

Reporting Year 2022

Metrics Report for Milestone 1.3 - Making Climate Change Science More Open and Accessible

Theme 1 of the National Action Plan on Open Government 2022-2024
“Climate Change and Sustainable Growth”

Environment and Climate Change Canada

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[National Action Plan on Open Government 2022-2024](#)

Theme 1: Climate Change and Sustainable Growth

The National Action Plan on Open Government 2022-2024 (NAP) commits to making the Government of Canada more transparent and accountable, while also giving Canadians the chance to take part in how government makes decisions¹.

This document reports on Milestone 1.3 of the NAP – “*Making climate change science more open and accessible*” – namely:

1.3.1 – New metric to be designed and included in yearly reports to assess open access of climate change science publication [by science-based departments and agencies] using data from an abstract and citation database.

1.3.2 – Yearly reports on progress against existing metrics² that measure how science-based departments and agencies implement open science, with a focus on open access metrics and diverse types of open access, to be released in the open.

This document provides the yearly report on progress of Science-Based Departments and Agencies (SBDAs) in implementing Open Science, in fulfillment of Milestone 1.3. It not only addresses the requirements of 1.3.2 to report on progress against existing open access metrics, but also includes the design of a new metric for climate change science publications, as required under 1.3.1. For this report, open access is defined as free and unrestricted online access to research publications and data (please see Annex 1 for descriptions of open access status for scientific publications). This greater access is expected to accelerate the progress of research, democratize access to knowledge worldwide, and ensure that publicly funded research is available to the public³.

¹ [National Action Plan on Open Government | Open Government, Government of Canada](#)

² Yearly reports on progress against existing metrics were produced in 2019 and 2020: [Federal Progress in Implementing Open Science: 2019 Annual Report | Zenodo](#) and [The 2020 annual report on the federal progress in implementing open science and its benefits | Zenodo](#)

³ [Frequently Asked Questions \(science.gc.ca\)](#)

This report covers results for the following SBDAs:

- Agriculture and Agri-Food Canada
- Atomic Energy of Canada Limited
- Canadian Food Inspection Agency
- Canadian Space Agency
- Defence Research and Development Canada / National Defence
- Environment and Climate Change Canada
- Fisheries and Oceans Canada
- Health Canada
- Innovation, Science and Economic Development Canada
- National Research Council of Canada
- Natural Resources Canada
- Parks Canada
- Polar Knowledge Canada
- Public Health Agency of Canada
- Statistics Canada
- Transport Canada

METHODOLOGY

The bibliometric data presented in this document is drawn from the Canadian Bibliometric Database (CBD™) built by the [Observatoire des sciences et des technologies](#) (OST), using Clarivate Analytics Web of Science (WoS). The WoS platform includes three databases (the Science Citation Index Expanded™, the Social Sciences Citation Index™, and the Arts & Humanities Citation Index™) covering, in 2020, more than 13,000 journals from all fields of knowledge (Observatoire des sciences et des technologies, 2021). Please see Annex 2 for additional details on methodology.

RESULTS

1.3.1 – New metric to be designed and included in yearly reports to assess open access of climate change science publication using data from an abstract and citation database.

New Metric: total consolidated *Annual Number and Percentage of Climate Change Science Publications by Open Access Status, for all SBDA's, for the period of 1998 to 2020* (See Annexes 2 and 3 for methodology). This new metric measures open access of climate change publications for all SBDA's.

A subsequent report to be published in late 2023 will include data for the years 2021 and 2022.

Table 1. Annual number and percentage of climate change publications for all SBDA's from 1998 to 2020.

