

# Seasonal Summary

## Great Lakes

Winter 2022-2023



By the North American Ice Service

July 5, 2023

## Combined Great Lakes

The 2022-2023 Great Lakes ice season had a very low ice coverage with substantially less ice than last year. Air temperatures were above normal for almost the entire season except for two short periods of below normal temperatures. January and February which are usually the coldest months saw very warm anomalous temperatures which prevented any significant ice formation to occur this season especially so in the southern lakes.

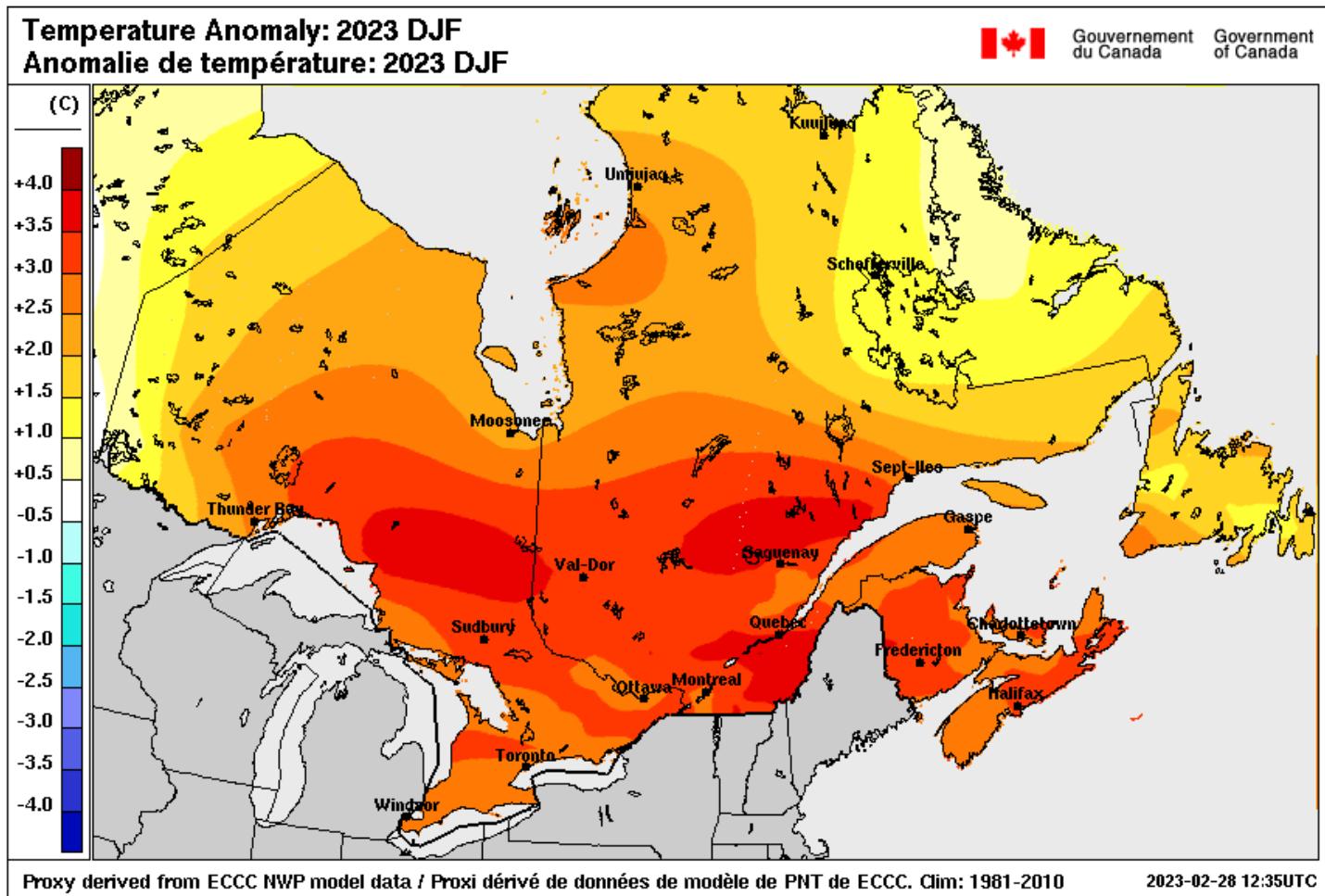
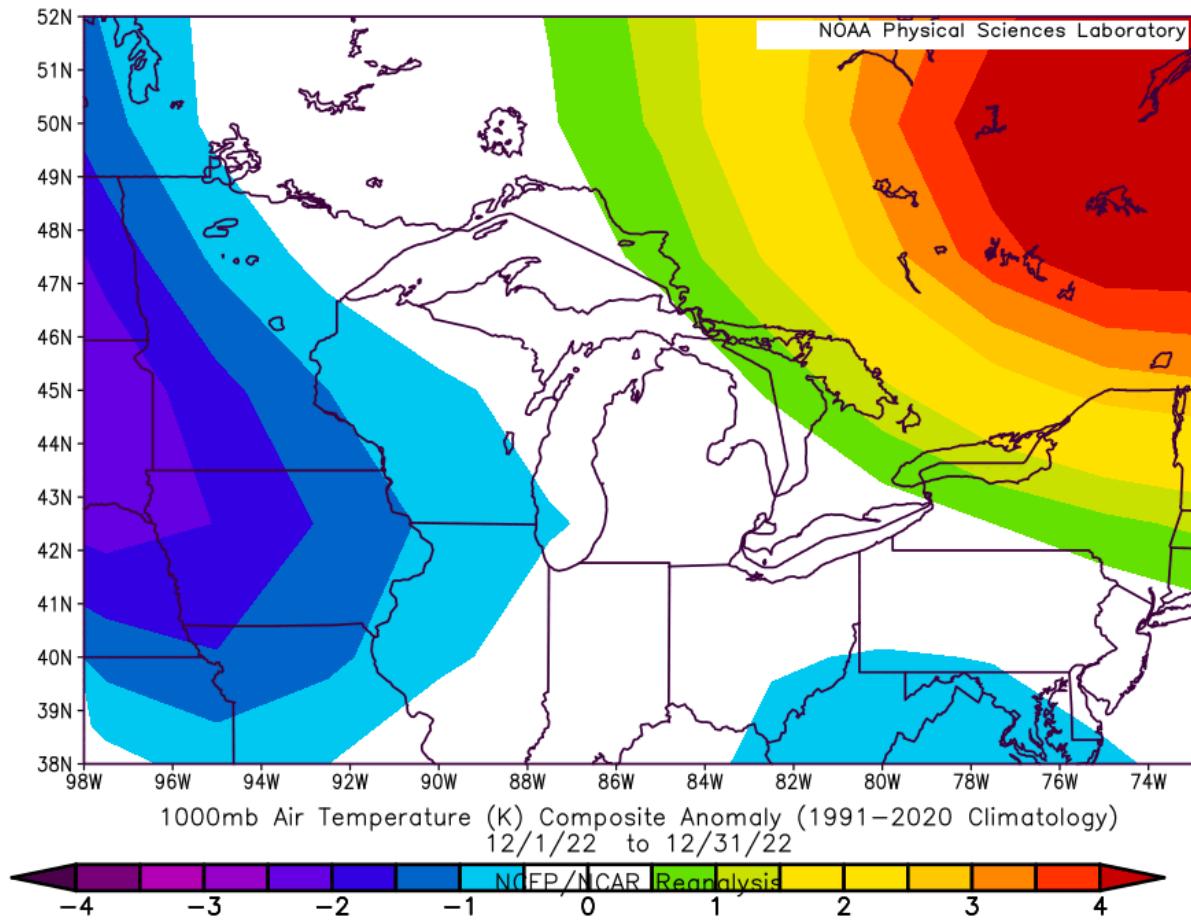


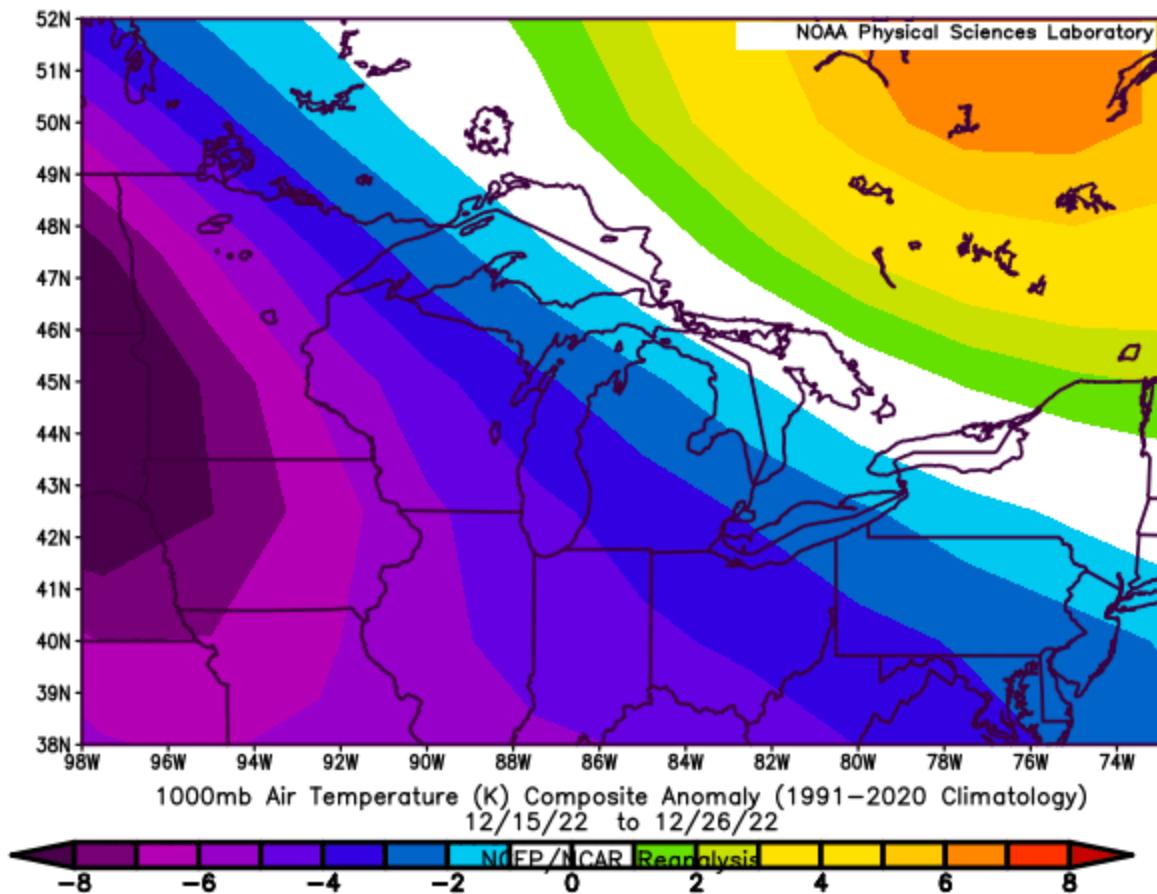
Figure 1: Three-month Surface Air Temperature Anomaly for the Great Lakes, 1<sup>st</sup> December 2022 to 28<sup>th</sup> February 2023

There were only two periods of cold air this season that resulted in rapid ice formation and an increase in the ice coverage over the lakes: the cold period during the last two weeks in December and the cold period in late January to the first week in February. Both cold periods were short lived and were subsequently followed by anomalously warm temperatures.



**Figure 2: Surface Air Temperature Anomaly for the Great Lakes, 1-31 December 2022**

*The above figure shows that for December the temperatures over the Great Lakes were near normal when averaged for the entire month.*



**Figure 3: Surface Air Temperature Anomaly for the Great Lakes, 15-26 December 2022**  
**Cold spell during middle of December 2022**

The above figure shows that for December 15-26<sup>th</sup> the temperatures over the southwestern Great Lakes were several degrees below normal values.

The Great Lakes ice season started at the end of November or early December over the Great Lakes. This is climatologically normal and what very similar to last year. Ice growth following this normal start was minimal in early December due to above normal temperatures which only cooled to below normal at the end of December with ice coverage finally surpassing normal values for the end of December.

This first cold temperature anomaly which arrived in mid December, see figure 3, saw the southern and western parts of the lakes experience temperatures at this time that were about 5 degrees Celsius colder than is normal. Ice coverage quickly increased in shallow areas that can respond quickly with ice formation with cold temperatures.

Areas along the shores, the western basin of Lake Erie, Lake St. Clair and Saginaw Bay saw rapid ice cover formation at this time. See figures 4 and 5.

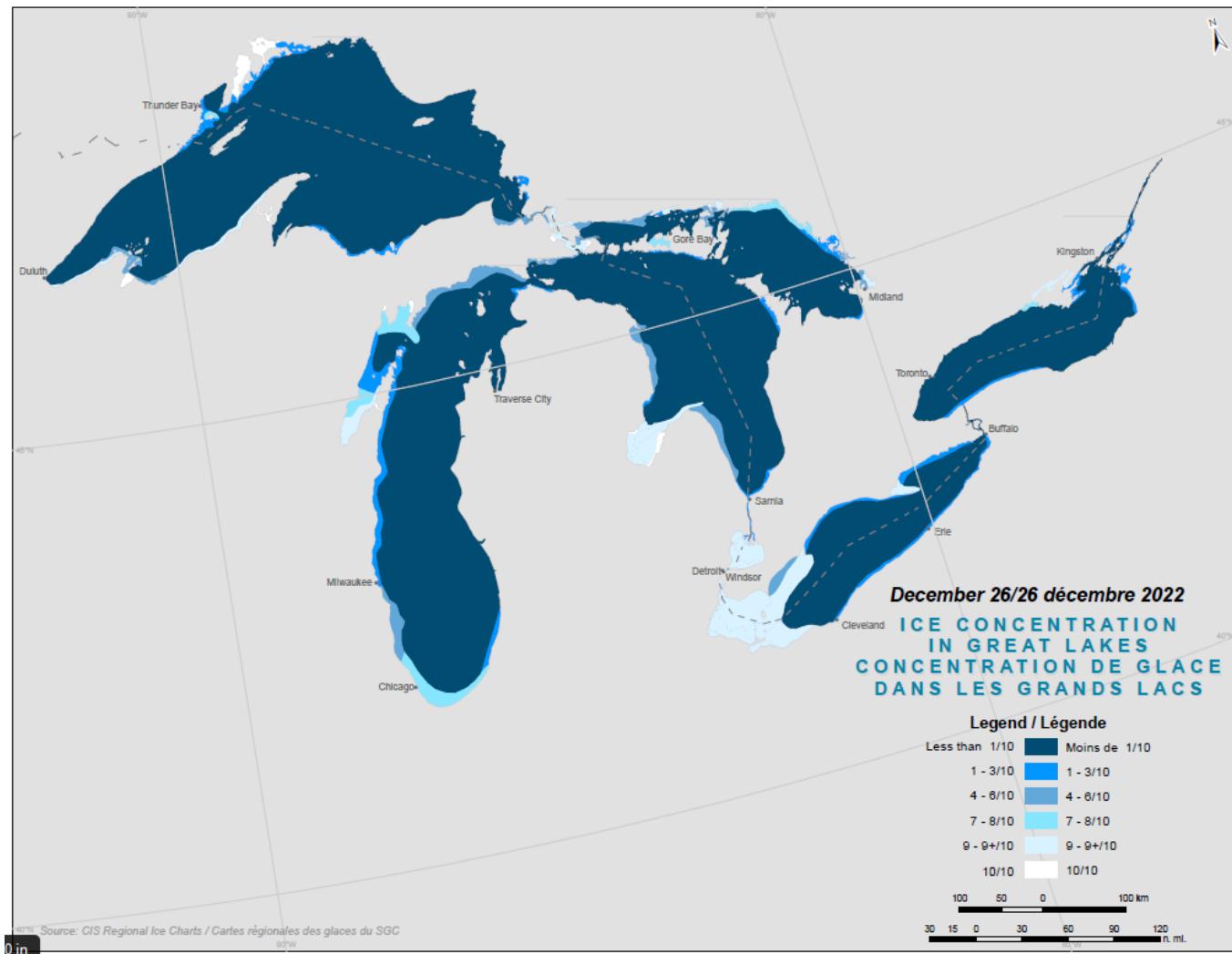


Figure 4: Ice Coverage on the Great Lakes, December 26<sup>th</sup> 2022

The above figure shows for December 15-26<sup>th</sup> cold spell what areas on the Great Lakes saw ice coverage form.

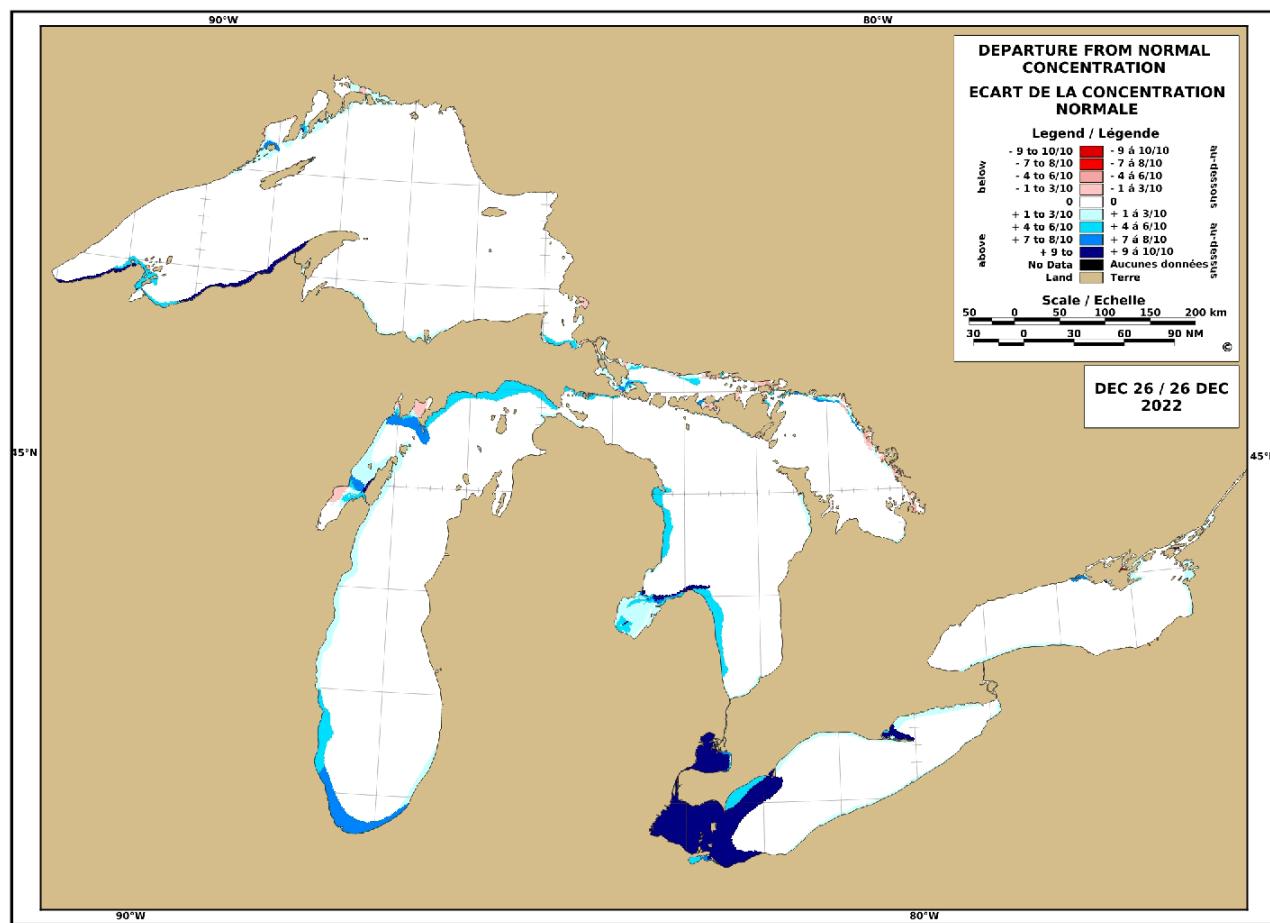


Figure 5: Departure from Normal Chart for December 26<sup>th</sup>, 2023.

Red is missing ice; Blue is extra ice compared to the median ice concentration from 1990-91 to 1919-20.

The above figure shows for December 15-26<sup>th</sup> cold spell what areas on the Great Lakes saw ice coverage that normally have no ice cover at this time period.

As Lake Erie, Lake St. Clair and Saginaw Bay are very shallow ice formation responds very quickly over these lakes when temperatures dip below freezing. These areas as well as the shores of Lake Michigan saw new and thin ice form at this time and had more ice than is normal during this stage of the season after the third week of December.

On the other lakes this early cold period after mid December was only able to form ice in shallow areas along the shores. Lake Superior for example saw ice form only along the south shore at this time from Duluth to near Houghton along the western shores of the Upper Peninsula. Lake Michigan saw thin ice form along the south shore and along the north shore from Mackinaw City westwards and in Green Bay. Lake Huron saw ice form in Saginaw Bay which is also very shallow at this time and along the shore from Saginaw to just south of Lexington. See figure 5 above.

The ice never had the chance to thicken as warm temperatures quickly returned ushered in with a weather system that arrived with winds and waves that quickly destroyed the ice and the warm temperatures that arrived prevented any further ice formation.

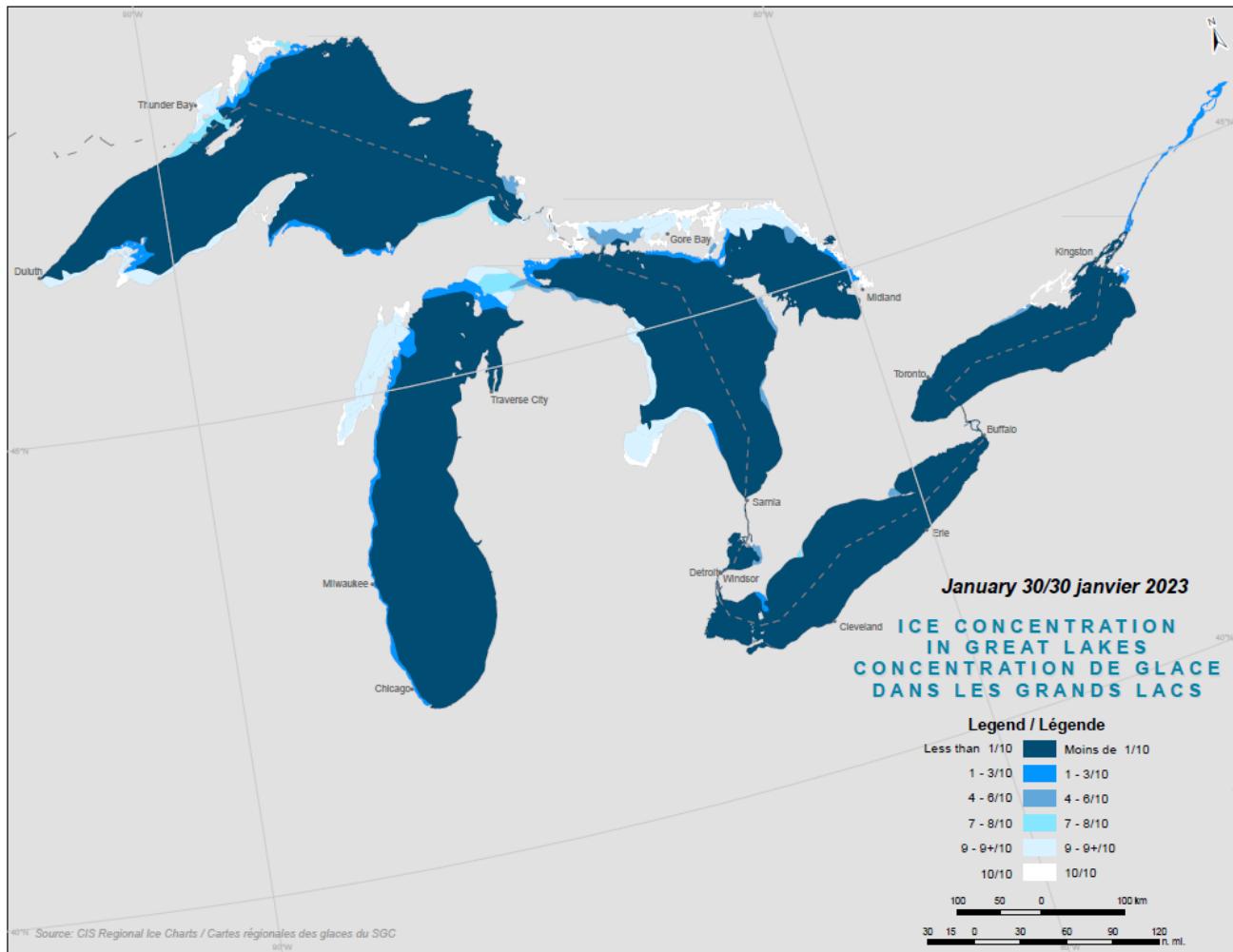


Figure 6: Ice Coverage on the Great Lakes, January 30<sup>th</sup> ,2023

This newly formed ice melted quickly as warm temperatures persisted over the Great Lakes for the first three weeks of January. In fact, even with the colder temperatures at the very end of January the average January temperatures were 2-3 degrees warmer over the northern lakes and 4-5 degrees warmer than is normal over the southern lakes. See figure 7.

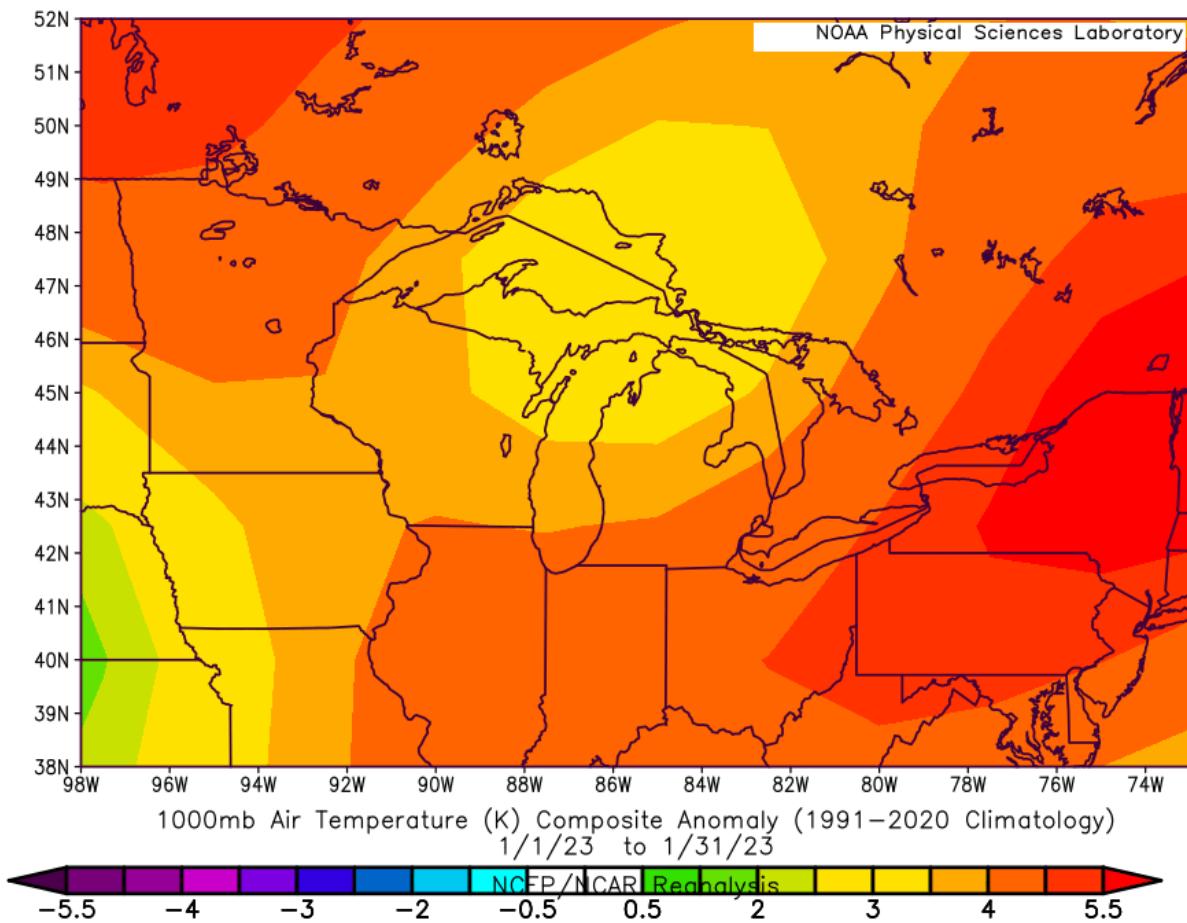


Figure 7: Surface Air Temperature Anomaly for the Great Lakes, 1-31 January 2023

This warm trend changed briefly to a second cold snap the last week of January lasting to the first week of February with rapid ice coverage growth once more during this second cold period of the season. The maximum ice concentration was during this time. Like the cold period in late December this one was also short lived, and temperatures quickly returned to above normal after the first week in February and generally temperatures remained above normal for the remainder of the season and correspondingly ice coverage remained significantly below normal over all the Great Lakes. Figure 8 below shows the colder than normal temperatures during the first week of February.

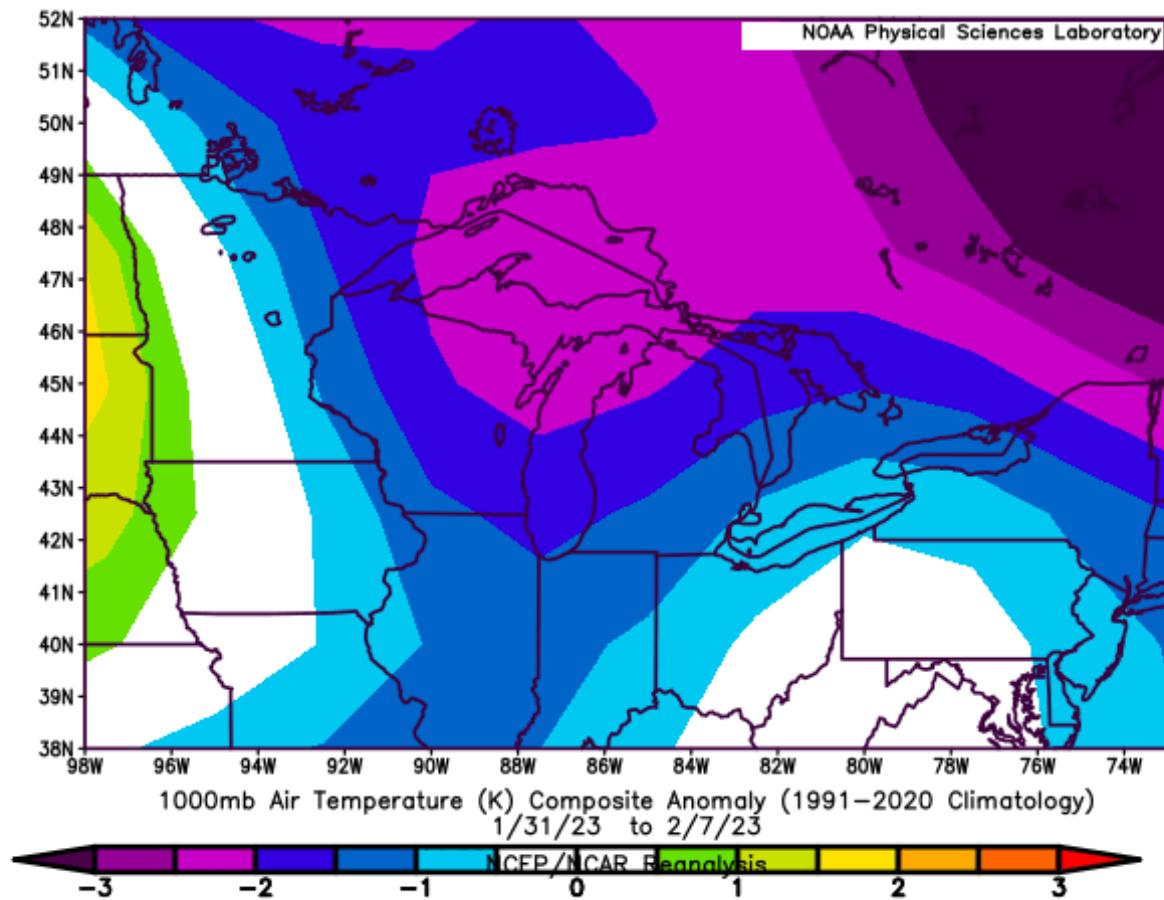


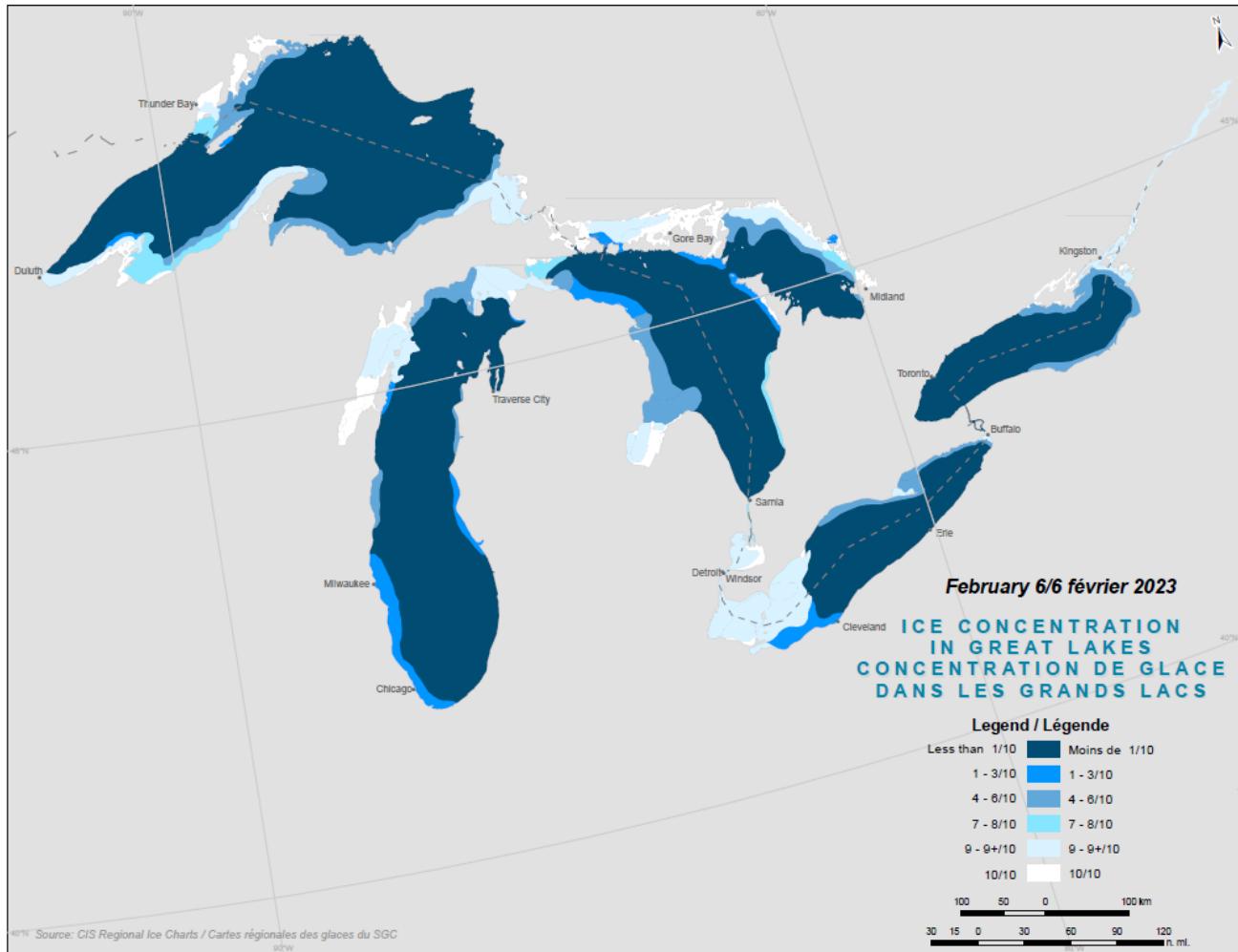
Figure 8: Surface Air Temperature Anomaly for the Great Lakes, 31 January-7 February 2023

The second and most significant cold period of the season occurred from late January to the first week in February.

