



Seasonal Summary

Eastern Canada

Winter 2022-2023



Canadian Ice Service
Le service canadien des glaces



Summary for the East Coast

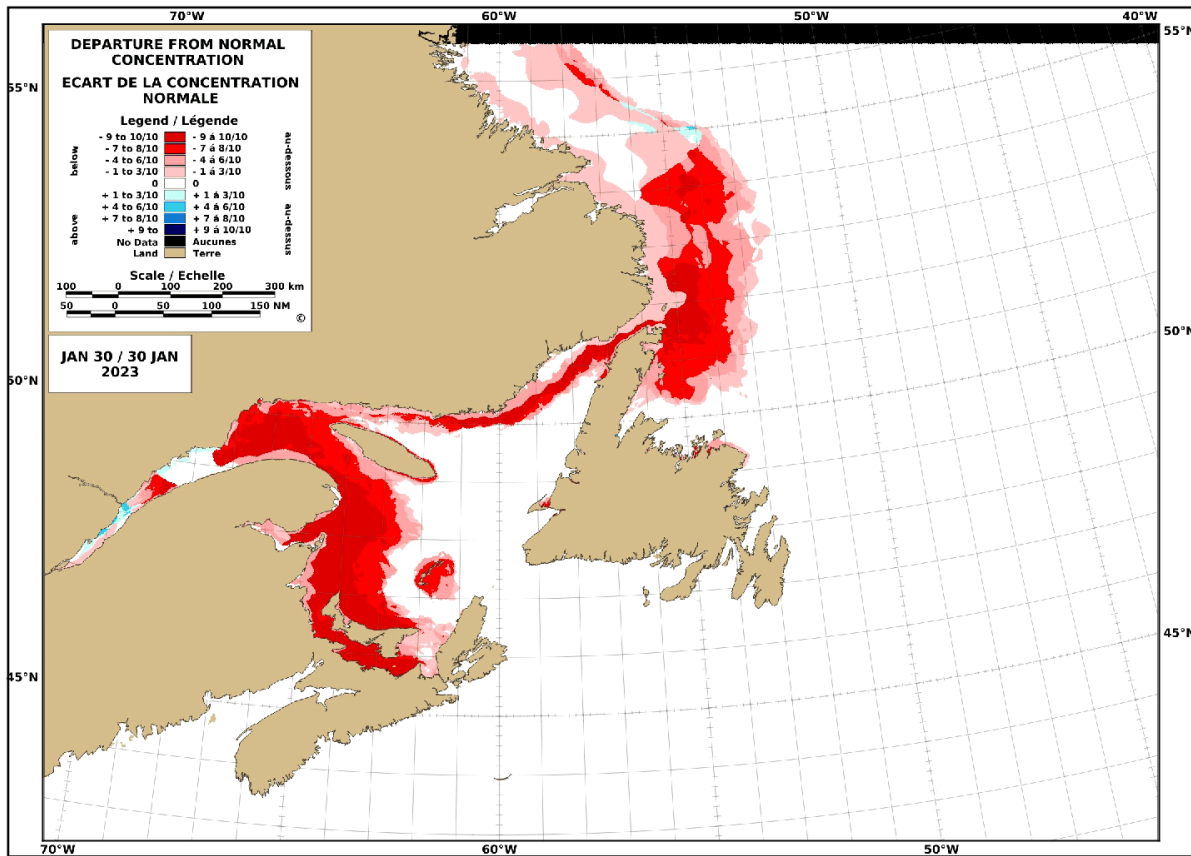
The 2022-2023 East Coast ice season followed a trend that had less ice for most of the season than would be followed by a normal ice season up until the beginning of March when it followed near normal total ice cover trends and slightly higher than normal ice amounts for the very tail end of the season. However, the Gulf experience well below normal ice cover for the entire season.

The ice season started on time in late November and ended a week later than normal as some thicker ice that remained off the mid Labrador Coast took some time to melt.

Ice first appeared in the third week in November with ice forming in Lake Melville and along the Labrador coast followed by some ice forming in small bays along the northern shore of the St Lawrence in the first week of December. By the second week of December Lake Melville was ice covered and the Labrador coast from Sandwich Bay northwards had ice in most of the bays along the shore. Temperatures for this period were mainly normal to slightly above normal for the period and ice development along the Labrador Coast remained behind normal trends for the period with ice not extending away from the coast as far as normal. These slightly above normal temperatures were not cold enough for ice to form away from the coast and until January when colder than normal temperatures would lie over Labrador as well as the northern shore of Quebec in the Gulf and in the St Lawrence River. The slightly colder than normal temperatures of November (see figures 4a and 4b) gave way to warmer than normal temperatures from December to near the end of January, see figures 6 and 7. Colder than normal temperatures would remain over these areas from the end of January until mid February, see figure 8.

Aided by the colder than normal temperatures ice started to form farther away from the Labrador Coast from late January thru February. Thus, this area off Labrador had about the same amount of sea ice at this time of year as is about normal for this part of the season, see the departure from normal charts figures 1 and 2 below.

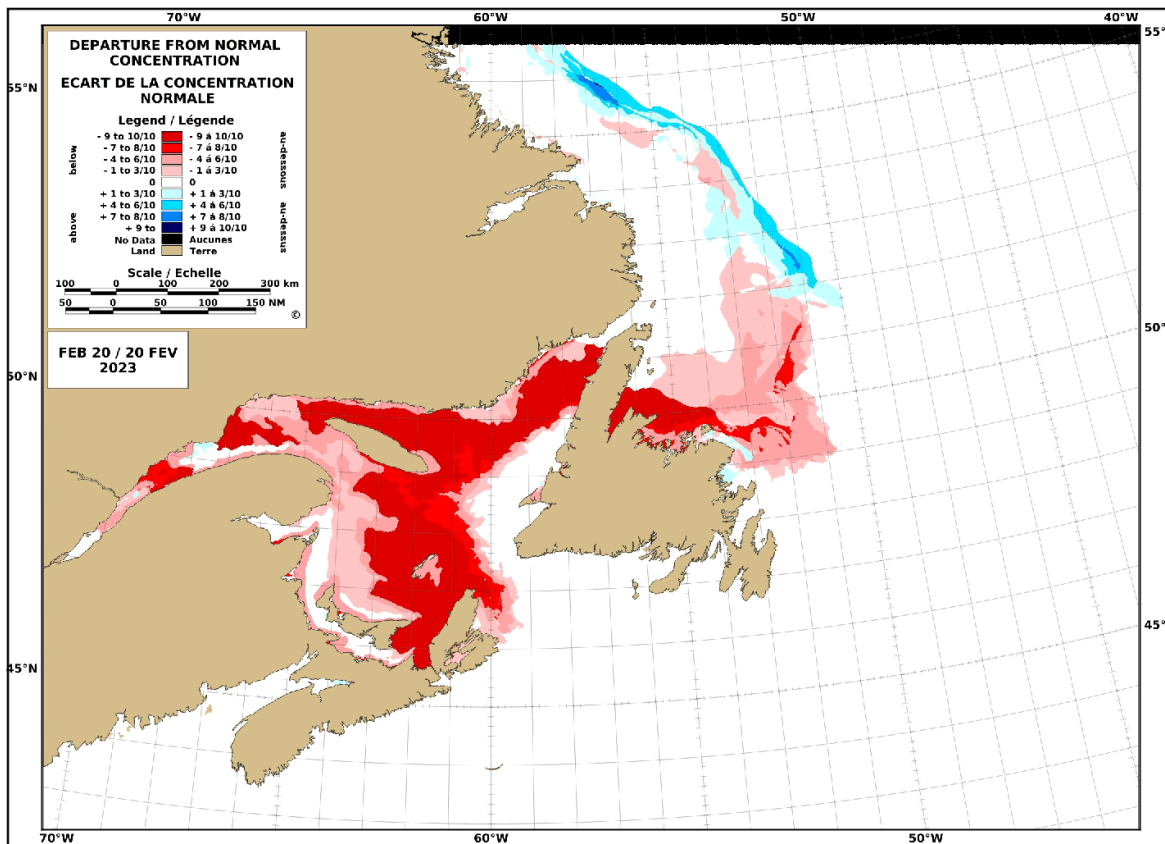
Ice amounts in the Gulf and off the coast of Newfoundland for the period however remained significantly below normal amounts also shown in figures 1 and figure 2 below which show the departure from normal ice coverage for January 30th and February 20th respectfully.



STATISTICS BASED UPON 1991-2020
LES STATISTIQUES BASÉES SUR 1991-2020

Figure 1: Departure from Normal Chart. Red indicates areas with less ice than is usually present, Blue indicates areas with greater ice coverage that is normally present. Can see the extensive areas in red indicating areas where ice would normally be expected at this period of the season and where this year no ice has formed.

The lack of ice compared to the normally expected amounts of ice in the Gulf and in Newfoundland waters would persist until the end of February despite colder than normal temperatures that existed from late January until just after mid February, see figure 8 which shows the colder temperatures that existed during February. As seen in the departure from normal chart in figure 2 for February 20th however the colder than normal temperatures did little to increase the ice coverage and large areas of the Gulf and Newfoundland waters were missing ice coverage where normally there would be ice.



STATISTICS BASED UPON 1991-2020
 LES STATISTIQUES BASEES SUR 1991-2020

Figure 2: Departure from Normal Chart. *Red* indicates areas with less ice than is usually present, *Blue* indicates areas with greater ice coverage that is normally present.

Air temperature is the main driver of sea ice formation; however, sea surface temperatures also play a role. This season saw sea ice formation delayed in the Gulf and in Newfoundland waters despite the almost normal air temperatures during January and the cooler than normal temperatures during February due to abnormally warm water surface temperatures that existed in these areas. Figure 8 below shows the sea surface temperatures for November 2022 over these areas, and it is seen that the water temperatures were significantly warmer than normal in these areas. Temperature is the main driver in the creation of sea ice however first the cooler temperatures needed to cool the warm water surface temperature anomaly before ice could form and this took most of the month of February.

A very warm December and January, see figure 6 and figure 7 also worked against ice formation and several storms in December would destroy any thin ice that had formed in the Gulf.

A steady period of cooler than normal air temperatures during the end of January to mid February (see figure 8) along the Labrador coast increased ice production off the Labrador coast. In addition, ice that had formed in the Davis Sea during a cold temperature anomaly in November, see figure 4b, had started to reach the mid Labrador Coast during February and moved southwards off the Labrador coast during February. Thus, at the end of February ice growth over the Labrador Coast was greater than the normal for the period and this lifted the accumulated ice amount for the East Coast to near normal amounts for sea ice coverage, see figure 12 below showing the Weekly Ice Coverage for the 2022-2023 Season for the East Coast and figure 3 below showing the departure from normal ice coverage.

Early in May offshore storms pushed this thicker ice against the east coast of the Great peninsula in Newfoundland and the Southern Labrador coast as well as into the eastern parts of the Strait of Belle Island resulting in these areas becoming completely covered with this thicker ice. Conditions remained this way until the third week of May when ice began to break up and melt in these areas. Ice cover would remain in the mid Labrador Coast for another month before starting to break up and melt the third week in June. The final ice did not melt until after the first week in July when ice that persisted off the mid Labrador Coast finally melted ending the 2022-23 ice season for the East Coast about a week later than is usual.

The 2022-2023 ice cover peak was only slightly below normal at 17% compared to the climatological peak of 20.1% and it occurred during the last week of February, a week later than normal. This peak ice cover was very short lived. The warm surface water temperatures and the warm air temperatures in the Gulf and off shores of Newfoundland mean that ice when it finally did form after a period of cooler temperatures in January and early February was thin and melted quickly soon after the peak in late February. By March ice cover on the East Coast was a third what would be the normal for the period; see figure 12 below showing the weekly ice coverage for the 2022-2023 season for the East Coast.

By the end of April ice coverage was once again near normal amounts for the East Coast. This was due to greater than normal amounts of ice along the Labrador Coast and Newfoundland waters as the Gulf below normal ice coverage amounts.

The season TAC (Total Accumulated Ice Coverage) for the 2022-2023 season was 4.0%. This is slightly less than last years 5.3% and normal TAC of 6.2%. This is the 6th lowest TAC since the 1968-1969 season. See figure 13 below showing the historical total accumulated ice coverage (TAC) for the East Coast by season.

Temperatures during the 2022-23 ice season:

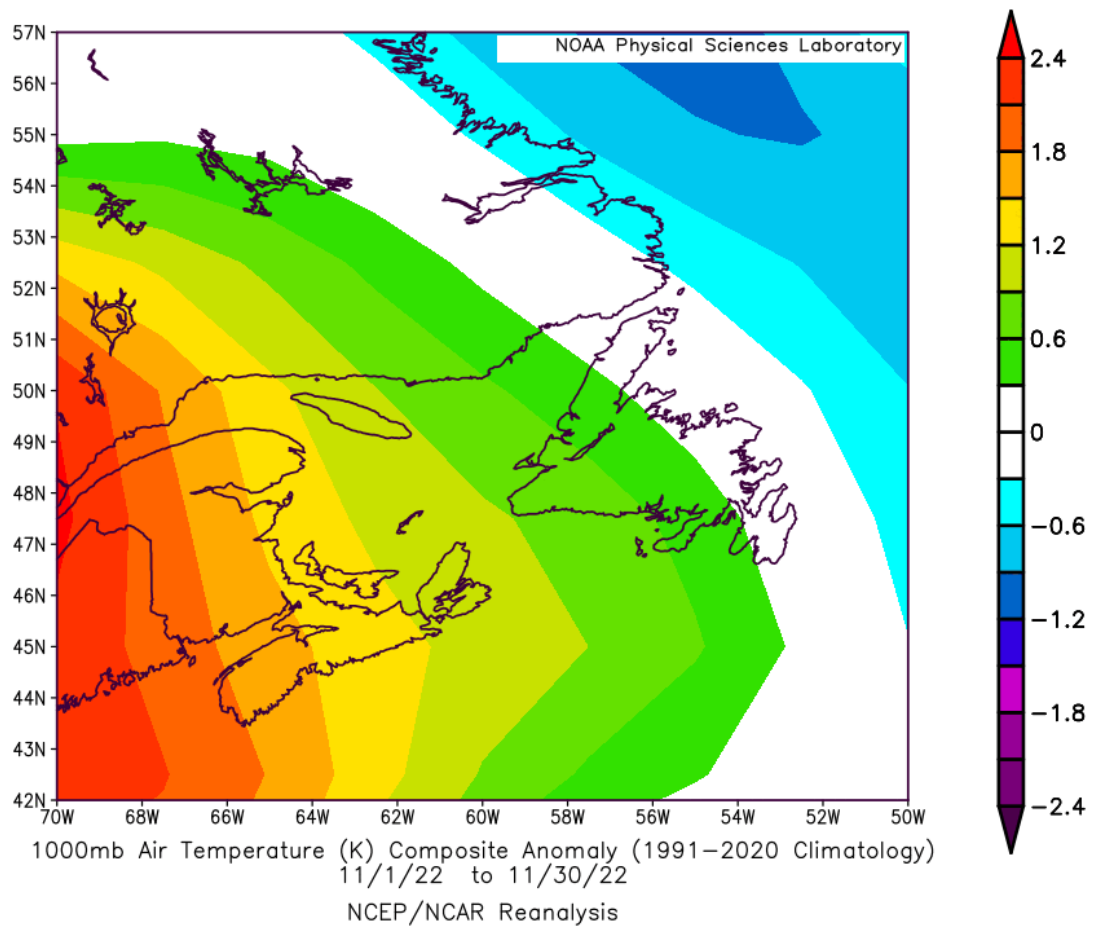


Figure 4a: Surface Air Temperature Anomaly - November 1-30, 2022.

