RVR
CYMO	Moosonee	ON	CZYZ	400	1	800	2	NPA (RNAV)
CYQA	Muskoka	ON	CZYZ	500	1 ½	800	2 ½	NPA (RNAV)
CYDP	Nain	NL	CZQX	1100	3	1400	3	NPA (RNAV)
CYCD	Nanaimo	BC	CZVR	600	1 ¾	900	2 ¾	NPA (RNAV)
CYNA	Natashquan	QC	CZUL	500	1 ¼	800	2 ¼	NPA (RNAV)
CYVQ	Norman Wells	NT	CZEG	400	1	800	2	NPA (RNAV)
CYQW	North Battelford (Cameron McIntosh)	SK	CZWG	500	1 ½	800	2 ½	NPA
CYYB	North Bay	ON	CZYZ	200	½	600	2	1 ILS RVR
CYNE	Norway House	MB	CZWG	500	1 ½	800	2 ½	NPA (RNAV)
CYOC	Old Crow	YT	CZEG	1100	3	1400	3	NPA
CYND	Ottawa/Gatineau	QC	CZUL	300	1	800	2	NPA (RNAV)
CYOW	Ottawa/MacDonald-Cartier Intl	ON	CZUL	200	½	400	1	2 ILS 2 RVR
CYXP	Pangnirtung	NU	CZEG	2600	3	2900	3	NPA
CYPC	Paulatuk (Nora Aliqatchialuk Ruben)	NT	CZEG	300	1	800	2	NPA (RNAV)
CYPE	Peace River	AB	CZEG	400	1	800	2	NPA
CYYF	Penticton	BC	CZVR	2500	3	2800	3	NPA
CYWA	Petawawa	ON	CZYZ	700	2	1000	3	-

ID	Aerodrome Name	Pr.	FIR	IFR Approach		Alternative		Notes
				CIG	VIS	CIG	VIS	
CYPQ	Peterborough	ON	CZYZ	500	1 ½	800	2 ½	NPA (RNAV)
CYPL	Pickle Lake	ON	CZWG	500	1 ½	800	2 ½	NPA (RNAV)
CYIO	Pond Inlet	NU	CZEG	500	1 ½	800	2 ½	NPA (RNAV)
CYZT	Port Hardy	BC	CZVR	300	1	600	2	1 ILS
CYPG	Portage La Prairie/Southport	MB	CZWG	200	½	600	2	1 ILS
CYPA	Prince Albert (Glass Field)	SK	CZWG	200	½	600	2	1 ILS RVR
CYXS	Prince George	BC	CZVR	200	½	600	2	1 ILS RVR
CYPR	Prince Rupert	BC	CZVR	200	½	600	2	1 ILS
CYPX	Puvirnituk	QC	CZUL	400	1 ¼	800	2 ¼	NPA (RNAV)
CYVM	Qikiqtarjuaq	NU	CZEG	2000	3	2300	3	NPA
CYHA	Quaqtaq	QC	CZUL	400	1 ¼	800	2 ¼	NPA (RNAV)
CYQB	Québec/Jean Lesage Intl	QC	CZUL	200	½	600	2	1 ILS RVR
CYQZ	Quesnel	BC	CZVR	700	2 ¼	1000	3	NPA (RNAV)
CYRT	Rankin Inlet	NU	CZEG	300	1	800	2	NPA (RNAV)
CYQF	Red Deer Regional	AB	CZEG	400	1 ¼	800	2 ¼	NPA (RNAV)
CYRL	Red Lake	ON	CZWG	500	1 ½	800	2 ½	NPA
CYQR	Regina Intl	SK	CZWG	200	½	600	2	1 ILS RVR
CYUT	Repulse Bay	NU	CZEG	500	1 ½	800	2 ½	NPA
CYRB	Resolute Bay	NU	CZEG	200	½	600	2	1 ILS RVR
CYRJ	Roberval	QC	CZUL	400	1	800	2	NPA
CYUY	Rouyn-Noranda	QC	CZUL	300	1	800	2	NPA (RNAV)
CWSA	Sable Island	NS	CZQM	500	1	1000	3	RCAP
CYSY	Sachs Harbour (David Nasogaluak JR. Saaryuaq)	NT	CZEG	300	1	800	2	NPA (RNAV)
CYSJ	Saint John	NB	CZQM	200	½	400	1	2 ILS 2 RVR
CYZP	Sandspit	BC	CZVR	300	1	600	2	1 ILS
CYZR	Sarnia (Chris Hadfield)	ON	CZYZ	200	½	600	2	1 ILS RVR
CYXE	Saskatoon/John G. Diefenbaker Intl	SK	CZWG	200	½	600	2	1 ILS RVR
CYAM	Sault Ste. Marie	ON	CZYZ	200	½	600	2	1 ILS RVR
CYKL	Schefferville	QC	CZUL	400	1	800	2	NPA (RNAV)
CYZV	Sept-Îles	QC	CZUL	200	½	600	2	1 ILS RVR
CYSC	Sherbrooke	QC	CZUL	300	1	800	2	NPA (RNAV)
CYXL	Sioux Lookout	ON	CZWG	300	1	800	2	NPA (RNAV)
CYZH	Slave Lake	AB	CZEG	500	1 ½	800	2 ½	NPA (RNAV)