This cold period saw the most significant ice coverage increase over the Great Lakes this season with all the lakes attaining their maximum ice coverage for the season at this time.

As can be seen from the figure for the ice coverage on the Great Lakes for February 6<sup>th</sup>, figure 9 below, ice formed over the northwestern part of Lake Superior as well along the south shore of Lake Superior to Whitefish Bay. Ice covered Whitefish Bay and Green Bay at this time as well as the shores of northern Lake Michigan. Many of these areas ended the week with more ice coverage than would be normal for this time of the season. Lake Erie saw ice coverage which had largely melted after forming late in December return to the western Basin at this time and recorded its highest ice coverage for the season at this time as well. Lake Erie would see no ice form on the eastern half of the Lake which is more normal for this time of the season the departure

from normal chart below shows this lack of ice as large areas of red representing missing ice as compared to normal ice coverage over Lake Erie. This period also saw ice coverage increase along the north shore of Lake Huron as well as in the North Channel.



**Figure 9: Ice Coverage on the Great Lakes, February 6<sup>th</sup>, 2023,**  
This chart shows the maximum ice coverage reached on the Great Lakes this season.

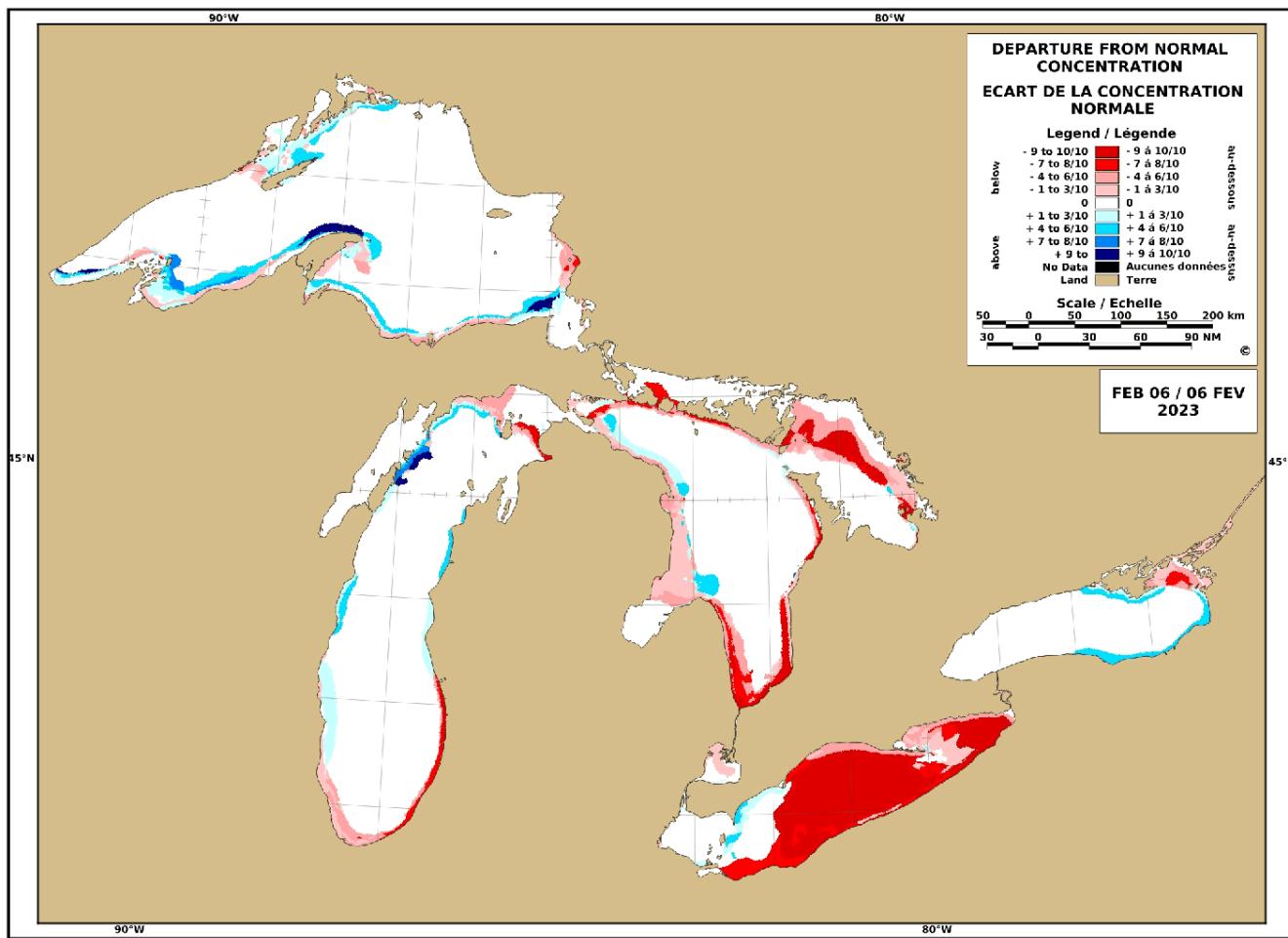


Figure 10: Departure from Normal Chart for February 6<sup>th</sup>, 2023.

Red is missing ice; Blue is extra ice compared to the median ice concentration from 1990-91 to 2019-20.

The maximum ice coverage over the combined Great Lakes occurred during this period and occurred the week of February 5<sup>th</sup> though the total coverage was less than 20% which is lower than the normal amount of 30% for this time in the season and less than half the over 50% that occurred last year. Having the maximum ice coverage occur this early in the season would mean that the ice is still thin. As the season progressed a quick return to warmer than normal temperatures did not allow this ice that had formed to thicken so that later in the winter the amount of thick ice (30-70 cm) was substantially lower this year than both last year and with what is normally seen, especially on the southern lakes. See figure 11 below. See also discussions for Lake Michigan, Lake Erie, and Lake Ontario in their respective sections below.

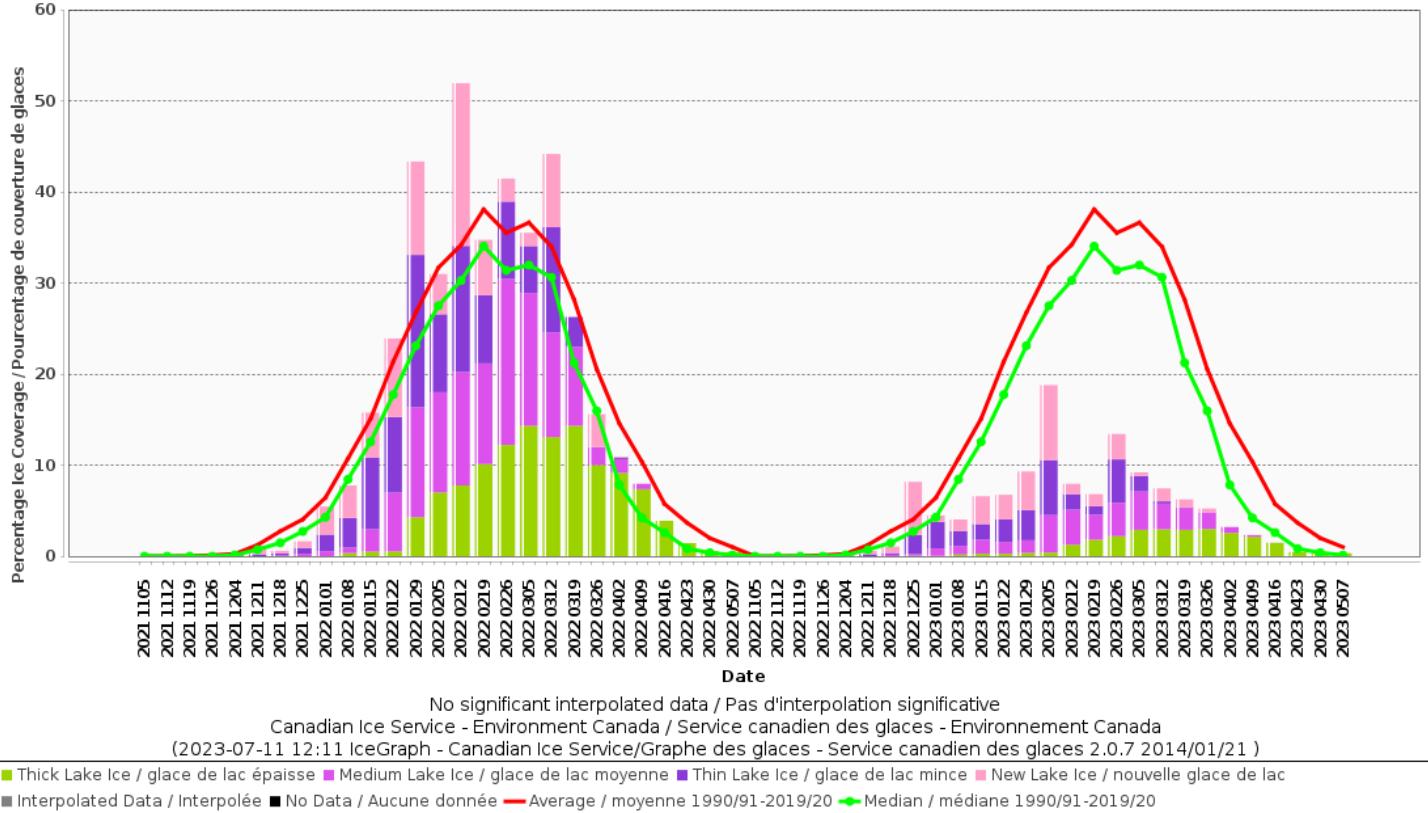
**Multiple Seasons: Weekly Ice Coverage by Stage of Development for the seasons 2021/22 and 2022/23, Weeks: 1105-0507**



**Plusieurs saisons: Couverture des glaces hebdomadaire par stade de formation pour les saisons 2021/22 et 2022/23, Semaines: 1105-0507**

Regional Great Lakes /  
Régionale Grands Lacs

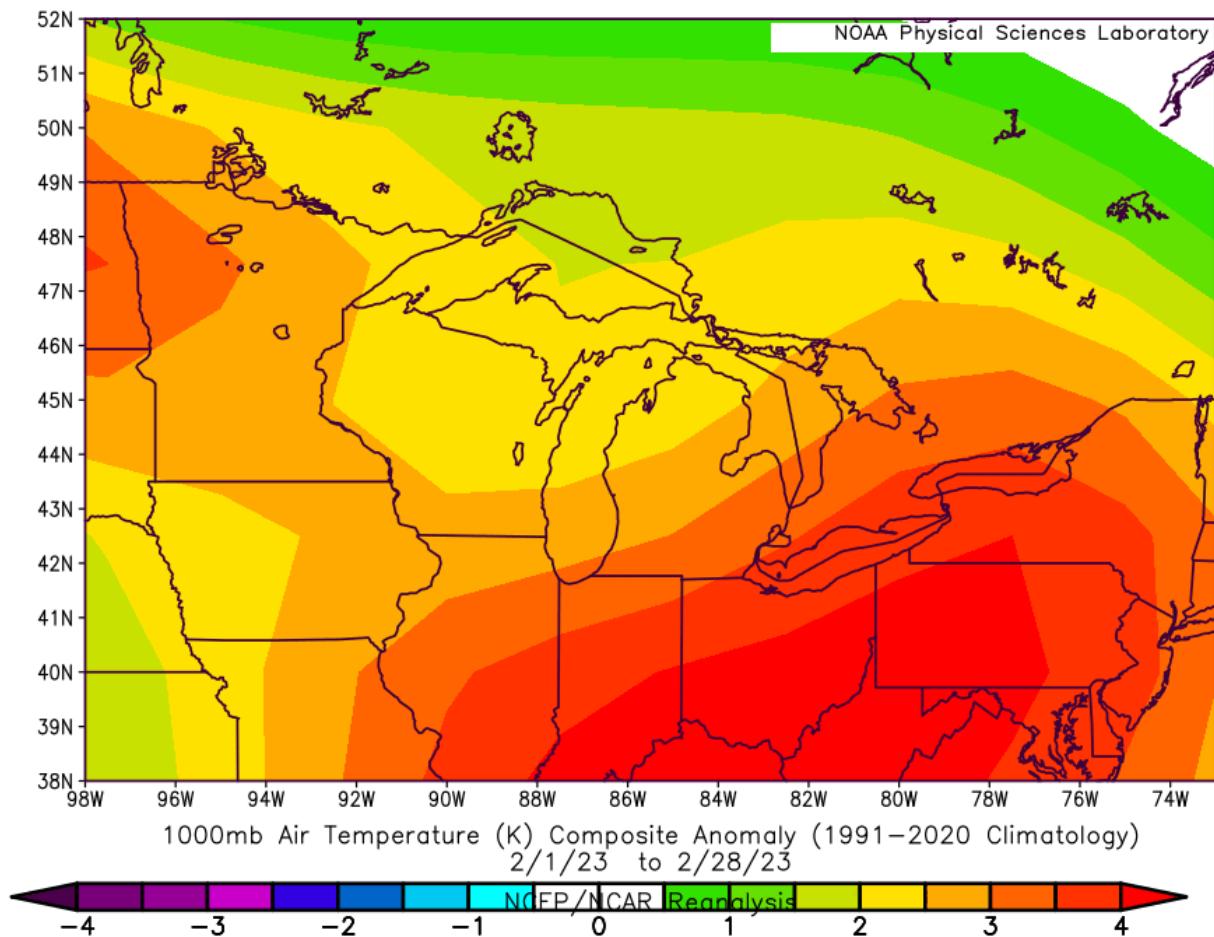
Area / Aire : 249,254 km<sup>2</sup>



**Figure 11: Weekly Ice Coverage on the Great Lakes for winters 2021-23 showing stage of development.**

Figure 11 above shows both how much less ice this year had than last year, how much less ice this year had to normal years and how much less thick ice this year had than last year.

Soon after attaining the maximal ice coverage amounts over the Great Lakes in early February the ice cover on the Great Lakes dipped to near record lows in mid-February and remained only slightly above record low levels for most of the rest of the season. This rapid reduction in ice concentration was brought about by a return to persistent warm temperatures that were several degrees above the normal seasonal values.



**Figure 12: Surface Air Temperature Anomaly for the Great Lakes, 1-28 February 2023**

Figure 12 above shows how much warmer than normal air temperatures were during February with temperatures over Lake Erie reaching more than 5 degrees Celsius warmer than normal.

## Temperature Anomaly: 2023-02 Anomalie de température: 2023-02



Gouvernement  
du Canada

Government  
of Canada

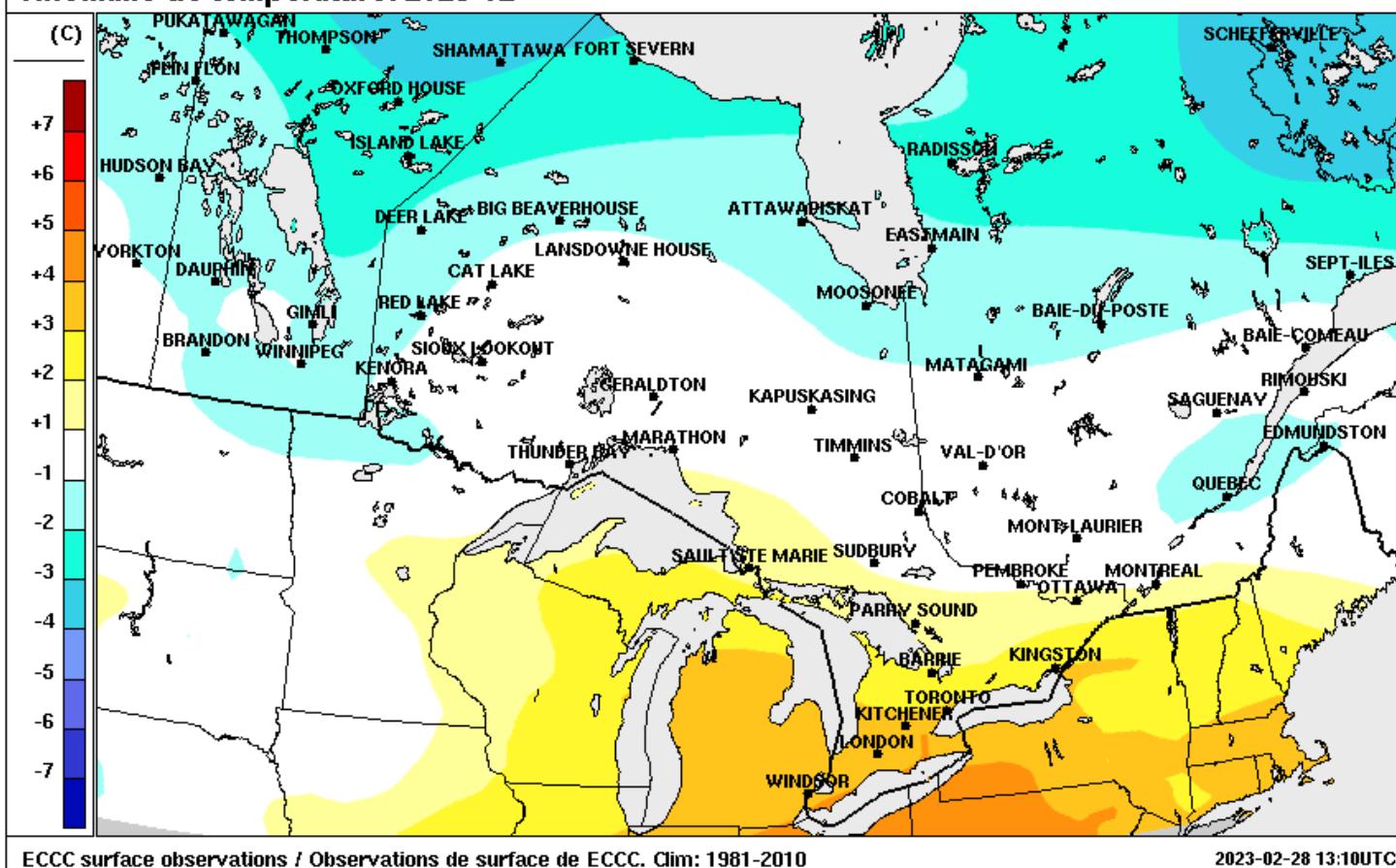


Figure 13: Surface Air Temperature Anomaly for the Great Lakes, 1-28 February 2023

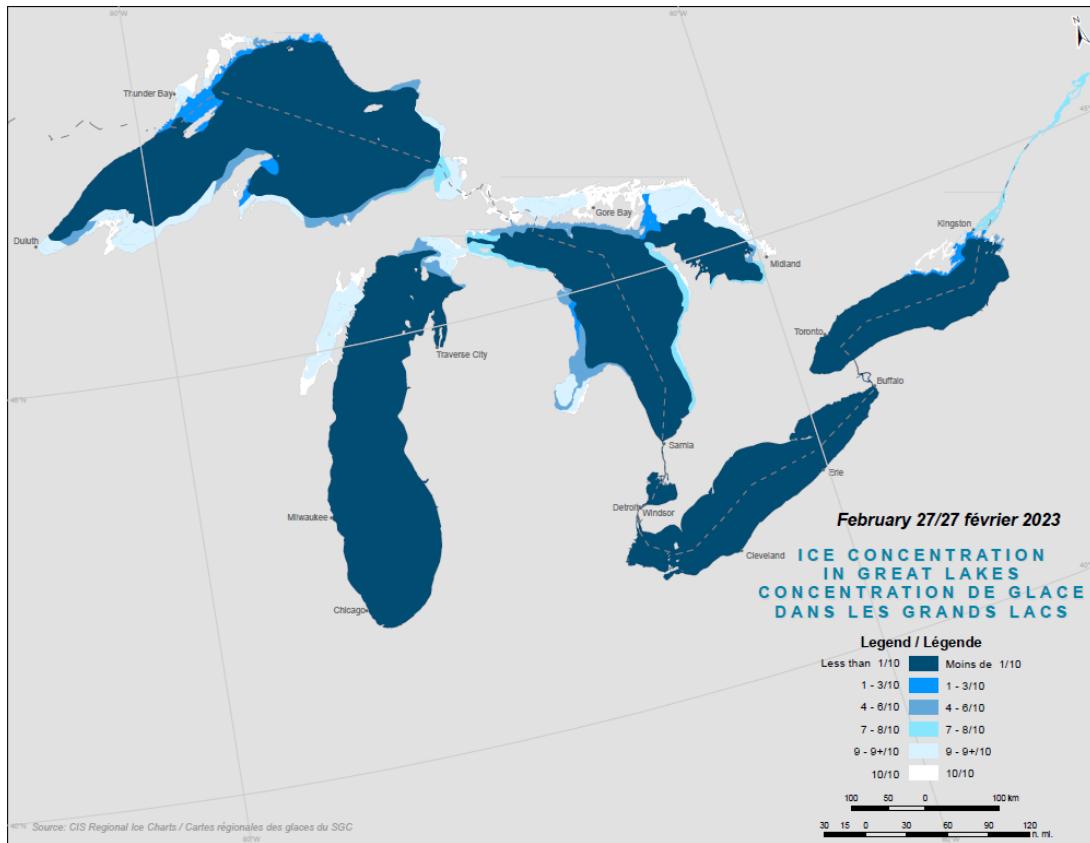


Figure 14: Ice Coverage on the Great Lakes, February 27<sup>th</sup>, 2023

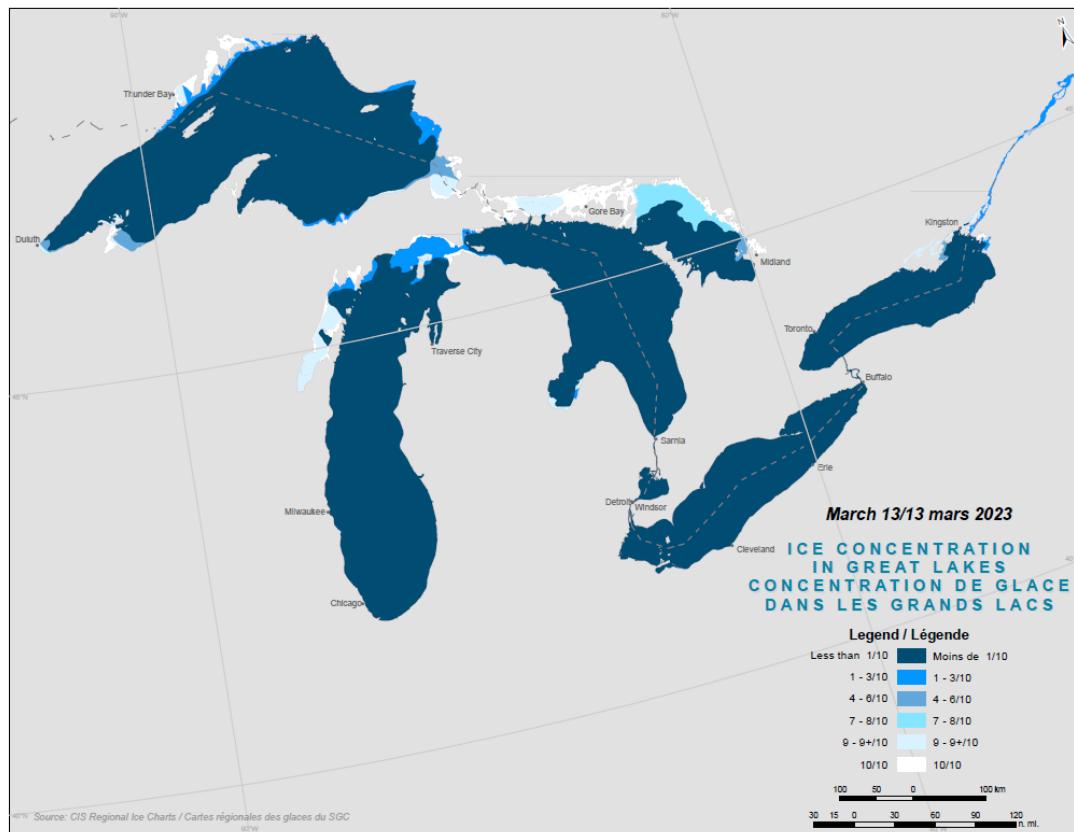
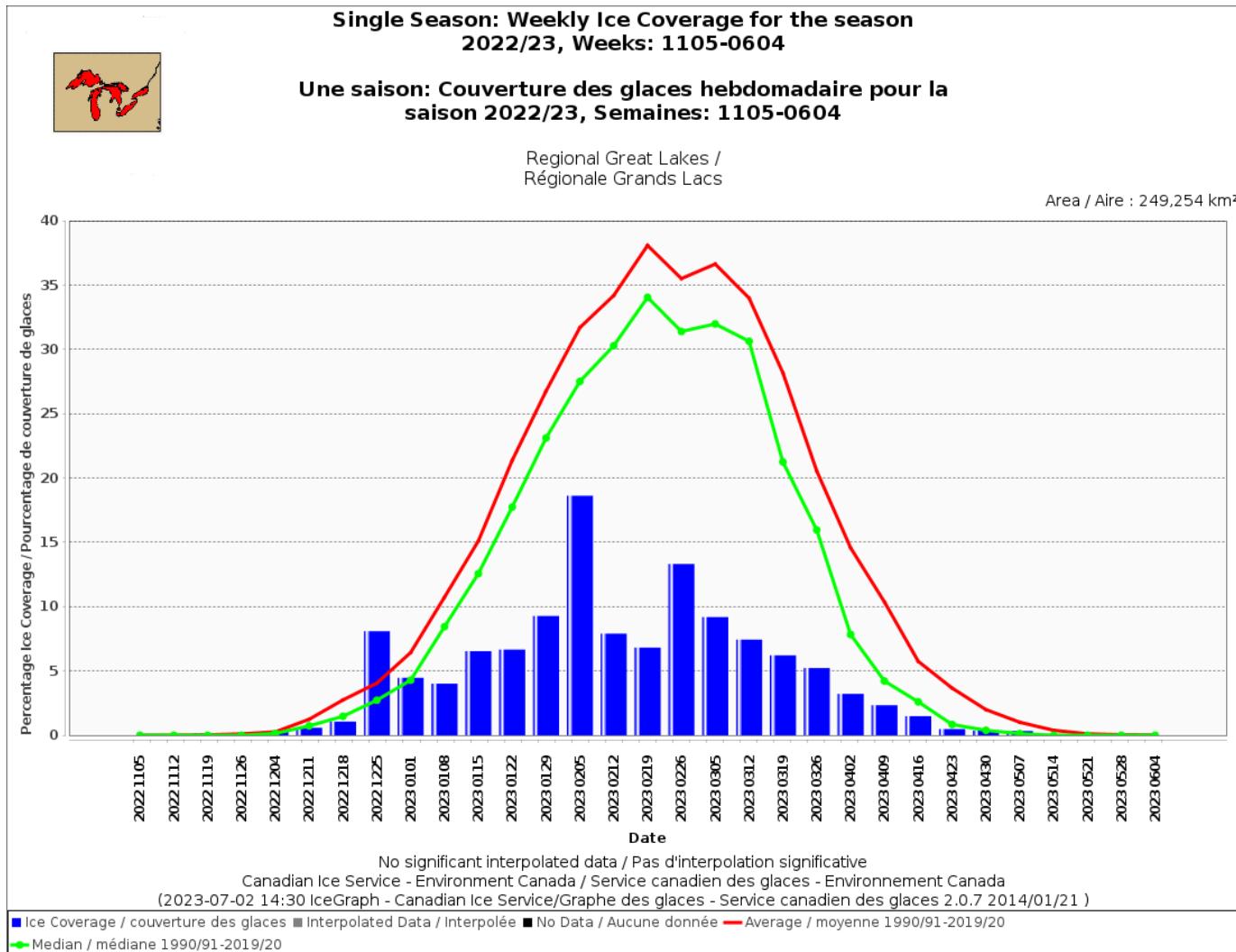


Figure 15: Ice Coverage on the Great Lakes, March 13<sup>th</sup>, 2023



**Figure 16: Weekly Ice Coverage for the Great Lakes, winter 2022-2023**

Can see from figure 16 showing the weekly ice coverage over the Great Lakes for the season that except for the rapid growth of new ice during the early cold spell in mid December, ice that was subsequently destroyed that this ice season was well below average.

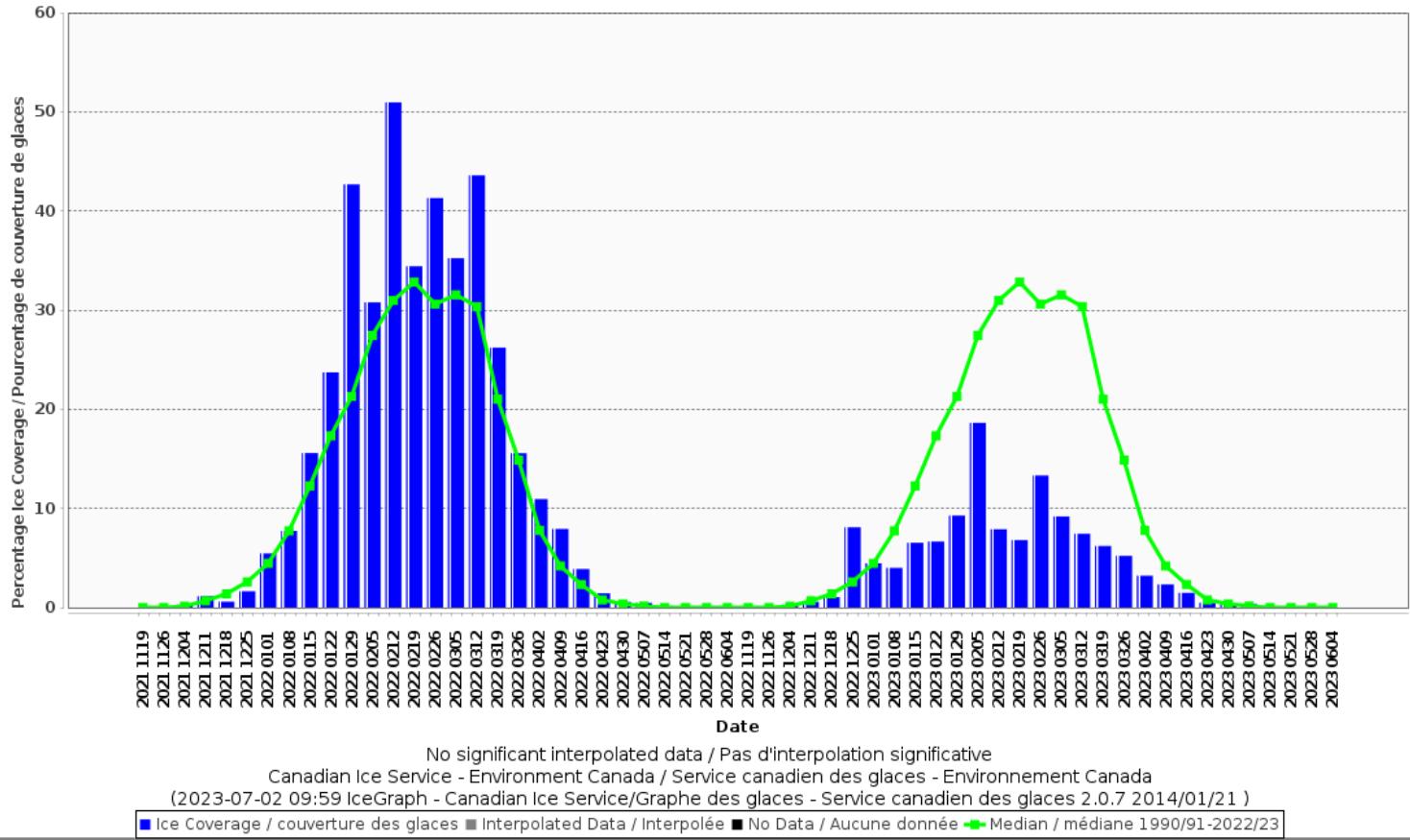
**Multiple Seasons: Weekly Ice Coverage for the seasons  
2021/22 and 2022/23, Weeks: 1119-0604**



**Plusieurs saisons: Couverture des glaces hebdomadaire  
pour les saisons 2021/22 et 2022/23, Semaines:  
1119-0604**

Regional Great Lakes /  
Régionale Grands Lacs

Area / Aire : 249,254 km<sup>2</sup>



**Figure 17: Great Lakes Ice Coverage for 2021-22 season and 2022-2023 season.**

*Figure 17 comparing this ice season to last years more normal ice season shows the extent to how much less ice there was this year.*

The spring melt started on time in mid-March however there was only about a third the amount of ice to melt as would be expected in on average and the ice was generally located only the thicker ice in sheltered areas such as North Channel of Lake Huron, the Bays along the northwestern part of Lake Superior, Keweenaw and Chequamegon Bays and within Green Bay.

The spring melt finally finished when the last of the ice on the Great Lakes melted in Nipigon Bay on May 15<sup>th</sup>, bringing a close to the 2021-2022 ice season.

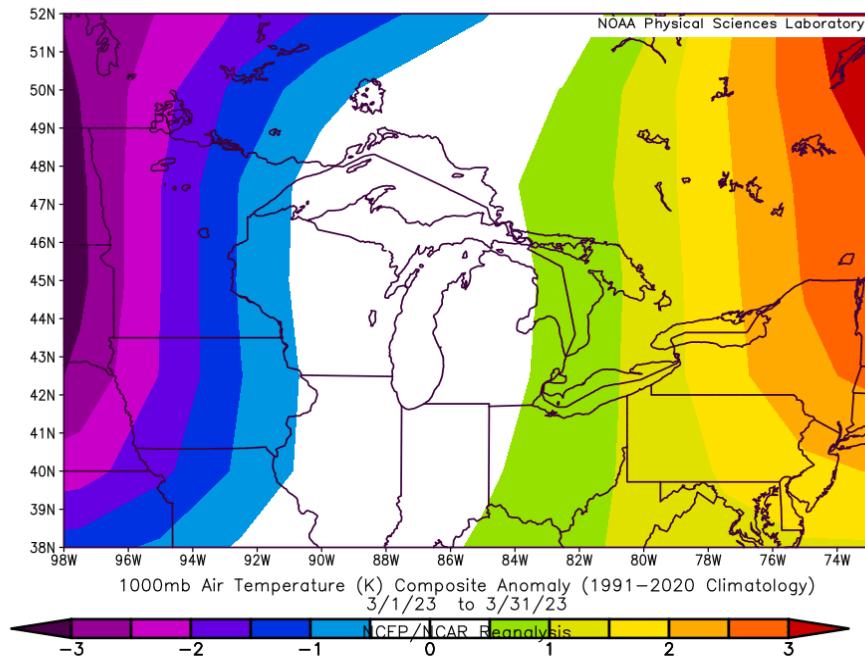


Figure 18: Surface Air Temperature Anomaly for the Great Lakes, 1-31 March 2023.