Temperatures were slightly warmer than normal for the months of November over the western Gulf and near normal over the eastern Gulf. Over 2 degrees Celsius warmer in the western sections. Temperatures were near normal in the East Newfoundland Waters in November and slightly below normal along the Labrador Coast at this time.

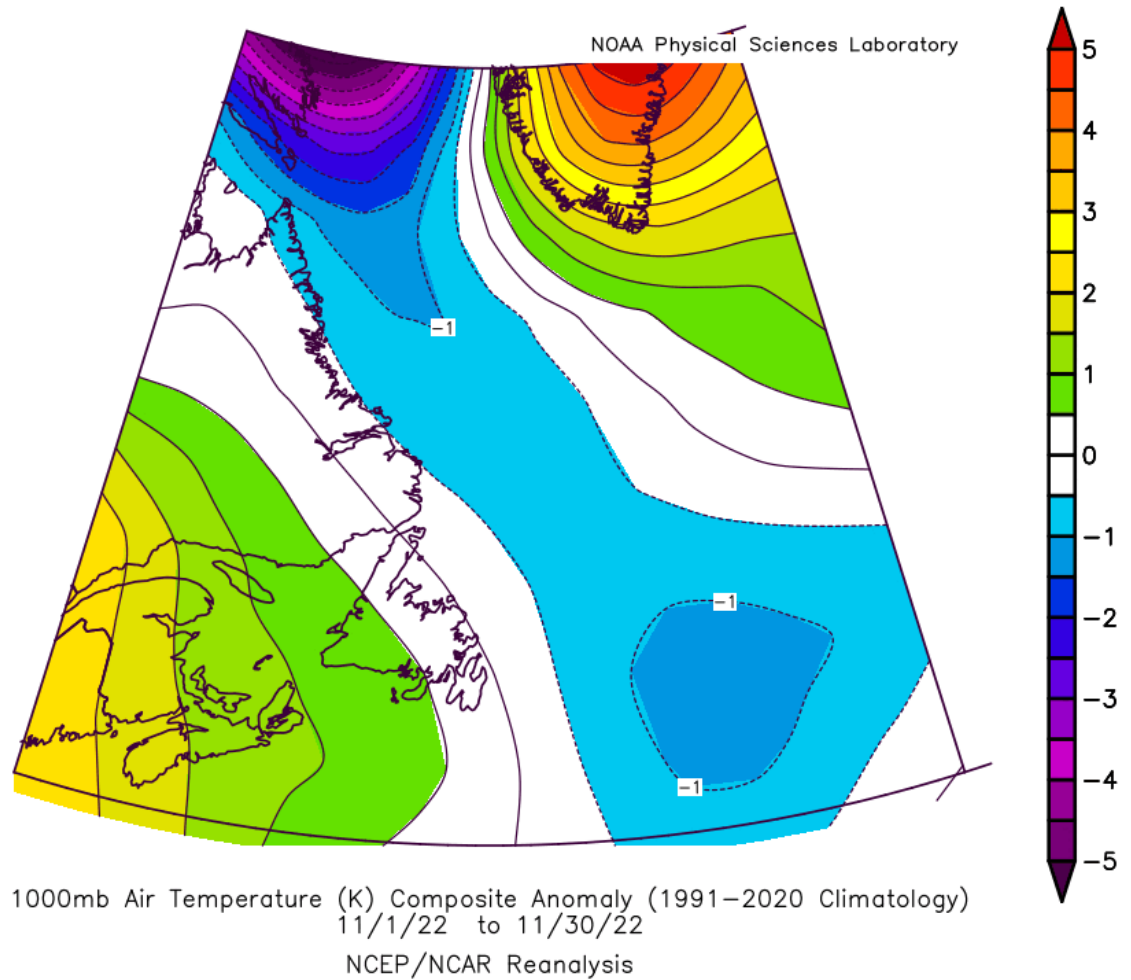


Figure 4b: Surface Air Temperature Anomaly - November 1-30, 2022.

Temperatures were slightly cooler over Labrador however temperatures as much as 5 degrees Celsius cooler than normal over Davis Strait forming ice several weeks earlier than is normal for that area. This ice that formed earlier would drift southwards reaching the Mid Labrador Coast in February on its way to the Strait of Belle Isle and East Newfoundland Waters in March.

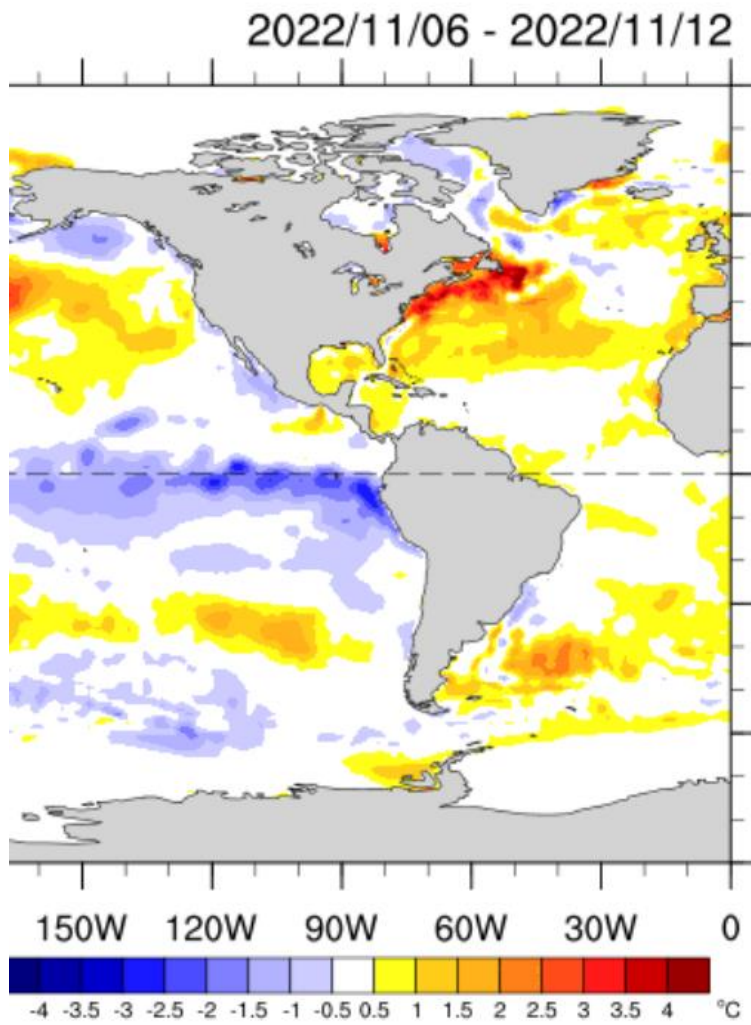


Figure 5: Sea Surface Temperature Anomalies for November 2022. NOAA Physical Sciences Laboratory

The sea surface temperatures were above normal all summer and were 3–4-degree Celsius above normal for the period at mid November over the Gulf. The surface water temperature would need to be cooled to freezing before any ice could form in the Gulf.

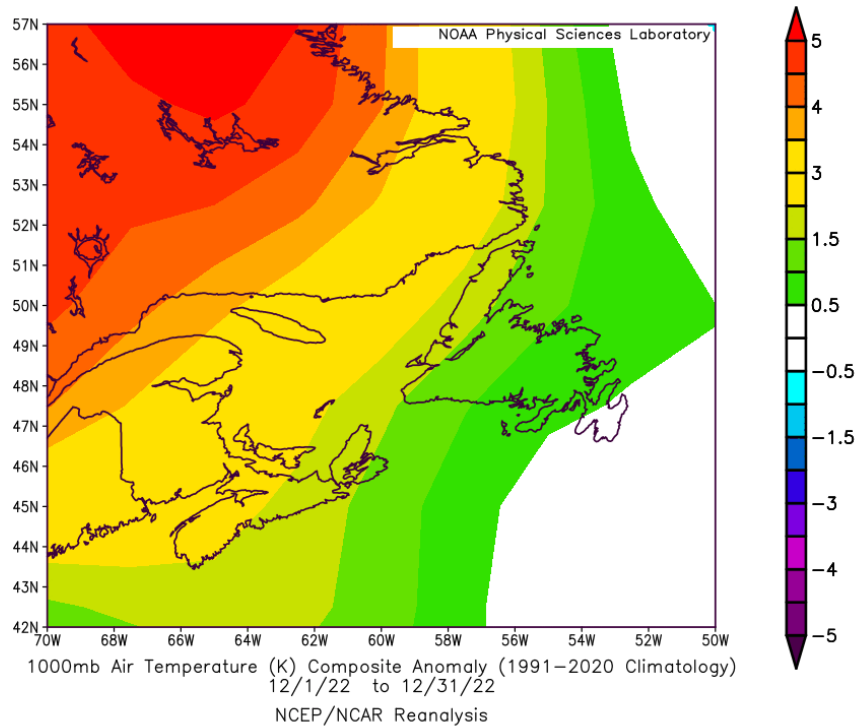


Figure 6: Surface Air Temperature Anomaly – December 1-31, 2022.

Warm air temperatures were experienced in December and in January over the entire area with temperatures reaching 4-5 degree Celsius above normal over the western Gulf and the mid Labrador Coast in January.

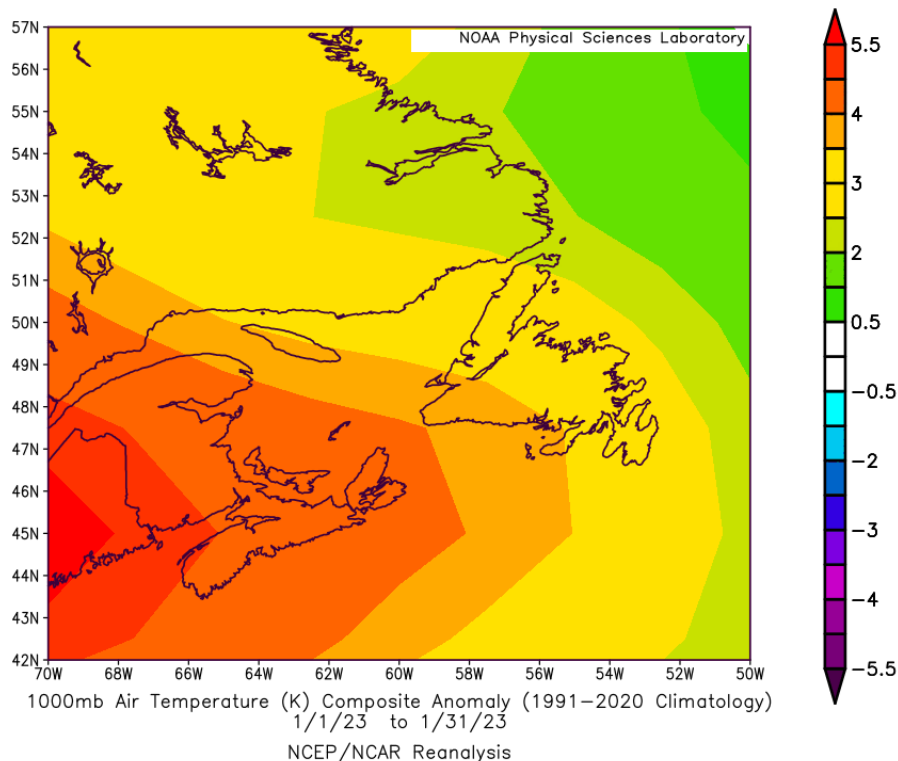


Figure 7: Surface Air Temperature Anomaly – January 1-31, 2023.

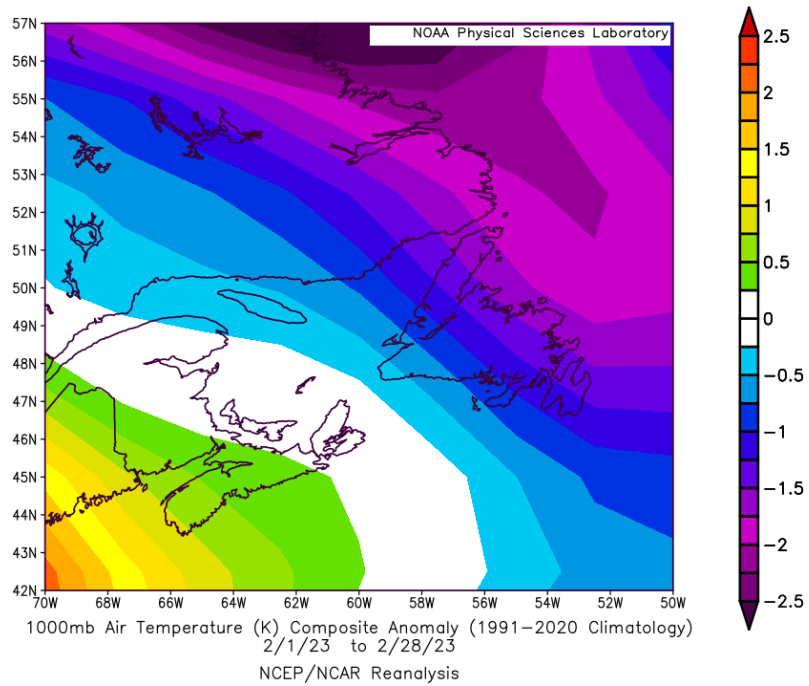


Figure 8: Surface Air Temperature Anomaly – February 1-28, 2023.

Late January and February saw cold temperatures arrive over Labrador, Newfoundland, and the eastern Gulf while the western Gulf remained near normal temperatures. Temperatures remained near normal over the western Gulf.