ID	Aerodrome Name	Pr.	FIR	IFR Approach		Alternative		Notes
				CIG	VIS	CIG	VIS	
CYYD	Smithers	BC	CZVR	500	1 ½	800	2 ½	NPA (RNAV)
CYAY	St. Anthony	NL	CZQX	400	1	800	2	NPA (RNAV)
CYSN	St. Catharines/Niagara District	ON	CZYZ	300	1	800	2	NPA (RNAV)
CYYT	St. John's Intl	NL	CZQX	100	¼	400	1	3 ILS 3 RVR /CAT II
CYJT	Stephenville	NL	CZQX	300	¾	600	2	1 ILS RVR
CYSF	Stony Rapids	SK	CZEG	600	1 ¾	900	2 ¾	NPA (RNAV)
CYSB	Sudbury	ON	CZYZ	200	½	600	2	1 ILS RVR
CYYN	Swift Current	SK	CZWG	400	1 ¼	800	2 ¼	NPA (RNAV)
CYQY	Sydney/J.A. Douglas McCurdy	NS	CZQM	200	½	600	2	1 ILS RVR
CYYH	Taloyoak	NU	CZEG	500	1 ½	800	2 ½	NPA (RNAV)
CYTQ	Tasiujaq	QC	CZUL	400	1 ¼	800	2 ¼	NPA (RNAV)
CYXT	Terrace	BC	CZVR	400	1	700	2	1 ILS
CYZW	Teslin	YT	CZEG	700	2	1000	3	NPA (RNAV)
CYQD	The Pas	MB	CZWG	400	1 ¼	800	2 ¼	NPA
CYTH	Thompson	MB	CZWG	200	½	600	2	1 ILS RVR
CYQT	Thunder Bay	ON	CZWG	200	½	600	2	1 ILS RVR
CYTS	Timmins/Victor M. Power	ON	CZYZ	200	½	600	2	1 ILS RVR
CYAZ	Tofino/ Long Beach	BC	CZVR	500	1 ½	800	2 ½	NPA (RNAV)
CYTZ	Toronto/Billy Bishop Toronto City Airport	ON	CZYZ	300	1	500	1 ½	2 ILS 2 RVR
CYKZ	Toronto/Buttonville Municipal	ON	CZYZ	400	1 ½	800	2 ½	NPA (RNAV)
CYYZ	Toronto/Lester B. Pearson Intl	ON	CYZY	100	¼	400	1	10 ILS RVR /CAT III
CYTR	Trenton	ON	CZYZ	200	½	600	2	2 ILS 2 RVR
CYRQ	Trois Rivieres	QC	CZUL	400	1	800	2	NPA (RNAV)
CYUB	Tuktoyaktuk/James Gruben	NT	CZEG	500	1 ½	800	2 ½	NPA (RNAV)
CYHI	Ulukhaktok/Holman	NT	CZEG	500	1 ½	800	2 ½	NPA (RNAV)
CYOY	Valcartier (W/C J.H.L. (Joe) Lecomte) (Heli)	QC	CZUL	-	-	-	-	-
CYVO	Val-d'Or	QC	CZUL	200	½	600	2	1 ILS RVR
CYVR	Vancouver Intl	BC	CZVR	100	¼	400	1	5 ILS RVR /CAT III
CYWH	Victoria Harbour (Water Aerodrome)	BC	CZVR	600	¾	800	1 ¾	NPA
CYYJ	Victoria Intl	BC	CZVR	200	¾	400	1 ¾	2 ILS 2 RVR
CYWK	Wabush	NL	CZUL	300	½	600	2	1 ILS
CYKQ	Waskaganish	QC	CZUL	500	1 ½	800	2 ½	NPA
CYQH	Watson Lake	YT	CZEG	300	¾	600	2	1 ILS RVR

ID	Aerodrome Name	Pr.	FIR	IFR Approach		Alternative		Notes
				CIG	VIS	CIG	VIS	
CYXZ	Wawa	ON	CZYZ	800	2 ¼	1100	3	RCAP NPA
CYWE	Wekweèti	NT	CZEG	600	1 ¾	900	2 ¾	RNAV only
CYZU	Whitecourt	AB	CZEG	500	1 ½	800	2 ½	NPA
CYXY	Whitehorse / Erik Nielsen Intl	YT	CZEG	200	½	600	2	1 ILS RVR
CYVV	Wiarton	ON	CZYZ	400	1 ¼	800	2 ¼	NPA (RNAV)
CYWL	Williams Lake	BC	CZVR	600	1 ¾	900	2 ¾	NPA
CYQG	Windsor	ON	CYZY	200	½	600	2	1 ILS RVR
CYWG	Winnipeg/James Armstrong Richardson Intl	MB	CZWG	100	¼	400	1	3 ILS 3 RVR /CAT II
CYQI	Yarmouth	NS	CZQM	300	1	600	2	NPA (RNAV)
CYZF	Yellowknife	NT	CZEG	200	½	600	2	1 ILS RVR
CYQV	Yorkton Muni	SK	CZWG	400	1¼	800	2¼	NPA

Legend:

A – Landing limits at heliports are best IFR approach limits. Gagetown CYCX, Borden CYBN, Namao CYED, Petawawa CYWA, and Valcartier CYOY are not IFR aerodromes.

B – DND aerodrome with TAF issued by CMAC-W

CAP – Canada Air Pilot

CAT (I, II or III) – ILS Categories I, II or III

FIR – Flight Information Region

ILS – Instrument Landing System

NPA – Non Precision Approach

RCAP – Restricted Canada Air Pilot

RVR – Runway Visual Range

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