Year	Number					Percentage												
	Gold	Green	Hybrid	Bronze	Sub-Total OA	Closed	NA	NoDOI	TOTAL	Gold	Green	Hybrid	Bronze	Sub-Total OA	Closed	NA	NoDOI	TOTAL
1998		1	1	12	14	51	19	3	87		1.1%	1.1%	13.8%	16.1%	58.6%	21.8%	3.4%	100.0%
1999		4		25	29	45	19	8	101		4.0%		24.8%	28.7%	44.6%	18.8%	7.9%	100.0%
2000		4	5	26	35	62	14	10	121		3.3%	4.1%	21.5%	28.9%	51.2%	11.6%	8.3%	100.0%
2001		7	1	19	27	74	15	7	123		5.7%	0.8%	15.4%	22.0%	60.2%	12.2%	5.7%	100.0%
2002	1	10	4	19	34	80	13	30	157	0.6%	6.4%	2.5%	12.1%	21.7%	51.0%	8.3%	19.1%	100.0%
2003		9	2	26	37	93	13	10	153		5.9%	1.3%	17.0%	24.2%	60.8%	8.5%	6.5%	100.0%
2004	1	10	2	25	38	93	8	6	145	0.7%	6.9%	1.4%	17.2%	26.2%	64.1%	5.5%	4.1%	100.0%
2005	1	13	7	33	54	99		4	157	0.6%	8.3%	4.5%	21.0%	34.4%	63.1%		2.5%	100.0%
2006	5	25	10	33	73	114		8	195	2.6%	12.8%	5.1%	16.9%	37.4%	58.5%		4.1%	100.0%
2007	4	10	6	46	66	133		7	206	1.9%	4.9%	2.9%	22.3%	32.0%	64.6%		3.4%	100.0%
2008	11	15	14	43	83	131		4	218	5.0%	6.9%	6.4%	19.7%	38.1%	60.1%		1.8%	100.0%
2009	12	22	13	39	86	138		7	231	5.2%	9.5%	5.6%	16.9%	37.2%	59.7%		3.0%	100.0%
2010	18	20	21	50	109	145		7	261	6.9%	7.7%	8.0%	19.2%	41.8%	55.6%		2.7%	100.0%
2011	32	27	20	58	137	170	1	3	311	10.3%	8.7%	6.4%	18.6%	44.1%	54.7%	0.3%	1.0%	100.0%
2012	29	38	20	51	138	193		6	337	8.6%	11.3%	5.9%	15.1%	40.9%	57.3%		1.8%	100.0%
2013	43	32	32	61	168	173		2	343	12.5%	9.3%	9.3%	17.8%	49.0%	50.4%		0.6%	100.0%
2014	53	36	35	42	166	175	1	2	344	15.4%	10.5%	10.2%	12.2%	48.3%	50.9%	0.3%	0.6%	100.0%
2015	47	33	51	46	177	184		1	362	13.0%	9.1%	14.1%	12.7%	48.9%	50.8%		0.3%	100.0%
2016	75	31	60	44	210	149	1	2	362	20.7%	8.6%	16.6%	12.2%	58.0%	41.2%	0.3%	0.6%	100.0%
2017	88	38	44	44	214	157		1	372	23.7%	10.2%	11.8%	11.8%	57.5%	42.2%		0.3%	100.0%
2018	166	53	81	49	349	145	3	1	498	33.3%	10.6%	16.3%	9.8%	70.1%	29.1%	0.6%	0.2%	100.0%
2019	160	36	73	32	301	188	1		490	32.7%	7.3%	14.9%	6.5%	61.4%	38.4%	0.2%		100.0%
2020	172	34	78	27	311	185	3	4	503	34.2%	6.8%	15.5%	5.4%	61.8%	36.8%	0.6%	0.8%	100.0%
1998-2020	918	508	580	850	2,856	2,977	111	133	6,077	15.1%	8.4%	9.5%	14.0%	47.0%	49.0%	1.8%	2.2%	100.0%

New Metric: total Number and Percentage of Climate Change Science Publications [broken down] by Department and Agency and Open Access Status, for the period of 1998 to 2020.

A subsequent report to be published in late 2023 will include data for the years 2021 and 2022.

Table 2. Number and percentage of SBDA climate change publications broken down by Department and Agency and Open Access status from 1998 to 2020.