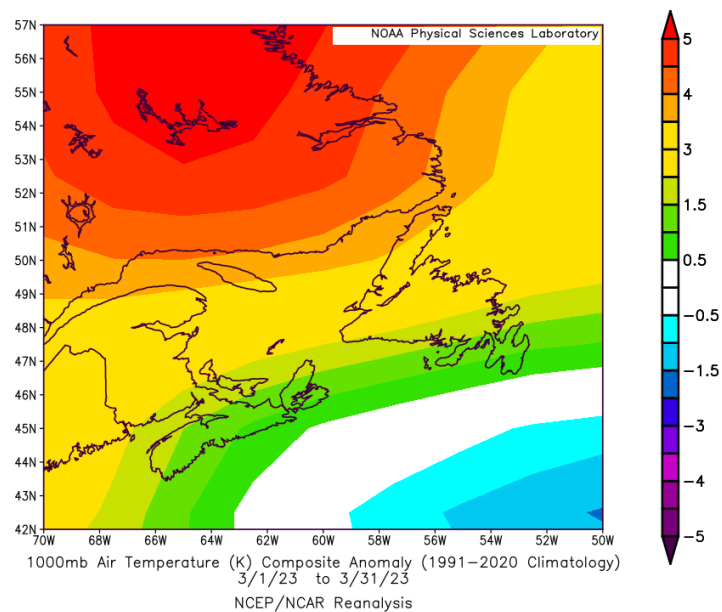


Figure 9: Surface Air Temperature Anomaly – March 1-31, 2023.

March was a warm month in most regions being 2-3 degrees above normal in the Gulf and Newfoundland and 4-5 degrees above normal along the mid Labrador coast.

April like March was a warm month in most regions being 0.5-1.5 degrees above normal in the Gulf and Newfoundland and 1-2 degrees above normal along the mid Labrador coast.

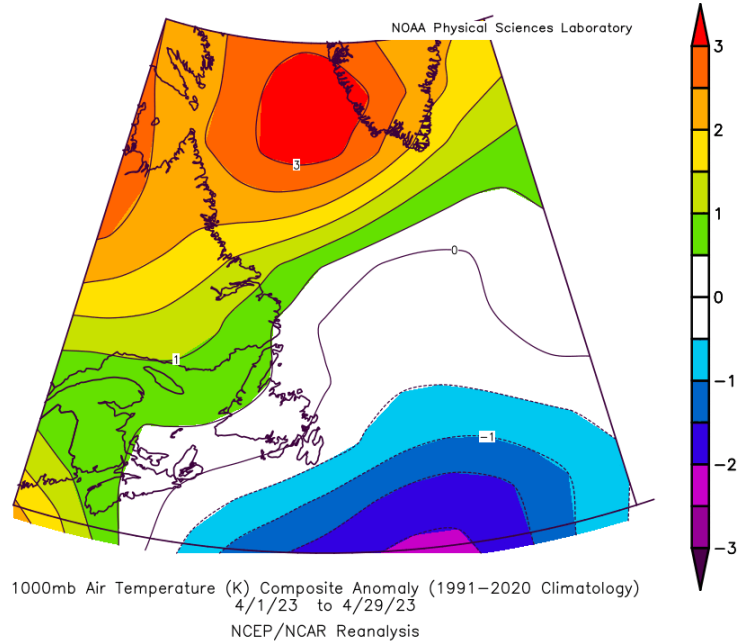


Figure 10a: Surface Air Temperature Anomaly – April 1-29, 2023.

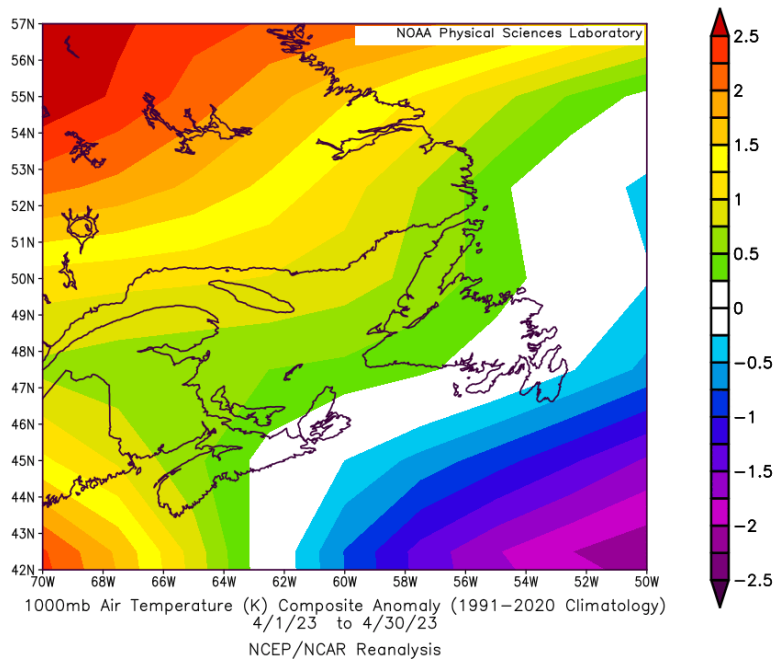


Figure 10b: Surface Air Temperature Anomaly - April 1-30, 2023.

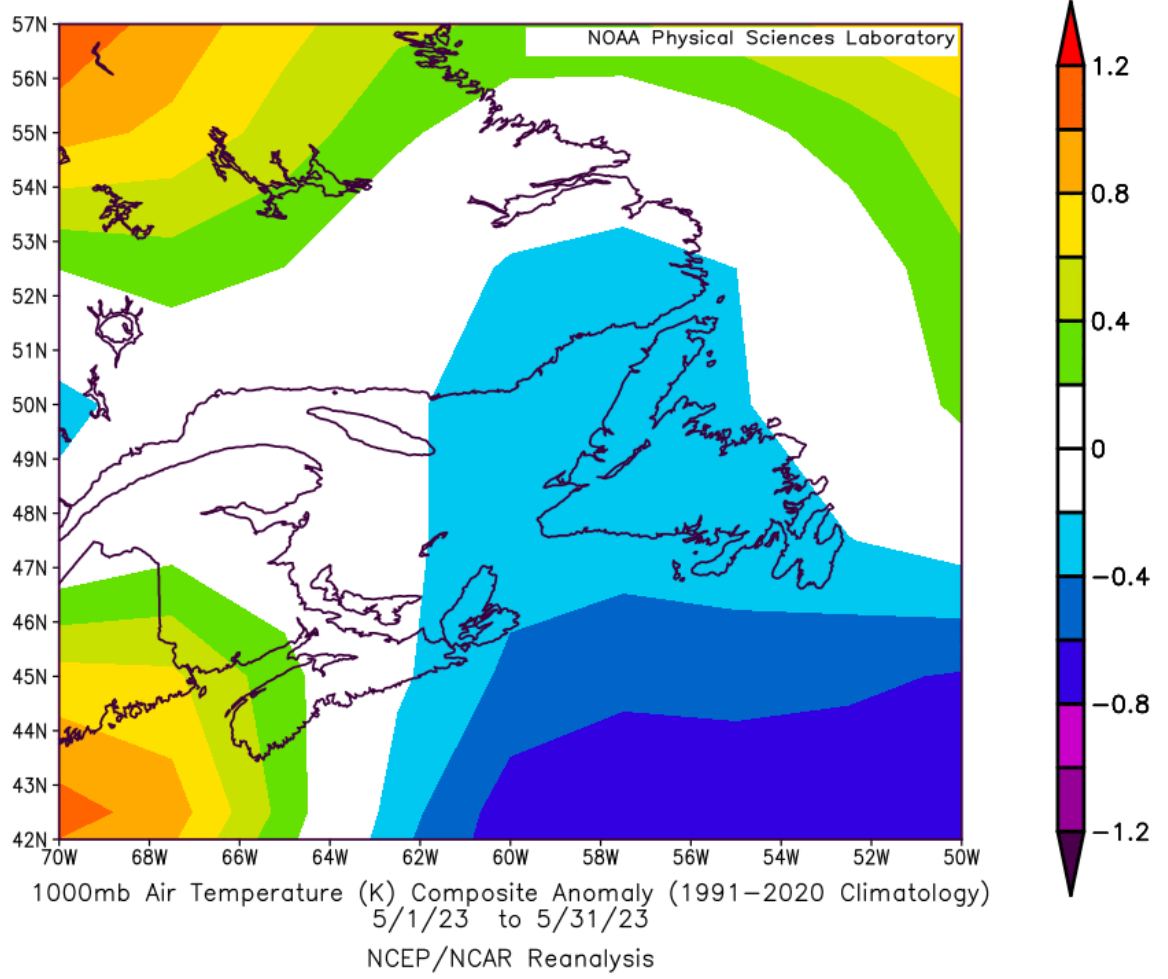


Figure 11: Surface Air Temperature Anomaly - May 1-31, 2023.

Single Season: Weekly Ice Coverage for the season
2022/23, Weeks: 1112-0723



Une saison: Couverture des glaces hebdomadaire pour la
saison 2022/23, Semaines: 1112-0723

Regional East Coast /
Régionale Côte Est

Area / Aire : 1,953,389 km²

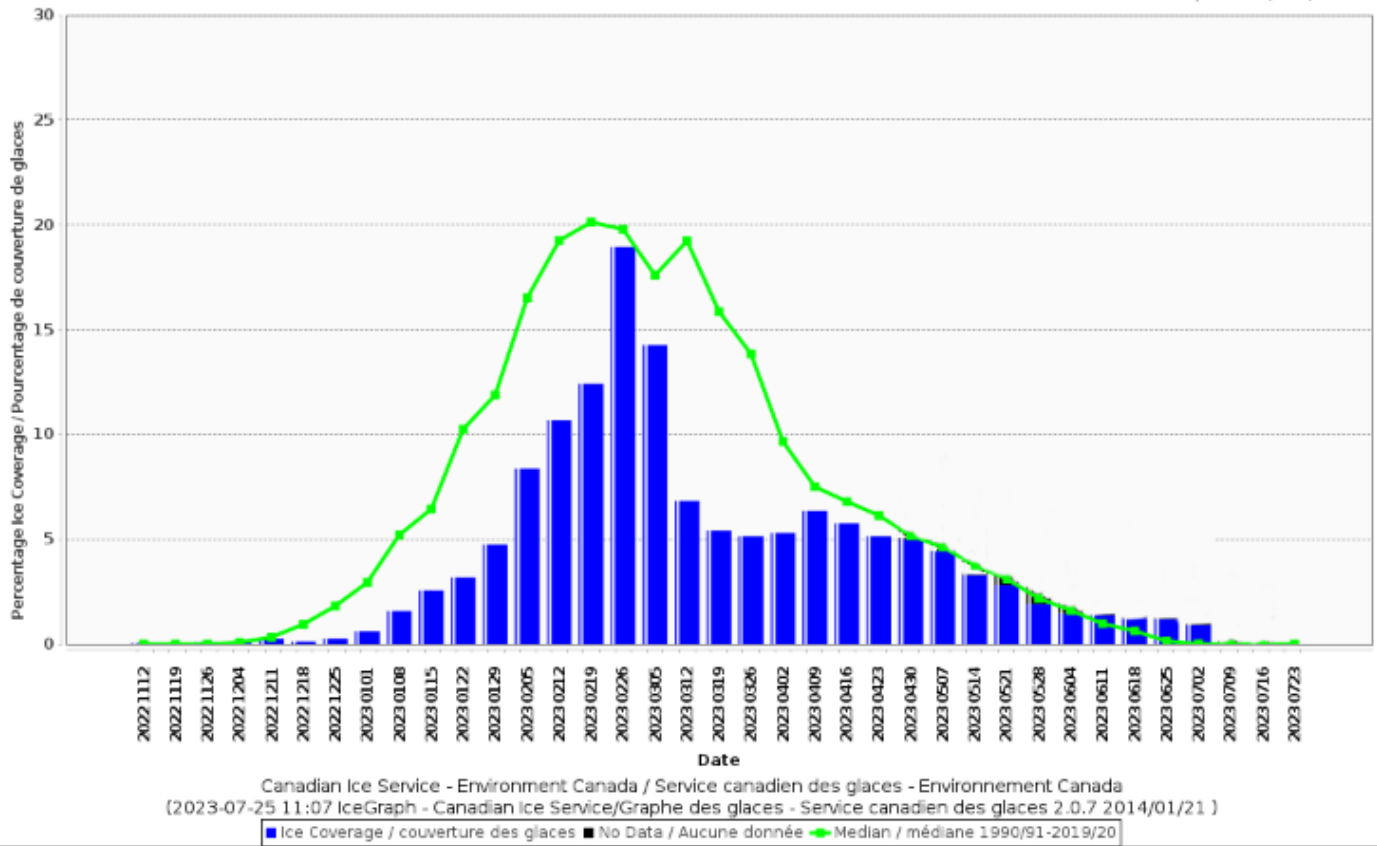


Figure 12: Weekly Ice Coverage for the 2022-2023 Season for the East Coast.