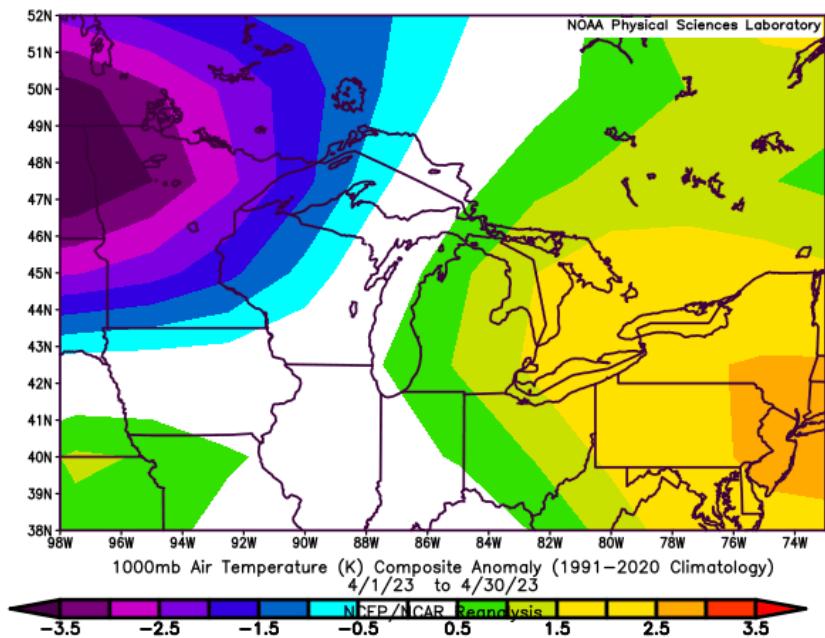


Figure 19: Surface Air Temperature Anomaly for the Great Lakes, 1-30 April 2023

Figures 18 and 19 above show how that some colder than normal temperatures existed over the western parts of Lake Superior during late March and April. This however is later than the normal maximum ice period of about the first week of March for Lake Superior.

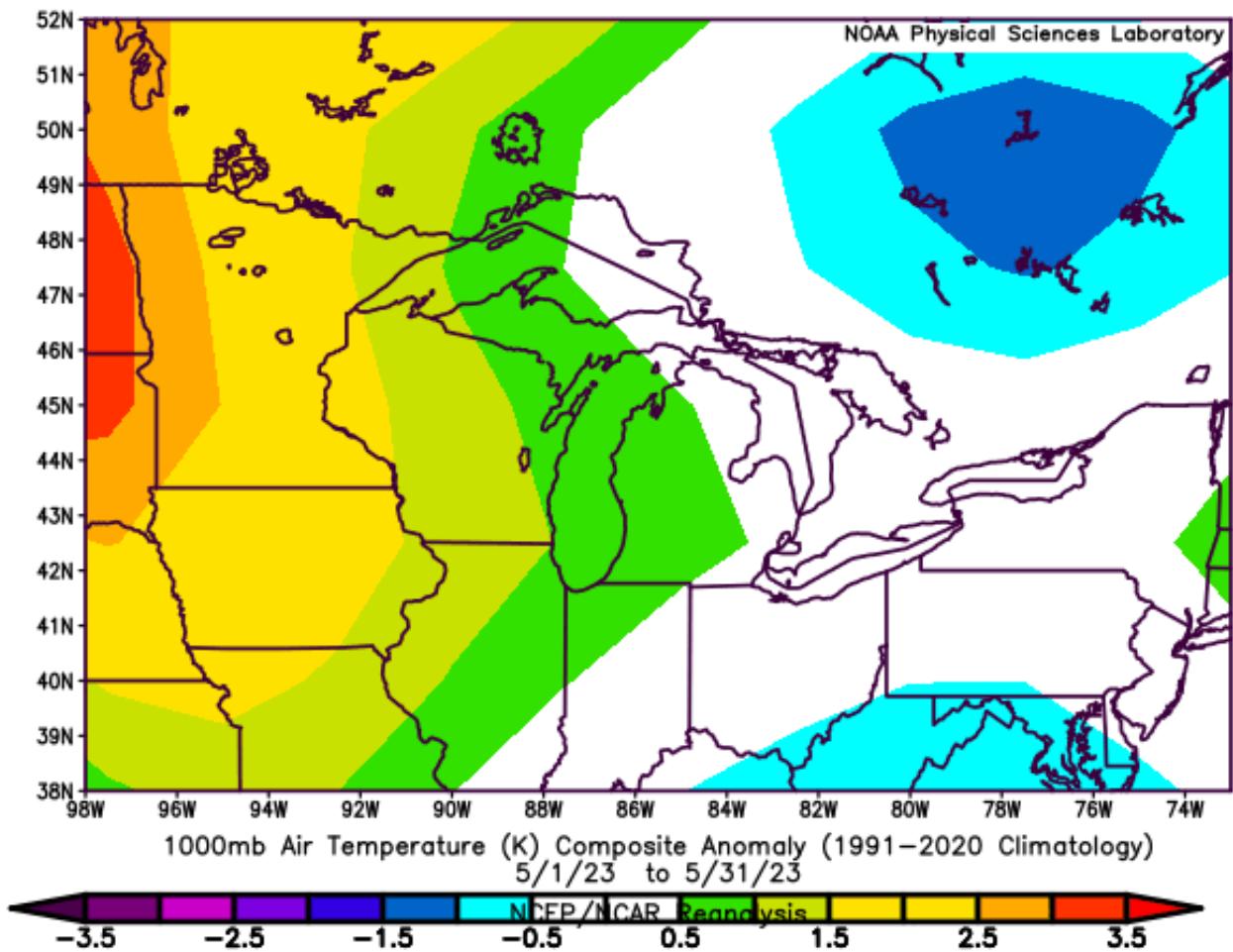


Figure 20: Surface Air Temperature Anomaly for the Great Lakes, 1-31 May 2023

Figure 20 above shows a return to normal to slightly above normal temperatures over the Great Lakes in May.

## Great Lakes Ice Coverage for the 2022-23 season:

	Ice coverage in %	Average ice coverage from 1973-2023 in %	+ above / - below average
Dec 7	0.4	1.0	-0.6%
Dec 12	0.5	3.0	-2.5%
Dec 19	0.9	5.0	-4.1%
Dec 26	8.0	6.0	+2%
Jan 2	4.0	11.0	-7%
Jan 9	4.0	16.0	-12%
Jan 16	6.0	22.0	-16%
Jan 23	7.0	25.0	-18%
Jan 30	9.0	30.0	-21%
Feb 6	18.0	36.0	-18%
Feb 13	8.0	41.0	-33%
Feb 20	7.0	43.0	-36%
Feb 27	1.0	42.0	-41%
Mar 6	9.0	41.0	-32%
Mar 13	7.0	36.0	-29%
Mar 20	8.0	29.5	-21.5%
Mar 27	5.0	22.0	-17%
Apr 3	3.5	15.5	-12%
Apr 10	2.0	11.0	-9%
Apr 17	2.0	7.0	-5%
Apr 24	0.5	4.5	-4%
May 1	0.4	3.0	-2.6%
May 8	0.3	2.0	-1.7%
May 15	0.0	0.0	0%

Table 1: Great Lakes ice coverage for the 2022-23 season compared to average concentrations from 1972-1973 to 2022-2023

Table 1 above shows that the Great Lakes had below normal ice coverage amounts every month this year except for December which had slightly more ice than is normal. The below normal ice amounts were due to the persistent above normal temperatures during the 2022-23 ice season and were greatest during the months of February and March when normally the Great Lakes have their greatest amount of ice cover. The above normal ice cover in December was due to the rapid ice cover increase mainly over the shallow western part of Lake Erie and along the shores of the other lakes. Much of this newly formed ice melted soon after it formed with a return to warmer temperatures.

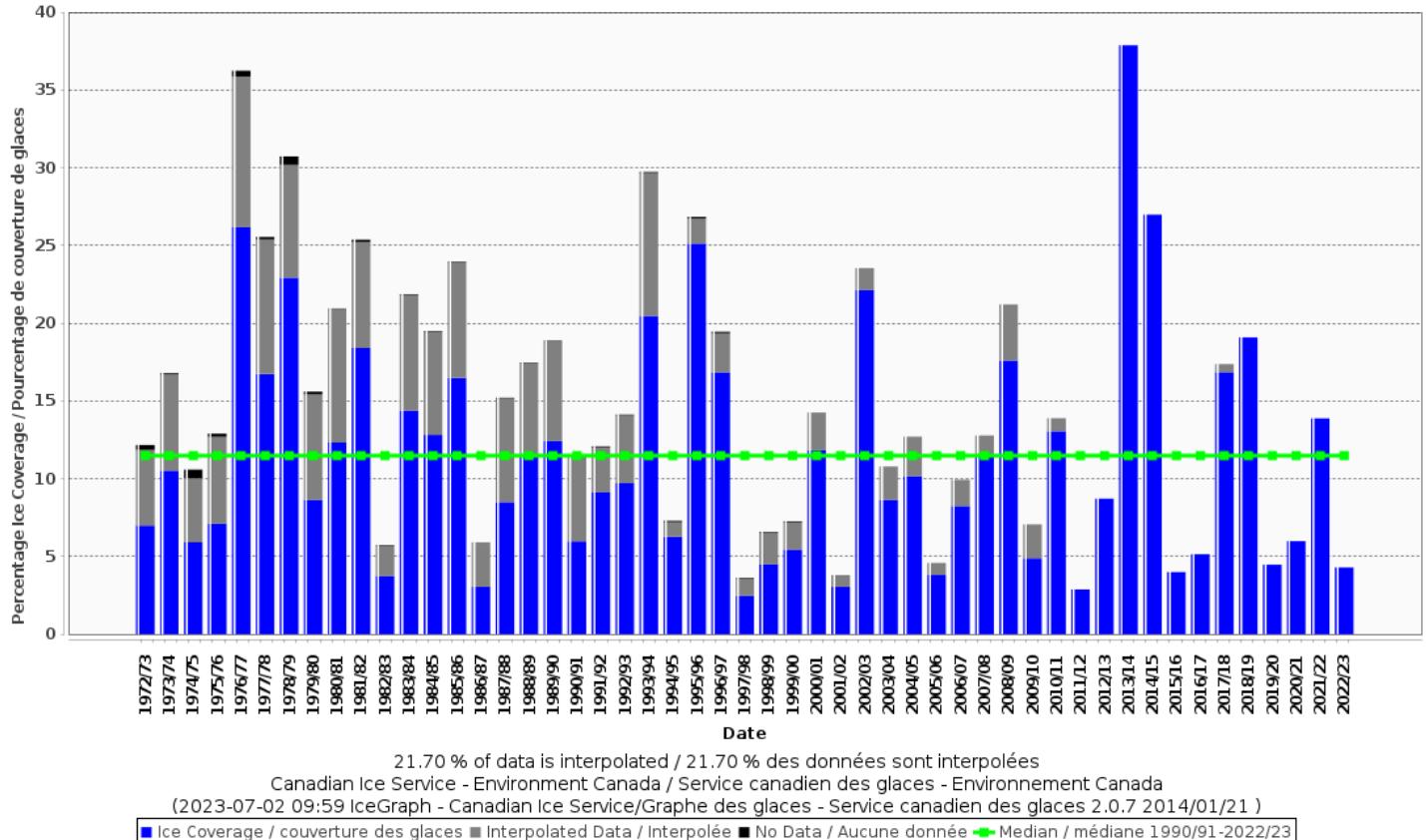
**Historical Total Accumulated Ice Coverage (TAC) for  
the weeks 1119-0604, seasons:1972/73-2022/23**



**Total accumulé de la couverture des glaces historique  
(TAC) pour les semaines 1119-0604,  
saisons:1972/73-2022/23**

Regional Great Lakes /  
Régionale Grands Lacs

Area / Aire : 249,254 km<sup>2</sup>



**Figure 21: Historical Total Accumulated Ice Coverage on the Great Lakes, 1972-1973 to 2022-2023**

This season ended very similar in ice cover amounts to the very low ice year of 2020. The 2022-23 season though not a record season is one of the lowest ice years on record both for amount of ice and thickness of the ice.

The total accumulated ice coverage (TAC) for the 2022-2023 ice season was 4.5%, which places this season below half the 30-year median of 10.7%. By rank the lowest ice coverage year was 2012 with less than 3% TAC. This year placed within a group of low ice coverage years with just slightly more ice but still below 5%.

The 2022-23 ice season finished with 4.5% TAC placing it the 5<sup>th</sup> lowest ice season since 1972-1973.

Maximum Ice Coverage for the weeks 1119-0604, seasons:  
1972/73-2022/23



La couverture maximale de glace pour les semaines  
1119-0604, saisons: 1972/73-2022/23

Regional Great Lakes /  
Régionale Grands Lacs

Area / Aire : 249,254 km<sup>2</sup>

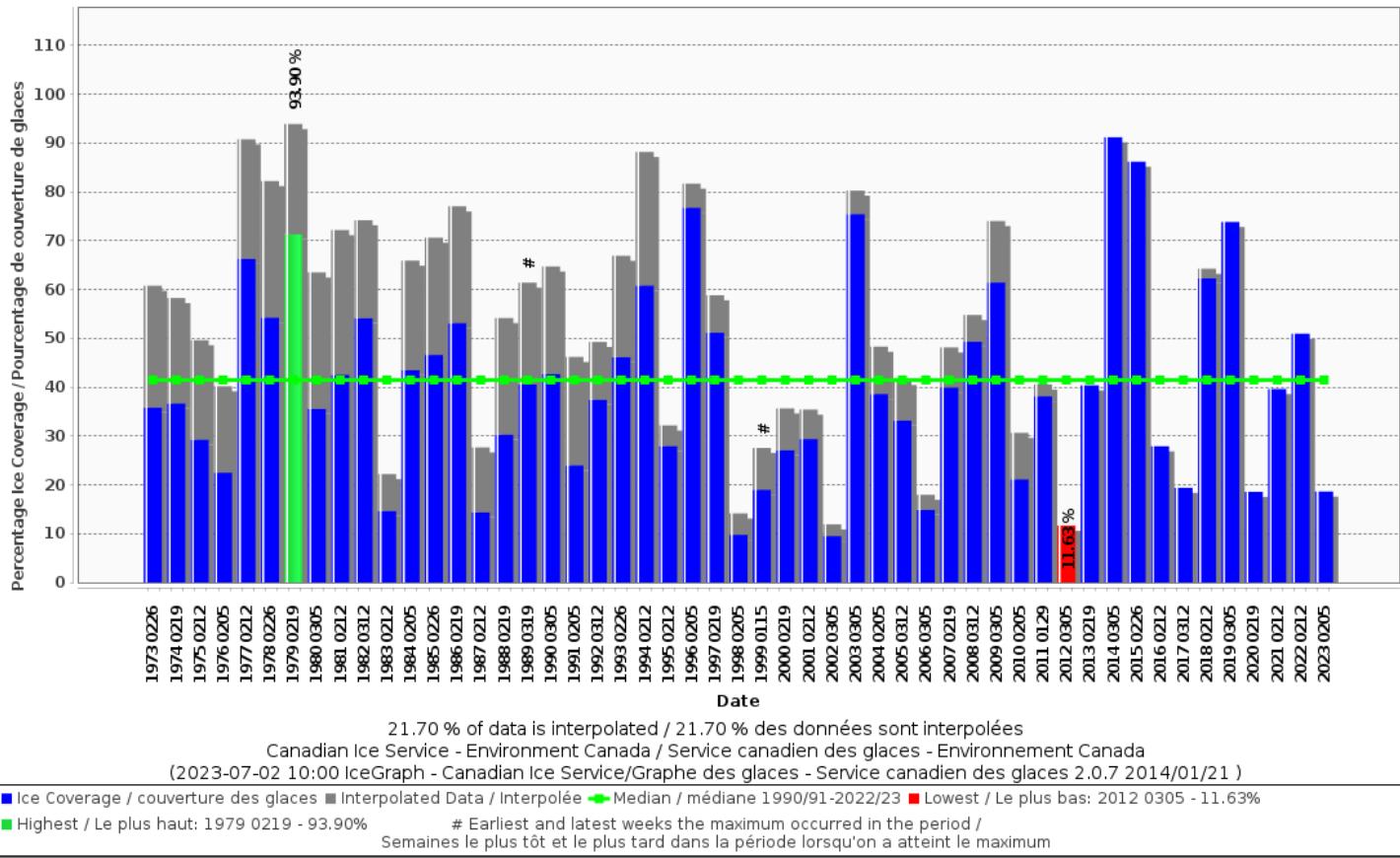


Figure 22: Maximum Ice Coverage on the Great Lakes, 1972-1973 to 2022-2023

The maximum ice coverage occurred on the combined Great Lakes on the week of February 5<sup>th</sup>. This is two to three weeks early as the maximum coverage on the Great Lakes is usually near the end of February or early in March, see peak in median ice coverage on the weekly ice coverage , figure 16 above.

## Lake Superior

The ice season started on Lake Superior near the end of the third week of November with ice coverage forming in Nipigon Bay and Black Bay along the northwestern shore as well as in Chequamegon Bay on the south shore. Above normal temperatures until the last week of December prevented further early season ice from forming on any other parts of the lake. It wasn't until the last week of December during a period of below normal colder temperatures that ice coverage started on Lake Superior outside of these three Bays. During this last week in December ice formation progressed along the south shore from Duluth eastwards along the south shore, from Grand Marais northeastwards to Marathon as well as along the shores in Whitefish Bay.

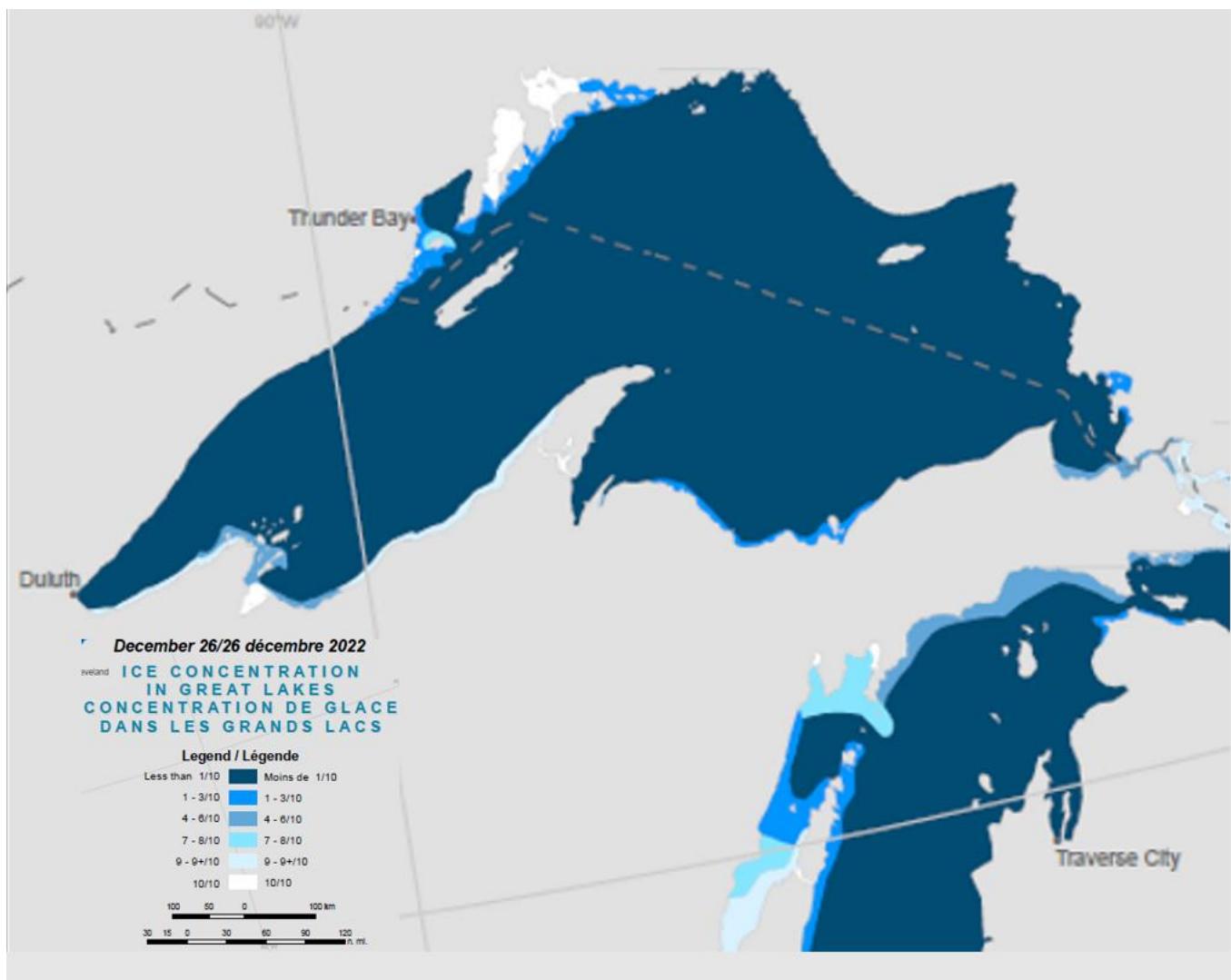


Figure 23: Ice Coverage on the Lake Superior, December 26<sup>th</sup>, 2023

At the end of this brief cold spell that the end of December temperatures over Lake Superior remained above normal and ice coverage did not grow until the last week in January and first week in February which saw the second and most significant cold outbreak of the season, see figure 25 below. This cold outbreak ended with ice coverage increasing to the maximum value on Lake Superior for the season on February 5<sup>th</sup>. The northwestern shores from Thunder Bay to Black Bay became ice covered at this time as did the shore from Duluth to Whitefish Bay. Whitefish Bay became ice covered at this time as well, see figure 24 below.

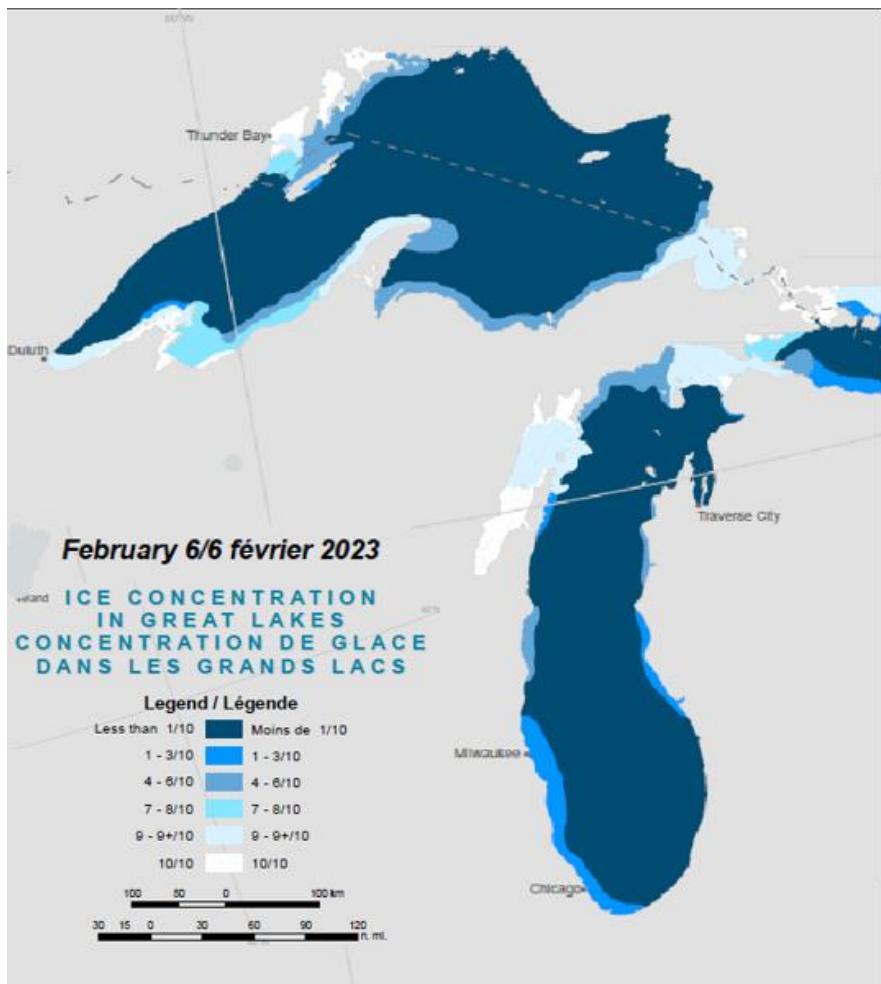


Figure 24: Ice Coverage on the Western Great Lakes, February 5<sup>th</sup>, 2023

Figure 24 above shows the ice coverage that formed in shallow areas along the shores after the first major cold spell in late January and the first week of February over the western Great Lakes.

By the first week in February the only areas that had ice coverage thicker than thin ice were Thunder Bay, the Apostle Islands and Keweenaw Bay and the western shores of Whitefish Bay which had medium lake ice (15-30 cm) and Black Bay, Nipigon Bay and

Chequamegon Bay which had thick lake ice (30-70 cm). By the end of February some thick ice also formed along the shore in Whitefish Bay. The only other area to form ice thicker than thin ice for the remainder of the season along parts of the south shore, the northwest shore from Thunder Bay to Marathon and parts of the eastern shore from Wawa southwards which had medium lake ice along the shore. Isolated areas of thick lake ice also formed in sheltered bays east of Marquette by late February.

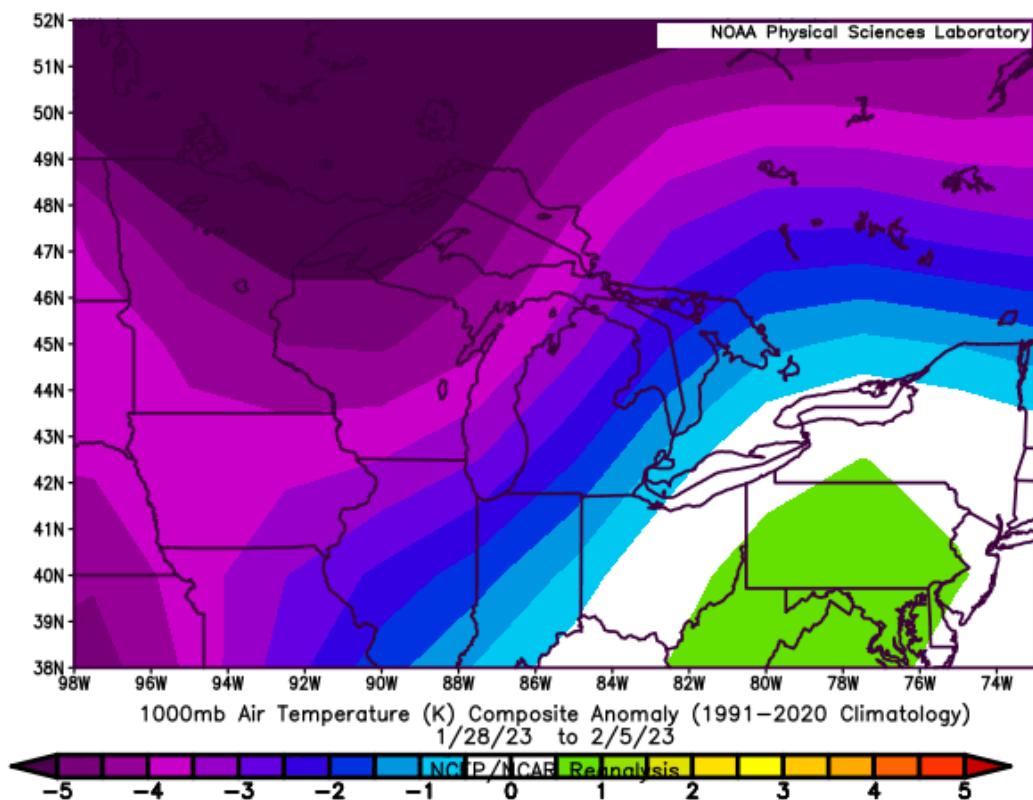


Figure 25: Surface Air Temperature Anomaly for the Great Lakes, January 28 - February 5, 2023

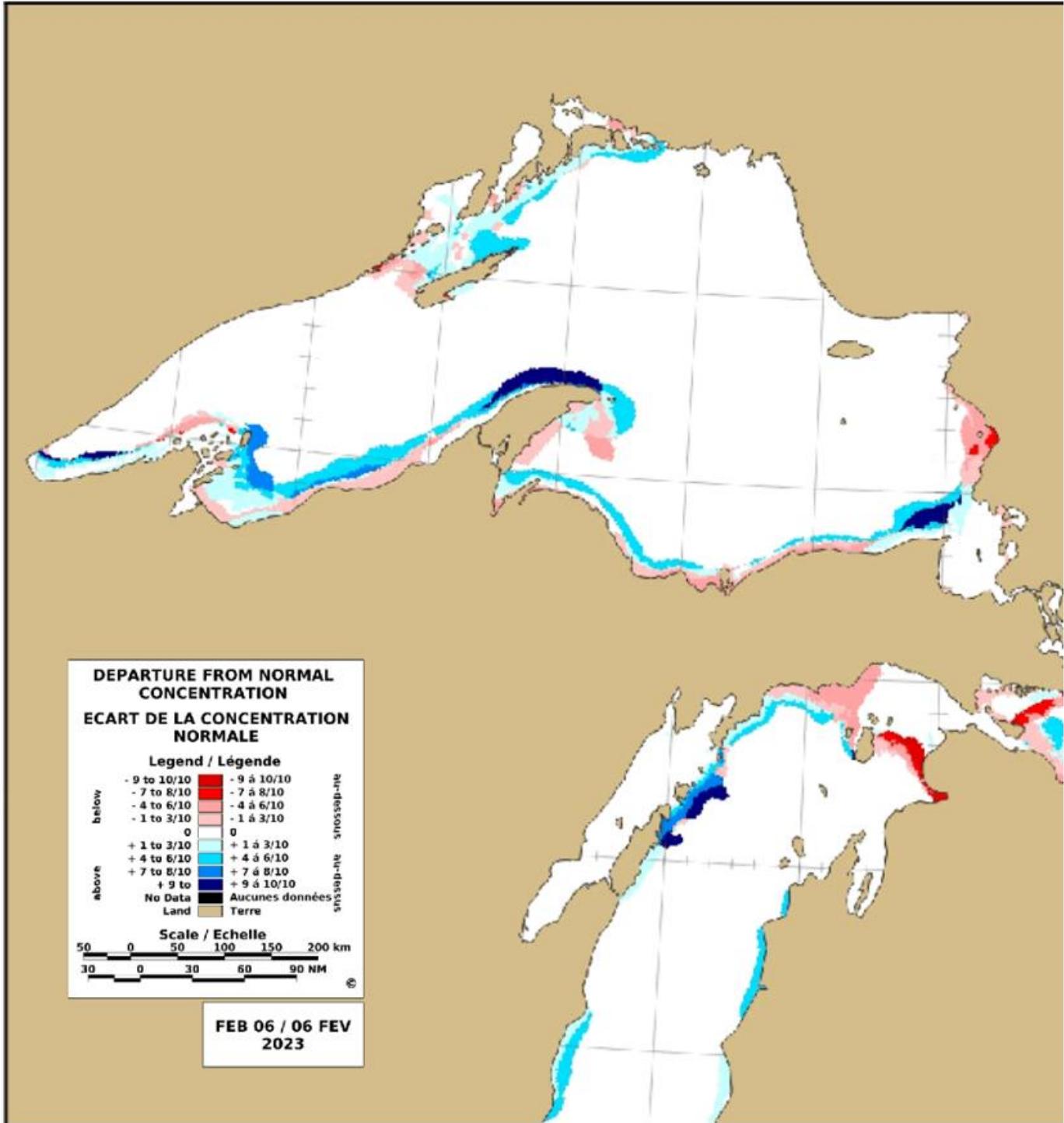


Figure 26: Departure from Normal Chart for February 6<sup>th</sup>, 2023.  
 Red is missing ice; Blue is extra ice compared to the median ice concentration from 1990-91 to 2019-20

Figure 26 above shows in blue the greater than normal amounts of ice coverage that formed along the shores the first week of February.

Warm temperatures returned quickly during the second week in February and about half the ice coverage that had formed along the shores was lost by mid February. There was a third and last cold period over Lake Superior that allowed for increased ice coverage along the southern and eastern shores at the end of February lasting to

the first week in March. This too was short lived and warm above seasonal temperatures returned by the second week in March and then temperatures remained above normal for the rest of the season.