Department & Agency	Number					Percentage												
	Gold	Green	Hybrid	Bronze	Sub-Total OA	Closed	NA	NoDOI	TOTAL	Gold	Green	Hybrid	Bronze	Sub-Total OA	Closed	NA	NoDOI	TOTAL
ALL SBDAs	918	508	580	850	2,856	2,977	111	133	6,077	15.1%	8.4%	9.5%	14.0%	47.0%	49.0%	1.8%	2.2%	100.0%
Agriculture and Agri-Food Canada	69	36	43	94	242	366	6	10	624	11.1%	5.8%	6.9%	15.1%	38.8%	58.7%	1.0%	1.6%	100.0%
Atomic Energy of Canada Limited				1	1	5			6				16.7%	16.7%	83.3%			100.0%
Canadian Food Inspection Agency	2		1	2	5	3		1	9	22.2%		11.1%	22.2%	55.6%	33.3%		11.1%	100.0%
Canadian Space Agency	4		2		6	10		1	17	23.5%		11.8%		35.3%	58.8%		5.9%	100.0%
Defence Research and Development Canada / National Defence	1		3		4	10			14	7.1%		21.4%		28.6%	71.4%			100.0%
Environment and Climate Change Canada	461	222	317	344	1,344	1,022	64	44	2,474	18.6%	9.0%	12.8%	13.9%	54.3%	41.3%	2.6%	1.8%	100.0%
Fisheries and Oceans Canada	151	89	110	231	581	610	23	30	1,244	12.1%	7.2%	8.8%	18.6%	46.7%	49.0%	1.8%	2.4%	100.0%
Health Canada	49	7	30	12	98	31		2	131	37.4%	5.3%	22.9%	9.2%	74.8%	23.7%		1.5%	100.0%
Innovation, Science and Economic Development Canada	5	2			7	1		1	9	55.6%	22.2%			77.8%	11.1%		11.1%	100.0%
National Research Council Canada	26	28	11	23	88	66		3	157	16.6%	17.8%	7.0%	14.6%	56.1%	42.0%		1.9%	100.0%
Natural Resources Canada	196	150	85	195	626	960	19	50	1,655	11.8%	9.1%	5.1%	11.8%	37.8%	58.0%	1.1%	3.0%	100.0%
Parks Canada	15	8	7	5	35	28		1	64	23.4%	12.5%	10.9%	7.8%	54.7%	43.8%		1.6%	100.0%
Polar Knowledge Canada	4	2	4		10	1			11	36.4%	18.2%	36.4%		90.9%	9.1%			100.0%
Public Health Agency of Canada	32	5	11	9	57	20			77	41.6%	6.5%	14.3%	11.7%	74.0%	26.0%			100.0%
Statistics Canada			1		1	1			2			50.0%		50.0%	50.0%			100.0%
Transport Canada					0	1			1					0.0%	100.0%			100.0%

1.3.2 – Yearly reports on progress against existing metrics that measure how science-based departments and agencies implement open science, with a focus on open access metrics and diverse types of open access, to be released in the open

Existing Metric⁴: total consolidated *Annual number and Percentage of SBDA publications by Open Access Status, for the period of 1998 to 2020*. This metric measures how SBDA implement Open Science.

A subsequent report to be published in late 2023 will include data for the years 2021 and 2022.

Table 3. Annual number and percentage of SBDA publications by open access status from 1998 to 2020.