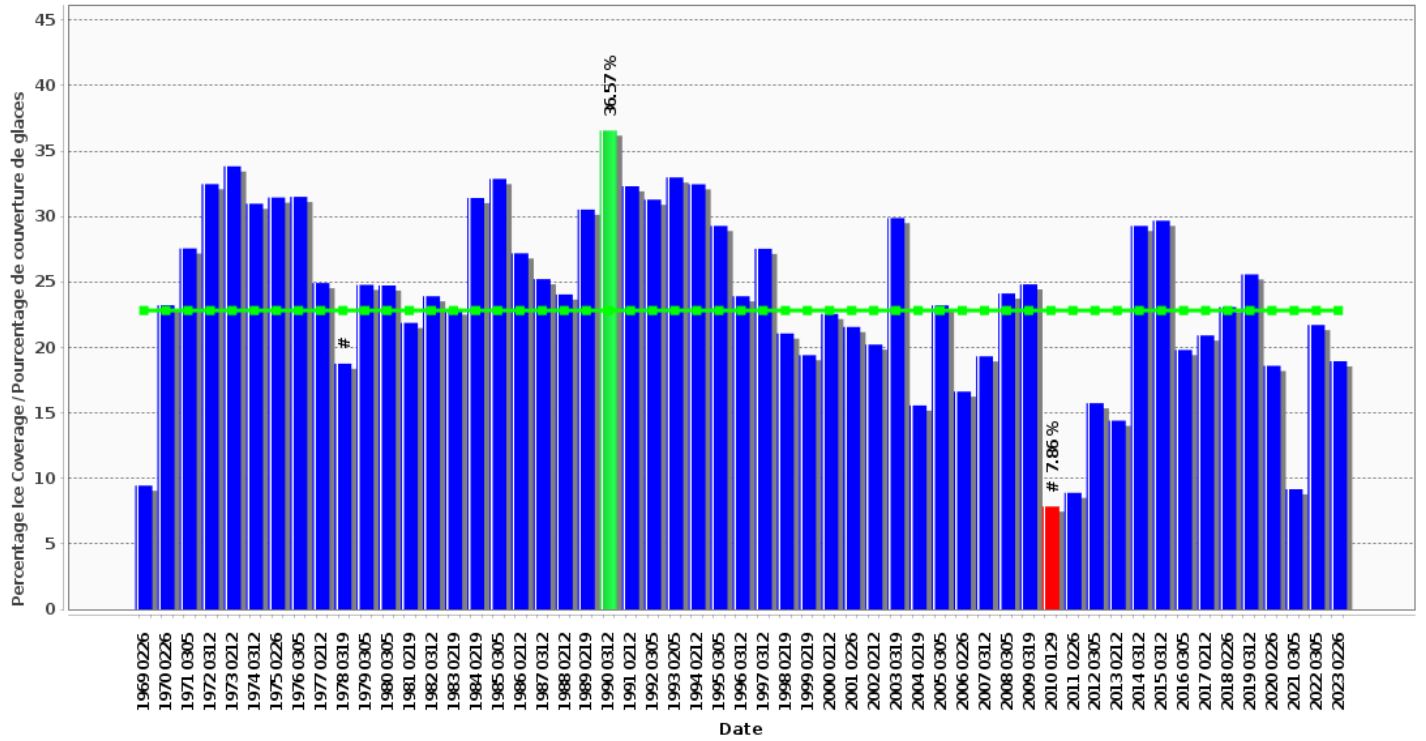
**Maximum Ice Coverage for the weeks 1112-0723, seasons:
1968/69-2022/23**



**La couverture maximale de glace pour les semaines
1112-0723, saisons: 1968/69-2022/23**

Regional East Coast /
Régionale Côte Est

Area / Aire : 1,953,389 km²



Canadian Ice Service - Environment Canada / Service canadien des glaces - Environnement Canada
(2023-07-25 11:34 IceGraph - Canadian Ice Service/Grphe des glaces - Service canadien des glaces 2.0.7 2014/01/21)

■ Ice Coverage / couverture des glaces ■ Median / médiane 1990/91-2019/20 ■ Lowest / Le plus bas: 2010 0129 - 7.86% ■ Highest / Le plus haut: 1990 0312 - 36.57%
Earliest and latest weeks the maximum occurred in the period /
Semaines le plus tôt et le plus tard dans la période lorsqu'on a atteint le maximum

Figure 13: Maximum Ice Coverage for the East Coast by Season, 1968/69-2022/23

The maximum ice coverage for the East Coast was the week of February 26th, see figures 52a and 52b below which show the ice coverage for the East Coast on this date.

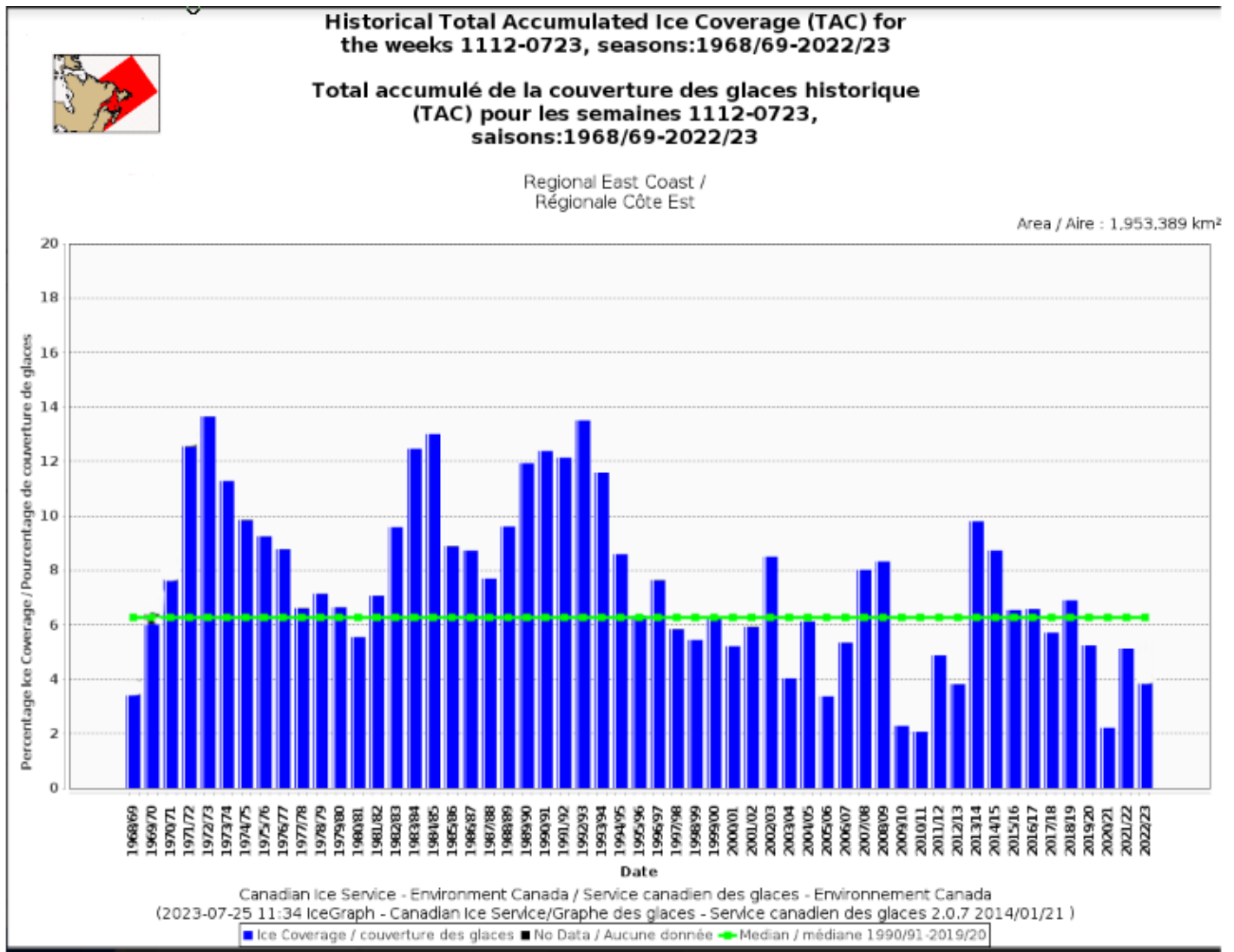


Figure 14: Historical Total Accumulated Ice Coverage (TAC) for the East Coast of Canada by Season, 1968/69-2022/23.

The season TAC (Total Accumulated Ice Coverage) for the 2022-2023 season was 4.0%. This is slightly less than last years 5.3% and normal TAC of 6.2%. This is the 6th lowest TAC since the 1968-1969 season.

Gulf of St Lawrence

Sea ice first formed around the Gulf of St. Lawrence the first week of December, with new ice forming along the north shore of the St Lawrence River and in some bays on the southwest coast of Anticosti Island. By the second week of December ice had formed in a few places along the north shore of Quebec from Sept-Iles to the Strait of Belle Isle. Near the end of the month ice also formed in a few bays along the coast of PEI, Chaleur Bay, and the Northumberland Strait. However, as December saw warmer than normal temperatures this isolated ice along parts of the shores and in sheltered bays was the extent of the ice formation in the Gulf during December. The warm water temperatures that were present in the fall also contributed to the slow ice formation.

The Gulf of St. Lawrence started out the month of December with less than 0.25% ice covered which is typical for that time of year. Ice coverage did grow very slightly through the month it remained below 1.0% ice covered, slightly below the 30-year median of 1.3%. Ice coverage through December was mainly restrained to coastal bays and inlets as well as along parts of the southern coast in the St Lawrence Seaway.

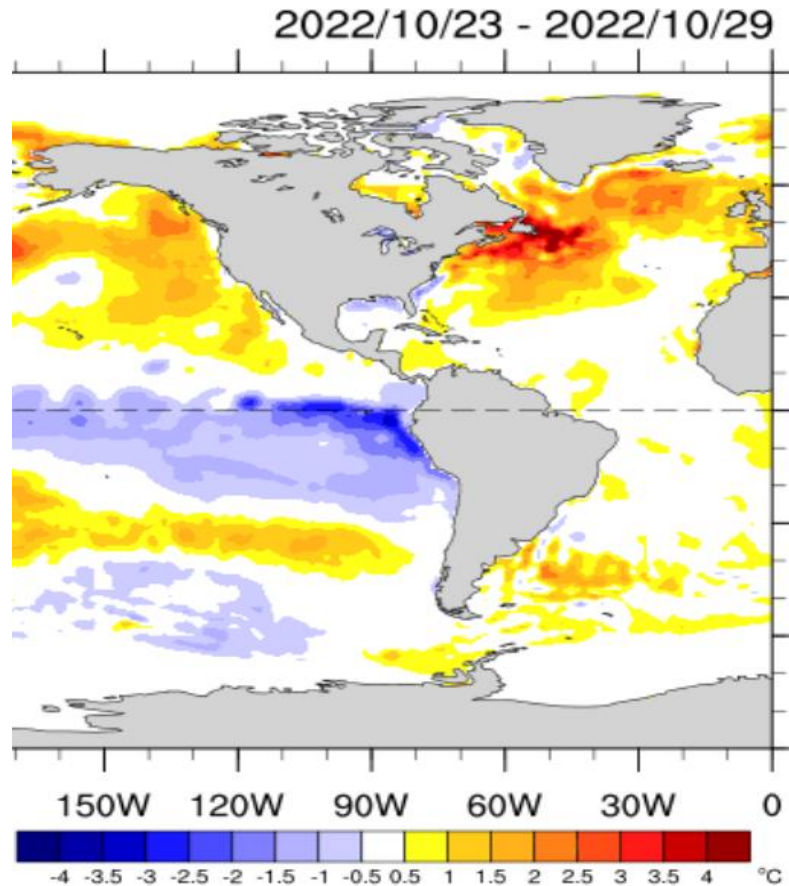


Figure 15: Sea Surface Temperature Anomaly October 23-29.022 (NOAA Physical Sciences Laboratory)

Sea surface temperatures in the Gulf were several degrees warmer than normal in October and November.

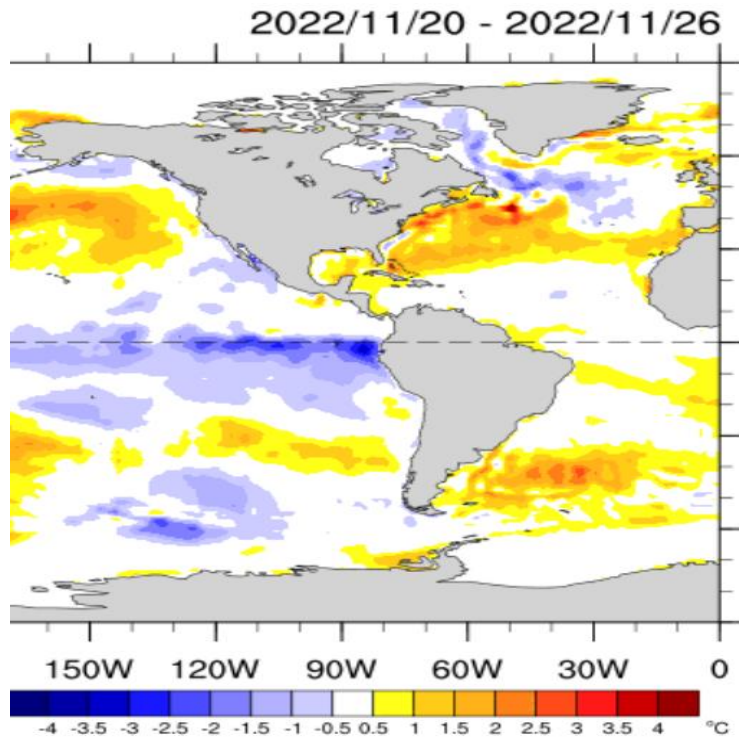


Figure 16: Sea Surface Temperature Anomaly October 23-29.022 (NOAA Physical Sciences Laboratory)

With warm sea surface temperatures at the start of the season and with warmer than normal temperatures during the winter months, the ice forms later in the year and doesn't form as much ice by the end of the year. As well the ice is generally not as thick and is easier to be destroyed by winds/storms which has been happening. As well, being thinner quicker to melt in spring.

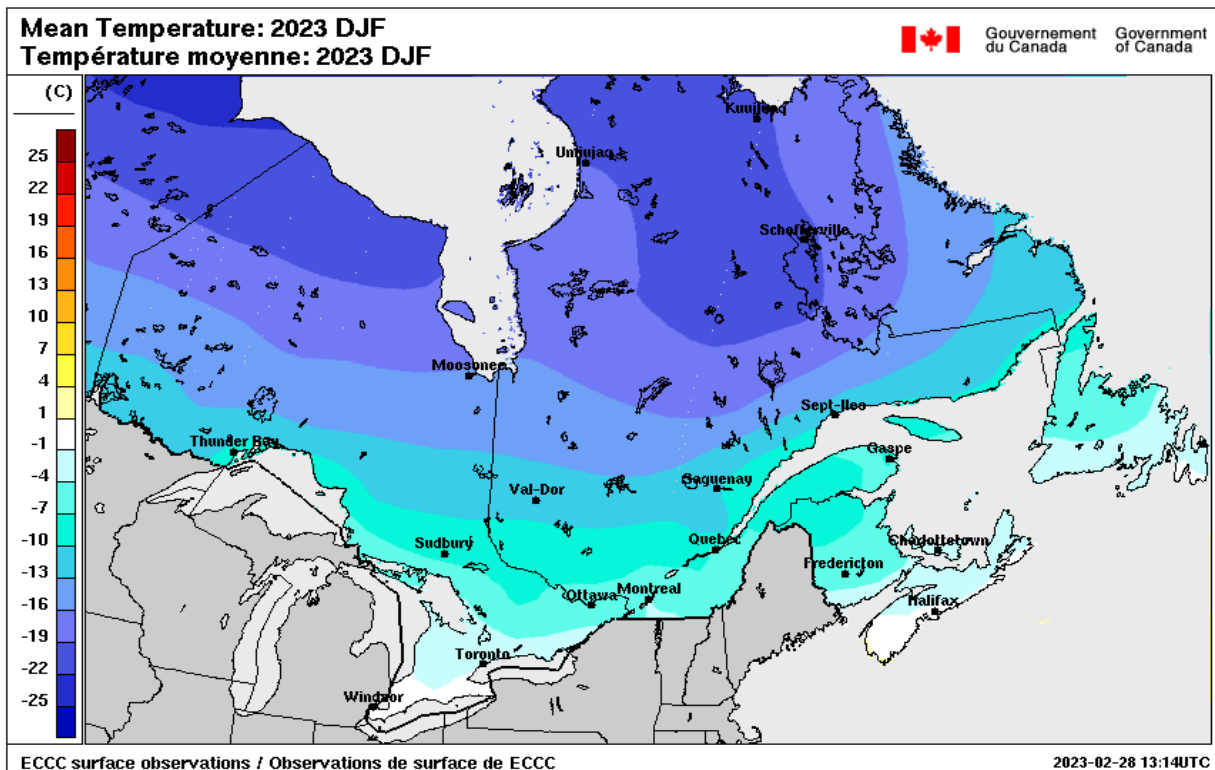


Figure 17: Mean Temperature for the months of December, January, and February

Figure 17 above shows the average temperature was just below freezing for the winter months over the Gulf. However, with the warm sea surface temperatures experienced over the Gulf this season, see figure 15 and 16 above ice would be slow to form.