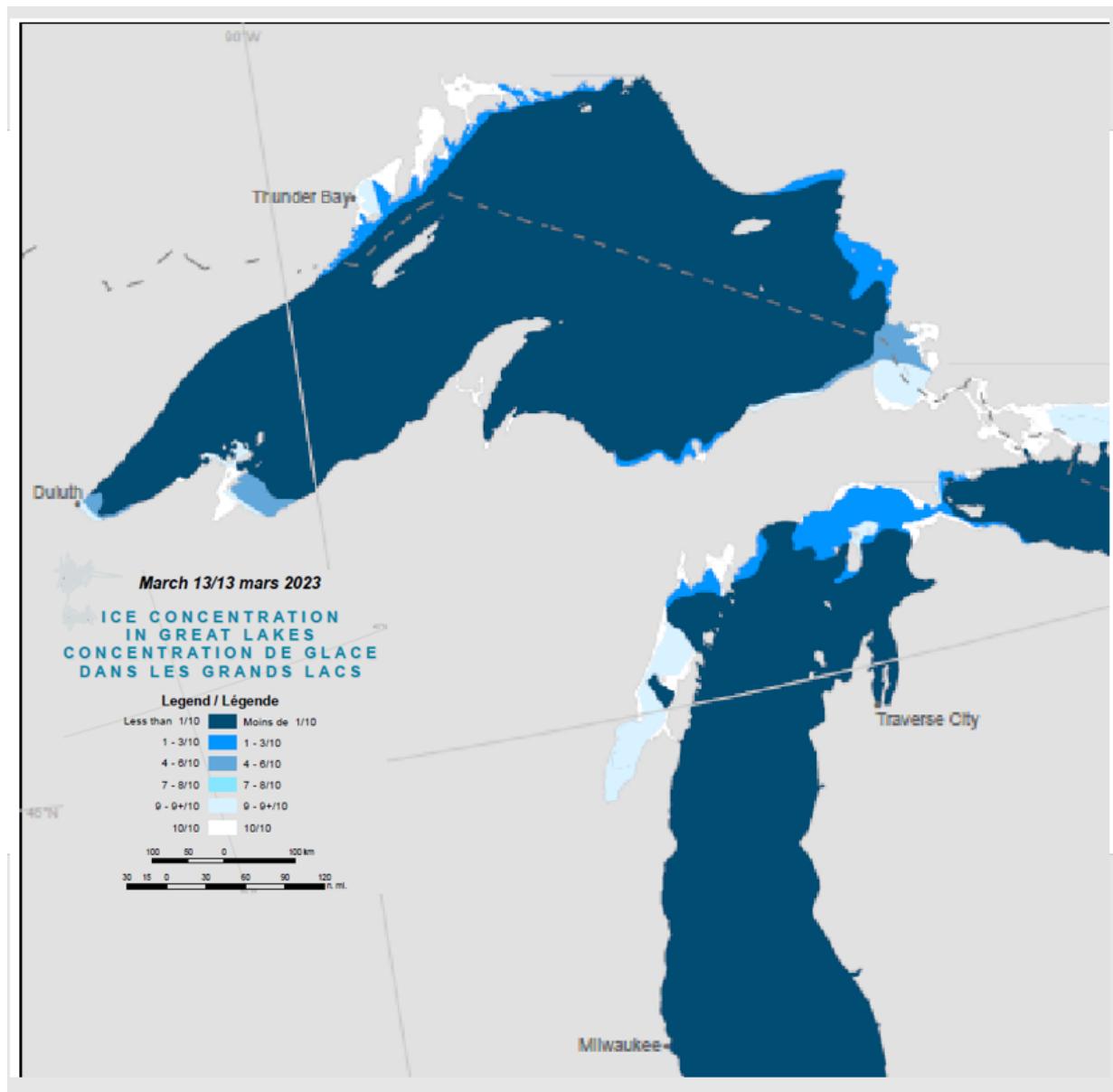


Figure 27: Ice Coverage on the Western Great Lakes, March 13<sup>th</sup>, 2023

Figure 27 above shows that much of the ice coverage that formed along the shores the first week of February had melted by mid March due to warm temperatures. The thicker ice found in protected areas such as bays remained,

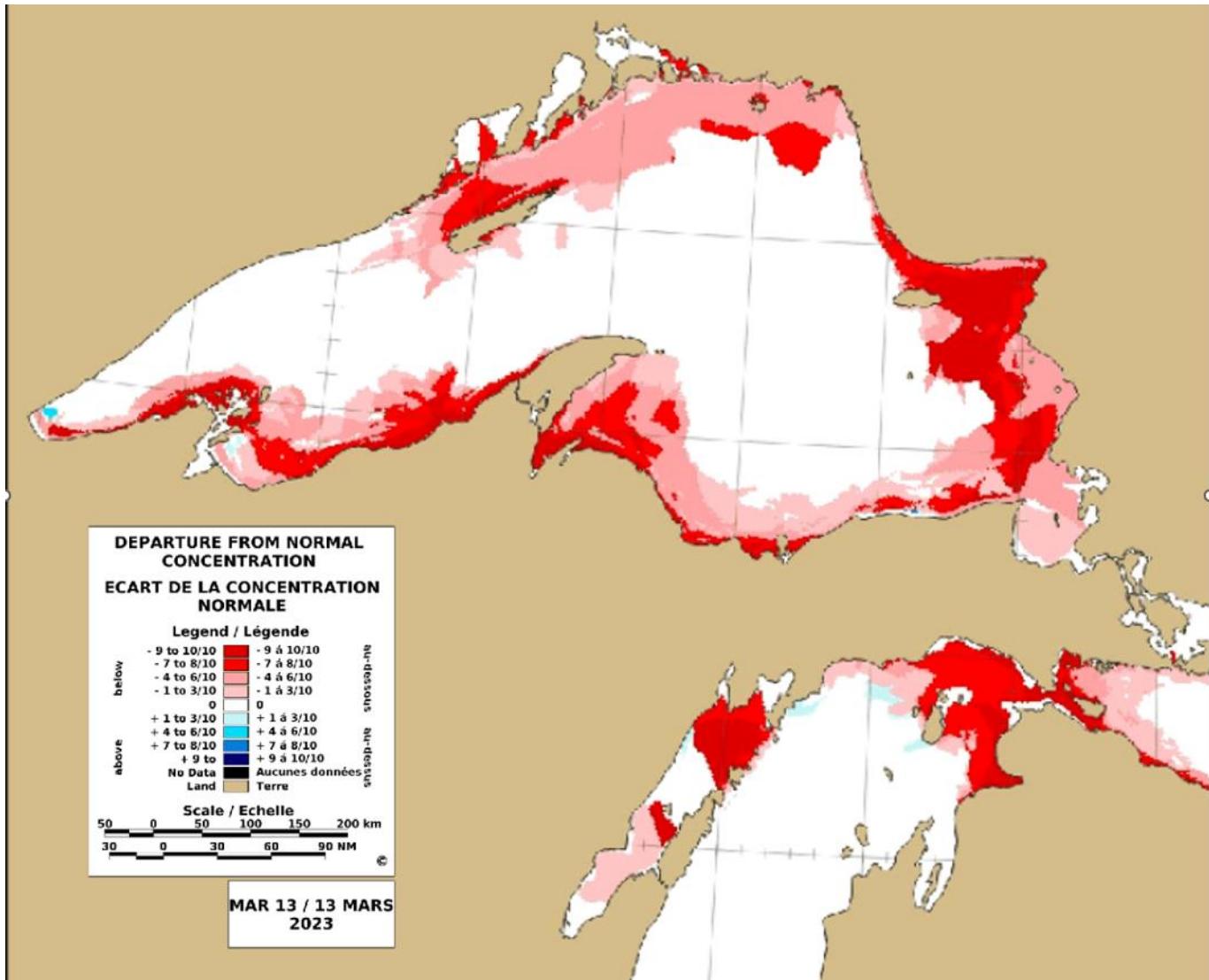


Figure 28: Departure from Normal Chart for March 13<sup>th</sup>, 2023.

Red is missing ice; Blue is extra ice compared to the median ice concentration from 1990-91 to 2019-20

Figure 28 above shows areas in red that normally would have ice cover on March 13<sup>th</sup> that were free of ice on that date this ice season.,

The areas of Lake Superior away from the shore and not within sheltered bays did not see any real ice coverage this season.

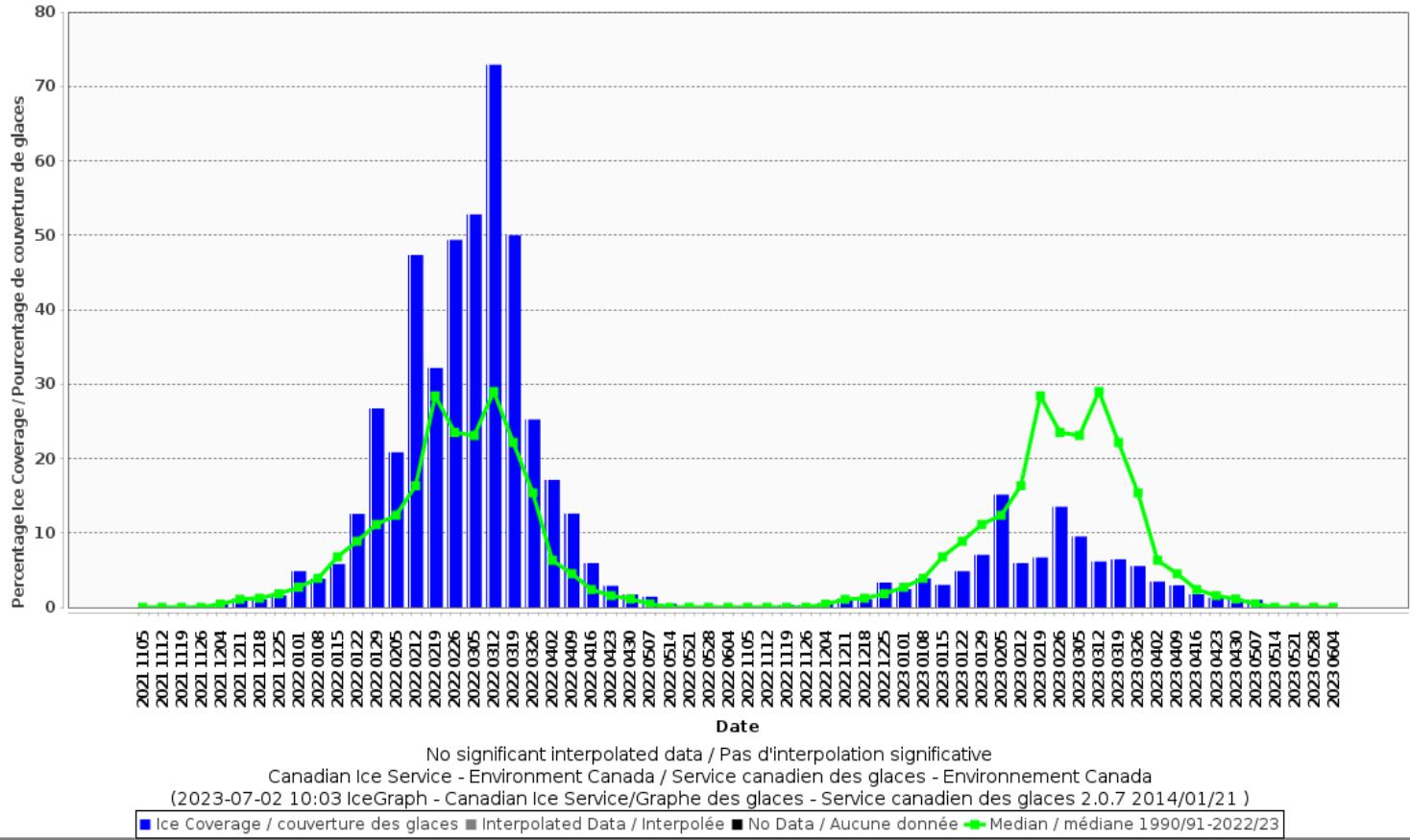
**Multiple Seasons: Weekly Ice Coverage for the seasons  
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**Plusieurs saisons: Couverture des glaces hebdomadaire  
pour les saisons 2021/22 et 2022/23, Semaines:  
1105-0604**

Lake Superior /  
Lac Supérieur

Area / Aire : 81,493 km<sup>2</sup>



**Figure 29 Lake Superior Ice Coverage for 2021-22 season and 2022-2023 seasons.**

*Figure 29 above shows the weekly ice coverage over Lake Superior for the last two seasons the extent to how much less ice there was this year than last season and how much less ice cover there was this year compared to the median year.*

March saw the steady disappearance of ice coverage over Lake Superior going from about 12% ice covered to below 5% ice covered by the start of March. The ice that remained at the start of March was the thicker ice that was in sheltered areas along the shores of the Lake. The normal average ice concentration at the start of March on Lake Superior is near 50% and at the end of March there is still on average near 30% of ice cover.

April was another month with above average air temperatures saw a gradual melting of what little ice was left on Lake Superior. Though warm temperatures predominated the ice that remained was predominately thicker and thus slow to melt as it was ice that had formed in sheltered areas along the shores and in bays. The last of the fast ice melted from; the Apostle Islands just after the first week of April, Keweenaw Bay after the second week of April, and Whitefish Bay after the third week of April. The last of the ice melted in Chequamegon Bay the first week of May, while in Thunder Bay and Black Bay it melted after the second week of May. The ice season finally ended after the third week in May with the last ice on Lake Superior melting in Nipigon Bay.

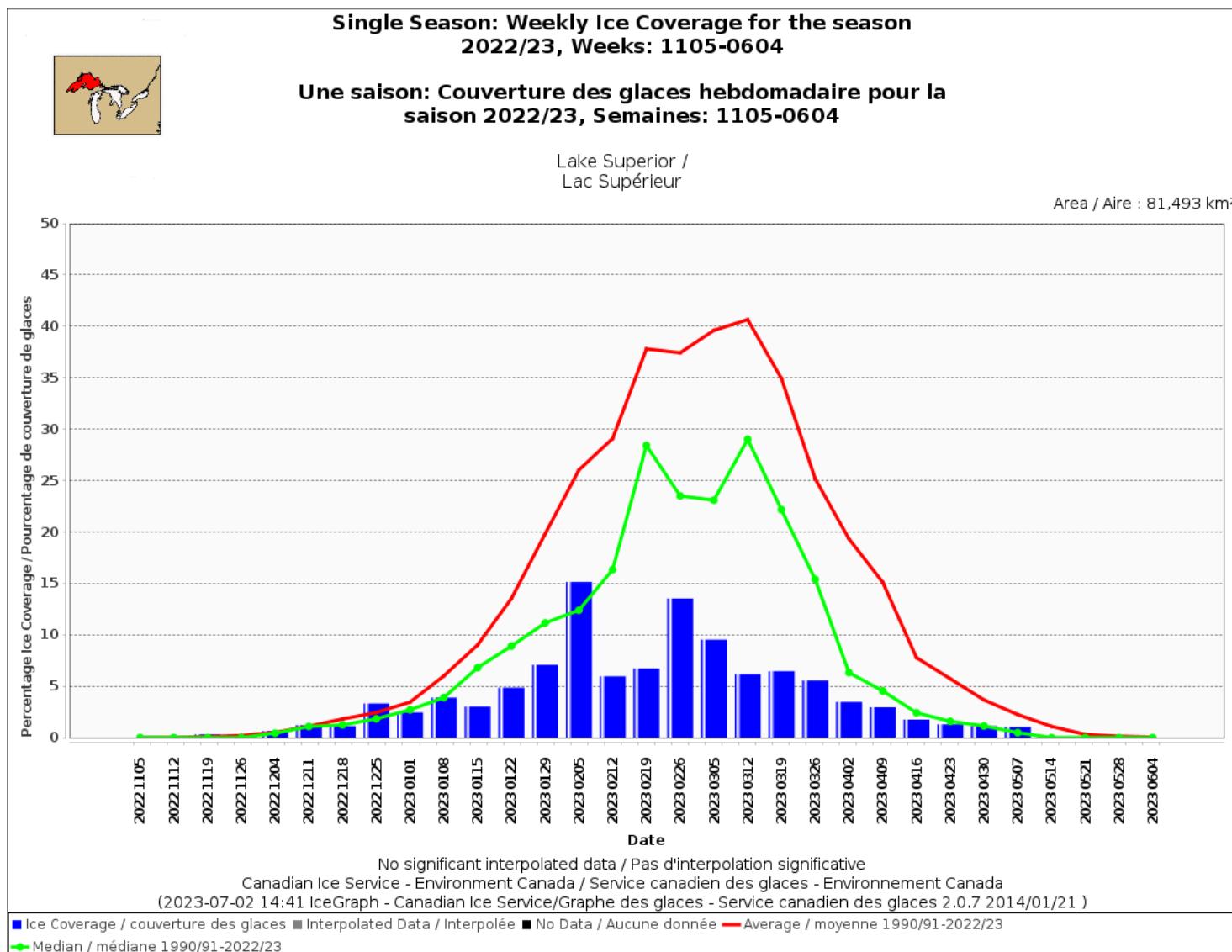


Figure 30: Weekly Ice Coverage on Lake Superior for winter 2022-23.

## Lake Superior Ice Coverage for the 2022-23 season:

	Ice coverage in %	Average ice coverage from 1973-2023 in %	% difference average + above / - below
Dec 7	0.9	2.0	-1.1%
Dec 12	1.0	3.0	-2%
Dec 19	1.5	3.5	-2%
Dec 26	3.5	3.0	+0.5%
Jan 2	2.0	8.0	-6%
Jan 9	4.0	11.0	-7%
Jan 16	3.0	16.0	-13%
Jan 23	5.0	19.0	-14%
Jan 30	7.0	24.0	-17%
Feb 6	15.0	33.0	-18%
Feb 13	6.0	39.5	-33.5%
Feb 20	7.0	44.0	-37%
Feb 27	13.0	46.0	-33%
Mar 6	9.5	48.0	-38.5%
Mar 13	6.0	44.0	-38%
Mar 20	8.0	40.0	-32%
Mar 27	4.0	30.0	-26%
Apr 3	4.0	20.0	-16%
Apr 10	3.0	16.0	-13%
Apr 17	2.0	10.0	-8%
Apr 24	1.0	6.0	-5%
May 1	1.0	4.0	-3%
May 8	1.0	3.0	-2%
May 15	0.0	1.0	-1%

Table 2: Lake Superior ice concentrations 2022-23 season compared to average concentrations from 1972-1973 to 2022-2023

Table 2 above shows that Lake Superior had below normal ice coverage amounts every month this year except for December which had slightly more ice than is normal. The below normal ice amounts were due to the persistent above normal temperatures during the 2022-23 ice season and were greatest during the from mid February to mid March when normally Lake Superior sees its greatest amount of ice cover. The above normal ice cover in December was due to the rapid ice cover increase mainly over the shallow along the shores of the lake. The lack of continued ice coverage growth as the season progressed due to above normal air temperatures meant that all other months had below normal ice coverage.

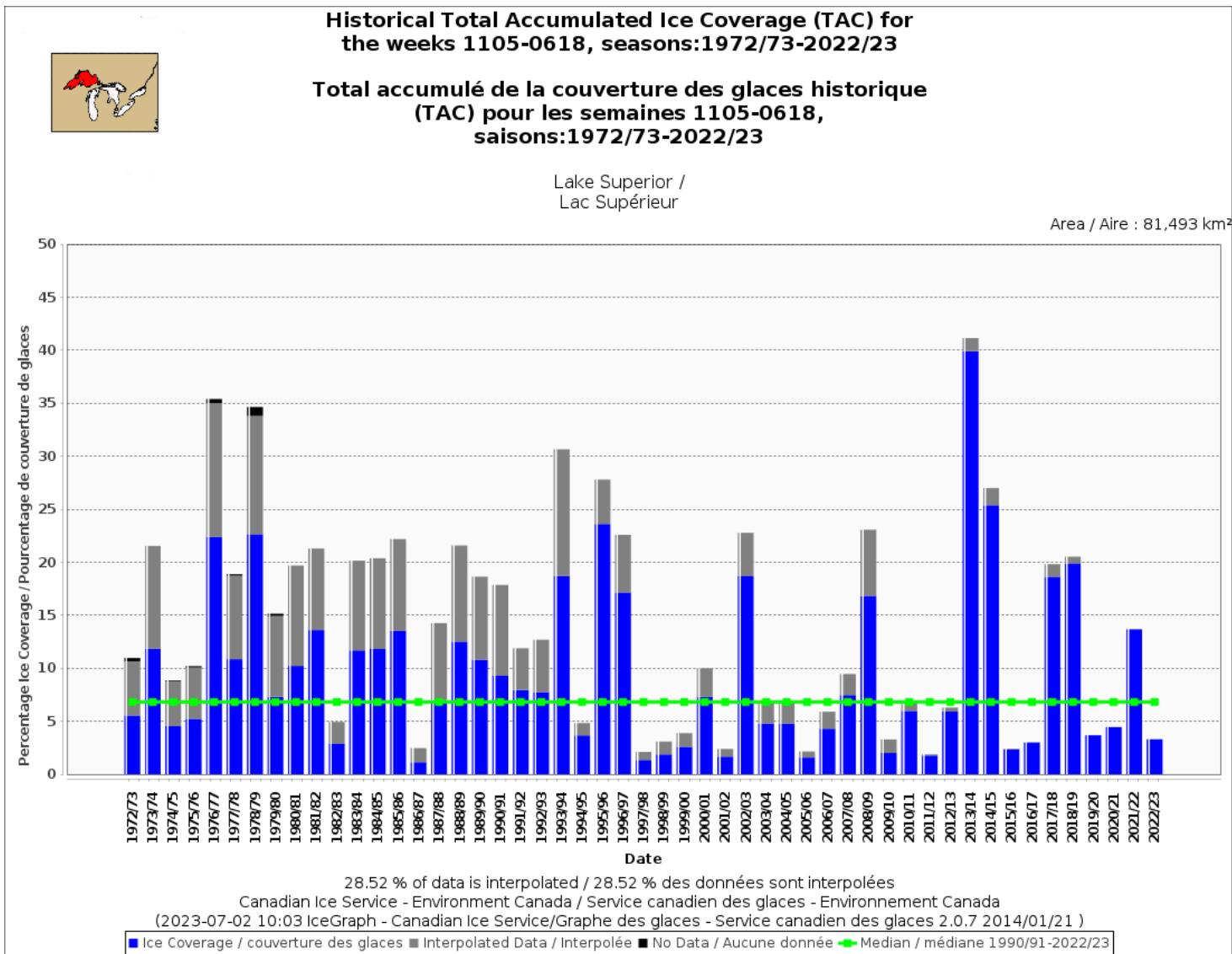


Figure 31: Historical Total Accumulated Ice Coverage in Lake Superior by season, 1972-2023.

The total accumulated coverage (TAC) of 3.5% for Lake Superior was about a quarter last years value of near 15% and about half the long-term median TAC of 7.8%.

The 2022-2023 ice season though not a record low ice coverage year for Lake Superior can be grouped with several years all of which had a TAC of less than 5%. Having a TAC less than 10% was rare before 1998. Since 1998 there have been a handful of years with a high value for the TAC above 20% but most years have been low ice years with the TAC less than 6%.

Though not a record low year 2022-23 was one of the 10 lowest total accumulated ice coverage years on Lake Superior since 1972.

Maximum Ice Coverage for the weeks 1105-0604, seasons:  
1972/73-2022/23



La couverture maximale de glace pour les semaines  
1105-0604, saisons: 1972/73-2022/23

Lake Superior /  
Lac Supérieur

Area / Aire : 81,493 km<sup>2</sup>

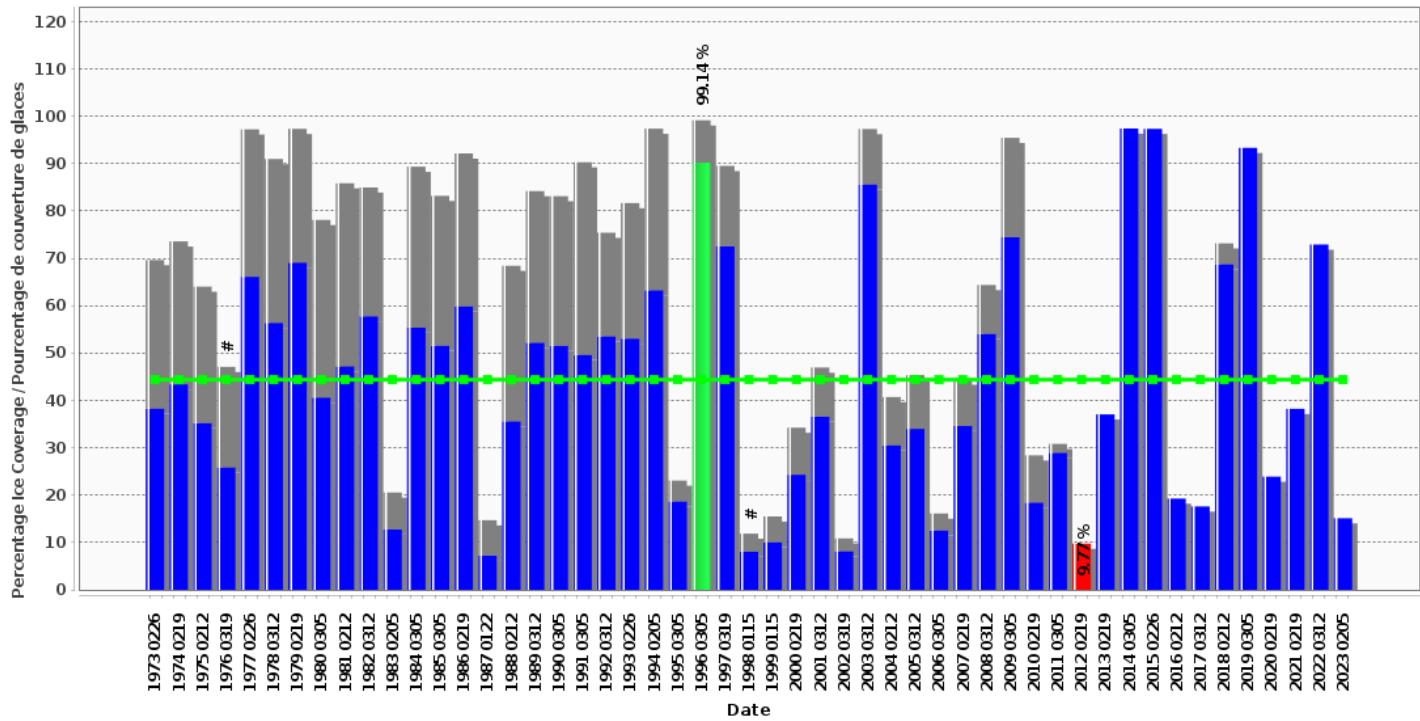


Figure 32: Maximum Ice Coverage in Lake Superior by season, 1972-2023.

The maximum ice coverage occurred on Lake Superior on the week of February 5<sup>th</sup>. This is five weeks early as the maximum coverage on Lake Superior is usually near the middle of March, see peak in median ice coverage on figure 30 showing the weekly ice coverage above.

## Lake Michigan

The Lake Michigan ice season started on schedule the first week of December when small concentrations of new lake ice formed in the Bays de Noc and along the southern shore of Green Bay. After this with above normal temperatures for the rest of the month until near the end of the last week of December.

The first real period ice formation occurred near the end of the last week of December as a cold air outbreak over the lake allowed for ice to form along the north, west and south shores of Lake Michigan as well as expanding to cover most of the area within Green Bay.

This cold air outbreak though cold and allowed for decent amounts of ice formation was brief and a quick return to warmer than normal temperatures in early January along with the accompanying winds that ushered in these warmer temperatures destroyed most of this newly formed thin ice leaving the ice that remained after the first week of January present only along the northern shore of Lake Michigan and within Green Bay.

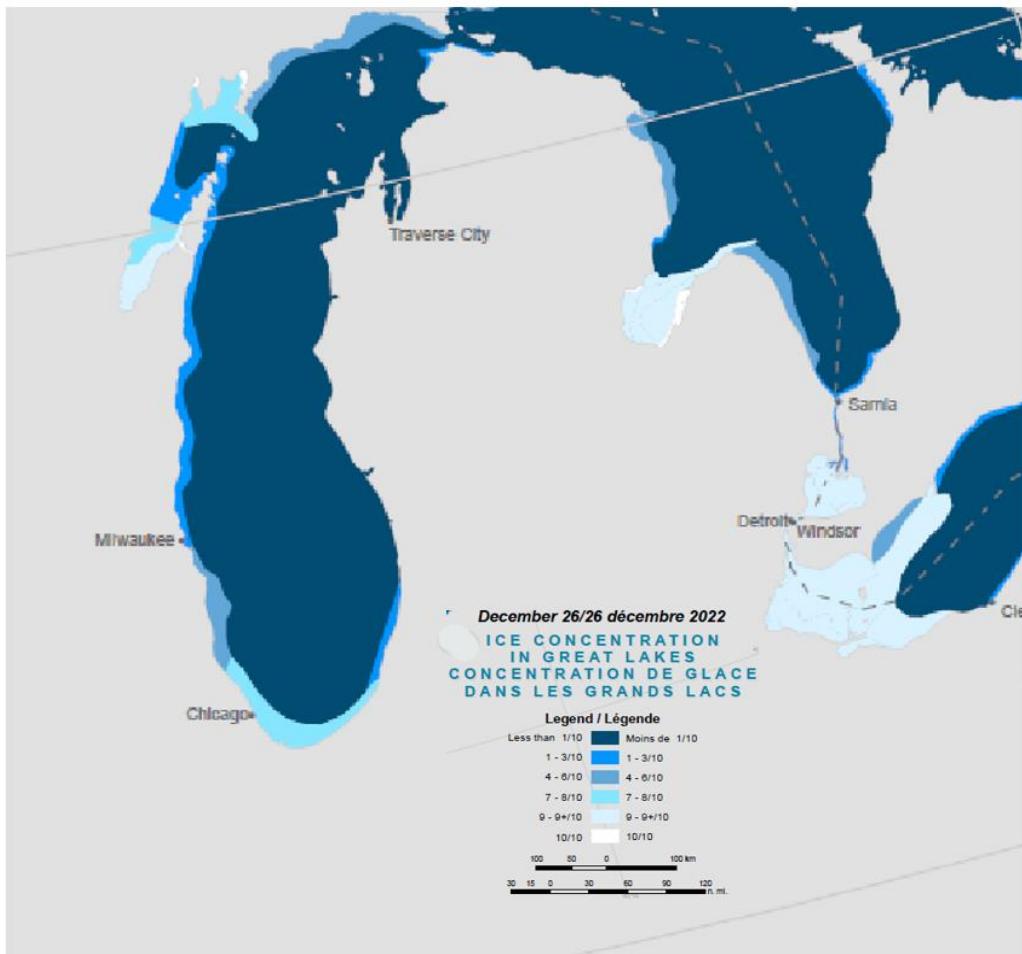


Figure 33: Ice Coverage on Lake Michigan, December 26<sup>th</sup>, 2023

The second and most significant cold outbreak of the season occurred the end of January into the first week of February. During this time the ice thickened and expanded in Green Bay with Bays de Noc and the southern part of Green Bay having medium (30 cm) thick ice at this time. The north shore of Lake Michigan was also ice covered along the shore at this time and was a mixture of thin (5-15 cm) and medium (15-30 cm) ice. There was also some new ice (<5 cm) along parts of the rest of the shores of Lake Michigan.

This ice coverage did not expand further after the first week in February as once more the cold period would be short lived and a return to above normal temperatures during the second week of February would see no further ice in Lake Michigan other than the ice within Green Bay and along the north shore. The maximum ice coverage for Lake Michigan occurred on the week of February 5<sup>th</sup> at the end of the cold spell.

After mid February the ice along the shores in the Straits of Mackinac also thickened to medium lake ice and though the ice covered the Straits of Mackinac completely with fasted ice by the end of the month the ice in the straits never thickened to beyond medium lake ice (15-30 cm).

The ice in Bays de Noc and the southern end of Green Bay became thick lake ice (30-70 cm) at the beginning of March while the ice in the rest of Green Bay and along the north shore of Lake Michigan was predominantly medium lake ice (15-30 cm).

With warmer than normal temperatures over the area for almost the entire period by the third week in March the only ice that remained on Lake Michigan was a thin area of medium lake ice along the north shore and the predominately medium lake ice in Green Bay which thickens to thick lake ice in the Bays de Noc and at the southern end of Green Bay.

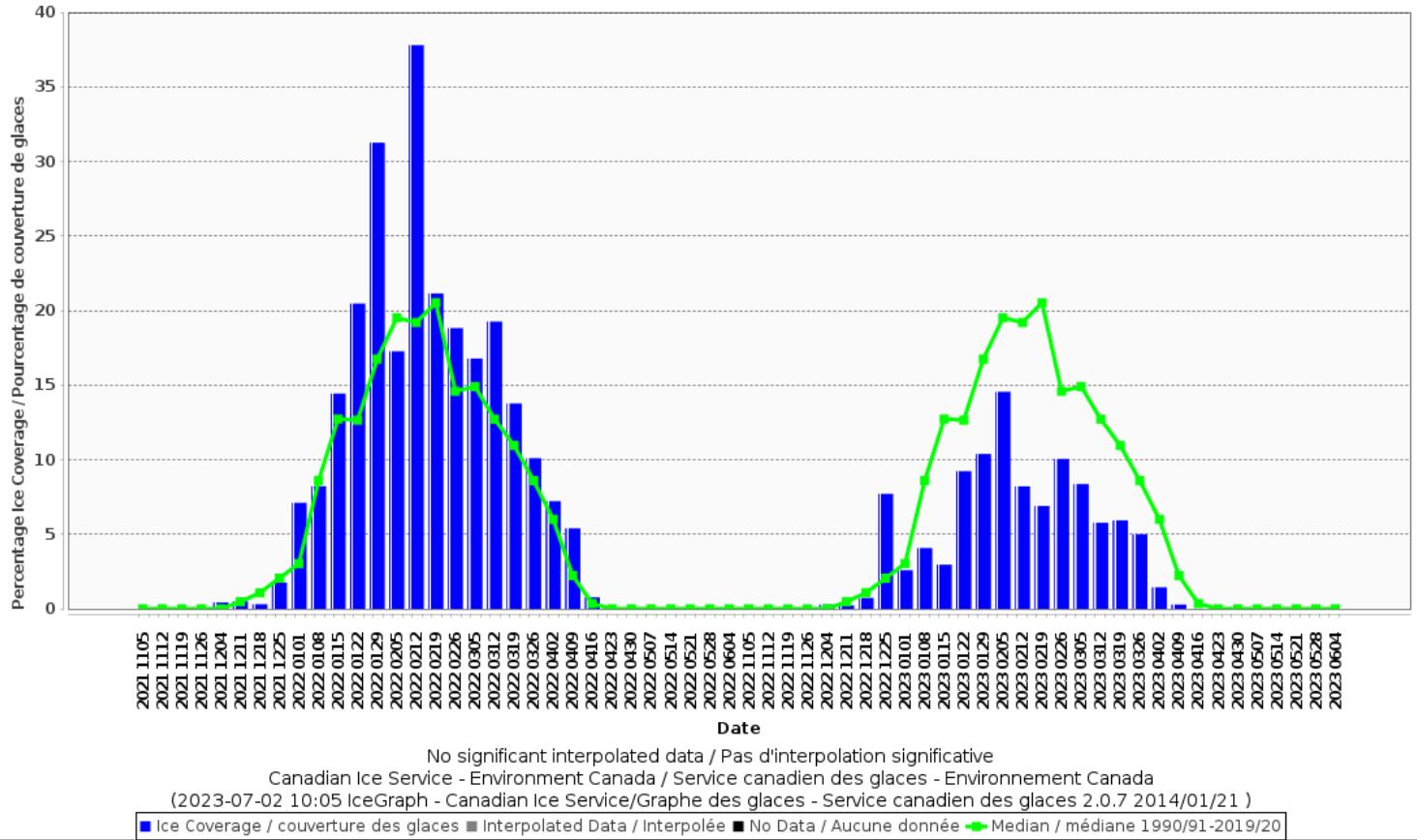
**Multiple Seasons: Weekly Ice Coverage for the seasons  
2021/22 and 2022/23, Weeks: 1105-0604**



**Plusieurs saisons: Couverture des glaces hebdomadaire  
pour les saisons 2021/22 et 2022/23, Semaines:  
1105-0604**

Lake Michigan /  
Lac Michigan

Area / Aire : 59,144 km<sup>2</sup>



**Figure 34: Lake Michigan Ice Coverage for 2021-22 season and 2022-2023 seasons.**

Figure 34 above shows the weekly ice coverage over Lake Michigan for the last two seasons the extent to how much less ice there was this year than last season and how much less ice cover there was this year compared to the median year.

By early April the only areas with remaining ice coverage were some patches of medium lake ice in Strait of Mackinac, thick lake ice in the southern part of Green Bay as well as fasted thick lake ice in Bays de Noc. By April 10<sup>th</sup> all the ice was melted except for a few patches along the shore in southern Green Bay and some fasted thick ice at the northern shores of Bays de Noc. By April 17<sup>th</sup> there was no more ice on lake Michigan and the ice season came to an end at about the climatological date for the ice season to end for lake Michigan. Other than the above normal amount of ice cover early in the season at the end of December the entire season after this time saw below normal ice cover and thickness for the entire season.