Year	Number					Percentage												
	Gold	Green	Hybrid	Bronze	Sub-Total OA	Closed	NA	NoDOI	TOTAL	Gold	Green	Hybrid	Bronze	Sub-Total OA	Closed	NA	NoDOI	TOTAL
1998	12	123	45	313	493	2,196	141	572	3,402	0.4%	3.6%	1.3%	9.2%	14.5%	64.6%	4.1%	16.8%	100.0%
1999	24	125	33	359	541	1,994	130	551	3,216	0.7%	3.9%	1.0%	11.2%	16.8%	62.0%	4.0%	17.1%	100.0%
2000	21	167	54	369	611	2,161	137	468	3,377	0.6%	4.9%	1.6%	10.9%	18.1%	64.0%	4.1%	13.9%	100.0%
2001	23	172	56	366	617	2,128	84	447	3,276	0.7%	5.3%	1.7%	11.2%	18.8%	65.0%	2.6%	13.6%	100.0%
2002	34	189	51	428	702	1,842	64	840	3,448	1.0%	5.5%	1.5%	12.4%	20.4%	53.4%	1.9%	24.4%	100.0%
2003	42	224	64	505	835	2,298	44	519	3,696	1.1%	6.1%	1.7%	13.7%	22.6%	62.2%	1.2%	14.0%	100.0%
2004	52	282	78	494	906	2,467	32	441	3,846	1.4%	7.3%	2.0%	12.8%	23.6%	64.1%	0.8%	11.5%	100.0%
2005	62	344	79	490	975	2,611	15	360	3,961	1.6%	8.7%	2.0%	12.4%	24.6%	65.9%	0.4%	9.1%	100.0%
2006	95	406	76	507	1,084	2,727	6	283	4,100	2.3%	9.9%	1.9%	12.4%	26.4%	66.5%	0.1%	6.9%	100.0%
2007	132	385	96	571	1,184	2,654	1	259	4,098	3.2%	9.4%	2.3%	13.9%	28.9%	64.8%	0.0%	6.3%	100.0%
2008	180	459	110	544	1,293	2,866	1	281	4,441	4.1%	10.3%	2.5%	12.2%	29.1%	64.5%	0.0%	6.3%	100.0%
2009	226	516	112	577	1,431	2,864	2	206	4,503	5.0%	11.5%	2.5%	12.8%	31.8%	63.6%	0.0%	4.6%	100.0%
2010	312	718	134	611	1,775	2,531	9	193	4,508	6.9%	15.9%	3.0%	13.6%	39.4%	56.1%	0.2%	4.3%	100.0%
2011	370	693	142	592	1,797	2,743	6	178	4,724	7.8%	14.7%	3.0%	12.5%	38.0%	58.1%	0.1%	3.8%	100.0%
2012	431	521	184	604	1,740	2,847	9	173	4,769	9.0%	10.9%	3.9%	12.7%	36.5%	59.7%	0.2%	3.6%	100.0%
2013	546	436	214	540	1,736	2,664	10	144	4,554	12.0%	9.6%	4.7%	11.9%	38.1%	58.5%	0.2%	3.2%	100.0%
2014	497	418	262	486	1,663	2,529	7	102	4,301	11.6%	9.7%	6.1%	11.3%	38.7%	58.8%	0.2%	2.4%	100.0%
2015	580	407	306	514	1,807	2,280	3	75	4,165	13.9%	9.8%	7.3%	12.3%	43.4%	54.7%	0.1%	1.8%	100.0%
2016	737	423	351	552	2,063	2,033	6	108	4,210	17.5%	10.0%	8.3%	13.1%	49.0%	48.3%	0.1%	2.6%	100.0%
2017	807	505	304	457	2,073	1,962	12	79	4,126	19.6%	12.2%	7.4%	11.1%	50.2%	47.6%	0.3%	1.9%	100.0%
2018	1,022	498	433	441	2,394	1,880	19	80	4,373	23.4%	11.4%	9.9%	10.1%	54.7%	43.0%	0.4%	1.8%	100.0%
2019	1,106	395	495	341	2,337	1,939	36	79	4,391	25.2%	9.0%	11.3%	7.8%	53.2%	44.2%	0.8%	1.8%	100.0%
2020	1,270	351	564	223	2,408	2,042	40	41	4,531	28.0%	7.7%	12.4%	4.9%	53.1%	45.1%	0.9%	0.9%	100.0%
1998-2020	8,581	8,757	4,243	10,884	32,465	54,258	814	6,479	94,016	9.1%	9.3%	4.5%	11.6%	34.5%	57.7%	0.9%	6.9%	100.0%

⁴ This metric has been used to produce past reports such as: [Federal Progress in Implementing Open Science: 2019 Annual Report](#) and [The 2020 annual report on the federal progress in implementing open science and its benefits](#).

Existing Metric⁵: total Number and Percentage of SBDA Publications [broken down] by Department and Agency and Open Access Status, for the period of 1998 to 2020.

A subsequent report to be published in late 2023 will include data for the years 2021 and 2022.

Table 4. Number and percentage of SBDA publications broken down by Department and Agency and Open Access status from 1998 to 2020.