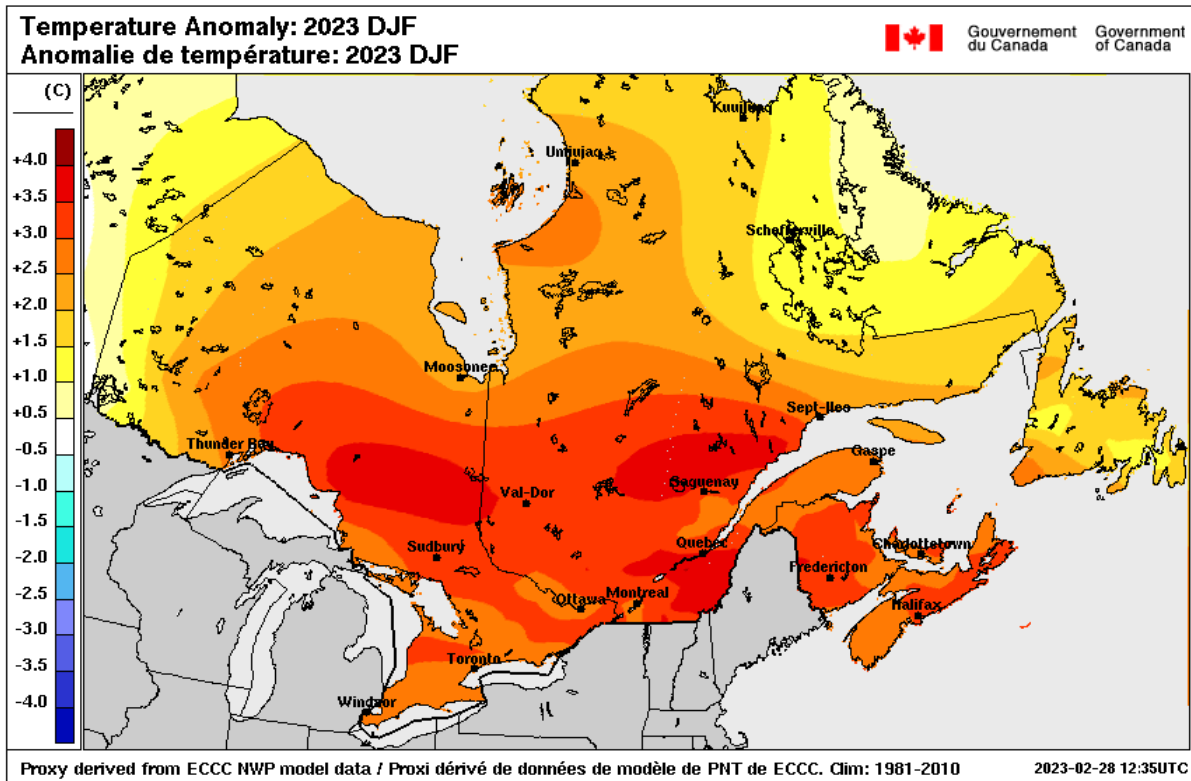


Figure 18: Temperature anomaly

The temperature anomaly chart above shows the difference between the actual temperature and the 'normal' temperature for the period. Can see that this winter has been warmer than normal especially in the western and central Gulf.

January saw no change in the ice cover as the warmer than normal temperatures lasted until mid January. The Gulf of St. Lawrence started 2023 at less than 0.5% ice covered, the climatological median is 3.2%.

There was almost no ice growth for the first half of the month as temperatures were between 4°C to 7°C warmer than average. What ice growth occurred was mainly near the end of the month after the warm spell passed. Any new ice that formed during short lived colder periods was quickly destroyed by winds. At mid month there was 1.8% ice coverage while the climatological average for January 15th is many times this value at 12%. After the middle of the month there was some ice formation and an increase in the ice cover in the St Lawrence River which became mainly ice covered by the end of the month. Ice cover also increased in Chaleur Bay and along the coasts of PEI, New Brunswick, and the North Shore of Quebec.

By months end the ice coverage in the Gulf reached 4% which is well below the average value of 21% ice coverage on January 31st. Ice coverage in January 2023 has been very low and reminiscent of the 2020-21 season where January 2021 also had very low amounts of ice of near 2% in January. That 2020-21 season ended up as one of the lowest total ice coverages. Looking at the charts in Figures 19 and 20 showing the ice coverage and thickness for this year and last year it becomes immediately apparent how the combination of warm temperatures and warm surface water combined to delay ice coverage formation in the Gulf this season. Looking at the median ice concentration and thickness in figures 21 and 22 can see last years ice amounts are much more representative to the average ice conditions.