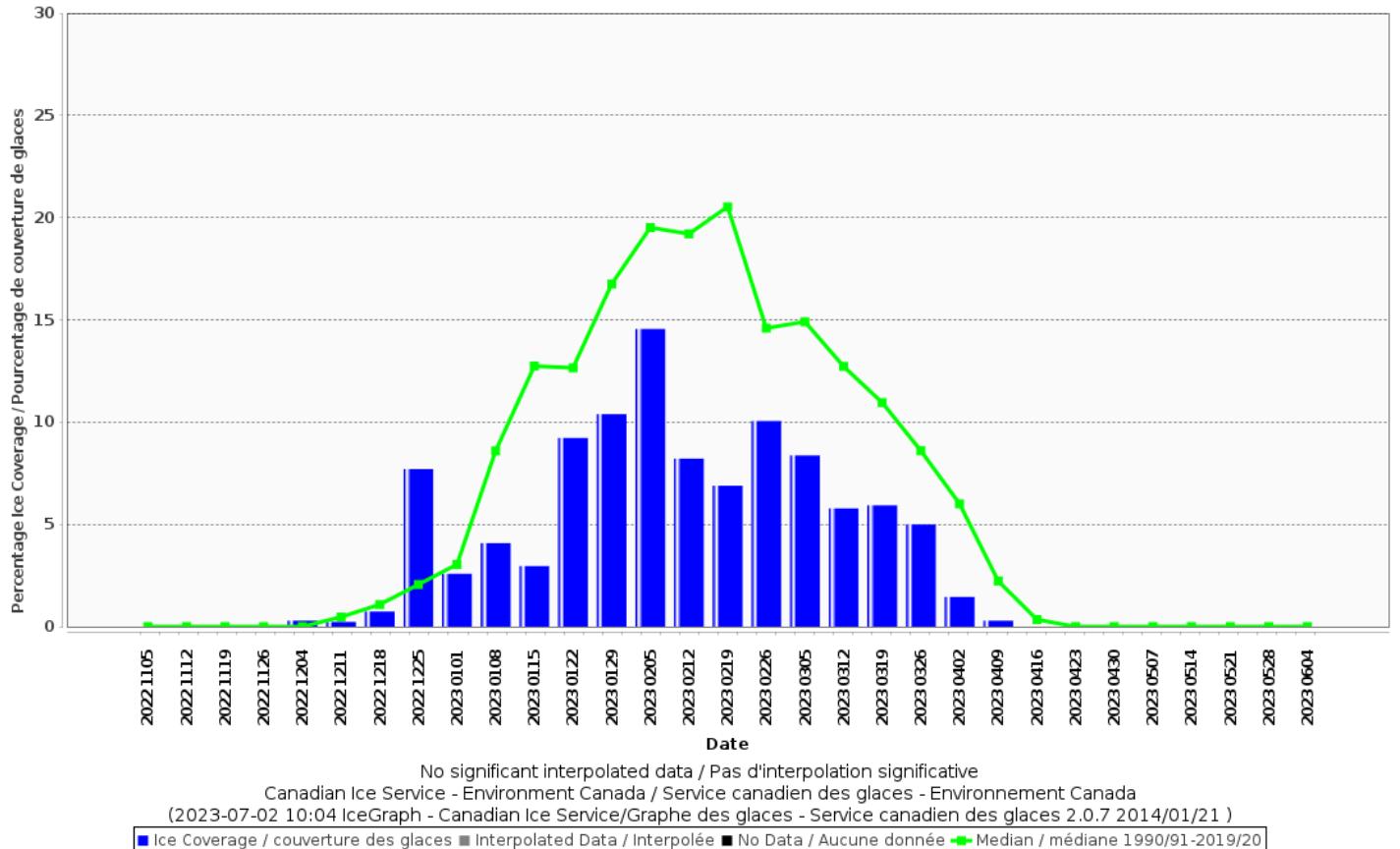
**Single Season: Weekly Ice Coverage for the season  
2022/23, Weeks: 1105-0604**



**Une saison: Couverture des glaces hebdomadaire pour la  
saison 2022/23, Semaines: 1105-0604**

Lake Michigan /  
Lac Michigan

Area / Aire : 59,144 km<sup>2</sup>



**Figure 35: Weekly Ice Coverage in Lake Michigan for winter 2022-23.**

The spike in ice coverage on December 25<sup>th</sup> in figure 35 above represents the new and thin ice that formed in shallow areas and along the shore in the seasons first cold spell. Much of this ice subsequently melted as is also shown on figure 34 above.

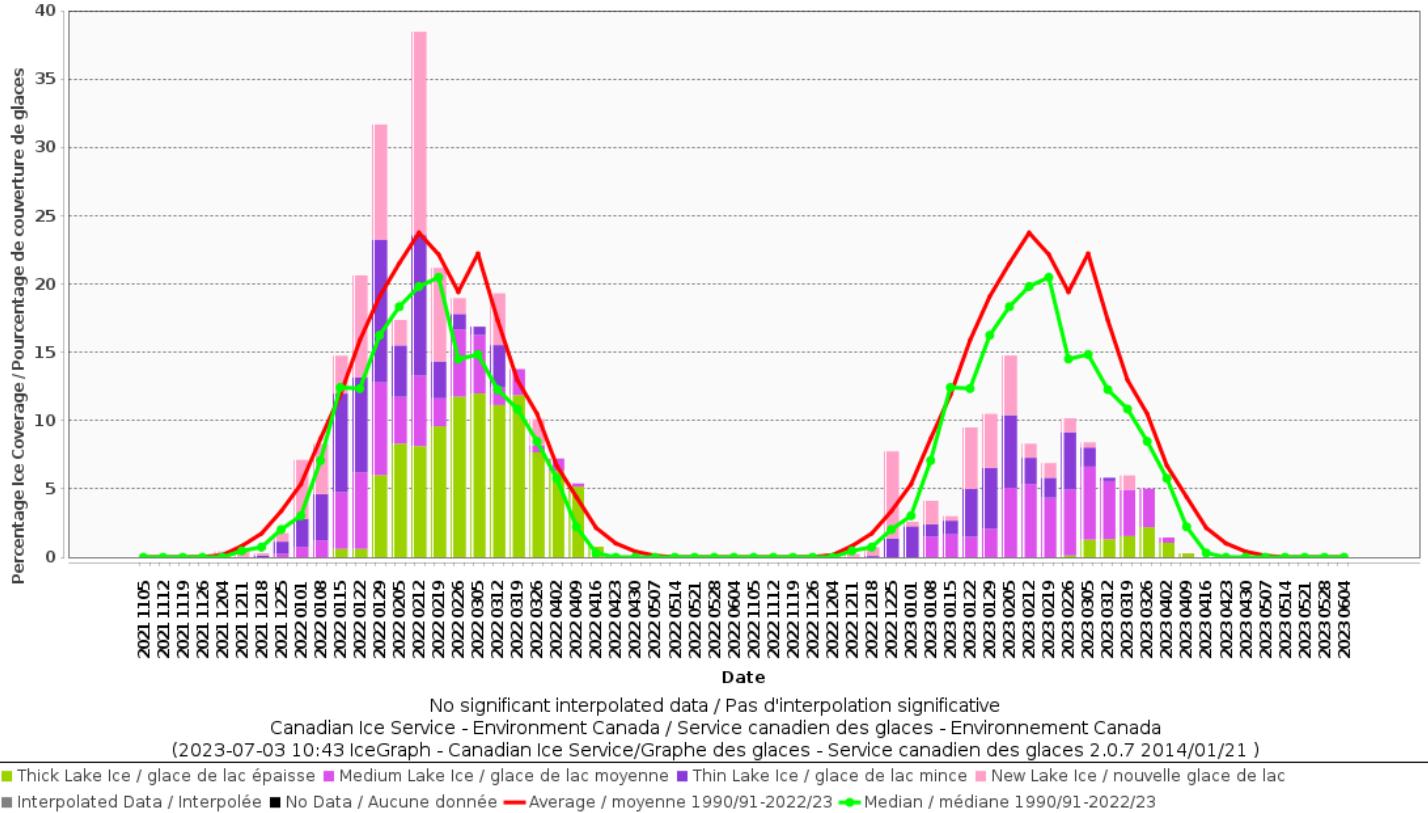
**Multiple Seasons: Weekly Ice Coverage by Stage of Development for the seasons 2021/22 and 2022/23, Weeks: 1105-0604**



**Plusieurs saisons: Couverture des glaces hebdomadaire par stade de formation pour les saisons 2021/22 et 2022/23, Semaines: 1105-0604**

Lake Michigan /  
Lac Michigan

Area / Aire : 59,144 km<sup>2</sup>



**Figure 36: Weekly Ice Coverage on Lake Michigan for winters 2021-23 showing stage of development.**

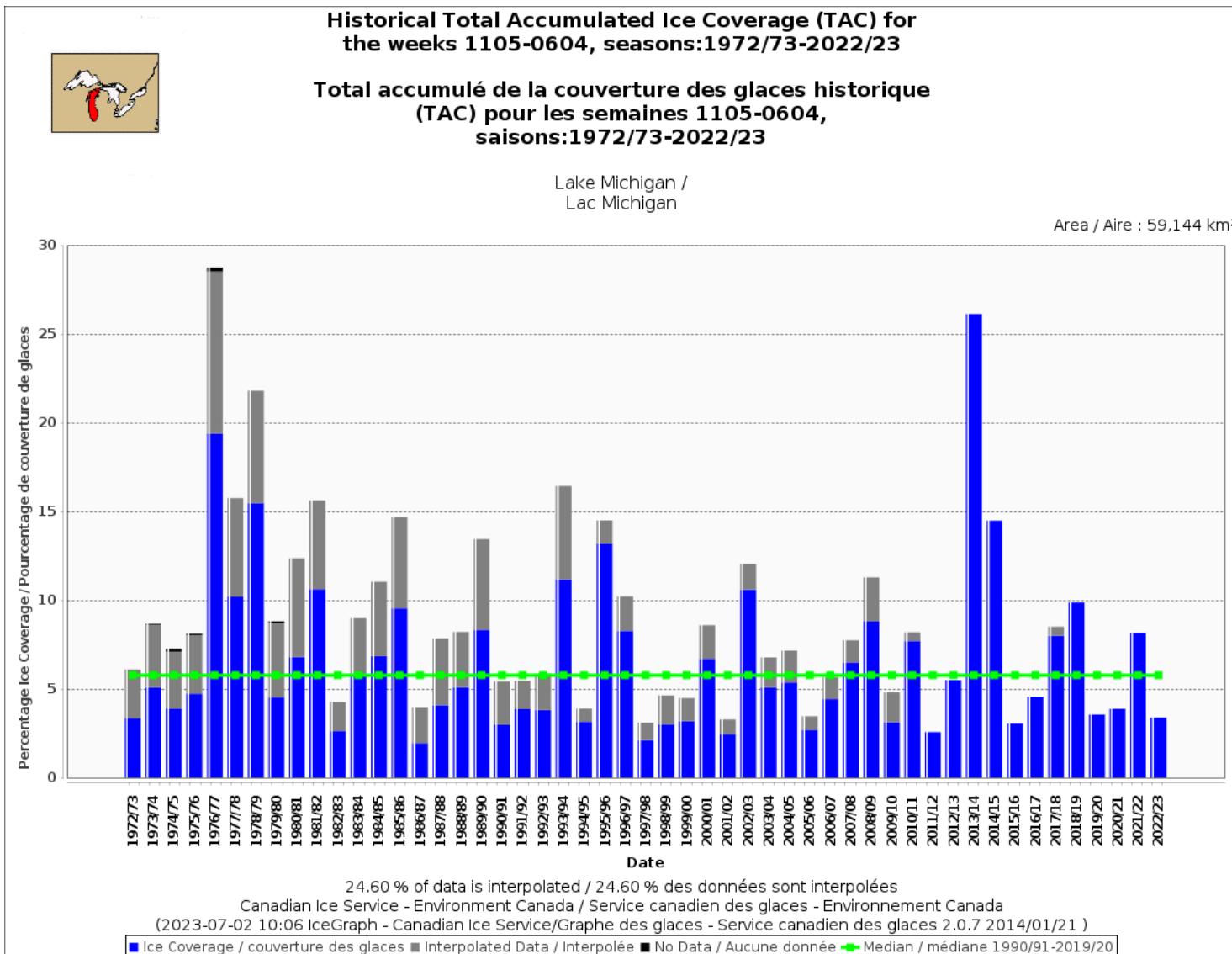
Can see from the figure 36 above showing the stage of development of the ice on Lake Michigan how the warm weather of this 2022-2023 season prevented the ice from thickening. The thick lake ice is shown in green and comparing with last year which was a more normal year the lack of thick ice is very apparent. This lack of thick ice was most obvious on Lake Michigan and the southern lakes.

## Lake Michigan Ice Coverage for the 2022-23 season:

	Ice coverage in %	Average ice coverage from 1973-2023 in %	% difference average + above / - below
Dec 7	0.2	1.0	-0.8%
Dec 12	0.2	1.5	-1.3%
Dec 19	0.2	2.0	-1.8%
Dec 26	8.0	4.0	4%
Jan 2	3.0	9.0	-6%
Jan 9	4.0	13.0	-9%
Jan 16	3.0	17.0	-14%
Jan 23	9.0	20.0	-11%
Jan 30	11.0	23.0	-12%
Feb 6	15.0	26.0	-11%
Feb 13	8.0	29.0	-21%
Feb 20	7.0	29.0	-22%
Feb 27	10.0	27.0	-17%
Mar 6	9.0	26.0	-17%
Mar 13	6.0	20.0	-14%
Mar 20	7.0	16.0	-9%
Mar 27	5.0	10.5	-5.5%
Apr 3	2.0	8.0	-6%
Apr 10	0.3	6.0	-5.7%
Apr 17	0.1	4.0	-3.9%
Apr 24	0.0	2.0	-2%
May 1	0.0	1.0	-1%
May 8	0.0	1.0	-1%
May 15	0.0	0.0	0%

Table 3: Lake Michigan ice concentrations 2022-23 season compared to average concentrations from 1972-1973 to 2022-2023

Table 3 above shows that Lake Michigan had below normal ice coverage amounts every month this year except for December which had slightly more ice than is normal. The below normal ice amounts were due to the persistent above normal temperatures during the 2022-23 ice season and were greatest during the month of February when normally Lake Michigan sees its greatest amount of ice cover. The above normal ice cover in December was due to the rapid ice cover increase mainly over the shallow along the shores of the lake. The lack of continued ice coverage growth as the season progressed due to above normal air temperatures meant that all other months had below normal ice coverage.



**Figure 37: Historical Total Accumulated Ice Coverage in Lake Michigan by season, 1972-2023**

The total accumulated coverage (TAC) was 3.6% for Lake Michigan or almost half the long-term median TAC of 6.7% and almost a third the TAC from last season of 9.4%.

The 2022-23 ice season ranked as one of the 6 lowest ice seasons over the last 50 years, since the 1972-1973 ice season. By rank the lowest ice coverage year on Lake Michigan was 2012 with less than 3% TAC.

Maximum Ice Coverage for the weeks 1105-0604, seasons:  
1972/73-2022/23



La couverture maximale de glace pour les semaines  
1105-0604, saisons: 1972/73-2022/23

Lake Michigan /  
Lac Michigan

Area / Aire : 59,144 km<sup>2</sup>

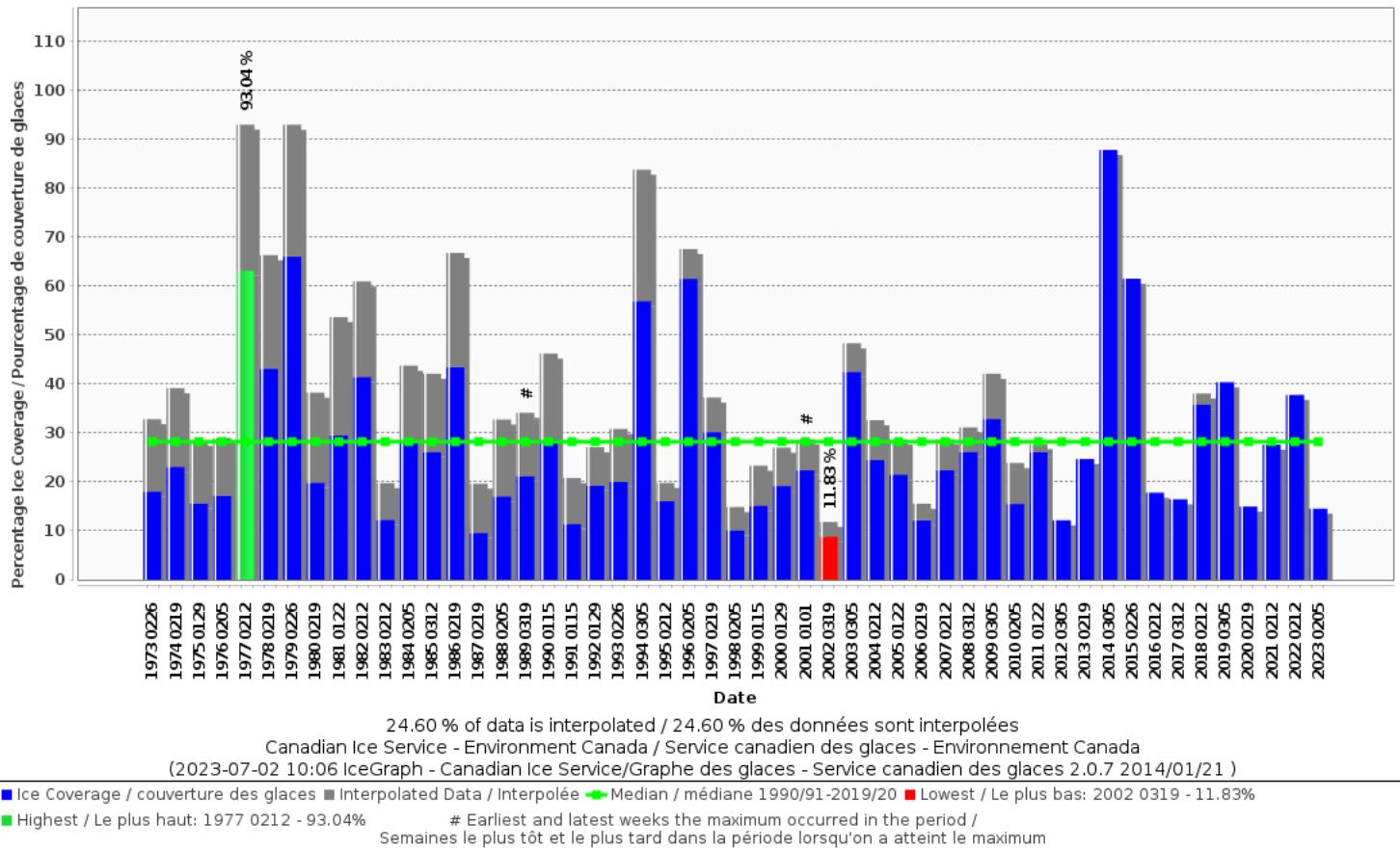


Figure 38: Maximum Ice Coverage in Lake Michigan by season, 1972-2023.

The maximum ice coverage occurred on Lake Michigan on the week of February 5<sup>th</sup>. This is five to six weeks early as the maximum coverage on Lake Michigan is usually near the middle of March, see peak in median ice coverage on figure 35 showing the weekly ice coverage above.

## Lake Huron

The ice season started on Lake Huron on December 5<sup>th</sup> with the first ice forming along the banks of the St. Mary's River. Though temperatures remained above normal until the last week of December ice did continue to form in bays along the shores of eastern and northern Georgian Bay and within the North Channel as well as along the coast in Saginaw Bay.

The last week of December to early January saw the first cold spell with below normal temperatures. During this period Saginaw Bay being quite shallow and thus very responsive to ice formation became ice covered. Ice continued to form in sheltered bays along the northern and eastern shores of Georgian Bay as well with the St. Mary's River becoming ice covered at this time.

Ice started forming in the Straits of Mackinac the third week of January and with the cold period at the end of January to the first week in February was able to thicken to medium lake ice and then quickly cover the straits with ice.

The remainder of January until just before the last few days of the month above average for temperature settled over the area and Lake Huron only saw a slow increase in the amount of ice along the shore in the northern and eastern parts of Georgian Bay and in the North Channel.

The seasons second and most significant below normal cold period in terms of ice coverage growth occurred at the very end of January lasting until the first week of February. This cold period resulted in both ice coverage growth away from the shores as well as thickening of the ice that was entrenched along the shores. By February 6<sup>th</sup> just after this cold spell the North Channel was ice covered while the eastern and western entrances of the North Channel including the St. Mary's River has fasted medium lake ice (15-30 cm). Ice started to expand outwards from the northern and eastern shores of Georgian Bay and fast ice formed in sheltered bays along the northern and eastern shores of Georgian bay. Thin ice also formed along the shores in Lake Huron as well by February 6<sup>th</sup>.

This cold spell however was short lived and by the second week in February and for the rest of the month temperatures returned to above seasonally normal. By mid February under the influence of above normal temperatures the ice along the shores of Lake Huron melted, much of the ice in Saginaw Bay also melted except for the thickest ice which was medium lake ice along the southern shore of Saginaw Bay. In Georgian Bay the ice retreated to lie near the shore along the northern and eastern shores. By mid February the Straits of Mackinac had some fasted ice along the shores.

By the end of February, the western end off the Straits of Mackinac were fasted medium lake ice. The maximum ice coverage for Lake Huron occurred on the last week of February.

Continued warmer than normal temperatures for March left the ice cover essentially unchanged from mid February except for the ice that was in place slowly thickened. This gradual thickening of the ice occurred mainly with fasted ice along the shores in northeastern Georgian Bay as well as in the North Channel and the St. Mary's River thickened from medium lake ice to thick lake ice (30-70 cm) at this time as temperatures though above normal remained below freezing. Farther south where temperatures where warmer the fasted ice along the southern shore of Saginaw Bay which was slowly melting during March disappearing completely at the start of the third week of March.

The first week in March the ice in the Straits of Mackinac fractured and though fasted ice remained along the southern shores the rest of the straits had little ice.

Warm above normal temperatures were experienced in April over Lake Huron and Georgian Bay would lead to the gradual melting of the ice along the northeast shores of Georgian Bay and the North Channel. The Straits of Mackinac were free of ice after the first week of April. By the third week of April only a few isolated bays in the North Channel and in the St. Mary's River had any ice. The last ice would melt ion Lake Huron at the end of April.

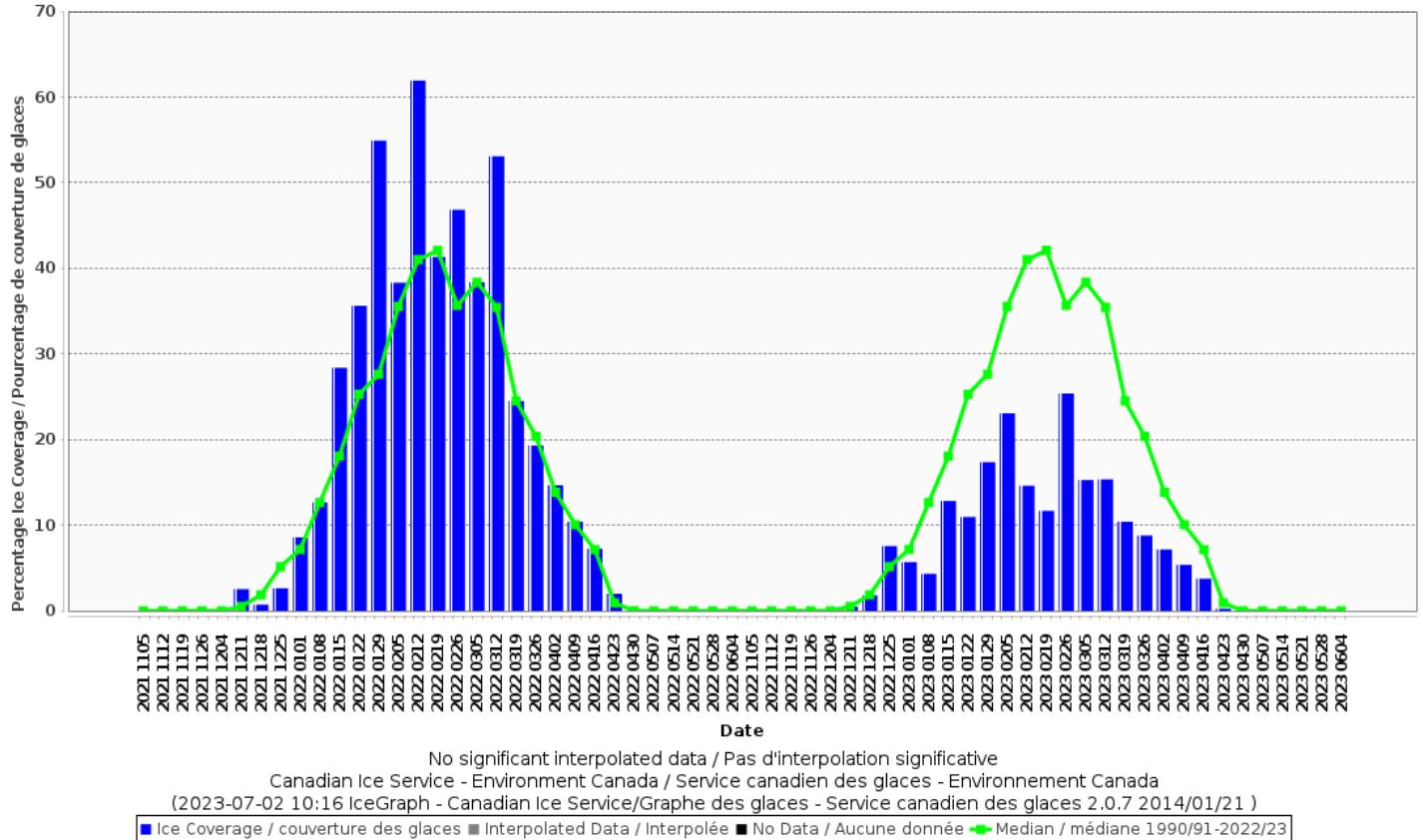
**Multiple Seasons: Weekly Ice Coverage for the seasons  
2021/22 and 2022/23, Weeks: 1105-0604**



**Plusieurs saisons: Couverture des glaces hebdomadaire  
pour les saisons 2021/22 et 2022/23, Semaines:  
1105-0604**

Lake Huron /  
Lac Huron

Area / Aire : 60,563 km<sup>2</sup>



**Figure 39: Lake Huron Ice Coverage for 2021-22 season and 2022-2023 season.**

Figure 39 above shows the weekly ice coverage over Lake Huron for the last two seasons the extent to how much less ice there was this year than last season and how much less ice cover there was this year compared to the median year.

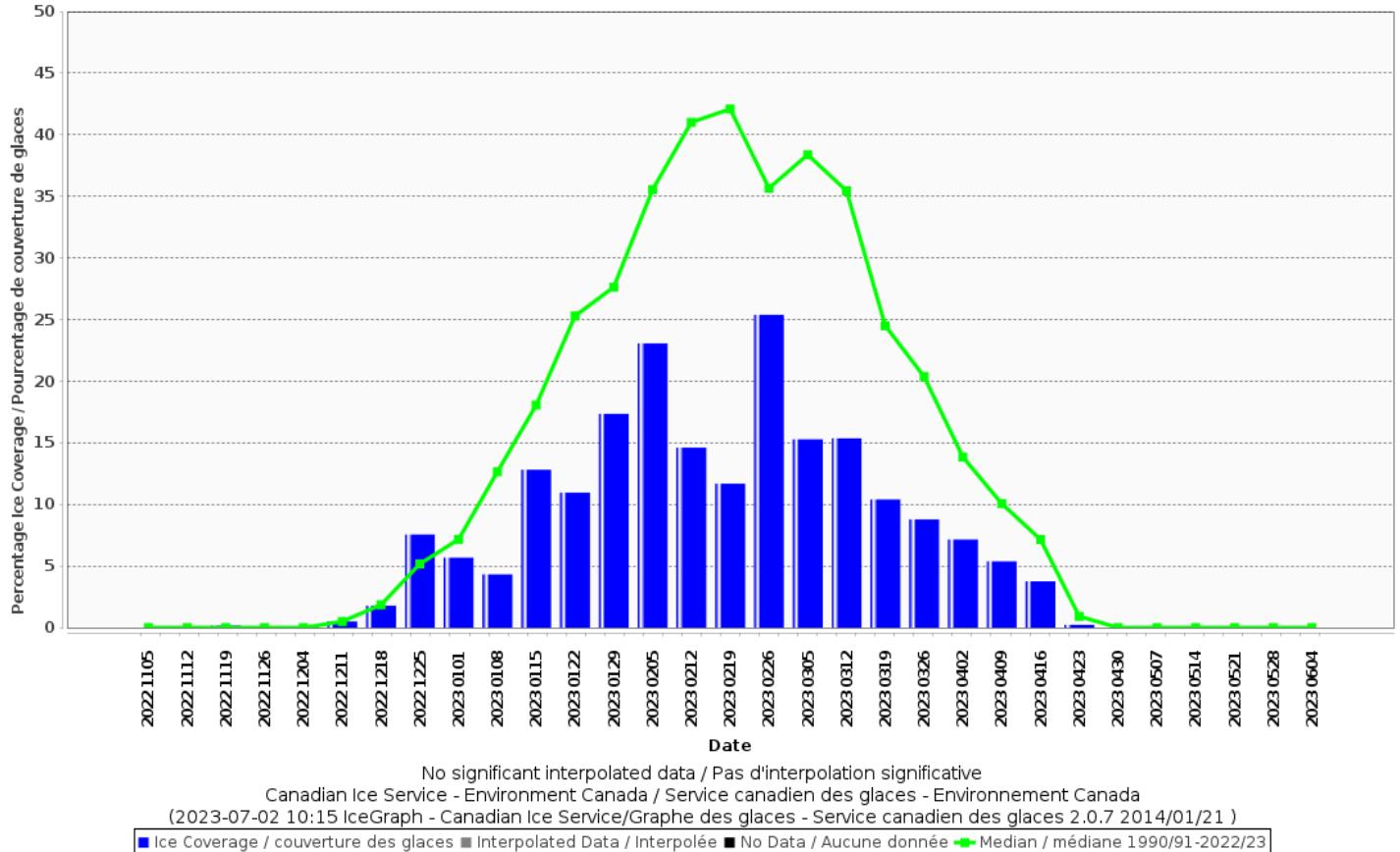
**Single Season: Weekly Ice Coverage for the season  
2022/23, Weeks: 1105-0604**



**Une saison: Couverture des glaces hebdomadaire pour la saison 2022/23, Semaines: 1105-0604**

Lake Huron /  
Lac Huron

Area / Aire : 60,563 km<sup>2</sup>



**Figure 40: Weekly Ice Coverage in Lake Huron for winter 2022-23.**

## Lake Huron Ice Coverage for the 2022-23 season:

	Ice coverage in %	Average ice coverage from 1973-2023 in %	% difference average + above / - below
Dec 7	0.1	2.0	-1.9%
Dec 12	0.4	3.0	-2.6%
Dec 19	2.0	4.0	-2%
Dec 26	7.5	7.0	+0.5%
Jan 2	6.0	14.0	-8%
Jan 9	4.0	20.0	-16%
Jan 16	13.0	27.0	-14%
Jan 23	11.0	33.0	-22%
Jan 30	17.0	39.0	-22%
Feb 6	23.0	45.0	-22%
Feb 13	15.0	50.0	-35%
Feb 20	12.0	51.0	-39%
Feb 27	25.0	50.0	-25%
Mar 6	15.0	49.0	-34%
Mar 13	15.0	44.0	-29%
Mar 20	14.0	39.5	-25.5%
Mar 27	9.0	28.0	-19%
Apr 3	7.0	20.0	-13%
Apr 10	5.0	15.0	-10%
Apr 17	4.0	10.0	-6%
Apr 24	2.0	6.0	-4%
May 1	0.0	3.0	-3%
May 8	0.0	1.0	-1%
May 15	0.0	0.0	0%

Table 4: Lake Huron ice coverage for the 2022-23 season compared to average ice cover from 1972-1973 to 2022-2023

Table 4 above shows that Lake Huron had below normal ice coverage amounts every month this year except for December which had slightly more ice than is normal. The below normal ice amounts were due to the persistent above normal temperatures during the 2022-23 ice season and were greatest during the months of February and March when normally Lake Huron normally sees its greatest amount of ice cover.

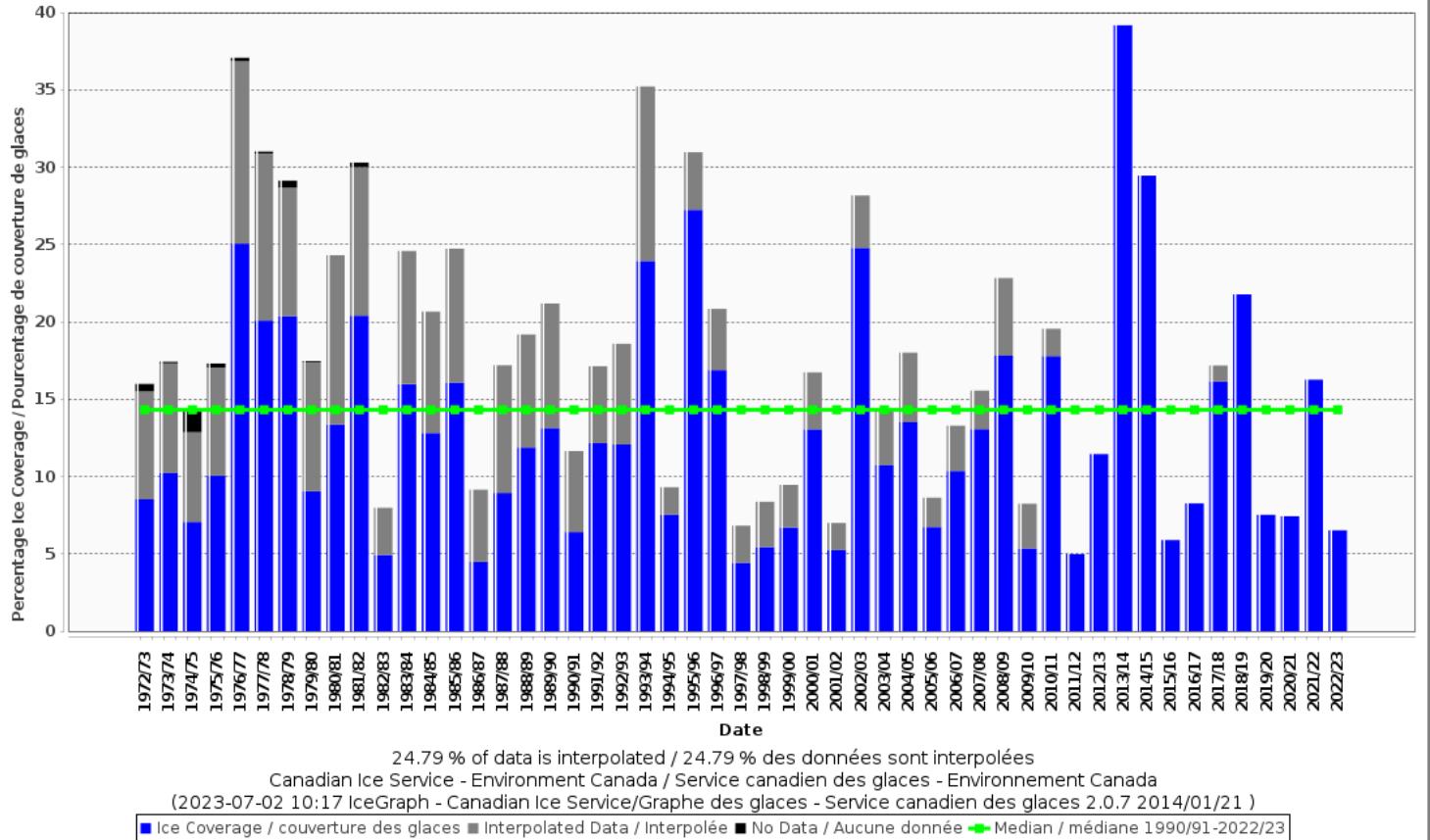
**Historical Total Accumulated Ice Coverage (TAC) for  
the weeks 1105-0604, seasons:1972/73-2022/23**



**Total accumulé de la couverture des glaces historique  
(TAC) pour les semaines 1105-0604,  
saisons:1972/73-2022/23**

Lake Huron /  
Lac Huron

Area / Aire : 60,563 km<sup>2</sup>



**Figure 41: Historical Total Accumulated Ice Coverage in Lake Huron by season, 1972-2023.**

The total accumulated coverage (TAC) of 3.5% for Lake Huron was below half last year's value of near 16% and about half the long-term median TAC of 14.5%.