Department & Agency	Number					Percentage												
	Gold	Green	Hybrid	Bronze	Sub-Total OA	Closed	NA	NoDOI	TOTAL	Gold	Green	Hybrid	Bronze	Sub-Total OA	Closed	NA	NoDOI	TOTAL
ALL SBDA's	8,581	8,757	4,243	10,884	32,465	54,258	814	6,479	94,016	9.1%	9.3%	4.5%	11.6%	34.5%	57.7%	0.9%	6.9%	100.0%
Agriculture and Agri-Food Canada	2,169	686	1,120	3,227	7,202	13,201	79	2,022	22,504	9.6%	3.0%	5.0%	14.3%	32.0%	58.7%	0.4%	9.0%	100.0%
Atomic Energy of Canada Limited	23	70	20	28	141	918	4	87	1,150	2.0%	6.1%	1.7%	2.4%	12.3%	79.8%	0.3%	7.6%	100.0%
Canadian Food Inspection Agency	267	74	113	221	675	940	6	295	1,916	13.9%	3.9%	5.9%	11.5%	35.2%	49.1%	0.3%	15.4%	100.0%
Canadian Space Agency	26	42	10	51	129	354	4	27	514	5.1%	8.2%	1.9%	9.9%	25.1%	68.9%	0.8%	5.3%	100.0%
Defence Research and Development Canada / National Defence	207	189	61	190	647	2,251	30	290	3,218	6.4%	5.9%	1.9%	5.9%	20.1%	70.0%	0.9%	9.0%	100.0%
Environment and Climate Change Canada	1,562	751	929	1,326	4,568	7,882	237	669	13,356	11.7%	5.6%	7.0%	9.9%	34.2%	59.0%	1.8%	5.0%	100.0%
Fisheries and Oceans Canada	894	505	443	1,421	3,263	5,638	104	436	9,441	9.5%	5.3%	4.7%	15.1%	34.6%	59.7%	1.1%	4.6%	100.0%
Health Canada	1,687	557	728	1,497	4,469	3,876	51	778	9,174	18.4%	6.1%	7.9%	16.3%	48.7%	42.2%	0.6%	8.5%	100.0%
Innovation, Science and Economic Development Canada	47	46	3	35	131	716	10	45	902	5.2%	5.1%	0.3%	3.9%	14.5%	79.4%	1.1%	5.0%	100.0%
National Research Council Canada	1,244	5,276	626	2,155	9,301	11,979	184	1,076	22,540	5.5%	23.4%	2.8%	9.6%	41.3%	53.1%	0.8%	4.8%	100.0%
Natural Resources Canada	984	725	435	1,237	3,381	8,771	88	888	13,128	7.5%	5.5%	3.3%	9.4%	25.8%	66.8%	0.7%	6.8%	100.0%
Parks Canada	75	27	25	42	169	297	2	21	489	15.3%	5.5%	5.1%	8.6%	34.6%	60.7%	0.4%	4.3%	100.0%
Polar Knowledge Canada	17	2	7	2	28	6			34	50.0%	5.9%	20.6%	5.9%	82.4%	17.6%			100.0%
Public Health Agency of Canada	1,111	261	267	718	2,357	1,134	15	232	3,738	29.7%	7.0%	7.1%	19.2%	63.1%	30.3%	0.4%	6.2%	100.0%
Statistics Canada	115	124	62	74	375	417	43	307	1,142	10.1%	10.9%	5.4%	6.5%	32.8%	36.5%	3.8%	26.9%	100.0%
Transport Canada	2	2	1	2	7	53	1	16	77	2.6%	2.6%	1.3%	2.6%	9.1%	68.8%	1.3%	20.8%	100.0%

⁵ This metric has been used to produce past reports such as: [Federal Progress in Implementing Open Science: 2019 Annual Report](#) and [The 2020 annual report on the federal progress in implementing open science and its benefits](#).

Annex 1: Description of open access status for scientific publications

Open access status	Description
Gold	Available on the publisher's website in a journal where all articles are open access.
Green	Available in an Open Access repository, including preprints servers.
Hybrid	Available on the publisher's website under an open licence in a journal where not all articles are open access.
Bronze	Available on the publisher's website without an open licence in a journal where not all articles are Open Access.
Closed	Not available in Open Access
No DOI	No Digital Object Identifier (DOI) included and is designated as a closed publication.

Annex 2: Methodology of retrieving bibliometric data and retrieving climate change keywords

Bibliometric Data

The bibliometric data presented in this document is drawn from the Canadian Bibliometric Database (CBD™) built by the *Observatoire des sciences et des technologies* (OST), using Clarivate Analytics Web of Science (WoS). The WoS platform includes three databases (the Science Citation Index Expanded™, the Social Sciences Citation Index™, and the Arts & Humanities Citation Index™) covering, in 2020, more than 13,000 journals from all fields of knowledge. The databases do not necessarily include all documents that may have been published by Canadian or foreign researchers, as some publications are disseminated by other scientific media not indexed by WoS (e.g., trade journals, national journals, grey literature, and conference proceedings not published in journals). However, in the Clarivate databases, the share of researchers' scientific results that is most visible to the Canadian and global scientific communities was indexed, and therefore is most likely to be cited. In addition, only articles, research notes, and review papers are included in the data as these are the main means of disseminating new knowledge.