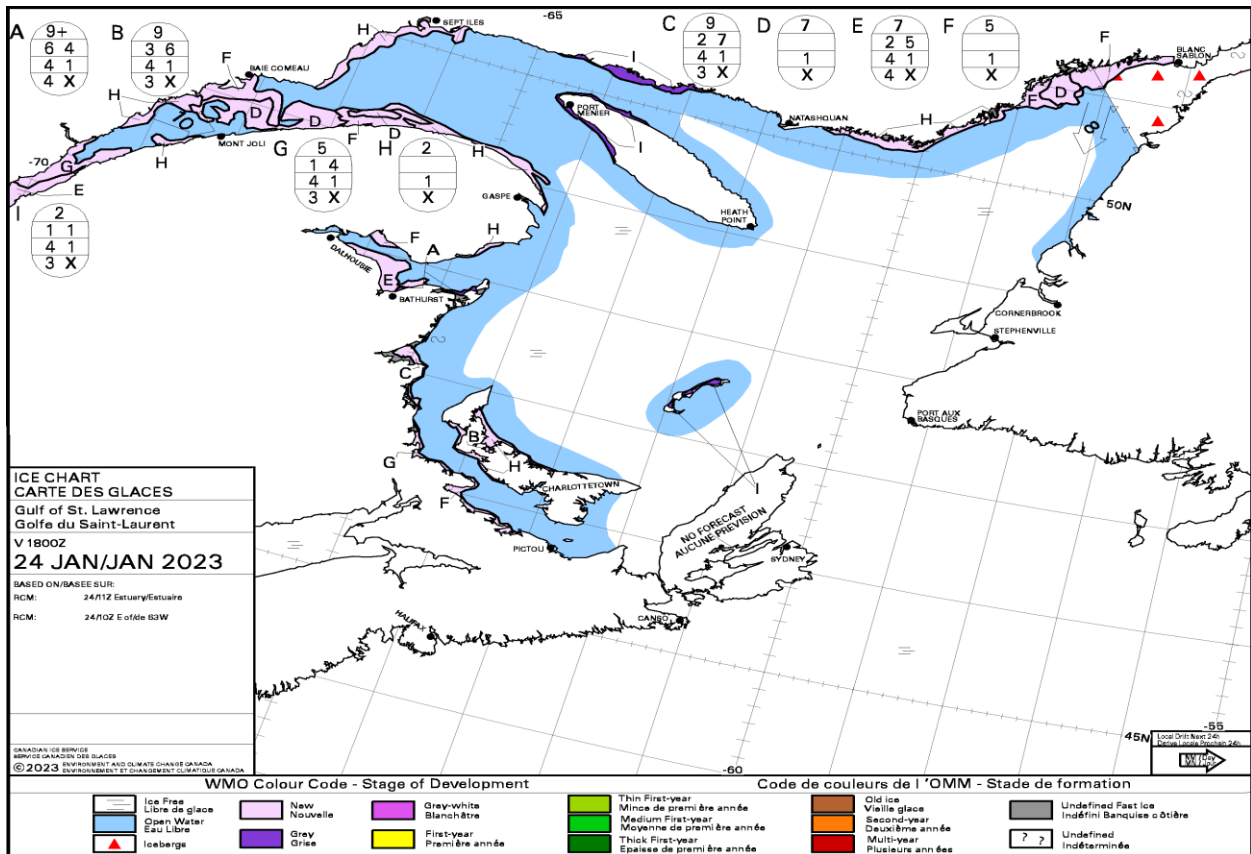


Figure 19: Gulf analysis ice thickness this year - Jan 24th, 2023

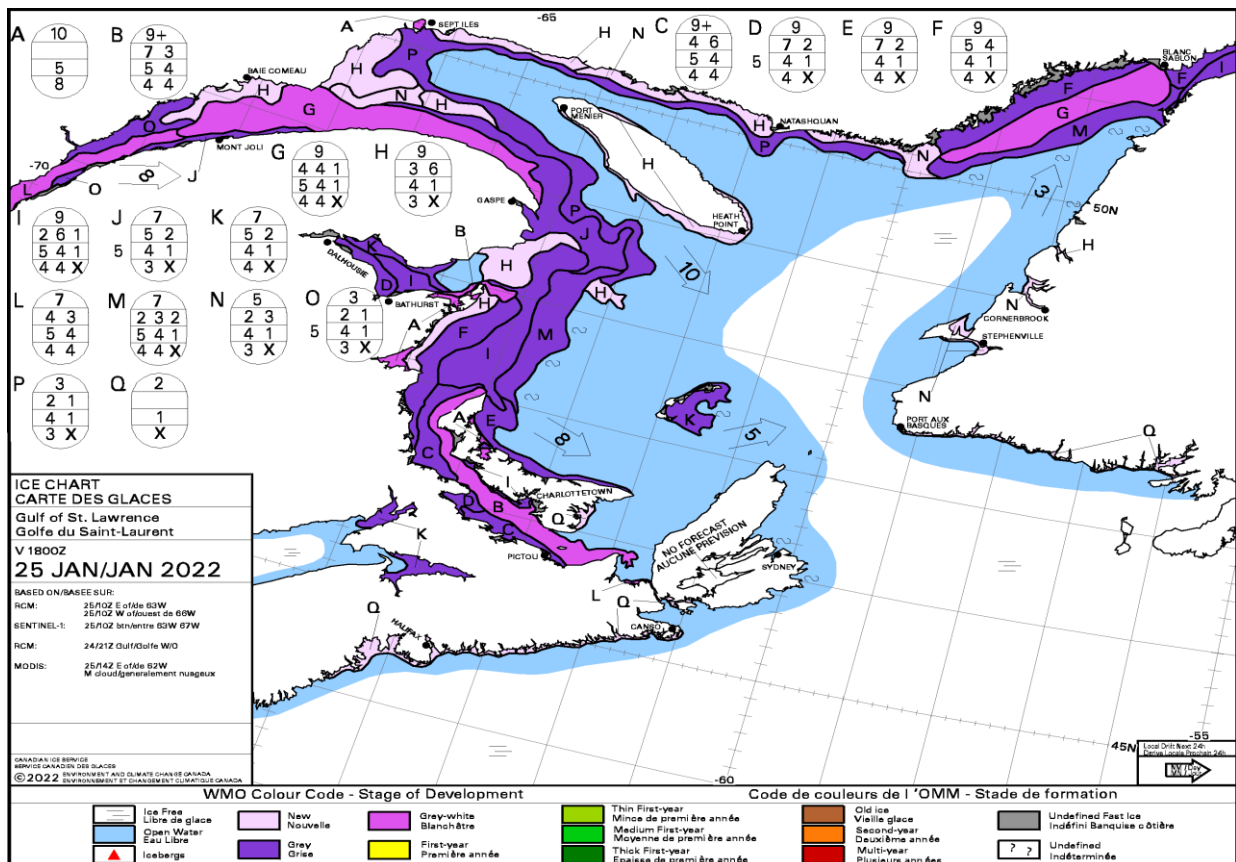


Figure 20: Gulf analysis thickness last year - Jan 25th, 2022

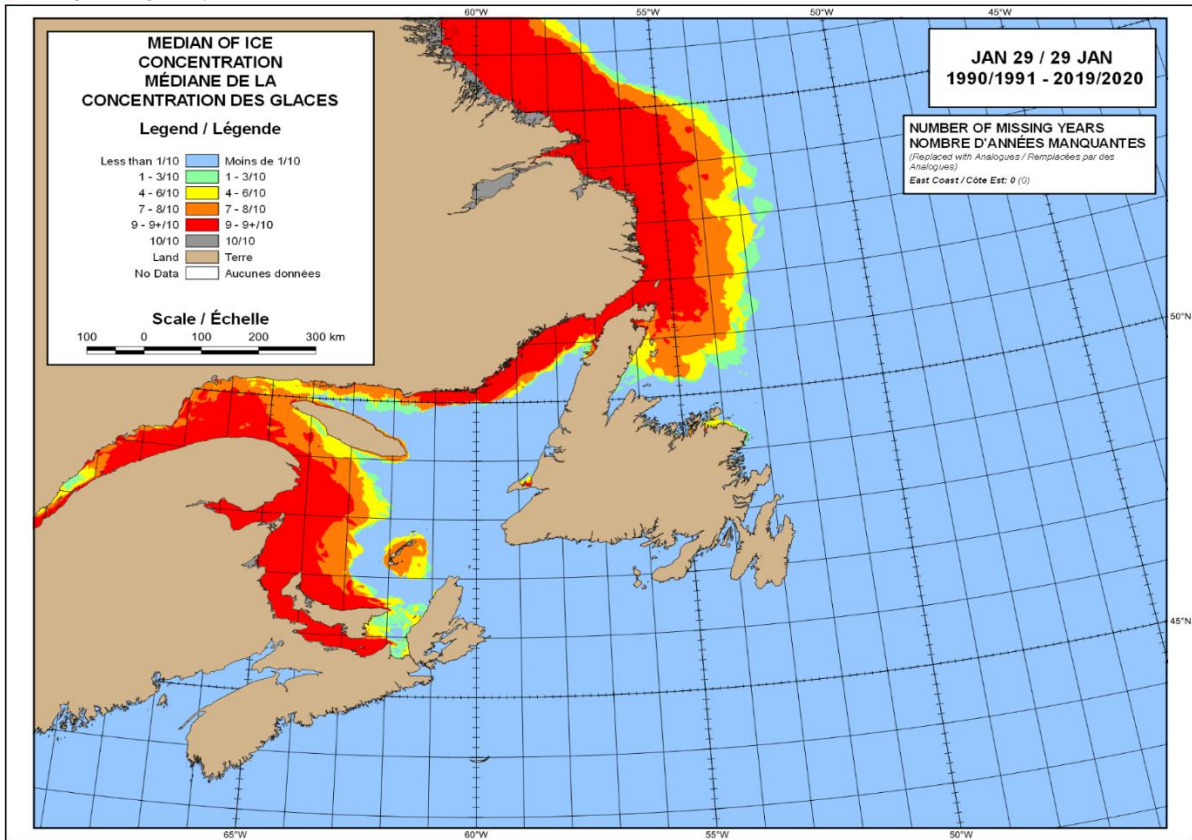


Figure 21: Median Ice concentration for Jan 29th from 1990-2020

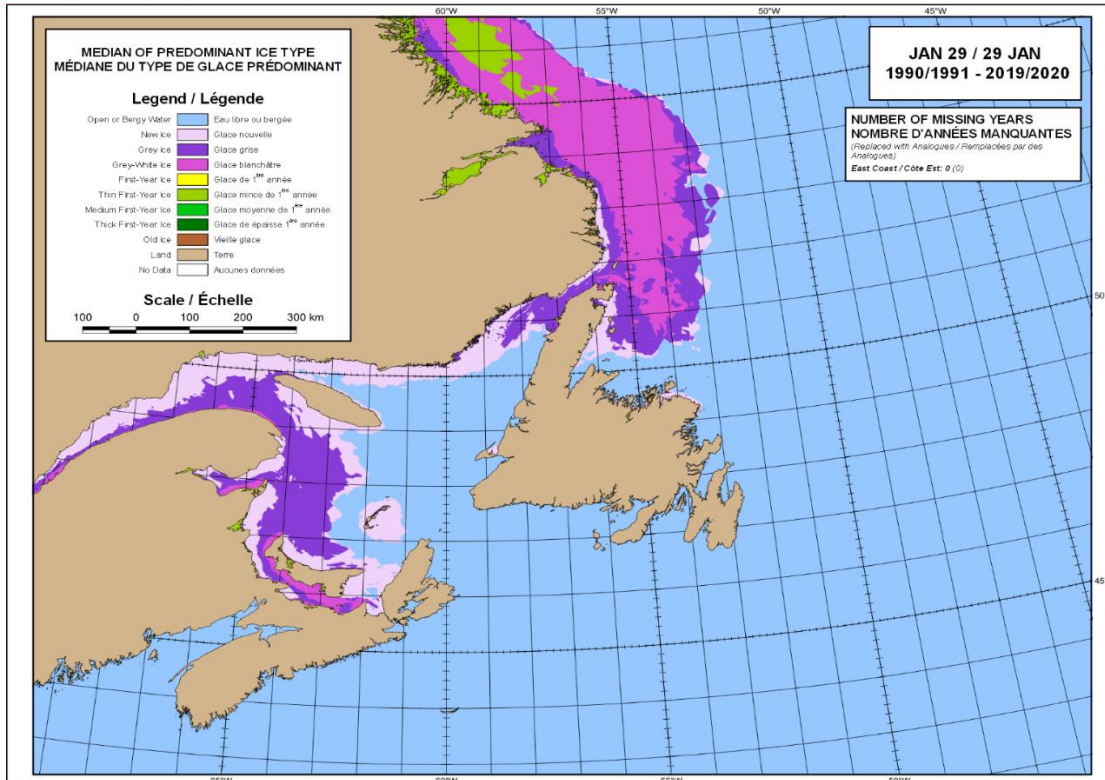


Figure 22: Median Ice thickness for Jan 29th from 1990-2020

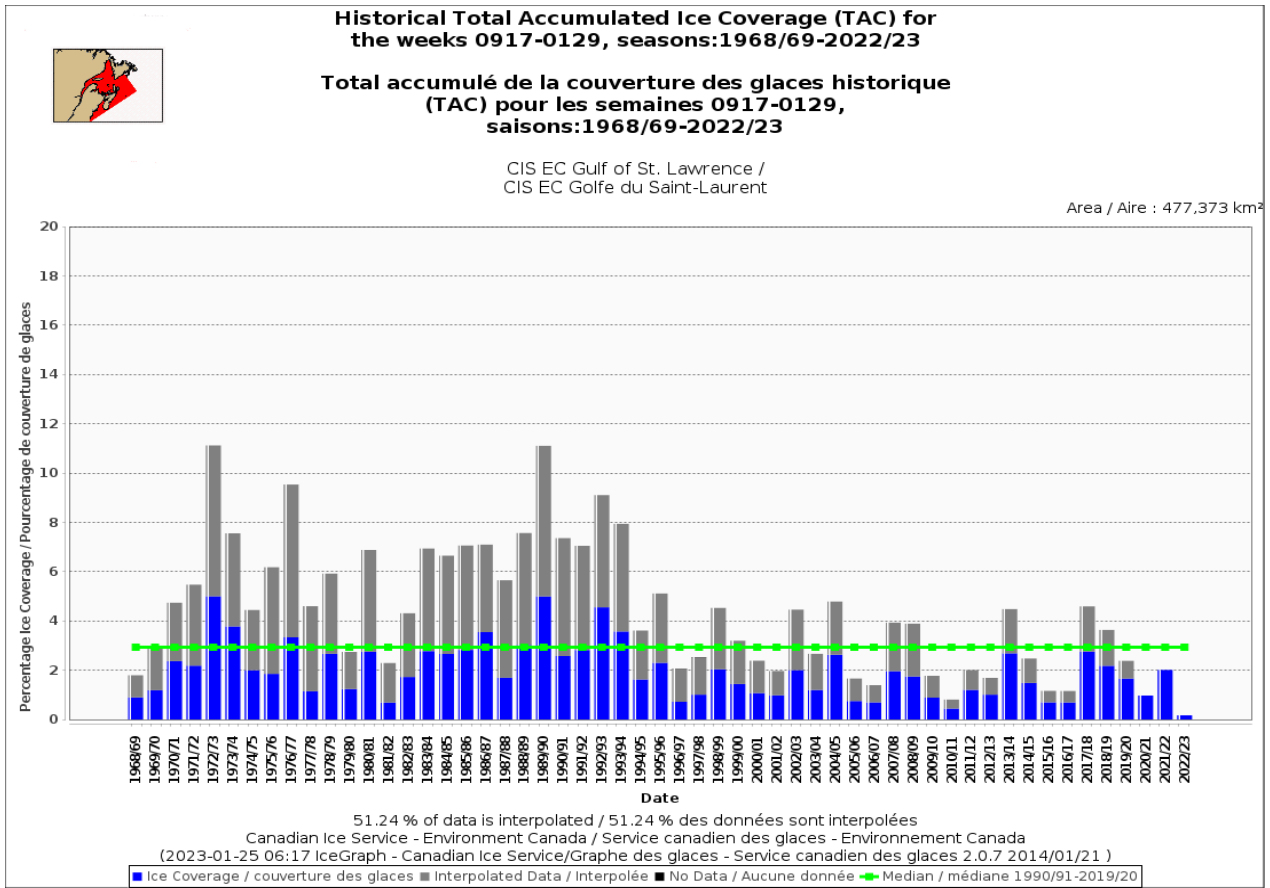


Figure 23: Gulf TAC 1973-2023 total concentration up to week of Jan 24th

Looking at the TAC, total accumulated ice for the week of January 24th we see that the ice coverage amounts were at record low levels of ice for the Gulf near the end of January.

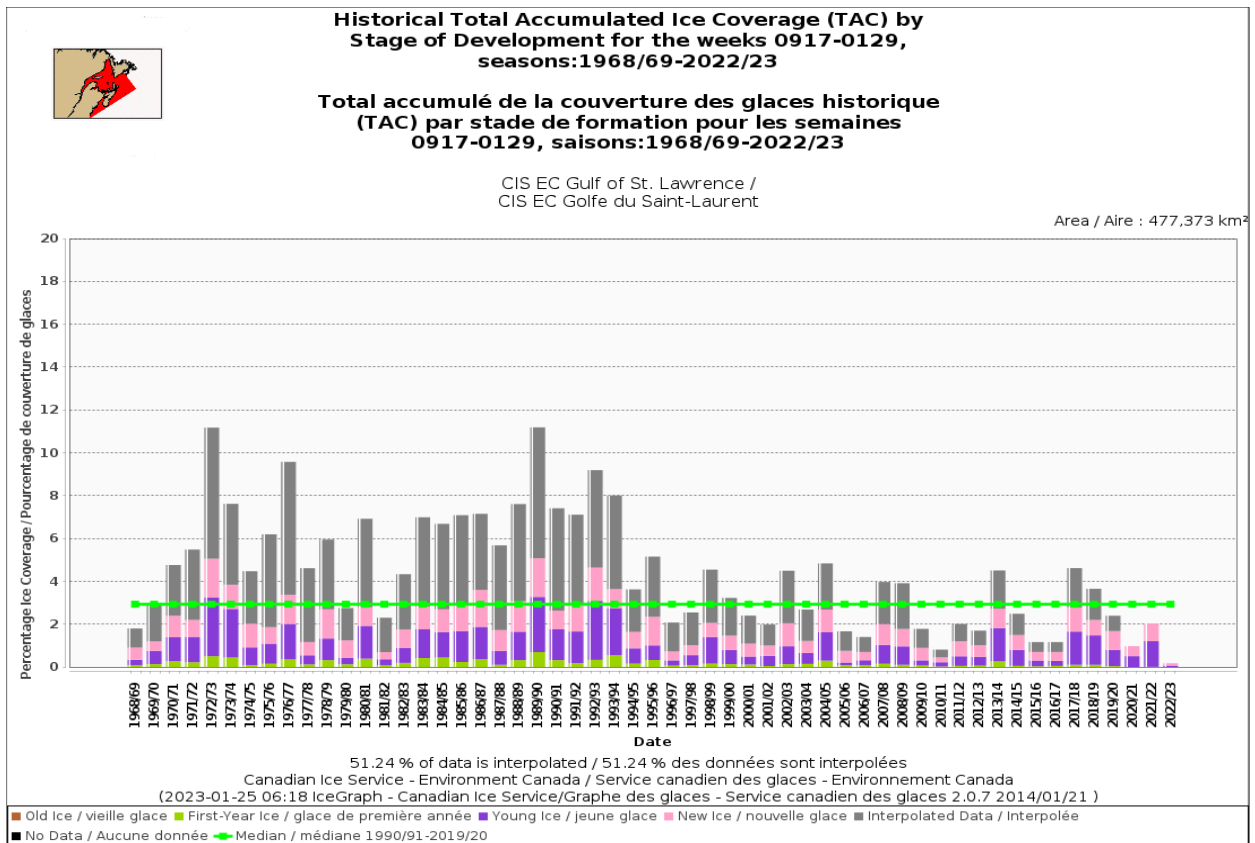
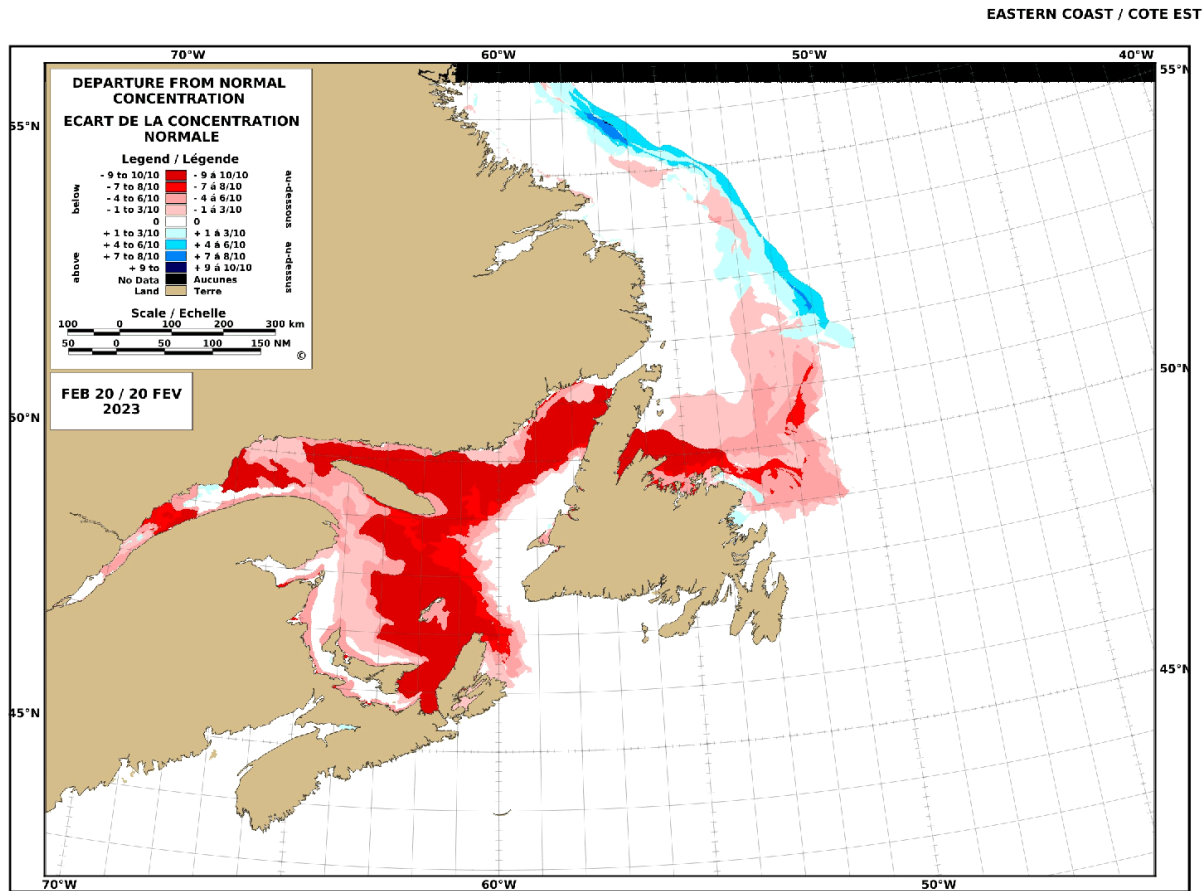


Figure 24: Gulf TAC 1973-2023 Total season accumulation by thickness so far ending week of January 24th.