The 2022-2023 ice season though not a record low total accumulated ice coverage year for Lake Huron it was in a group of very low ice years at just over 5% TAC, historically only one year ended with a TAC of less than 5%.

Maximum Ice Coverage for the weeks 1105-0604, seasons:  
1972/73-2022/23



La couverture maximale de glace pour les semaines  
1105-0604, saisons: 1972/73-2022/23

Lake Huron /  
Lac Huron

Area / Aire : 60,563 km<sup>2</sup>

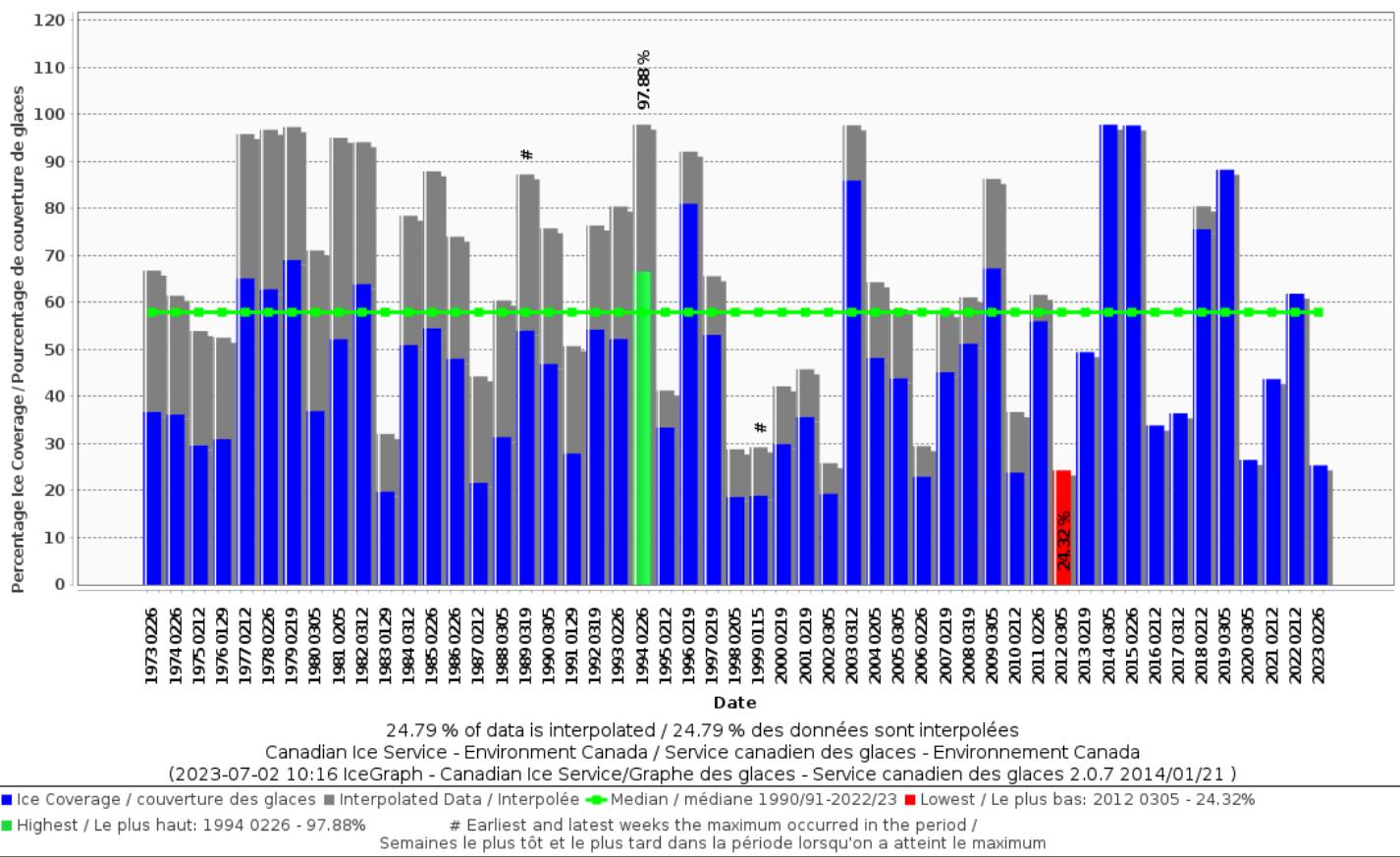


Figure 42: Maximum Ice Coverage in Lake Huron by season, 1972-2023.

The maximum ice coverage occurred on Lake Huron on the week of February 26<sup>th</sup>. This is about the average date for Lake Huron to attain maximum ice coverage as the peak in ice coverage over Lake Huron is normally in the last week of February. See median ice coverage on figure 40 above.

## Lake Erie

The ice season got underway on Lake Erie and Lake St. Clair when ice formed on Lake St. Clair and in the western basin of Lake Erie following the first of the seasons below average temperature periods the third week of December. As these lakes are very shallow especially on the western side of Lake Erie and all of Lake St. Claire the ice formed quickly once the cold air arrived. Lake Erie was the first lake to have reached 10% ice coverage this season doing so in response to this first cold weather of the season in mid December. It crossed the 10% ice mark on Dec 25 during the cold snap a week before the long-term median 10% ice cover date of January 1<sup>st</sup>.

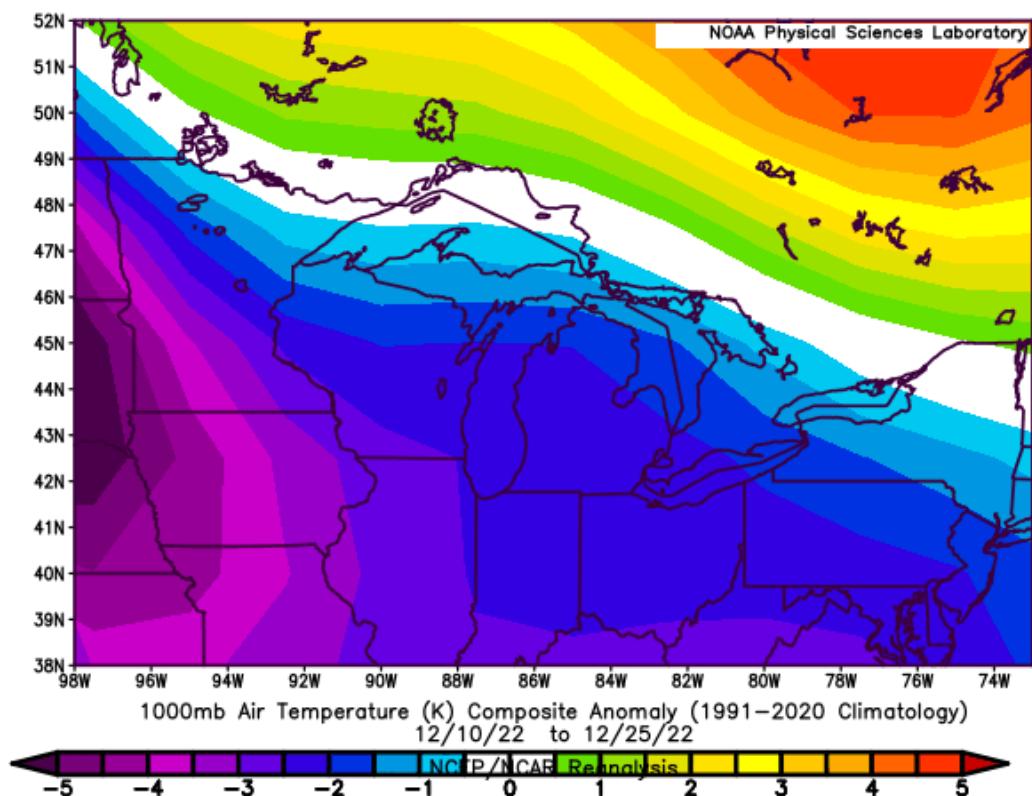


Figure 43: Surface Air Temperature Anomaly for the Great Lakes, 10-25 December 2022

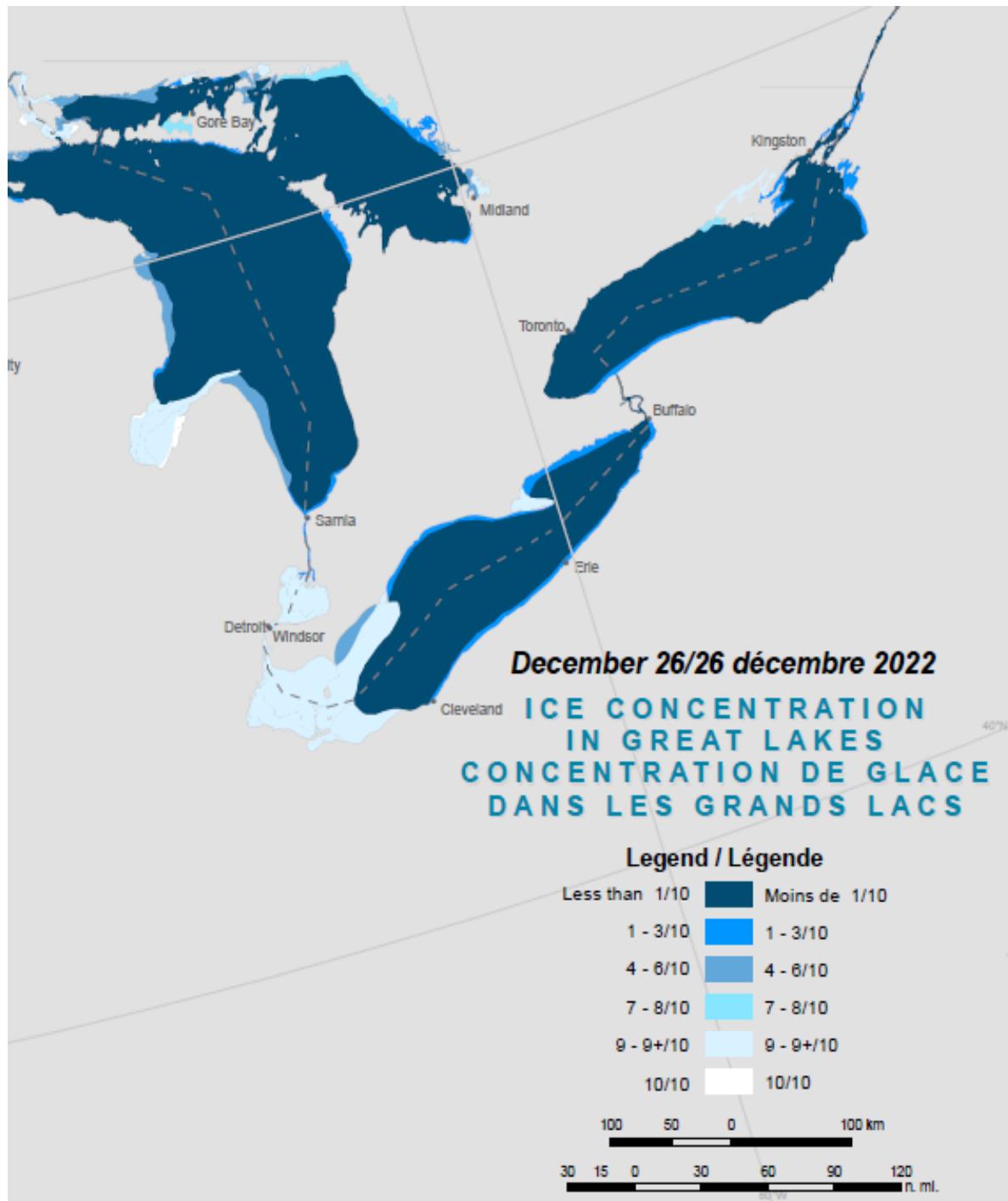


Figure 44: Ice Coverage on the eastern Great Lakes, December 26<sup>th</sup>, 2023

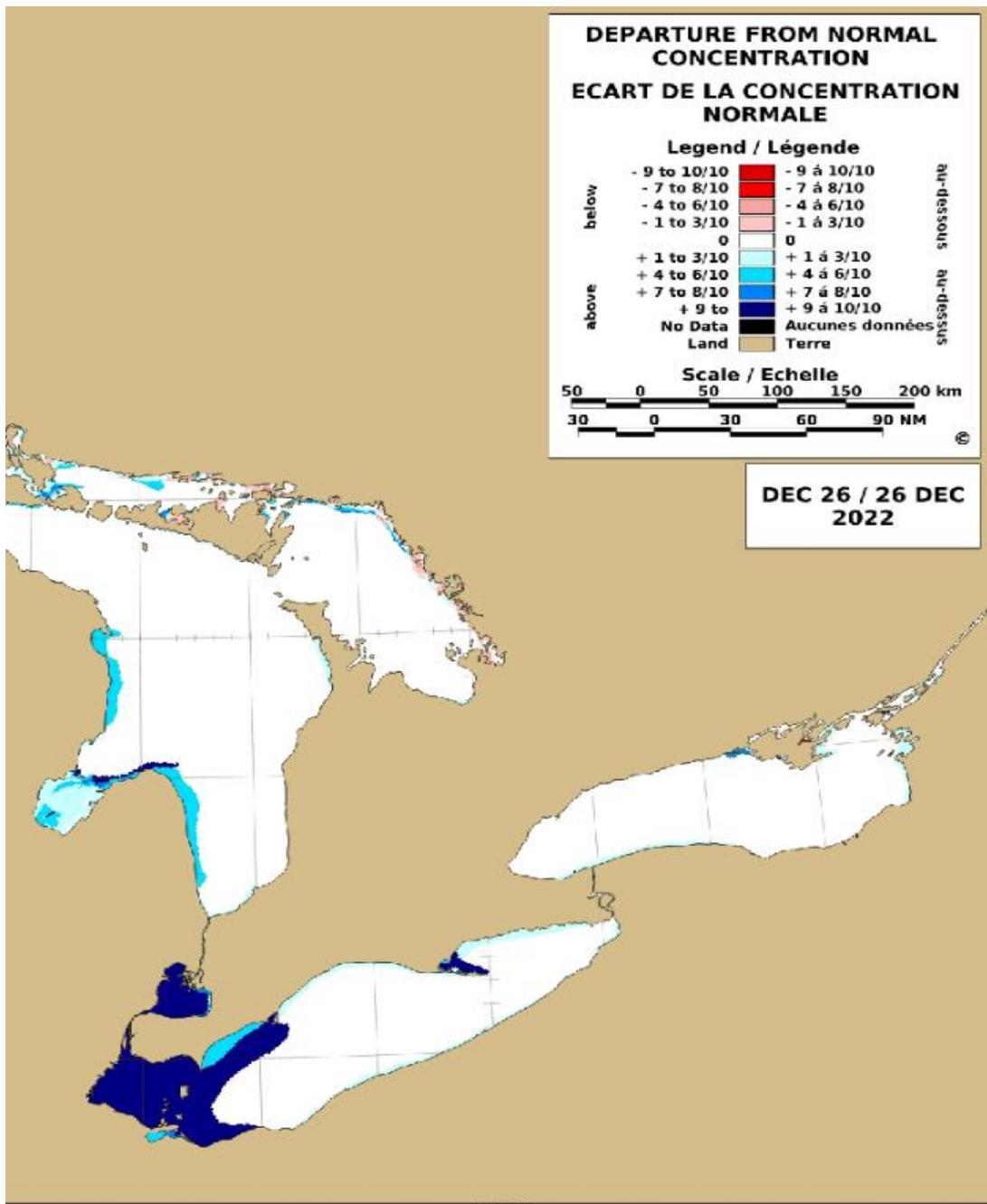


Figure 45: Departure from Normal Chart for December 26<sup>th</sup>, 2023.  
 Red is missing ice; Blue is extra ice compared to the median ice concentration from 1990-91 to 2019-20

The cold temperatures were short lived, and the ice never thickened so that with the next period of warm temperatures in early January ushered in by strong winds this thin ice was easily destroyed with less than half the ice that had formed during the cold period surviving past the first week of January.

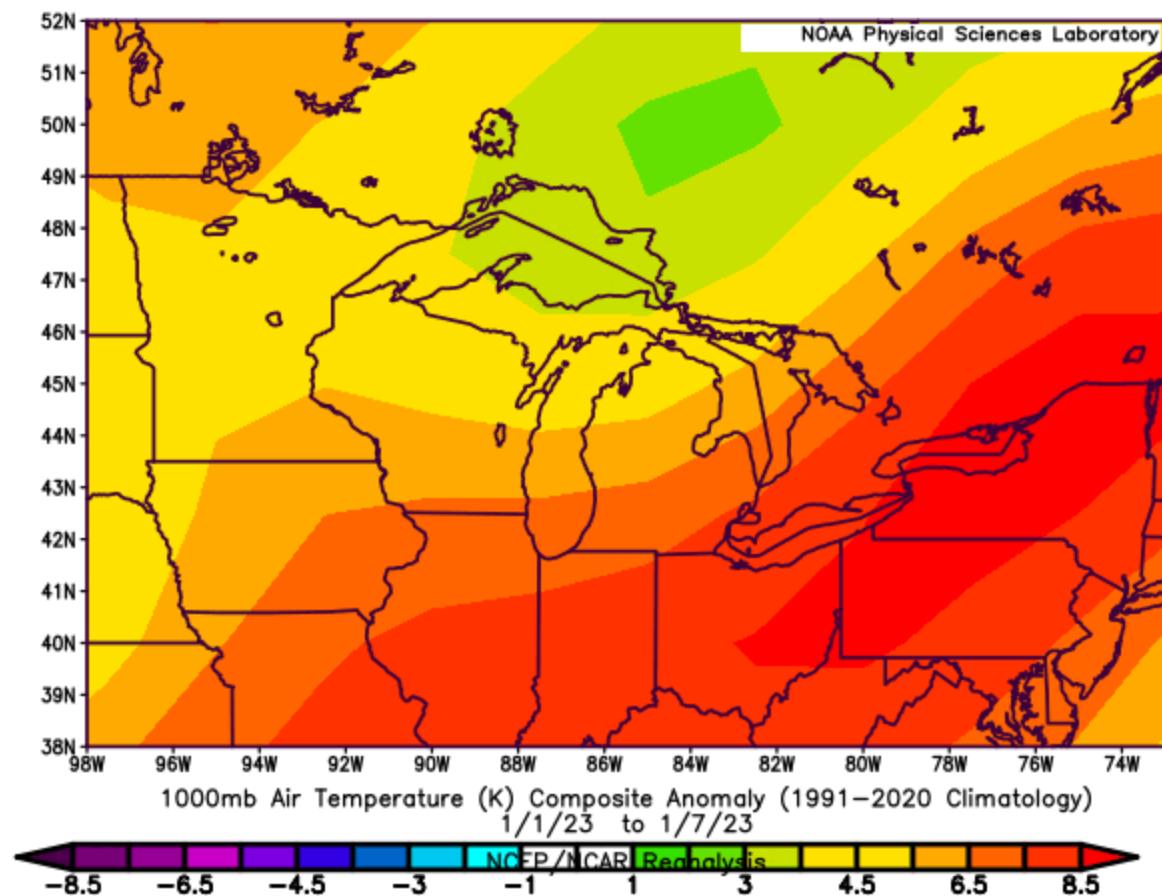


Figure 46: Surface Air Temperature Anomaly for the Great Lakes, 1-10 January 2023

After the first week of January a return to above seasonal temperatures for most of the rest of January resulted in the ice over Lake St. Clair and the western basin of Lake Erie slowly melting and completely disappearing by the end of the third week of January in the warm temperatures.

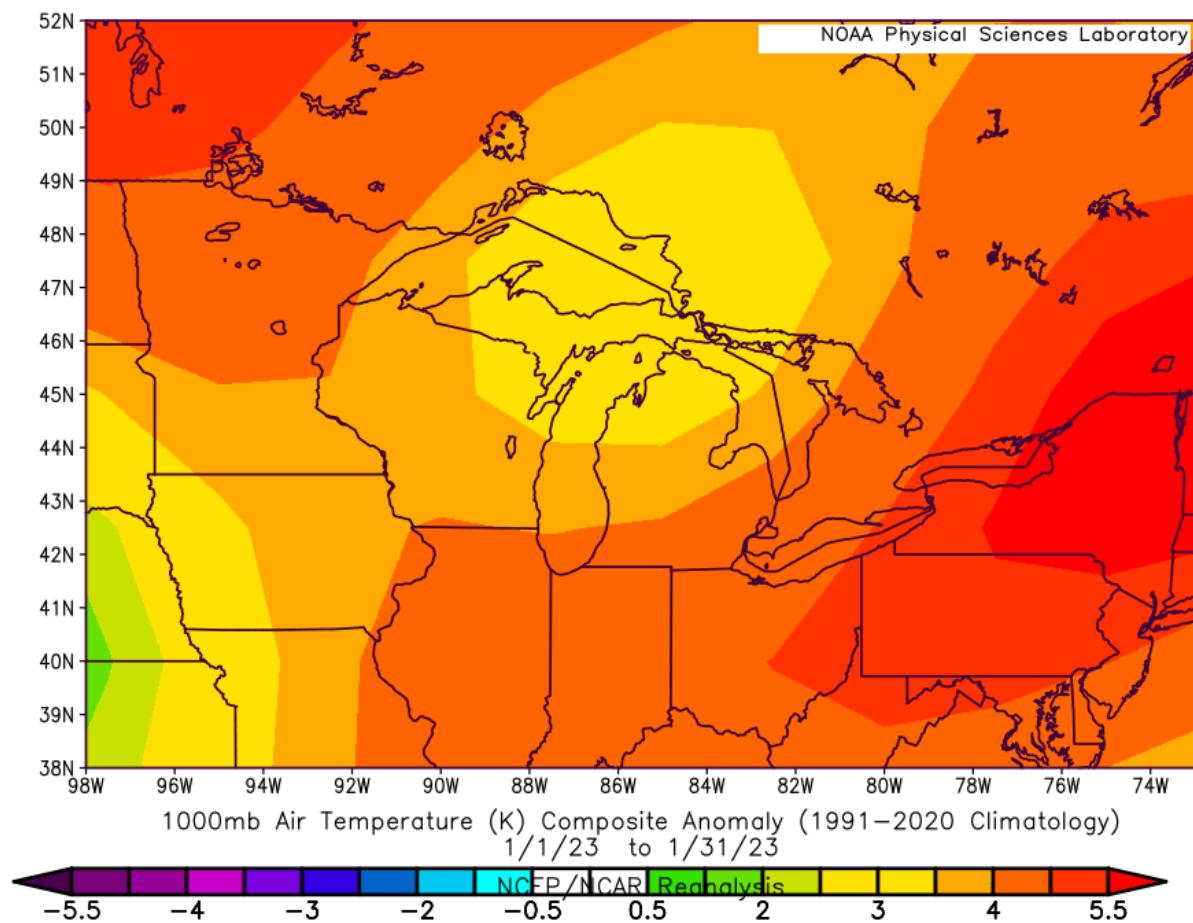


Figure 47: Surface Air Temperature Anomaly for the Great Lakes, 1-31 January 2023.

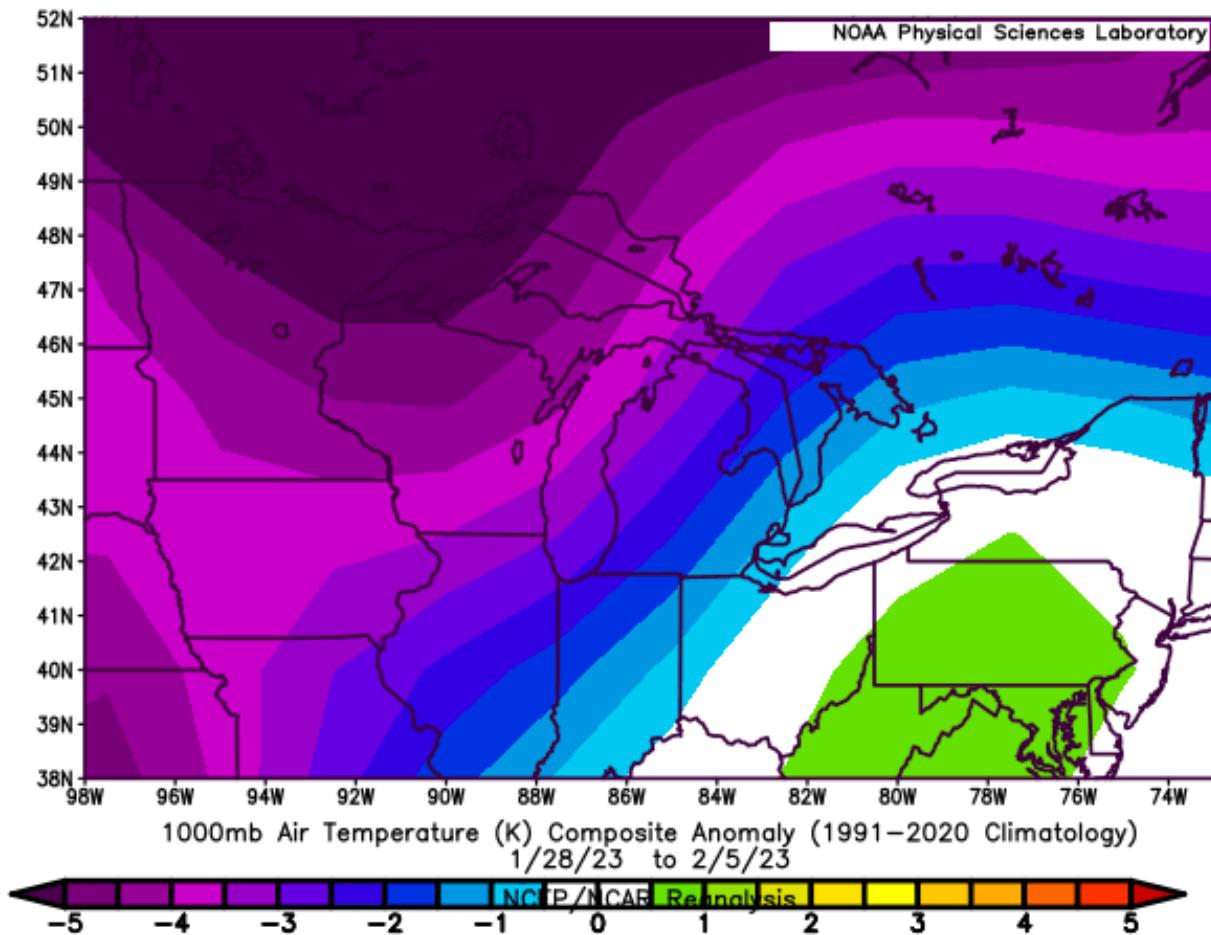


Figure 48: Surface Air Temperature Anomaly for the Great Lakes, 28 January to 5 February 2023

During the end of January to the first week of February Lake Erie saw the second and most significant cold temperature period of the season, see figure 48 above.

It is during this cold spell where the largest ice coverage for this season on Lake Erie developed, see figure 49 below.

After the first week in February once more Lake St. Claire, the Western basin of Lake Erie and this time the north shore of Lake Erie as well were covered in new (<5 cm) and thin (5-15 cm) ice.

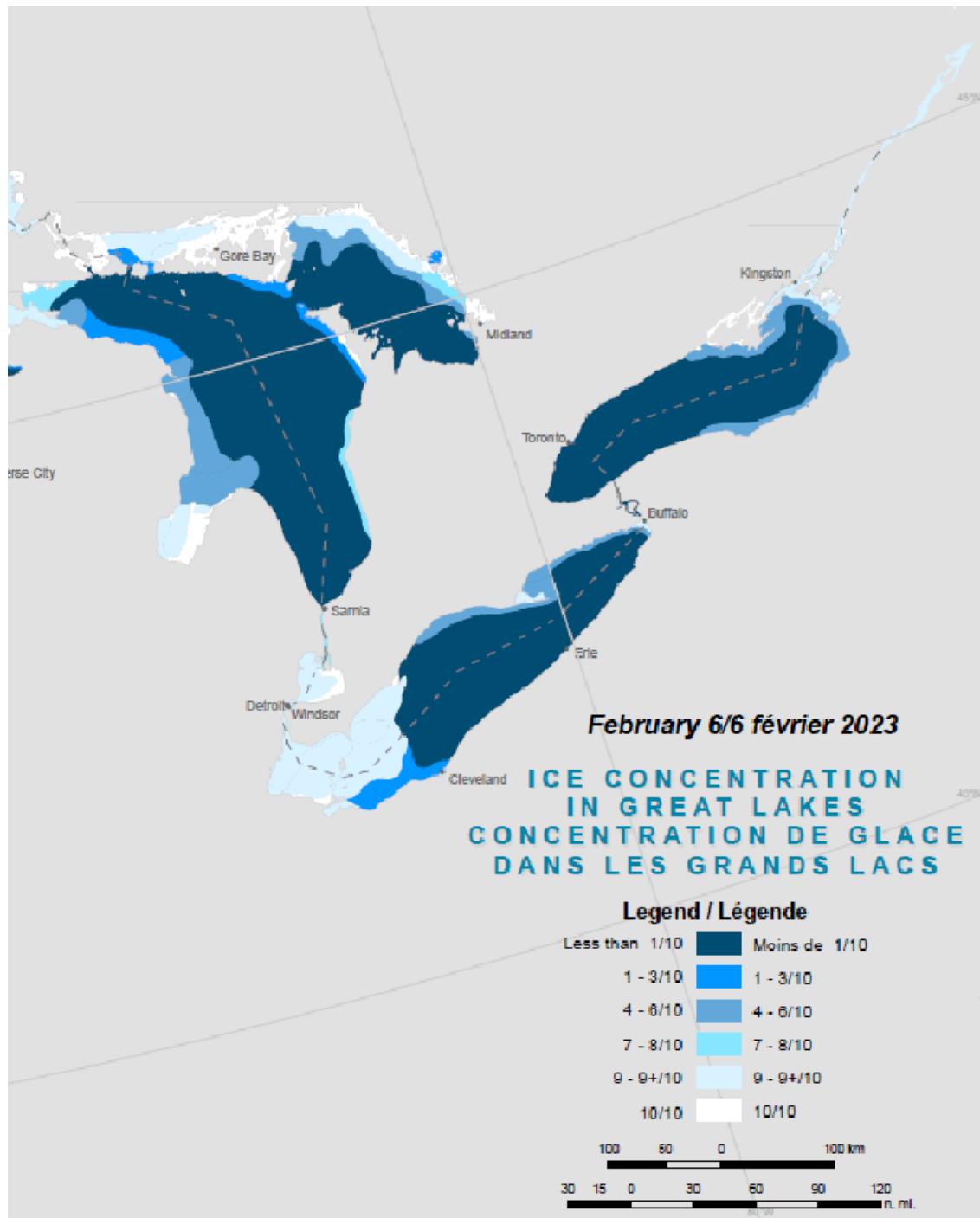
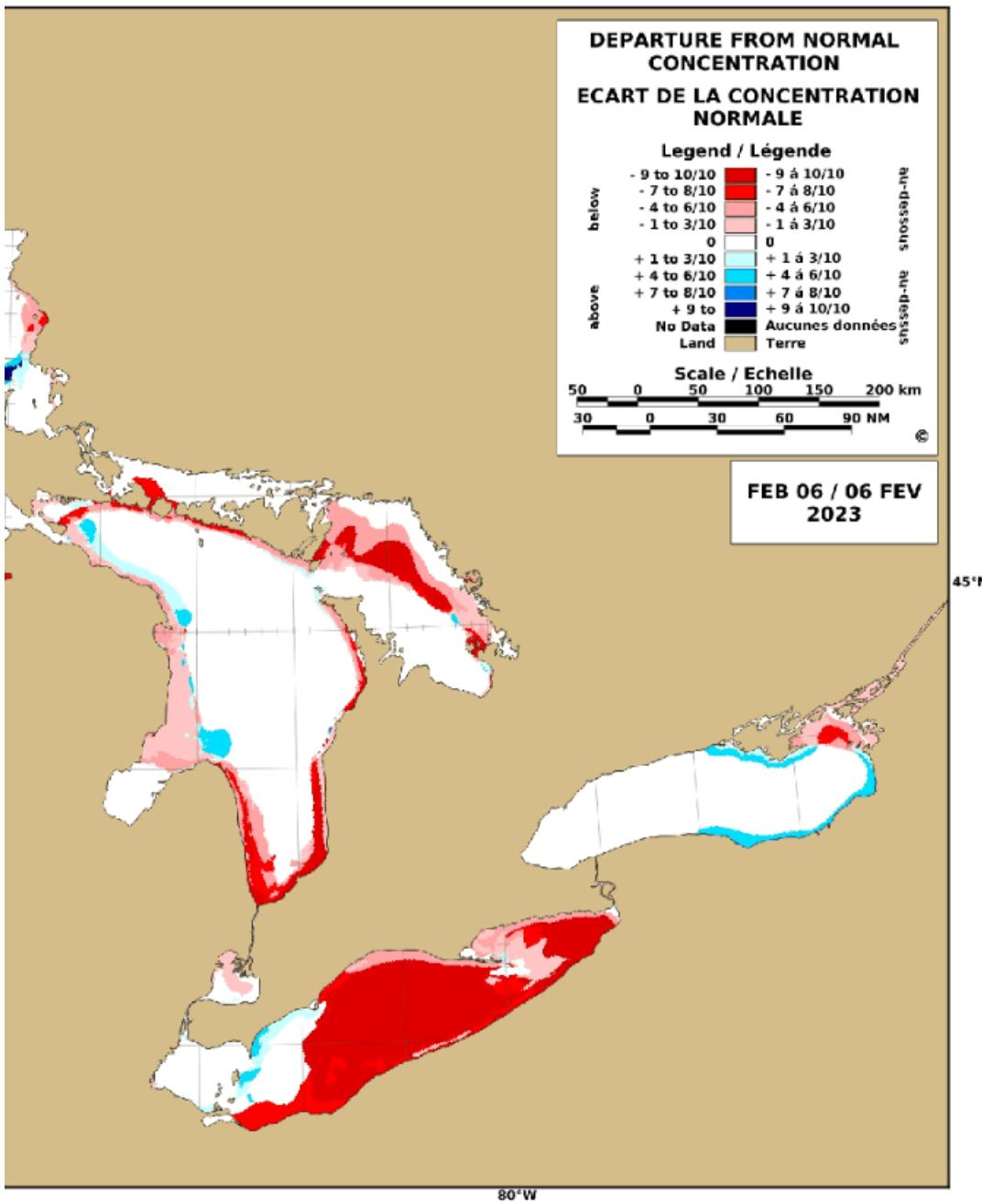


Figure 49: Ice Coverage on the eastern Great Lakes, February 6<sup>th</sup>, 2023



**Figure 50: Departure from Normal Chart for February 6<sup>th</sup>, 2023.**  
**Red is missing ice; Blue is extra ice compared to the median ice concentration from 1990-91 to 2019-20**

This cold temperature period was short lived, and temperatures quickly returned to warmer than seasonal temperatures and very low ice cover by the second week of February. Can see the rapid melting of the ice on Lake Erie by comparing the departure from normal charts in figures 50 and 51, The area with ice in white on figure 50 above is seen to return to a solid red color over the western basin of Lake Erie on the departure from normal chart for February 13<sup>th</sup>, figure 51. Red representing areas without ice where climatologically ice would be present.