Climate Change Keywords

Research on climate change, to a great extent, is a multidisciplinary field which cannot be delimited by the traditional disciplinary classifications used in the bibliometric database. The OST, within *L'Université du Québec à Montréal* (UQAM), created a retrieval strategy with keyword queries and selected keywords from a list of the most frequent keywords extracted from 30,014 bibliographic records of papers cited in the third and fourth reports of the three working groups under the Intergovernmental Panel on Climate Change (IPCC). Keywords used in the retrieval strategy are summarized in Annex 3, covering a broad range of climate change topics studied by IPCC.

Annex 3: Keywords used in the retrieval strategy, [extracted from] [based on] climate change scientific publications

Climate Change Keywords				
Model Parameters	Atmosphere	Climate	Earth & Space Sciences	Ocean
Air-Temperature Variation	Aerosol Effect	Annular Mode	Lagrangian Model	Albedo
Atmospheric model	Aerosol Emission	Anthropogenic Climate	AMOC ⁶	Antarctic Melting
Atmospheric	African Monsoon	Climate Change	Drought	Atlantic Circulation
Parameterization	Antarctic Oscillation	Climate Dynamics	ENSO ⁷	Atlantic Thermohaline Circulation
Climate Change Scenario	Anthropogenic Aerosol	Climate Extreme		Coastal Erosion
Climate Model	Anthropogenic Carbon	Climate Feedback		Coastal Management
Climate Modelling	Anthropogenic Emission	Climate Forcing		Coastal Vulnerability
Climate Simulation	Anthropogenic Sulfate	Climate Forecast		Coral Mortality
Climatic Modelling	Arctic Oscillation	Climate Governance		Deep Convection
Climatic Simulation	Asian Monsoon	Climate Impact		East Greenland Current
Cyclone Activity	Asian Summer Monsoon	Climate Interannual Variability		Equilibrium Line Altitude
Dynamic Global Vegetation Model	Atmosphere Dynamics	Climate Interdecadal Variability		Greenland Ice
Extreme Rainfall	Atmospheric Aerosol	Climate Oscillation		Greenland Ice Sheet
Extreme Weather	Atmospheric Carbon Dioxide	Climate Policy		Greenland Melting
Flood Risk	Atmospheric Circulation	Climate Response		Ice Core
GCM Simulation	Atmospheric Circulation Pattern	Climate Sensitivity		Ice Shelf
General-Circulation Model	Atmospheric CO ₂	Climate Simulation		Ice Sheet
Heatwave	Atmospheric Methane	Climate Trend		North Atlantic Circulation
Intra-Seasonal Oscillation	Black Carbon	Climate Variability		North Atlantic Deep-Water
Kyoto Protocol	Carbon Budget	Climate Variation		North Atlantic Drift
Ocean Model	Carbon Cycle	Climate Warming		North Atlantic Ocean
Ocean Modelling	Carbon Sequestration	Climatic Change		Ocean Carbon
Ocean Simulation	Carbon Sink	Climatic Impact		Ocean Circulation
Ocean-Atmosphere	Carbon Storage	Climatic Oscillation		Ocean Heat
General Circulation Model	Carbonaceous Aerosol	Climatic Response		Pacific Circulation
Ocean-Atmosphere Model	Carbon Dioxide Capture	Climatic System		Permafrost
Potential	Carbon Dioxide Emission	Climatic Trend		Polar Ice
Evapotranspiration	CH ₄ Emission	Climatic Variability		Sea Ice Extent
Precipitation Event	CO ₂ Emission	Climatology		Sea-Ice Cover
Precipitation Variability	El-Nino	Cost of Climate		Sea-Ice Cover Duration

⁶ Atlantic meridional overturning circulation (AMOC)

⁷ El Niño-Southern Oscillation (ENSO)

Seasonality" and "Climate Simulated Climate Storm Surge Surface Air-Temperature Temperature Trend	Extratropical Circulation GHG Emission Greenhouse Effect Greenhouse Gases Greenhouse Warming La Nina Madden-Julian Oscillation Methane Emission North Atlantic Oscillation Stratospheric Circulation Sulphate Aerosol Tropospheric Aerosol Tropospheric Methane	Effect of Climate Future Climate Global Warming Long-Term Climate Potential Climate Regional Warming Transient Climate Warming Potential Winter Climate		Sea-Level Change Sea-Level Rise Sea-Surface Salinity Sea-Surface Temperature SST Anomaly Thermohaline Circulation Tropical Convection Upper Ocean
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