The Gulf of St. Lawrence started February at less than 5% ice covered, the climatological median for the start of February is near 15%, see Figure 28 below showing the weekly ice coverage this season in the Gulf of St. Lawrence

As the beginning of the month saw colder temperatures which continued the ice growth that had started at the end of January. At mid-month there was 13% ice coverage while the climatological average for mid-February is near 32%. At the mid month period the St Lawrence River, the north shore of Quebec, PEI and the Northumberland Strait were covered in sea ice. However, at mid January the central Gulf around the Iles de Madeleine were ice free when normally during this period the area surrounding the Iles de la Madeleine as well as Anticosti are covered in ice. See Figure 25 below showing the departure from normal chart for the Gulf.



STATISTICS BASED UPON 1991-2020
LES STATISTIQUES BASEES SUR 1991-2020

Figure 25: Departure from Normal Chart. Red indicates areas with less ice than is usually present, Blue indicates areas with greater ice coverage that is normally present.

Ice cover in the Gulf would continue to expand at the end of February with colder temperatures and on the 27th of February the maximum ice coverage was reached for the Gulf for the 2022-23 season at 32% which approached within 10% of the climatological value of 37.7% for the end of February.

The ice however was thinner than its climatological average being mainly grey (10-15 cm) and grey-white ice (15-30 cm) so that when warm temperatures and some winds returned in March much of the ice coverage was destroyed by the waves and lost. Hence, though ice concentration increased to near 30% at the end of February warmer temperatures and a few storms quickly destroyed this ice to 15% ice coverage or half the normal 30% ice coverage for the period after the first week in March. By mid March the ice concentration was further reduced to only about a fifth its normal value or less than 4% ice coverage versus the average of about 18%.

By the second week in March the only areas with substantial ice coverage were the Strait of Belle Isle and the area south of Gaspé to Nova Scotia including the north shore of PEI. The ice in the central Gulf was no longer present. Areas like the Iles de la Madeleine and Anticosti Island which are normally surrounded by sea ice during this time of year had no ice.

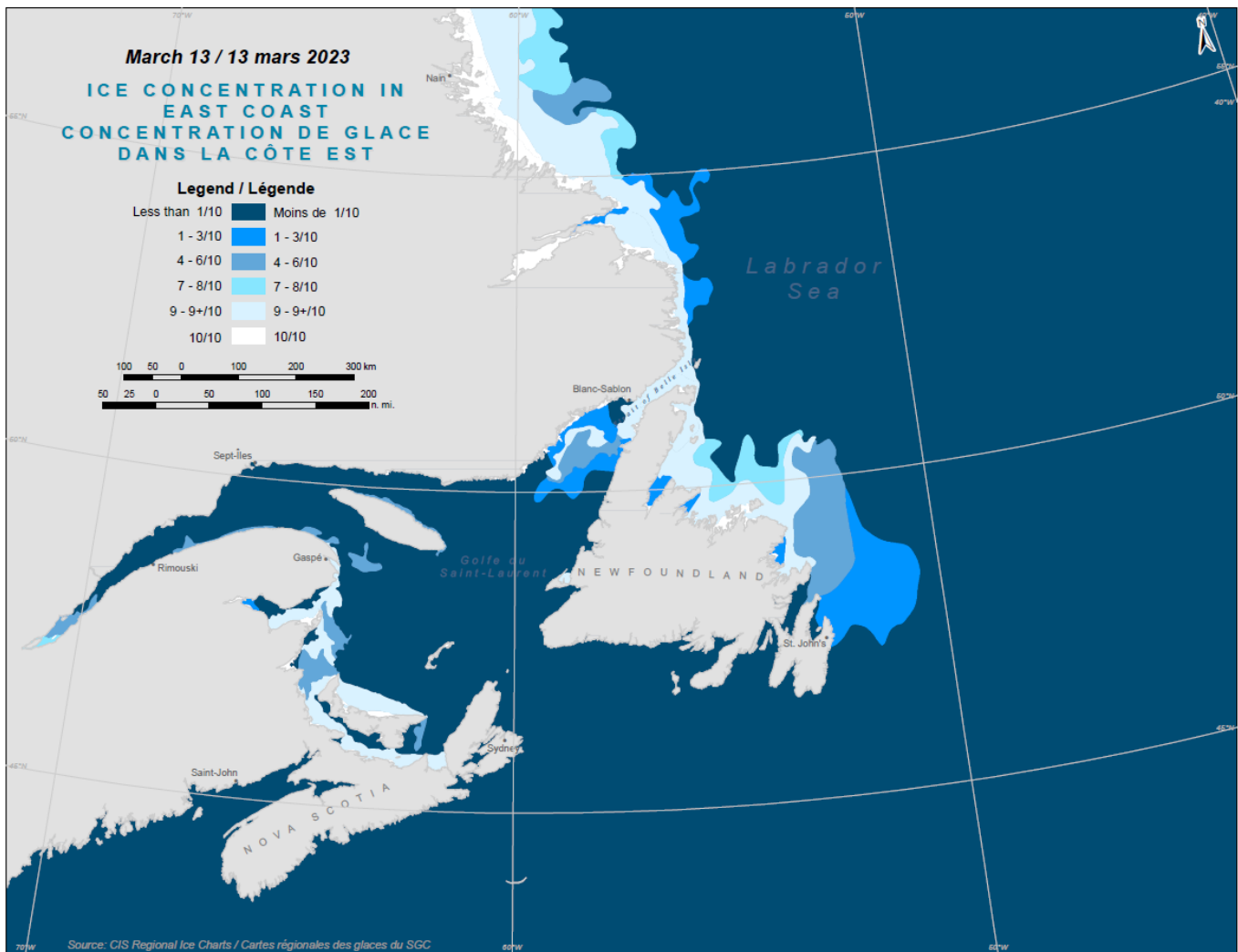
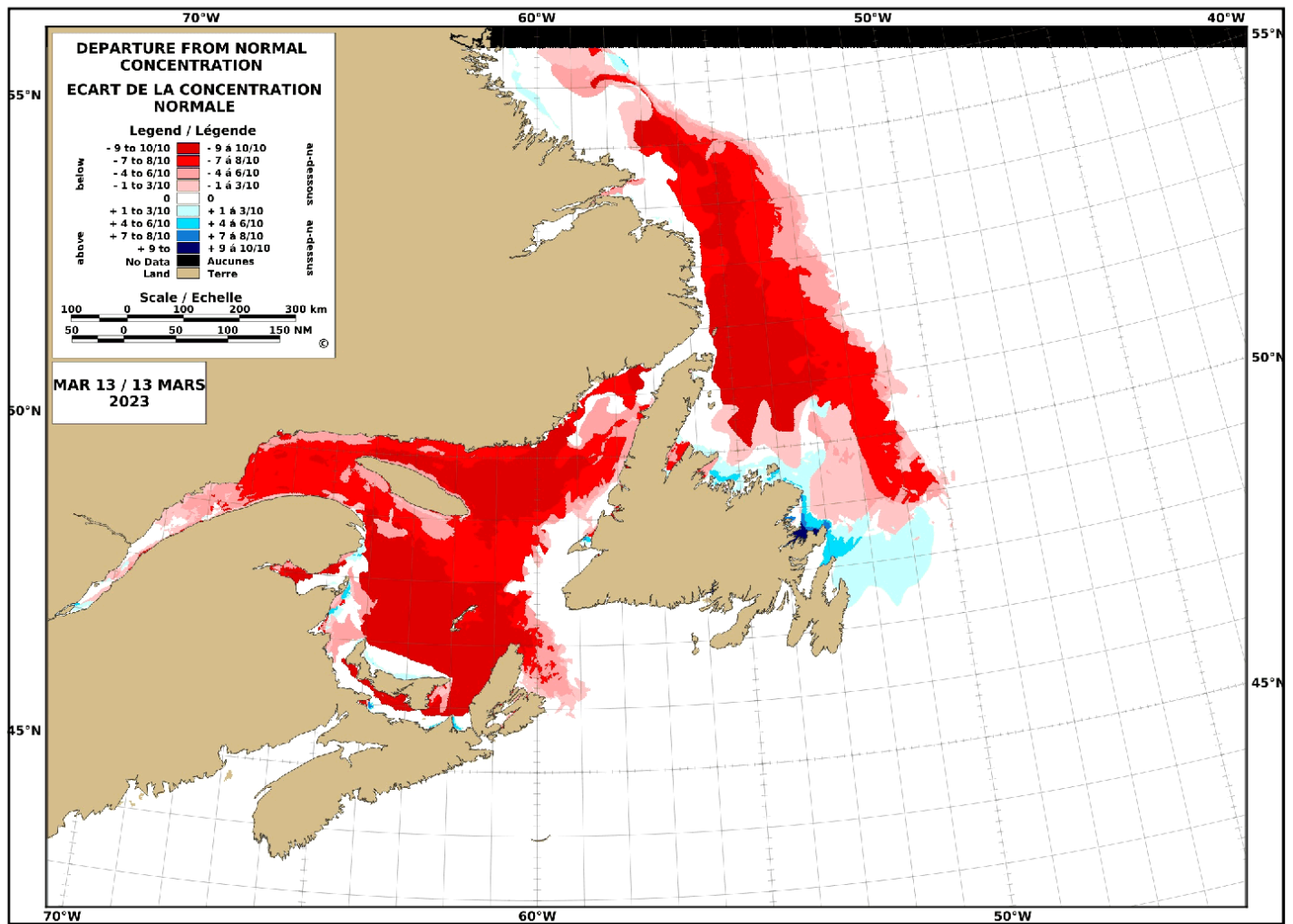


Figure 26: Ice cover on March 13th, 2023.



STATISTICS BASED UPON 1991-2020
LES STATISTIQUES BASÉES SUR 1991-2020

Figure 27: Departure from Normal Chart. *Red* indicates areas with less ice than is usually present, *Blue* indicates areas with greater ice coverage than is normally present.

The area around the Magdalen Islands to Cape Breton is conspicuously devoid of ice whereas in normal years the area is not only ice covered but ice covered with thin first year ice or ice between 30 and 70 cm in thickness.

At mid March the Gulf was about 7% ice covered which is substantially below the 32% normal for this period.

The only areas with thicker ice were along the north coast of PEI and parts of the Northumberland Strait which were covered at mid March by a mix first-year ice and grey-white ice. The other area with thicker ice cover was the Strait of Belle Island which was covered in first-year ice in the eastern section and was starting to have first-year ice with some old ice pushing into the Strait from the Labrador coast. By the end March the Strait of Belle Island is covered in first-year ice containing a trace of old ice. The only other area with ice at the end of March is Chaleur Bay, PEI and Northumberland Strait which have first-year ice and some grey-white ice.

The area around the Magdalen Islands to Cape Breton is conspicuously devoid of ice whereas in normal years the area is not only ice covered but ice covered with thin first year ice or ice between 30 and 70 cm in thickness. The lack of ice here can readily be seen in the departure from normal chart below.

At the end of March, the Gulf is about 3% ice covered which is substantially below the 22% normal for this period. See Figure 28 showing the weekly ice coverage for the 2022-2023 season in the Gulf of St. Lawrence.

By mid April first-year ice containing a trace of old ice continued to drift into the Northeast Arm of the Gulf. All the other areas had become free of ice by mid April with the last ice melting in the southeastern part of the Northumberland Strait on the 12th of April.

The Northeast Arm of the Gulf remained covered in first-year ice with a trace of old ice until the third week of May when it started to dissipate both because of warmer temperatures and a stoppage in the ice flowing into the Strait from the South Labrador Coast.

The last of the ice, located just west of Blanc Sablon, melted on May 29th, bringing an end to the 2022-2023 ice season in the Gulf of St. Lawrence. The TAC for the 2022-2023 Gulf of St. Lawrence ice season was 3.2%, half the TAC of last year and well below the long-term median of 8.3%. This places the 2022-2023 ice season as 5th lowest TAC on record since the 1968-1969 season.

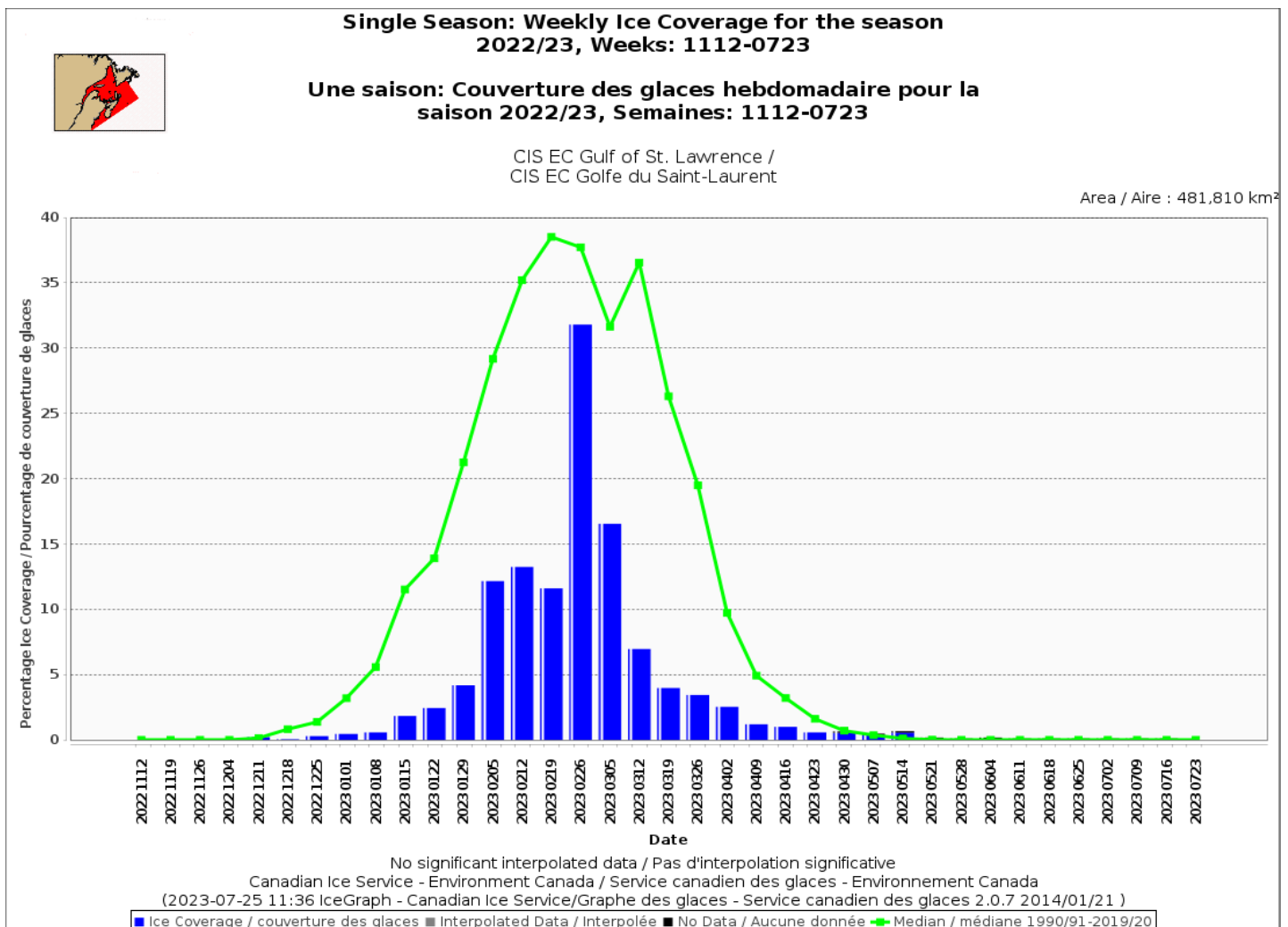


Figure 28: Weekly Ice Coverage for the 2022-2023 Season in the Gulf of St. Lawrence