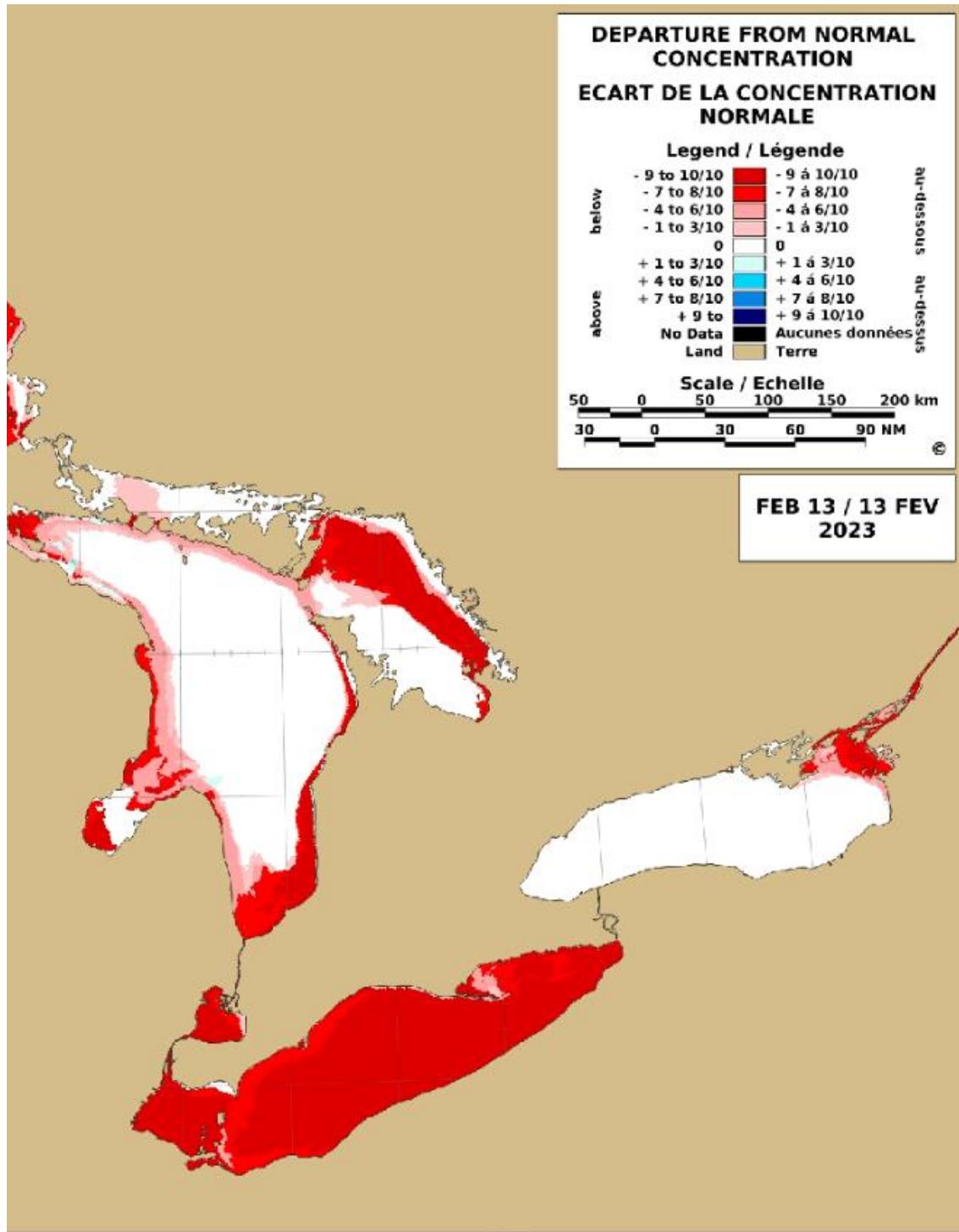


Figure 51: Departure from Normal Chart for February 13<sup>th</sup>, 2023.

Red is missing ice; Blue is extra ice compared to the median ice concentration from 1990-91 to 2019-20

Other than a couple short-lived cold periods above seasonal temperatures were the norm for this year's ice season over Lake Erie. Under the influence of the above normal temperature all the ice on Lake Erie and Lake St. Clair had melted away before the third week of February came to an end.

This would be the last ice cover on Lake Erie, while Lake St. Claire would see a small amount of new ice form along its north shore in mid March that lasted only a few days.

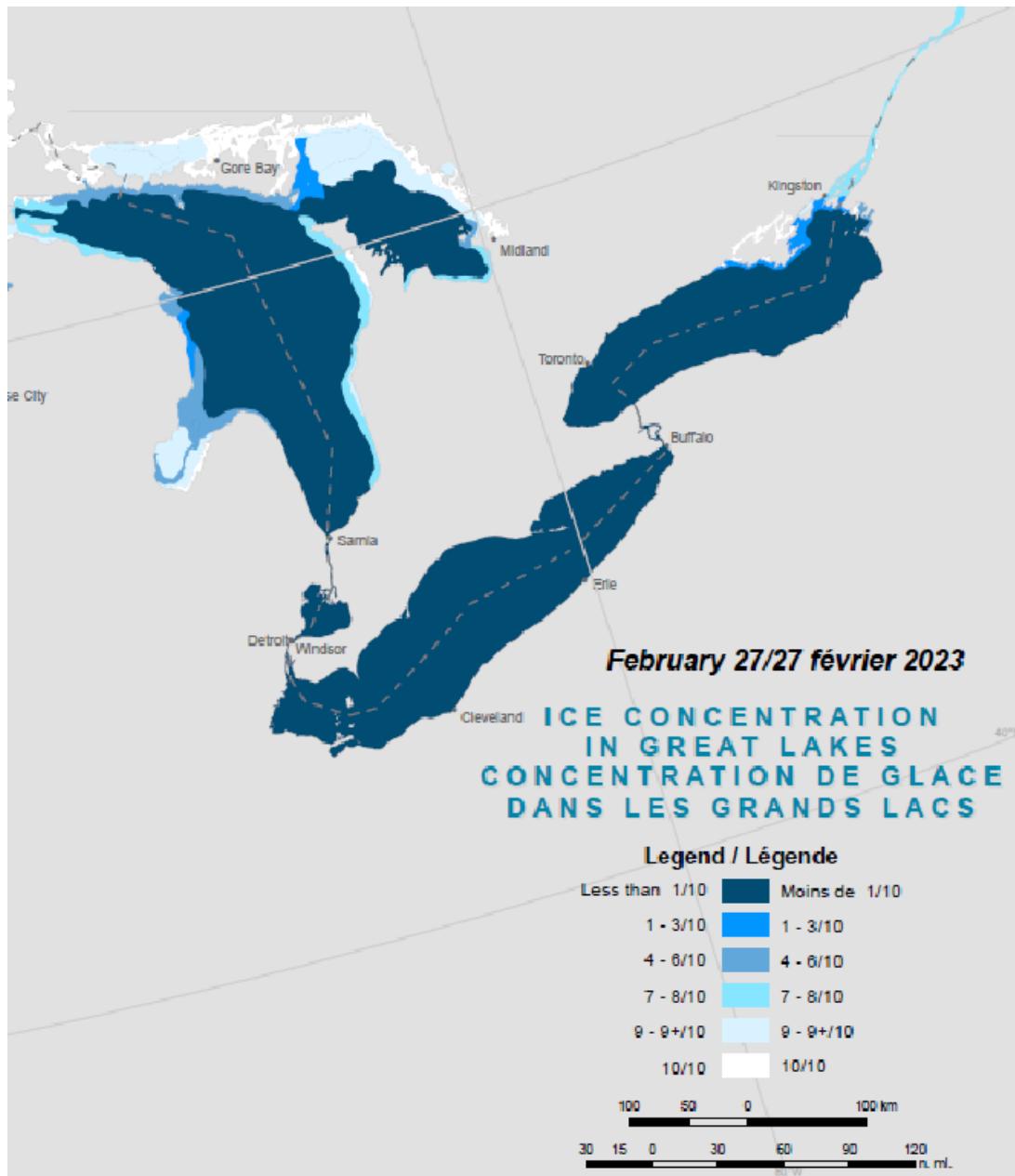


Figure 52: Ice Coverage on the eastern Great Lakes, February 27<sup>th</sup>, 2023

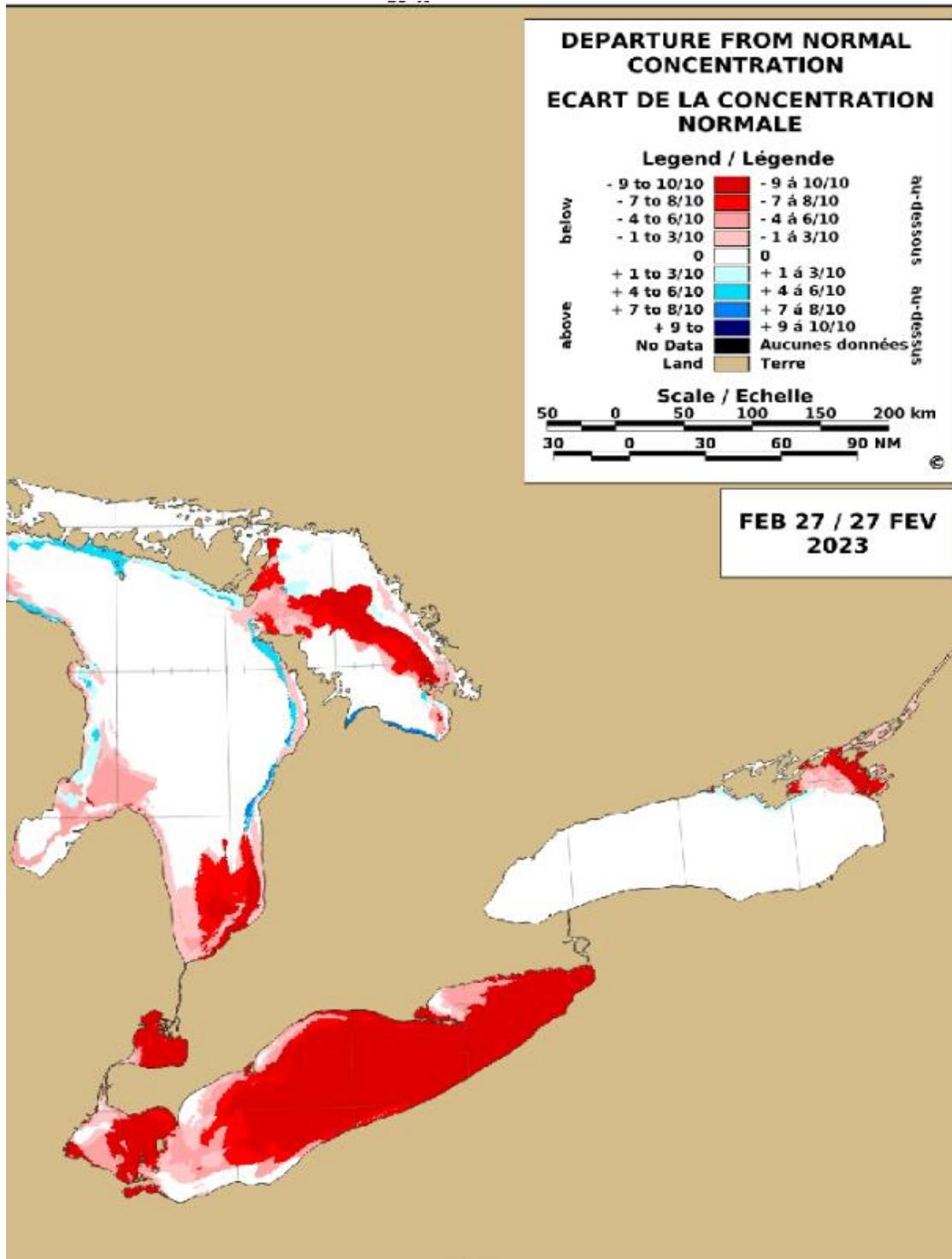


Figure 53: Departure from Normal Chart for February 27<sup>th</sup>, 2023.  
**Red** is missing ice; **Blue** is extra ice compared to the median ice concentration from 1990-91 to 2019-20

The average temperatures over the lake averaged for the entire month of February were warmer than is normal for the month even with the cold start at the beginning of February. This shows both the shortness of the cold spell and the magnitude of the heat that followed.

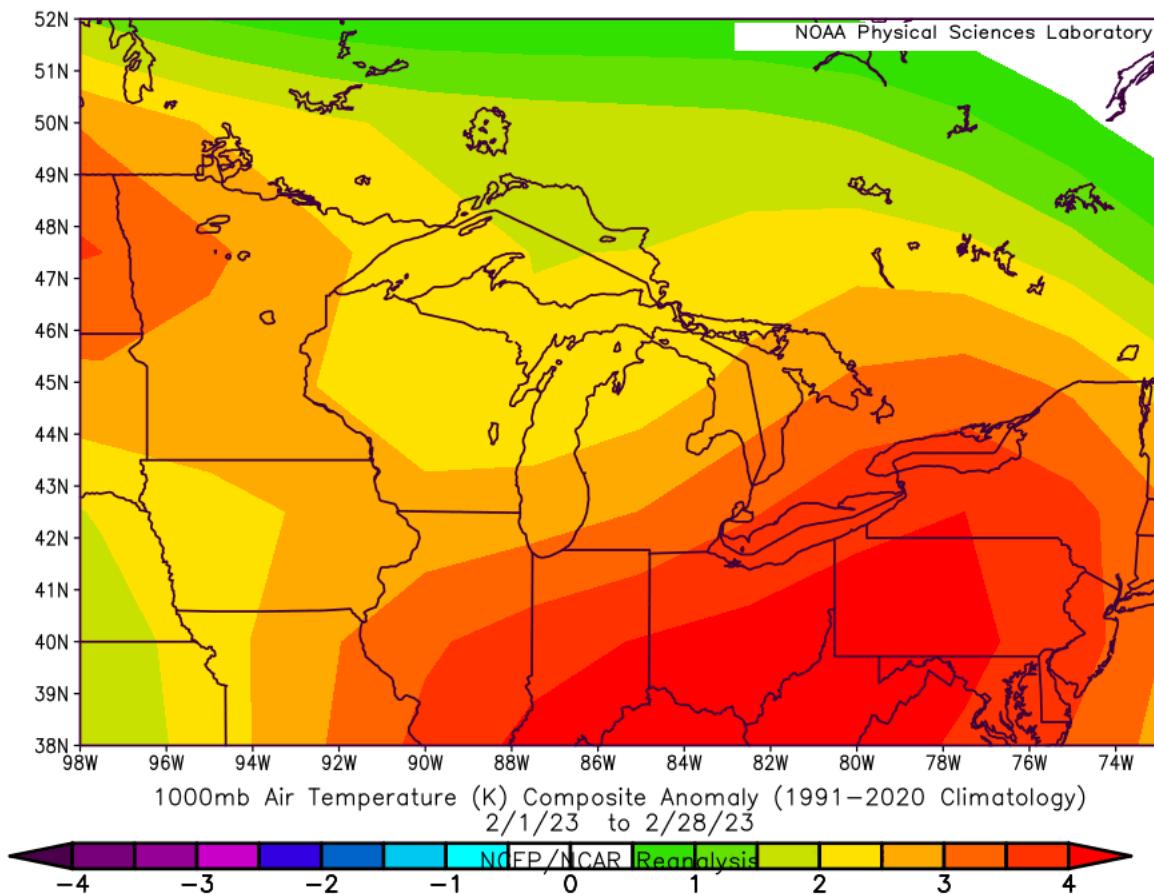
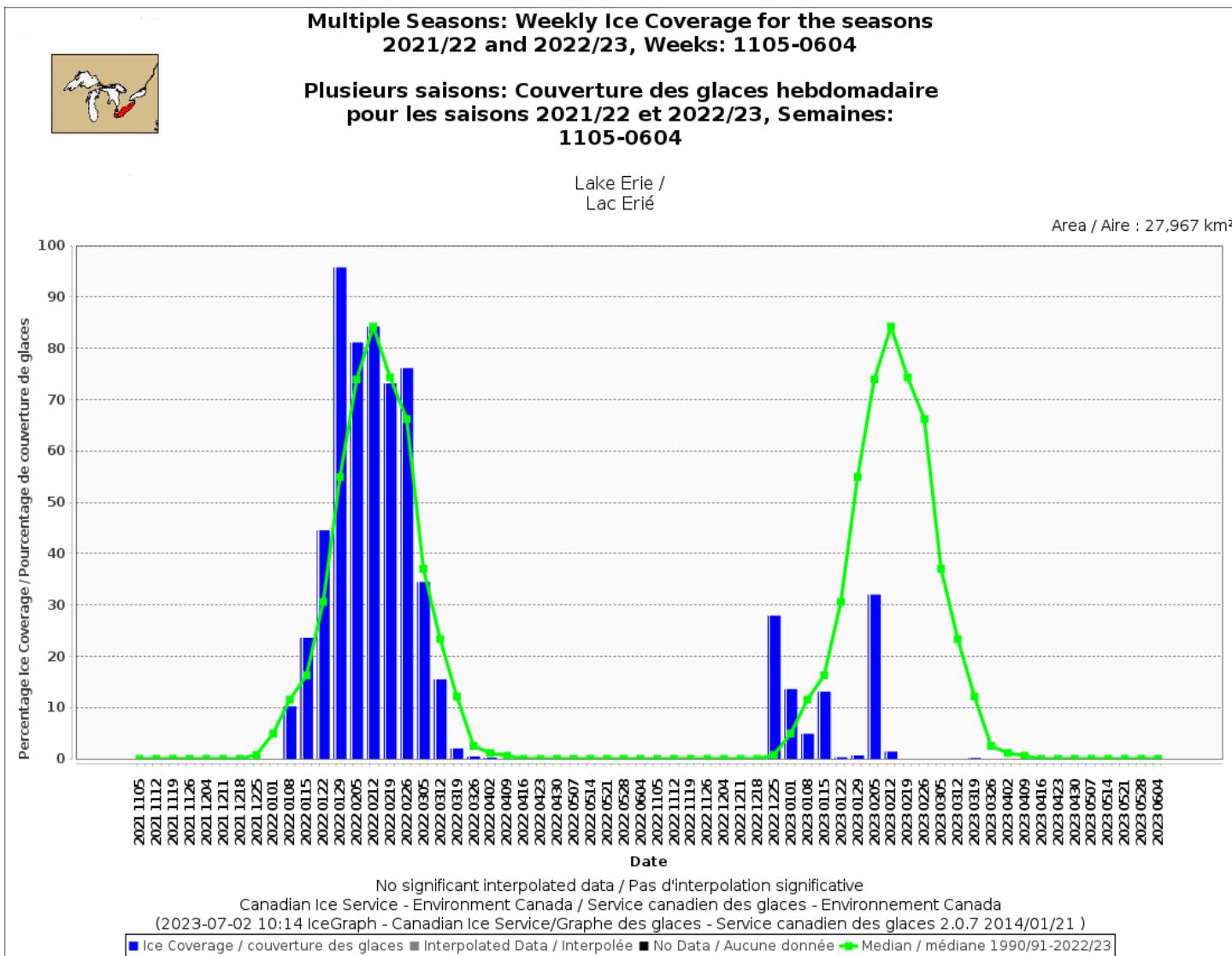


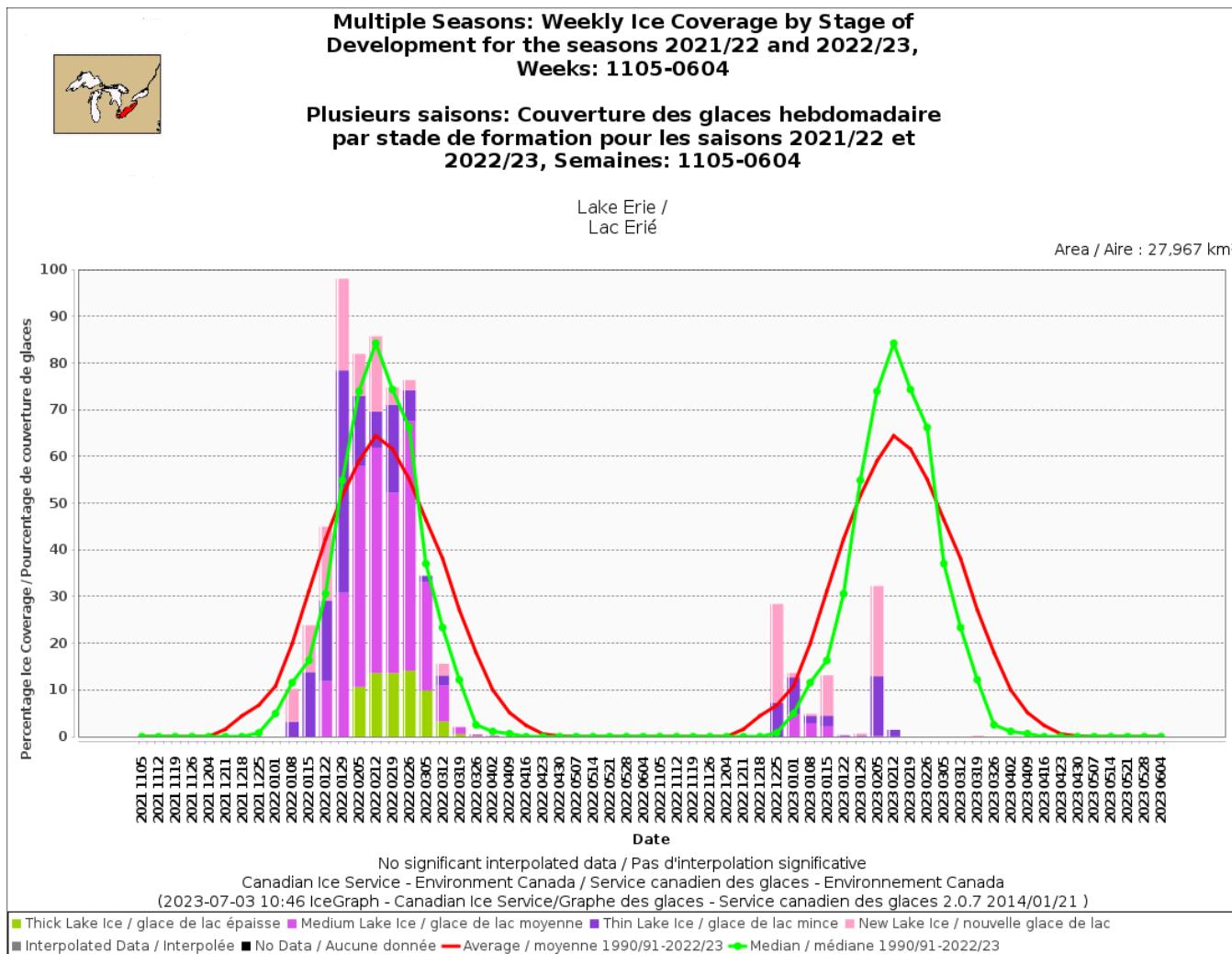
Figure 54: Surface Air Temperature Anomaly for the Great Lakes, 1-28 February 2023

Though the ice season officially ended with the melting of this new ice along the north shore of Lake St. Claire on March 22<sup>nd</sup> the ice season effectively ended on Lake Erie quite early on the second week in February as almost no ice remained after that time.



**Figure 55: Lake Erie Ice Coverage for 2021-22 season and 2022-2023 season.**

The above chart shows ice coverage on Lake Erie had two peaks this year. The first in the third week of December and the second the first week of February. Typically, ice coverage on Lake Erie would peak in the second week of the February and begin to decline in terms of ice coverage during the second half of the month.



**Figure 56: Weekly Ice Coverage on Lake Erie for winters 2021-23 showing stage of development.**

The above chart shows the stage of development of the ice on Lake Erie. Can see how the warm weather of this 2022-2023 season prevented the ice from thickening. The thick lake ice is shown in green and comparing with last year which was a more normal year the lack of thick ice is very apparent.

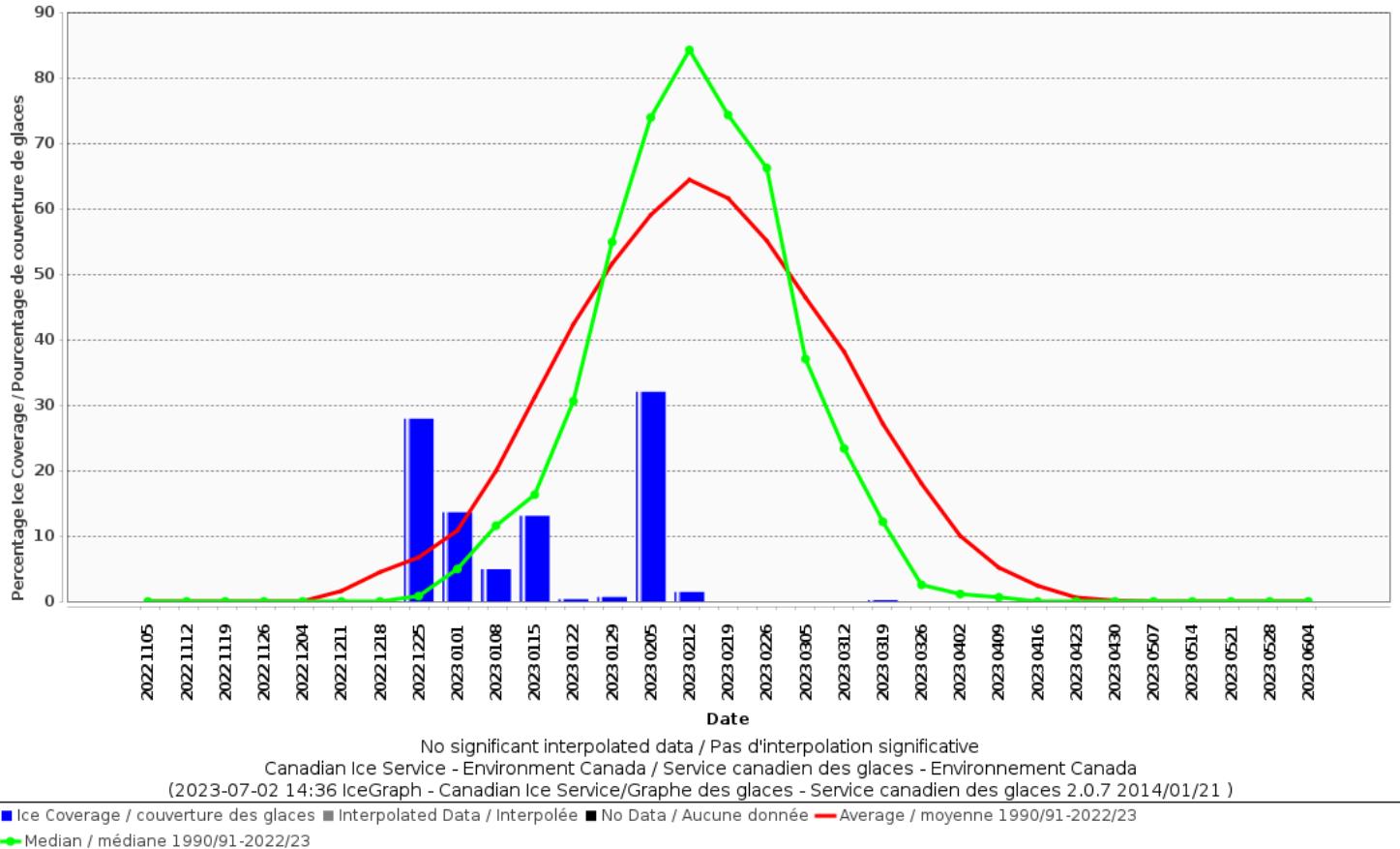
**Single Season: Weekly Ice Coverage for the season  
2022/23, Weeks: 1105-0604**



**Une saison: Couverture des glaces hebdomadaire pour la  
saison 2022/23, Semaines: 1105-0604**

Lake Erie /  
Lac Erié

Area / Aire : 27,967 km<sup>2</sup>



**Figure 57: Weekly Ice Coverage in Lake Erie for winter 2022-23.**

The weekly ice coverage chart above shows that the ice coverage on Lake Erie consisted of basically two short lived peaks one very early in the year and the second at the start of February. Lake Erie was in fact, the first of the Great Lake to surpass 10% ice cover this season in early December. Lake Erie reached over 25% ice cover in response to the first cold weather of the season in mid December. Lake Erie crossed the 10% ice mark on December 25<sup>th</sup> during the cold snap. This is a week before the long-term median 10% ice cover date on the lake of January 1<sup>st</sup>. Ice cover on Lake Erie reached over 24% on Dec 26-27 and just over 30% on February 5<sup>th</sup>. These two peaks in ice coverage this season are very evident on the weekly ice cover chart for Lake Erie above.

As the ice coverage was thin it was quickly destroyed in the unseasonably warm temperatures that followed in late December and January.

## Lake Erie Ice Coverage for the 2022-23 season:

	Ice coverage in %	Average ice coverage from 1973-2023 in %	% difference average + above / - below
Dec 7	0.0	1.0	-1%
Dec 12	0.0	3.0	-3%
Dec 19	0.0	5.0	-5%
Dec 26	27.0	9.5	+17.5%
Jan 2	12.0	15.0	-3%
Jan 9	5.0	29.0	-24%
Jan 16	11.0	41.0	-30%
Jan 23	0.3	48.0	-47.7%
Jan 30	0.4	53.0	-52.6%
Feb 6	31.0	61.0	-30%
Feb 13	1.0	69.0	-68%
Feb 20	0.0	67.0	-67%
Feb 27	0.0	62.0	-62%
Mar 6	0.0	52.0	-52%
Mar 13	0.0	43.0	-43%
Mar 20	0.0	33.0	-33%
Mar 27	0.0	20.0	-20%
Apr 3	0.0	11.0	-11%
Apr 10	0.0	7.0	-7%
Apr 17	0.0	4.0	-4%
Apr 24	0.0	1.0	-1%
May 1	0.0	1.0	-1%
May 8	0.0	1.0	-1%
May 15	0.0	0.0	0%

Table 5: Lake Erie ice coverage for the 2022-23 season compared to average concentrations from 1972-1973 to 2022-2023

Table 5 above shows that Lake Erie had ice coverage that was well below normal ice coverage amounts this season. The months with the greatest discrepancy from the normal amount of ice coverage were from about the third week of January to about the middle of March. Every month this year had less ice than normal except for after the third week of December which had almost 20% more ice cover than normal. The below normal ice amounts were due to the persistent above normal temperatures during the 2022-23 ice season.

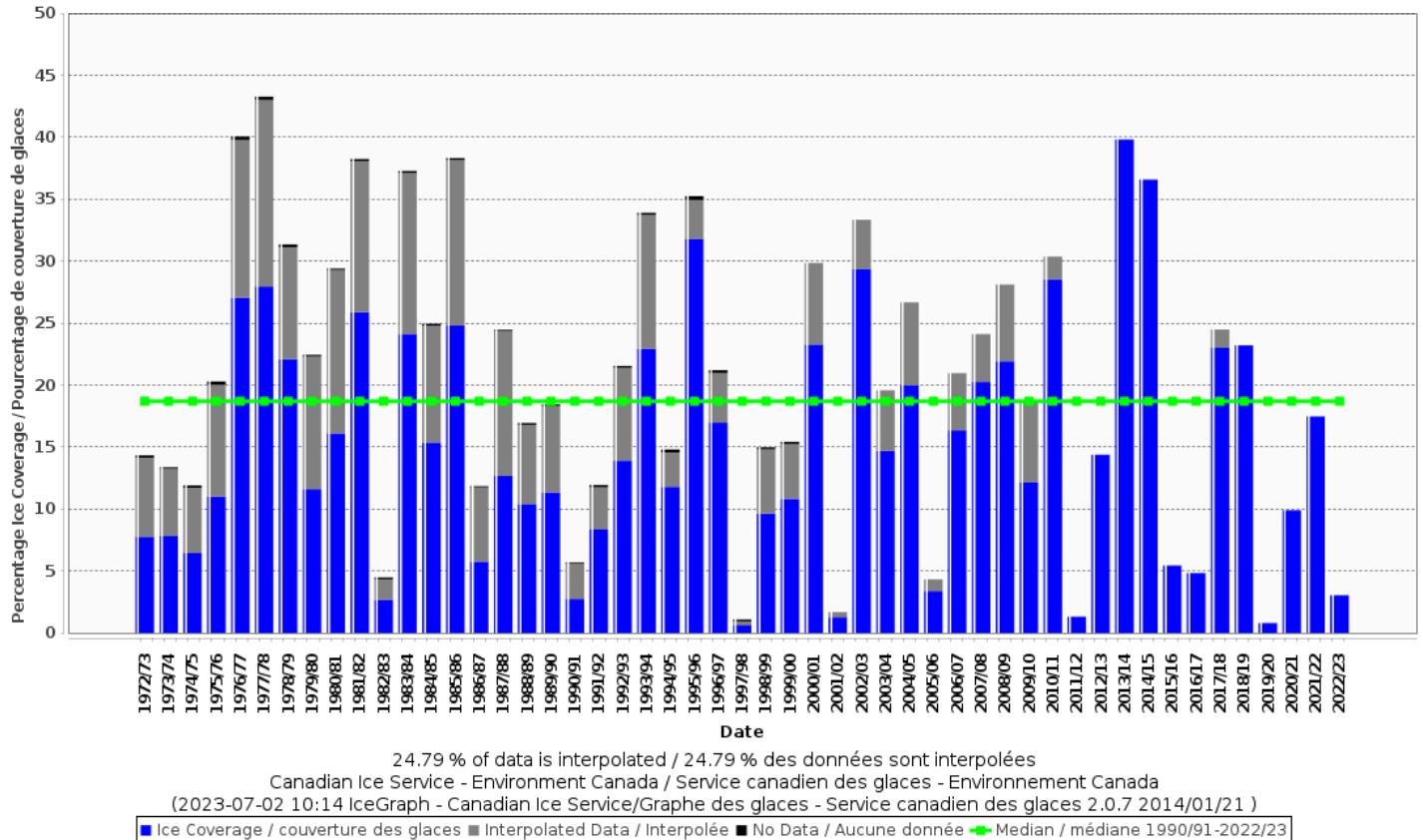
**Historical Total Accumulated Ice Coverage (TAC) for  
the weeks 1105-0604, seasons:1972/73-2022/23**



**Total accumulé de la couverture des glaces historique  
(TAC) pour les semaines 1105-0604,  
saisons:1972/73-2022/23**

Lake Erie /  
Lac Erié

Area / Aire : 27,967 km<sup>2</sup>



**Figure 58: Historical Total Accumulated Ice Coverage in Lake Erie by season, 1972-2023.**

The total accumulated coverage (TAC) was 3.3% for Lake Erie or under one sixth the long-term median TAC of about 19%.

The 2022-23 ice season ranked as one of the 6 lowest ice seasons over the last 50 years, since the 1972-1973 ice season. By rank the lowest ice coverage year on Lake Erie was 2020 with near 2.5% TAC.

Maximum Ice Coverage for the weeks 1105-0604, seasons:  
1972/73-2022/23



La couverture maximale de glace pour les semaines  
1105-0604, saisons: 1972/73-2022/23

Lake Erie /  
Lac Erie

Area / Aire : 27,967 km<sup>2</sup>

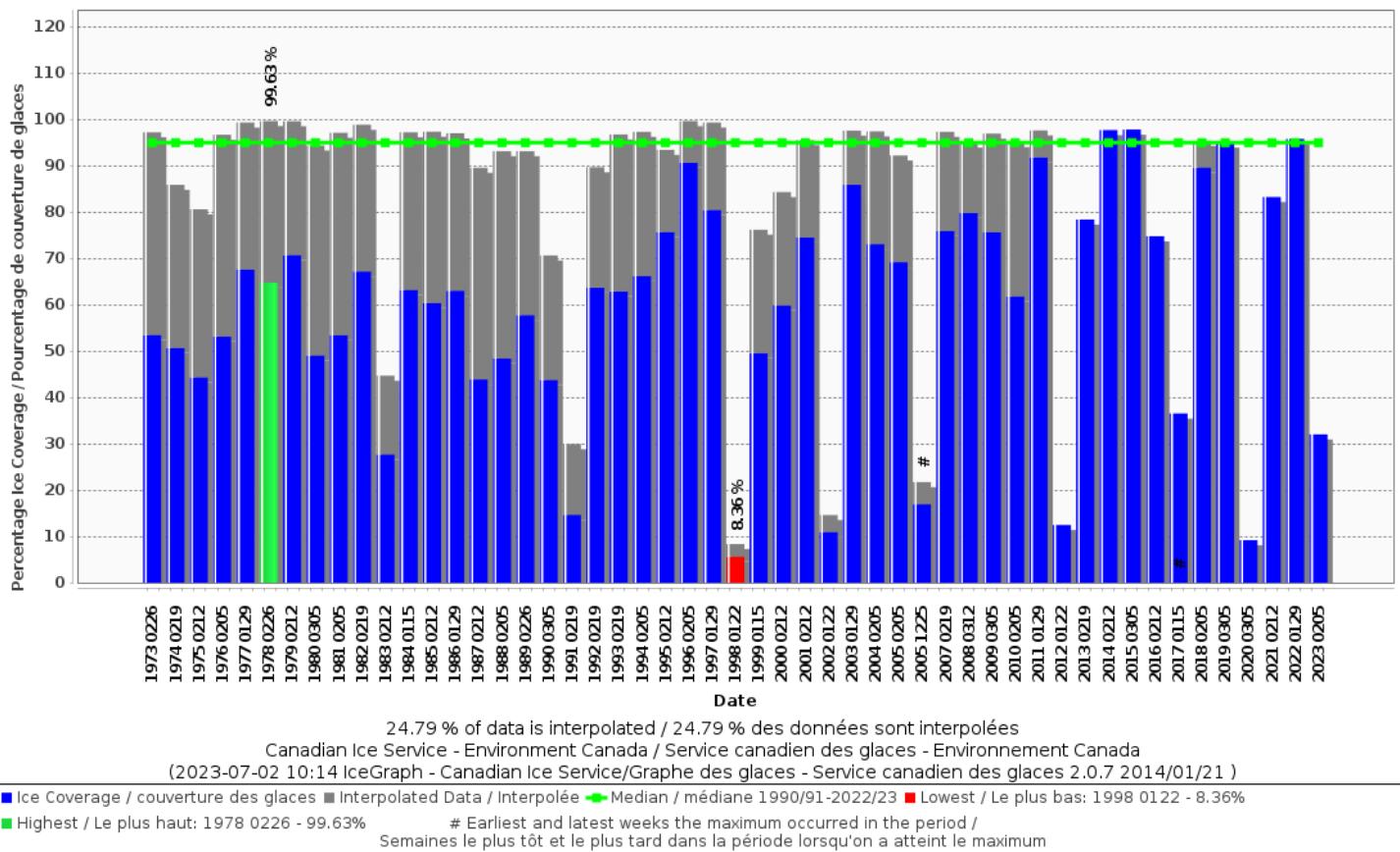


Figure 59: Maximum Ice Coverage in Lake Erie by season, 1972-2023.

The maximum ice coverage occurred on Lake Erie on the week of February 5<sup>th</sup>. This is about two weeks earlier than is the normal date for Lake Erie to attain maximum ice coverage. Lake Erie normally reaches maximal ice coverage during the third week in February. See median ice coverage on figure 57 above.

## **Lake Ontario**

The ice season began on Lake Ontario on December 15<sup>th</sup> with the first of only two ice coverage producing cold periods this ice season. The first ice formed in the Bay of Quinte and in a few bays along the shore of the northeast corner of Lake Ontario. Though the ice season started at about the same time and pace as last year this cold spell was short lived ending after the first week in January with a return to anomalously warm temperatures kept the ice coverage from continuing to increase as they did last year.

Without cold temperatures for the rest of January the ice that formed in the bays along the shores of northeastern Lake Ontario did not see any growth during the month of January until the second and most significant cold period of the year arrived during the last week of January and lasting until the end of the first week of February. This second cold period in early February brought a short-lived peak in ice coverage the ice coverage on Lake Ontario however ice coverage this season would remain very low as temperatures remained anomalously warm almost all season.

During this second cold period Lake Ontario saw the most ice it would see this season. Near the end of the first week of February Lake Ontario had about 13% ice cover. Ice rapidly formed in bays and along the coast in the northeast with this cold spell as can be seen by the spike in the weekly ice coverage chart below.

The entrance to the St Lawrence River only had ice in sheltered bays for most of the winter and never became ice covered.

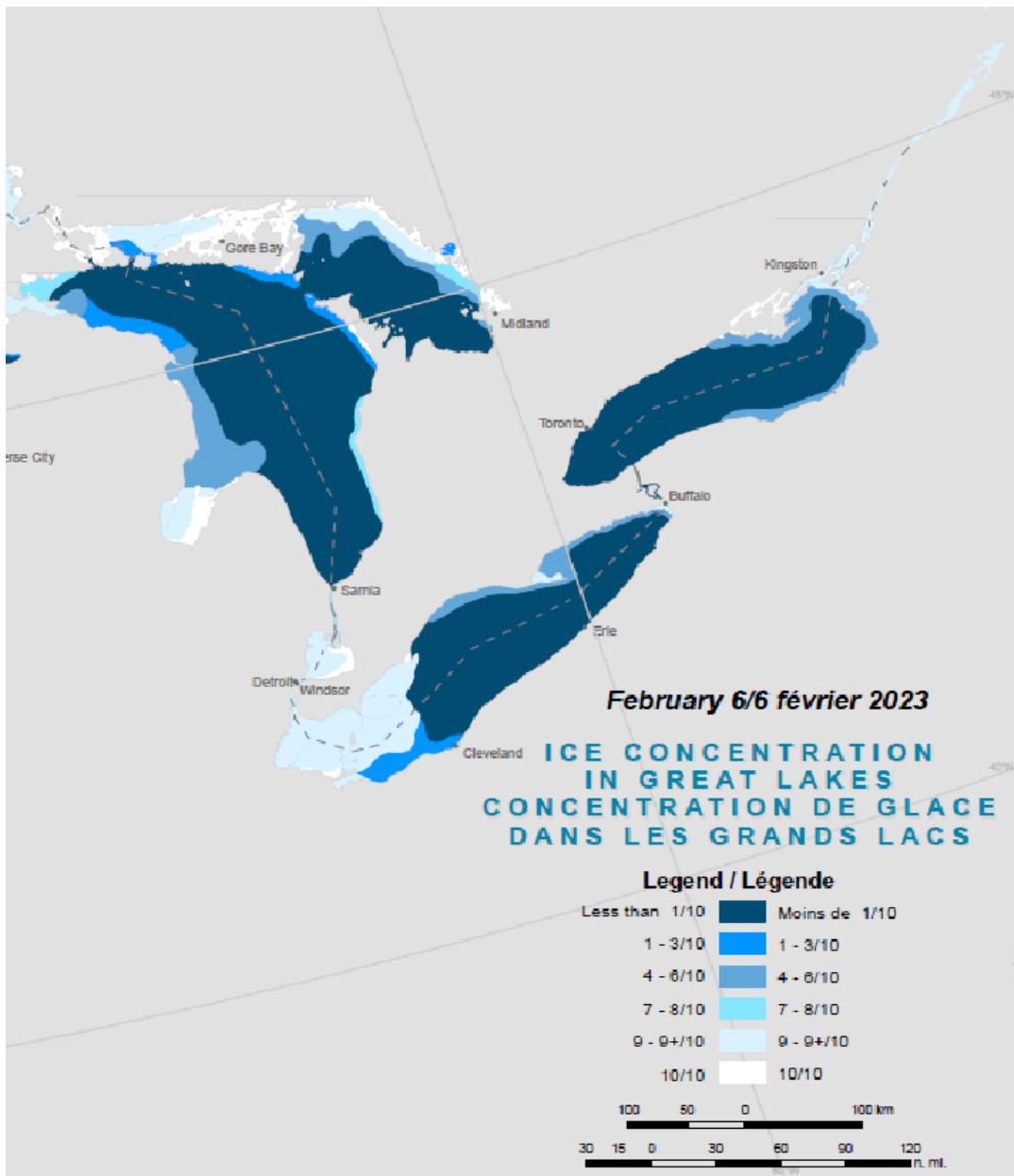
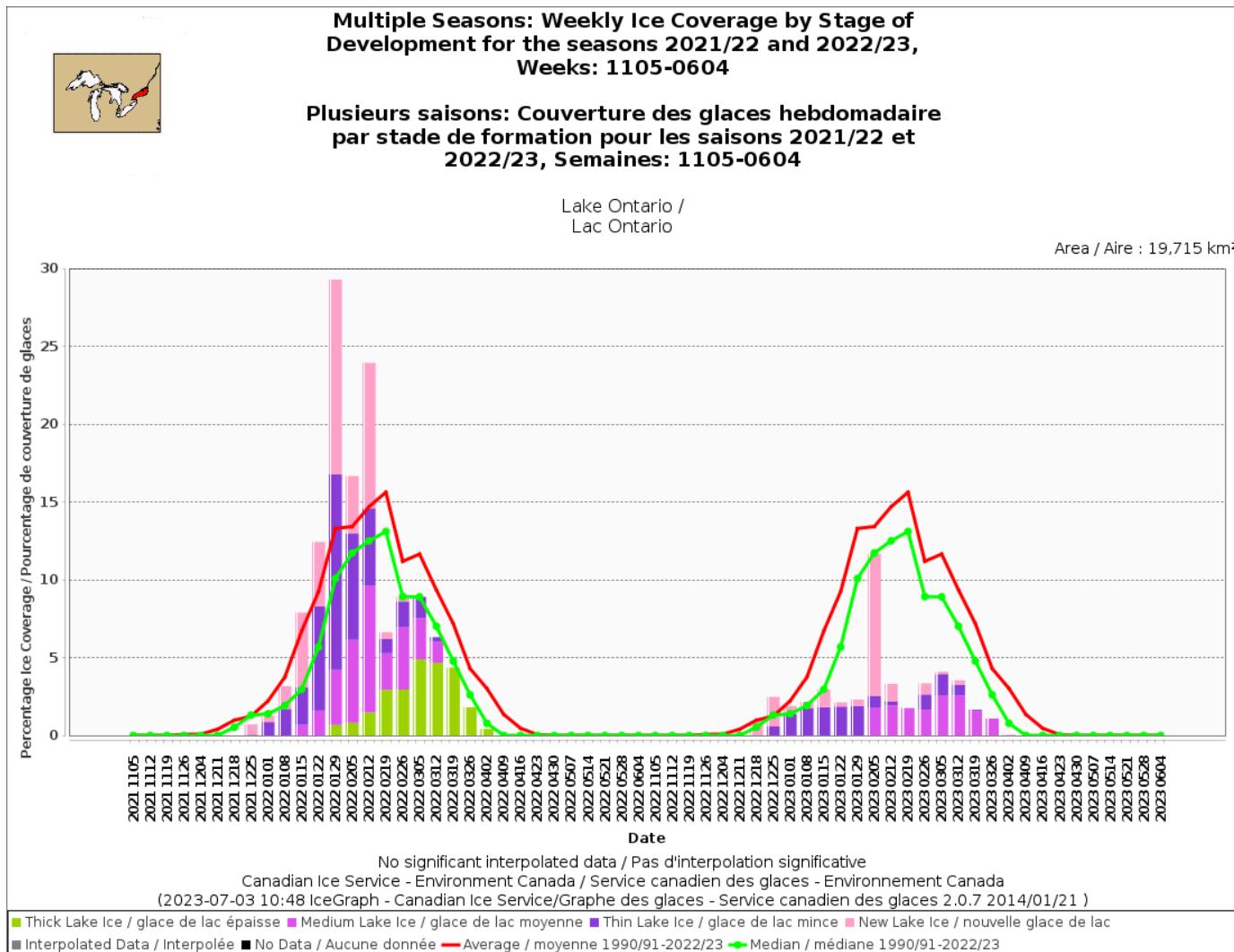


Figure 60: Ice Coverage on the eastern Great Lakes, February 6<sup>th</sup>, 2023

This second cold period was also ended abruptly by a return to warmer than normal temperatures and ushered in with a weather system that quickly destroyed the young and very thin ice everyplace except in a few sheltered bays along the shores in the northeastern part of the Lake.

For most of the rest of the 2022-23 ice season there would be not ever be more than between 2-4% ice cover on Lake Ontario. Thus, ice cover more than tripled during this short period in early February however it quickly returned to its unseasonably low amounts of ice cover as quickly as it had formed. See the spike in ice concentration on the weekly ice cover chart below, figure 63 below.



**Figure 61: Weekly Ice Coverage on Lake Ontario for winters 2021-23 showing stage of development.**

Can see from the figure 61 above showing the stage of development of the ice on Lake Ontario how the warm weather of this 2022-2023 season prevented the ice from thickening. The thick lake ice is shown in green and comparing with last year which was a more normal year the lack of thick ice is very apparent. Ice on Lake Ontario never thickened beyond medium lake ice in isolated bays.

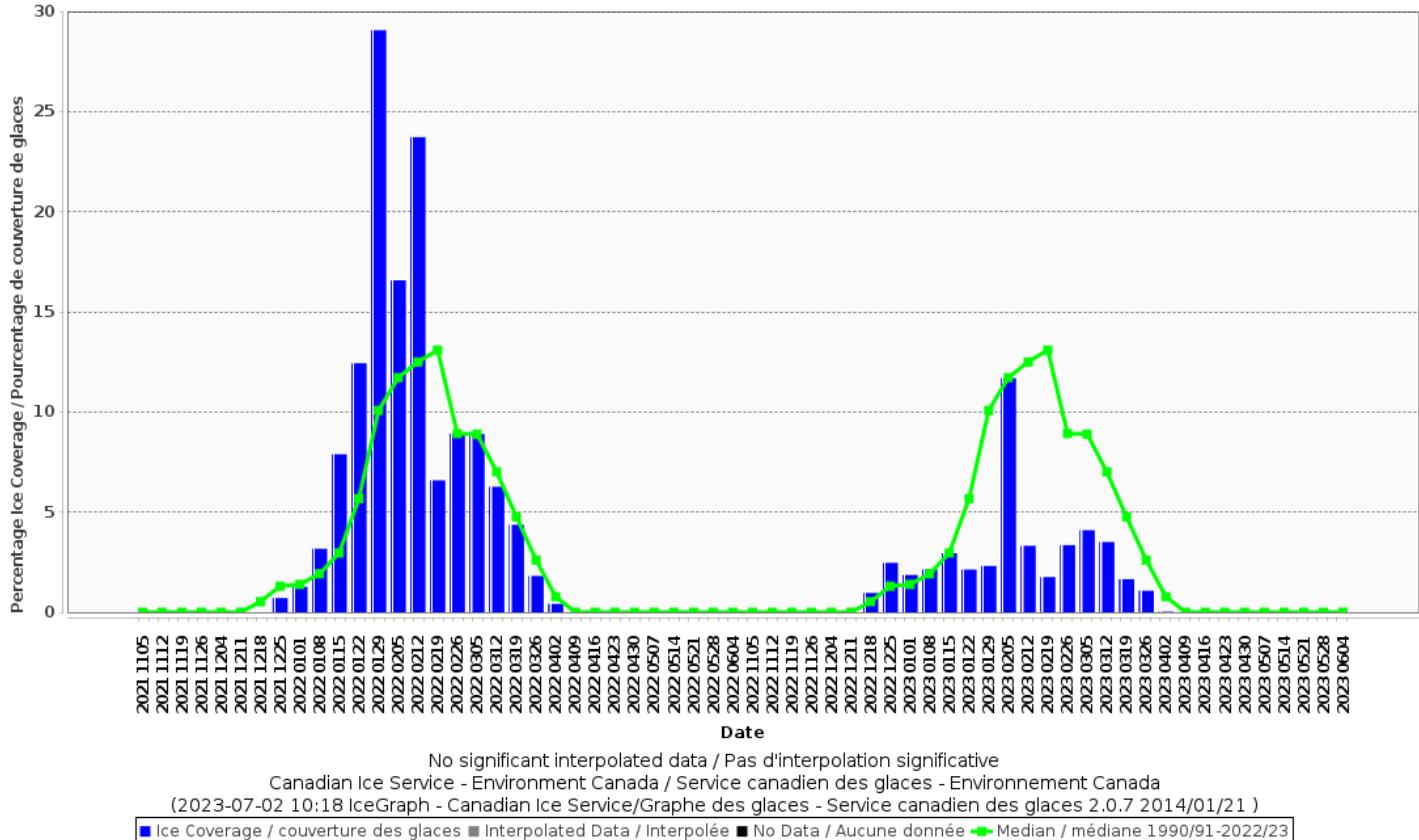
**Multiple Seasons: Weekly Ice Coverage for the seasons  
2021/22 and 2022/23, Weeks: 1105-0604**



**Plusieurs saisons: Couverture des glaces hebdomadaire  
pour les saisons 2021/22 et 2022/23, Semaines:  
1105-0604**

Lake Ontario /  
Lac Ontario

Area / Aire : 19,715 km<sup>2</sup>



**Figure 62: Lake Ontario Ice Coverage from 2021-22 season and 2022-23 season.**

The above chart, figure 62, shows ice coverage on Lake Ontario this year was for most of this years' ice season substantially below normal values. This season saw substantially less ice coverage than last season as well as is seen on the above chart.

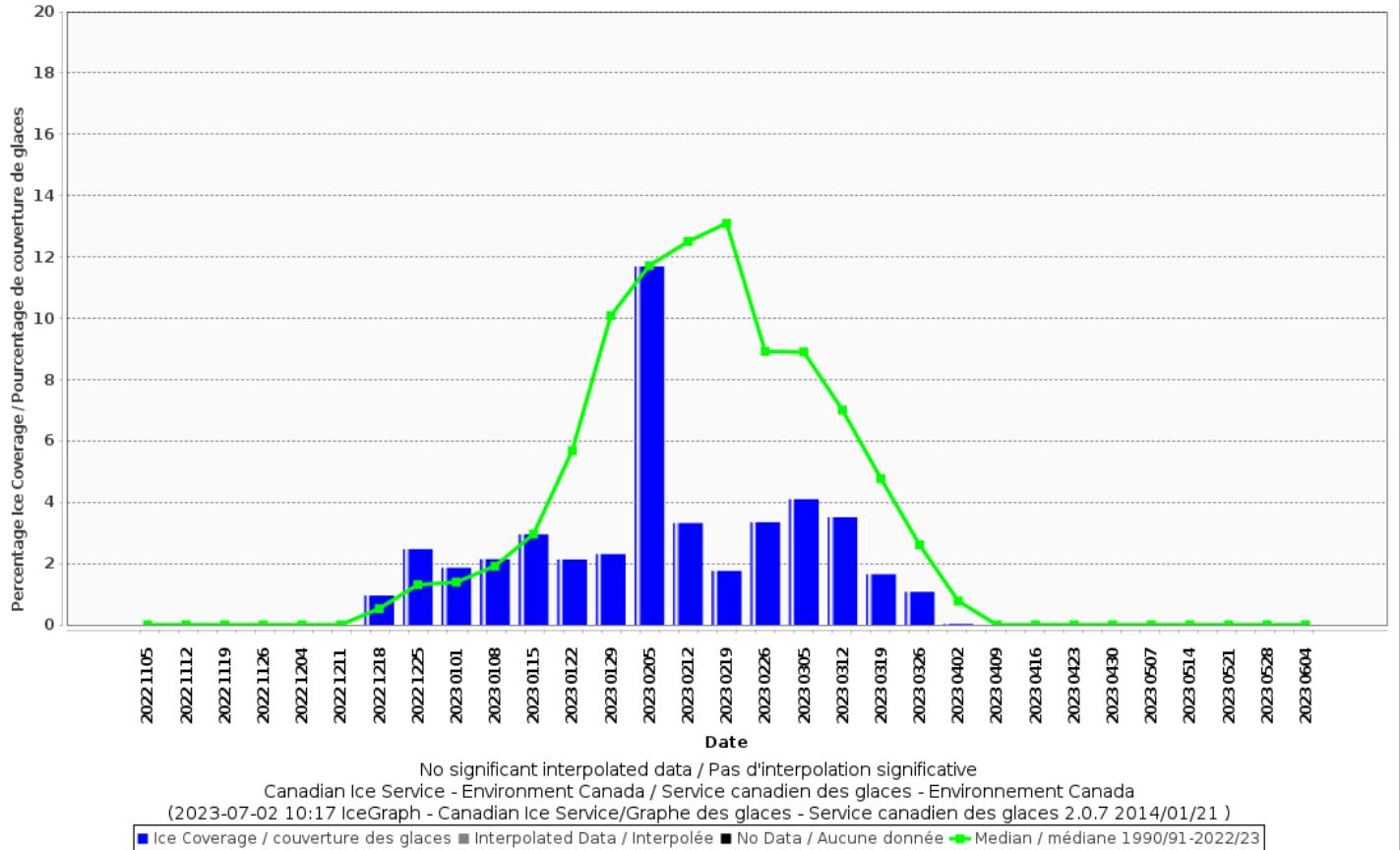
**Single Season: Weekly Ice Coverage for the season  
2022/23, Weeks: 1105-0604**



**Une saison: Couverture des glaces hebdomadaire pour la  
saison 2022/23, Semaines: 1105-0604**

Lake Ontario /  
Lac Ontario

Area / Aire : 19,715 km<sup>2</sup>



**Figure 63: Weekly Ice Coverage in Lake Ontario for winter 2022-2023**

The above chart, figure 63, shows ice coverage on Lake Ontario had a peak this year in the first week of February. After a normal start to the ice season in early December the ice coverage amounts were substantially below normal values at all the times of the ice season except for the short-lived spike in ice coverage the first week of February.

## Lake Ontario Ice Coverage for the 2022-23 season:

	Ice coverage in %	Average ice coverage from 1973-2023 in %	% difference average + above / - below
Dec 7	0.0	1.0	-1%
Dec 12	0.0	1.0	-1%
Dec 19	1.0	2.0	-1%
Dec 26	3.5	3.0	+0.5%
Jan 2	2.0	5.0	-3%
Jan 9	2.0	8.0	-6%
Jan 16	3.0	11.0	-8%
Jan 23	2.0	13.0	-11%
Jan 30	2.0	15.0	-13%
Feb 6	12.0	18.0	-6%
Feb 13	4.0	20.0	-16%
Feb 20	2.0	19.0	-17%
Feb 27	4.0	17.0	-13%
Mar 6	4.0	15.0	-11%
Mar 13	4.0	11.0	-7%
Mar 20	3.0	9.0	-6%
Mar 27	0.4	6.0	-5.6%
Apr 3	0.0	4.0	-4%
Apr 10	0.0	2.0	-2%
Apr 17	0.0	2.0	-2%
Apr 24	0.0	1.0	-1%
May 1	0.0	1.0	-1%
May 8	0.0	1.0	-1%
May 15	0.0	0.0	0%

Table 6: Lake Ontario ice coverage for the 2022-23 season compared to average concentrations from 1972-1973 to 2022-2023

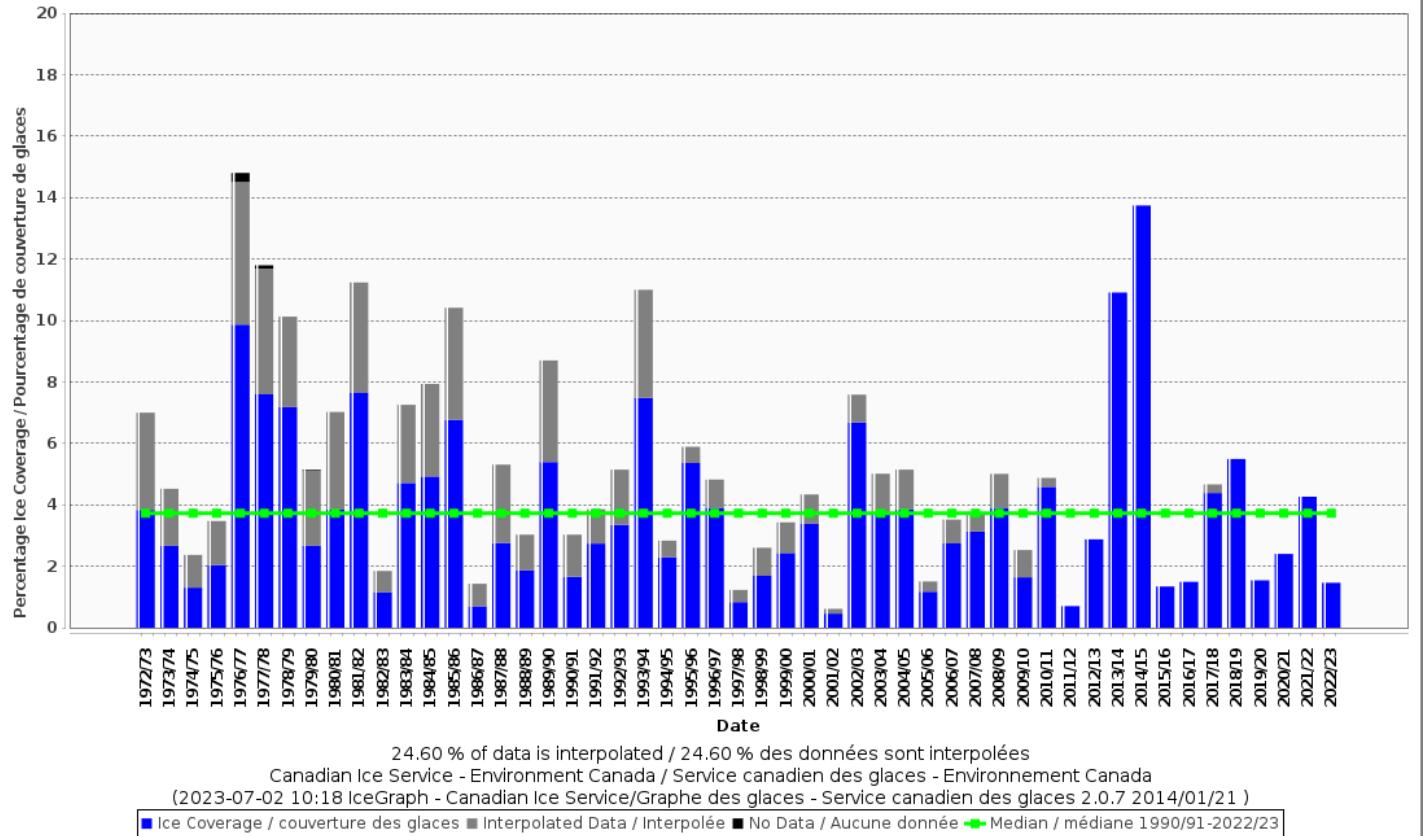
Table 6 above shows that Lake Ontario had below normal ice coverage amounts every month this year except for December which had slightly more ice than is normal. The below normal ice amounts were due to the persistent above normal temperatures during the 2022-23 ice season.

**Historical Total Accumulated Ice Coverage (TAC) for  
the weeks 1105-0604, seasons:1972/73-2022/23**

**Total accumulé de la couverture des glaces historique  
(TAC) pour les semaines 1105-0604,  
saisons:1972/73-2022/23**

Lake Ontario /  
Lac Ontario

Area / Aire : 19,715 km<sup>2</sup>



**Figure 64: Historical Total Accumulate Ice Coverage in Lake Ontario by season, 1972-2023.**

The total accumulated coverage (TAC) was 1.4% for Lake Ontario just under half the long-term median TAC of 4.2%.

The 2022-23 ice season ranked as one of the 10 lowest ice seasons over the last 50 years, since the 1972-1973 ice season. By rank the lowest ice coverage year on Lake Ontario was 2001/2002 with near 0.5% TAC followed by 2011/2012 with 0.6% TAC.

Maximum Ice Coverage for the weeks 1105-0604, seasons:  
1972/73-2022/23



La couverture maximale de glace pour les semaines  
1105-0604, saisons: 1972/73-2022/23

Lake Ontario /  
Lac Ontario

Area / Aire : 19,715 km<sup>2</sup>

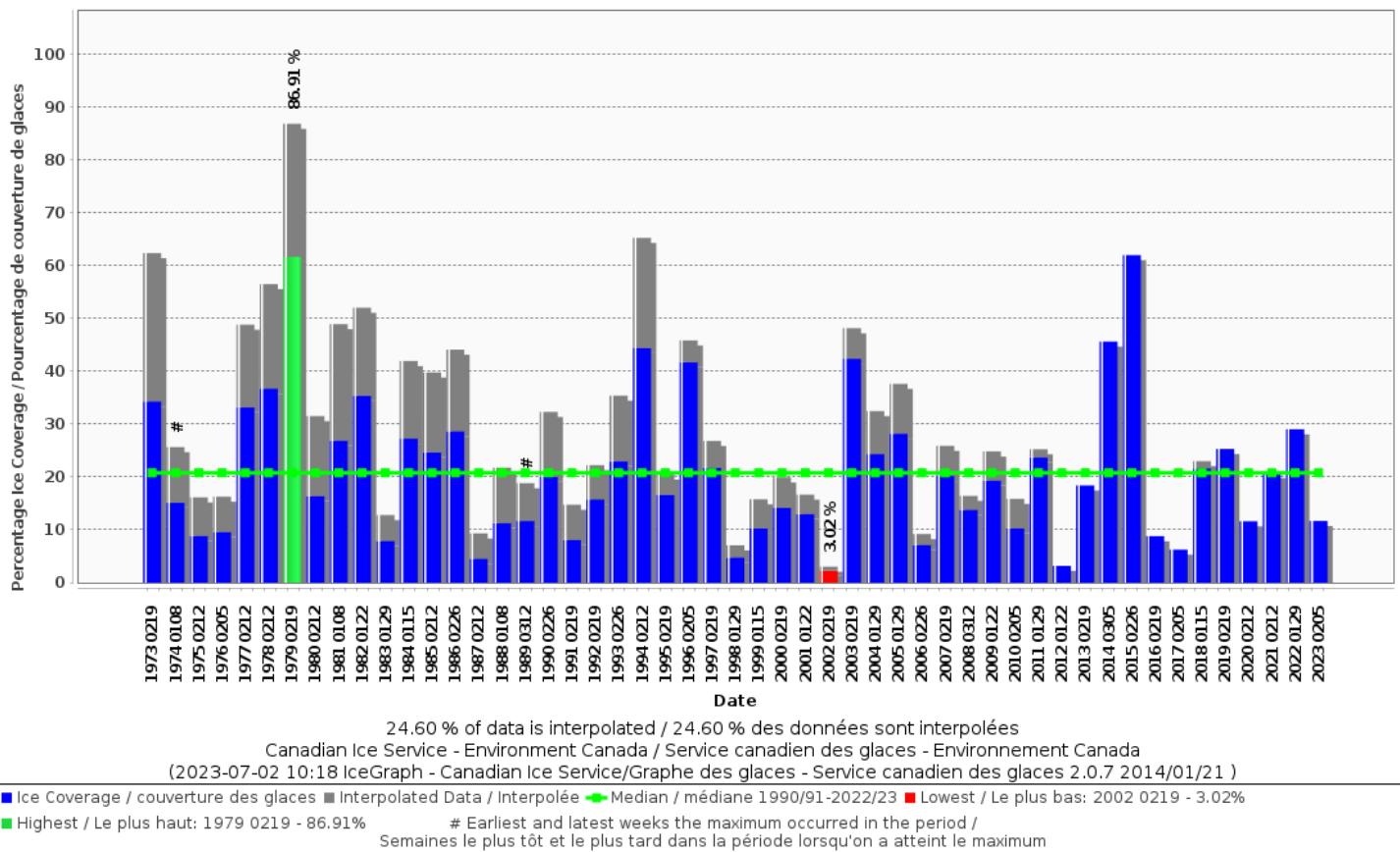


Figure 65: Maximum Ice Coverage in Lake Erie by season, 1972-2023.

The maximum ice coverage occurred on Lake Ontario on the week of February 5<sup>th</sup>. This is about two weeks earlier than is the normal date for Lake Ontario to attain maximum ice coverage as the lake normally reaches maximal ice coverage near the end of the third week in February. See median ice coverage on figure 63 above.

**Notes:**

**Lake ice thickness in cm:**

new lake ice	<5 cm
thin lake ice	5-15 cm
medium lake ice	15-30 cm
thick lake ice	>30 cm

The “**Total Accumulated Ice Coverage**” (TAC) represents the average quantity of ice (ice coverage) over a geographical area for a specified period of time.

It is expressed as a fraction or percentage of the region with values ranging from 0 (no ice) to 100% (area (not volume) fully covered with ice over the entire period).

The TAC is a good indication of average ice conditions during the winter. Good for year-to-year comparison.

*Reanalysis charts from The NOAA Physical Sciences Laboratory (PSL)*

*All other charts and data are found at <https://iceweb1.cis.ec.gc.ca/>*

**Contact:**

**Canadian Ice Service**

**Telephone: 1-877-789-7733**

**Email: [cisclients-scgclients@ec.gc.ca](mailto:cisclients-scgclients@ec.gc.ca)**