**Historical Total Accumulated Ice Coverage (TAC) for
the weeks 1112-0723, seasons:1968/69-2022/23**



**Total accumulé de la couverture des glaces historique
(TAC) pour les semaines 1112-0723,
saisons:1968/69-2022/23**

CIS EC Gulf of St. Lawrence /
CIS EC Golfe du Saint-Laurent

Area / Aire : 481,810 km²

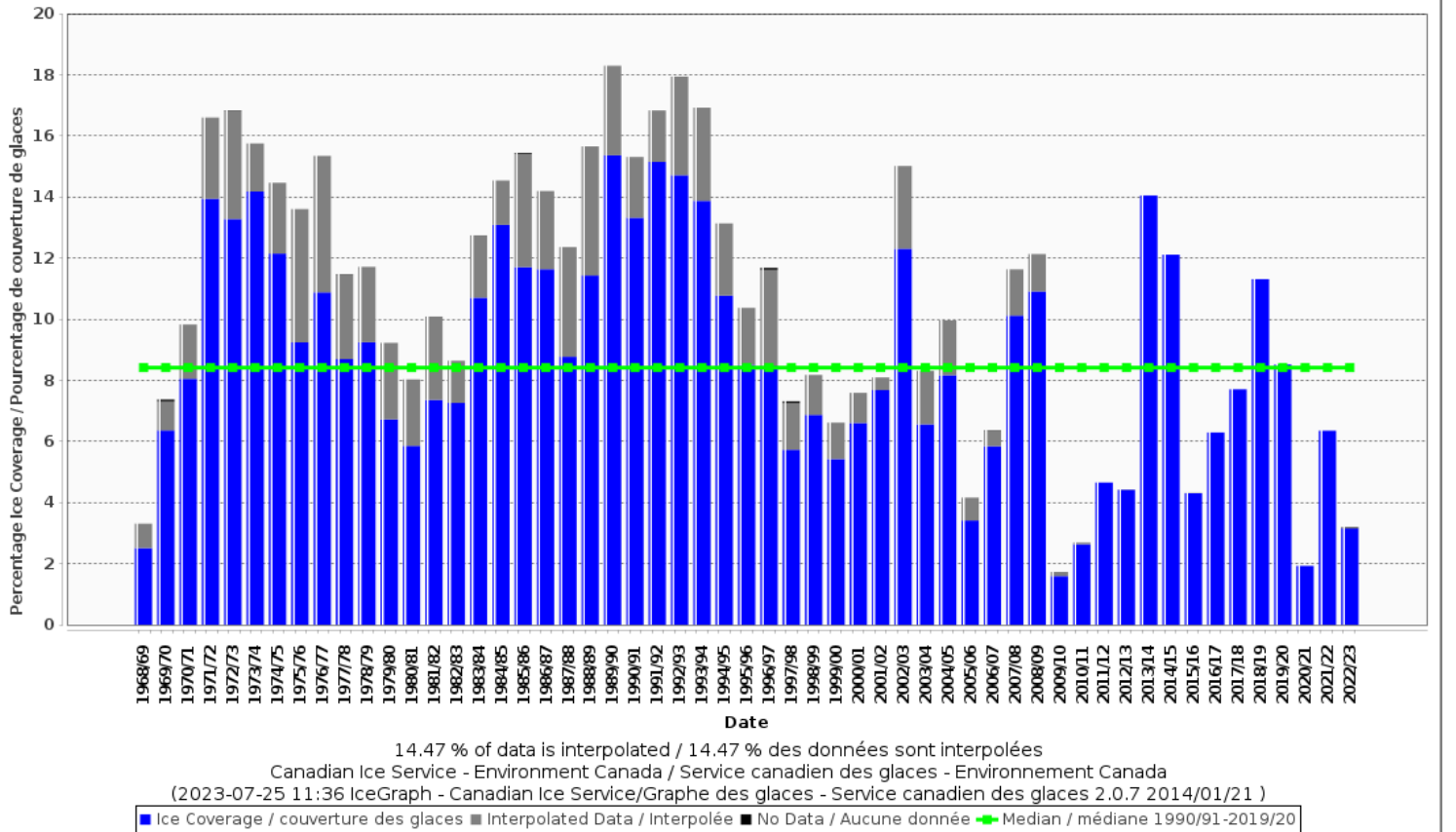


Figure 29: Historical Total Accumulated Ice Coverage for the Gulf of St. Lawrence by Season, 1968/69-2022/23.

The TAC for the 2022-2023 Gulf of St. Lawrence ice season was 3.2%, half the TAC of last year and well below the long-term median of 8.3%. This places the 2022-2023 ice season as 5th lowest TAC on record since the 1968-1969 season.

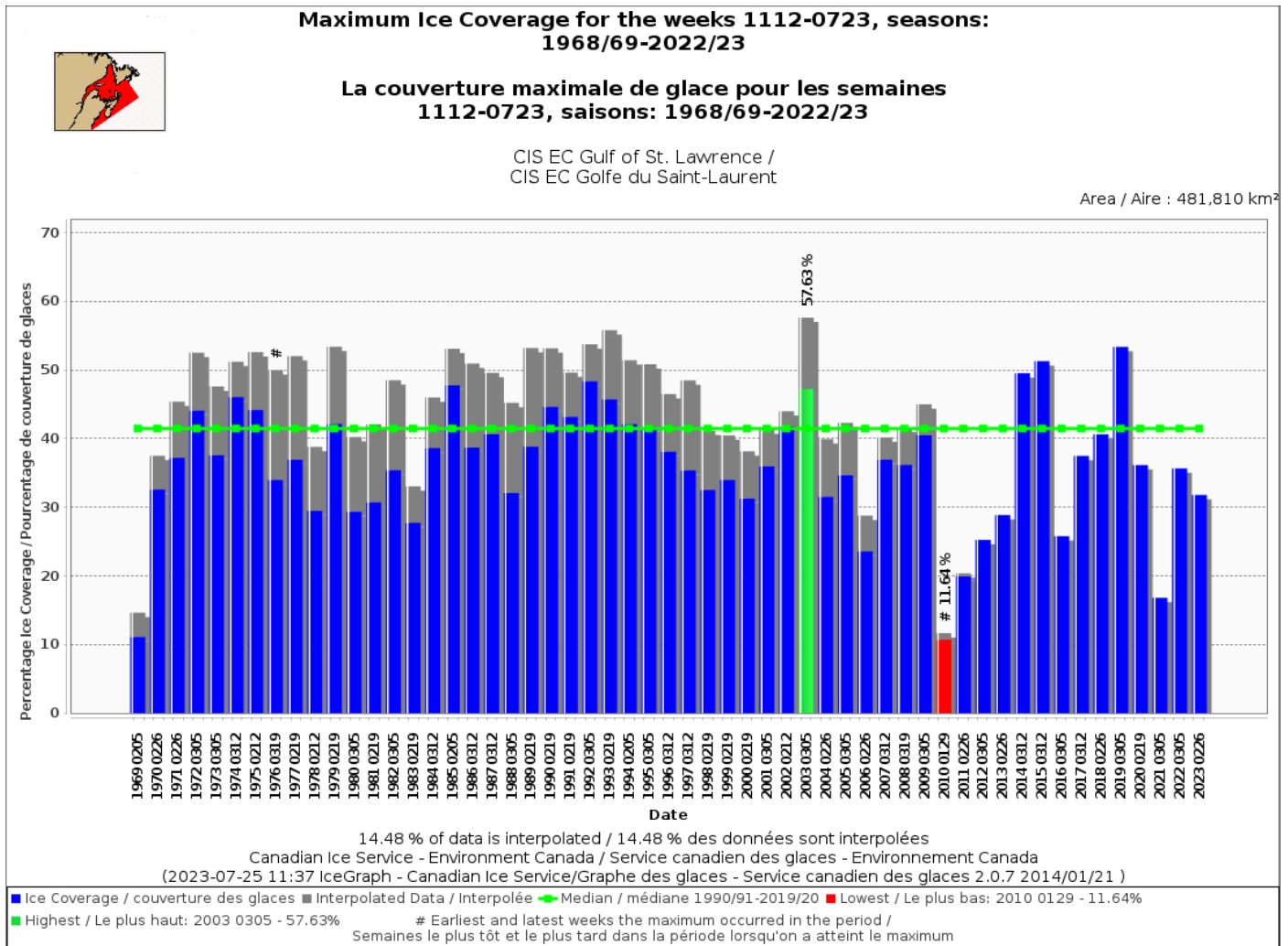


Figure 30: Maximum Ice Coverage in the Gulf of St. Lawrence by Season, 1968/69-2022/23
Maximum coverage occurred on February 26th, 2023.

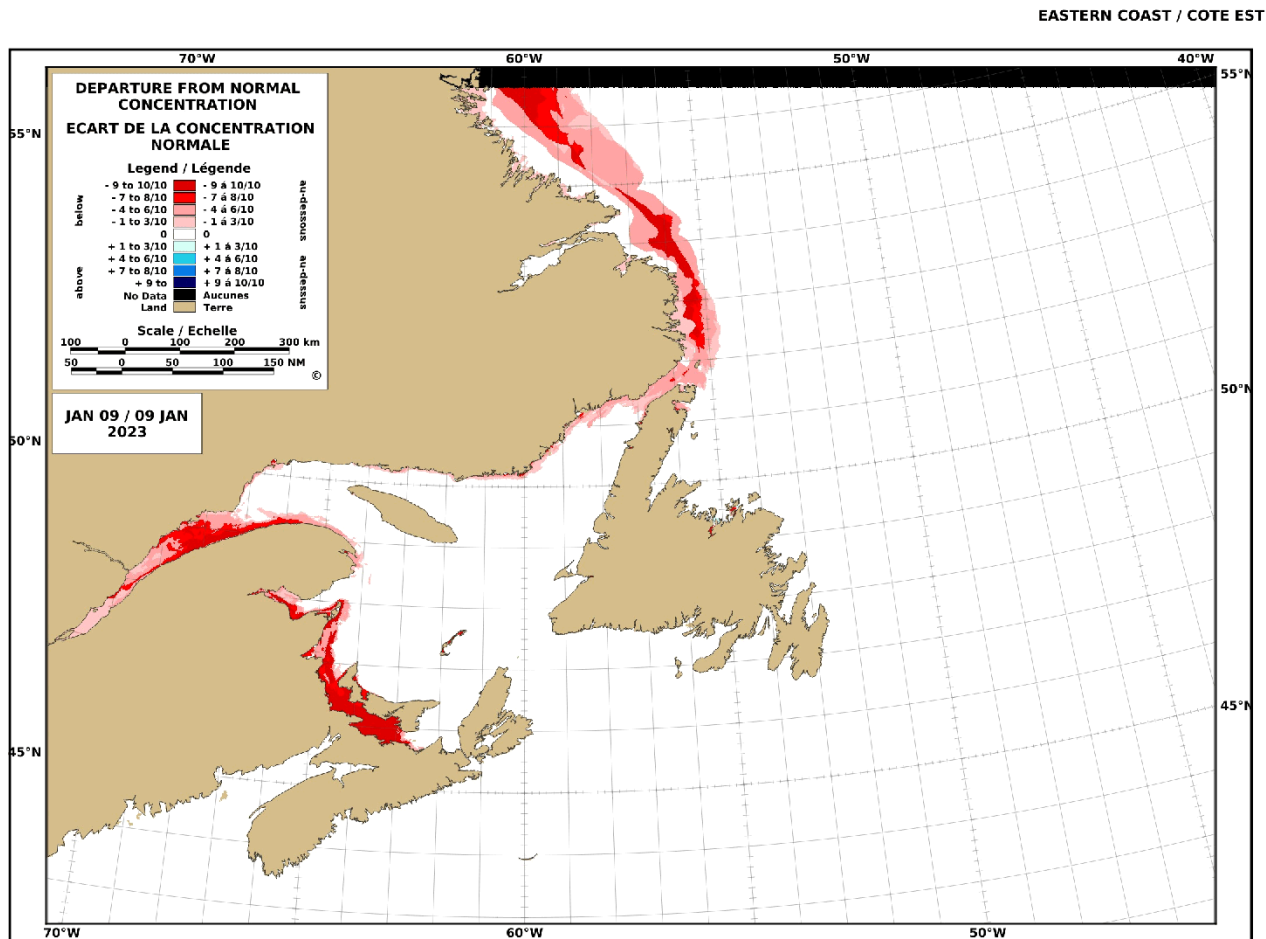
South Labrador Waters

The first sea ice formed in Lake Melville on November 14th, 2022. The ice never thickened beyond new ice thickness (<10 cm) until the 21st of November when grey ice (10-15 cm) started to appear along the western shores of lake Melville. At this time some new ice was also present along parts of the Sandwich Bay shore. There was very little change for the remainder of the month except for some patches of new ice along the coasts in a few isolated bays along the Mid Labrador Coast. Temperatures were near to slightly below normal values along the Labrador Coast during November. During December temperatures along the Labrador Coast were from 3 degrees above normal in the south to 4 degrees above normal along the Mid Labrador Coast, see figure 6 above. With the warmer than normal temperatures very little new ice formed except for Lake Melville with the western shores of the lake thickening to grey-white ice (15-30 cm) at mid December.

After the middle of December new ice started to form along the coast of the mid Labrador Coast however with warm temperatures and stormy winds any ice not in sheltered bays along the mid Labrador Coast was destroyed after the third week of December once more leaving only Lake Melville with any appreciable amounts of ice.

During the last week of December new ice (<10 cm) started to form along the Labrador Coast from near Cartwright northwards.

By the end of the first week off January 2023, the South Labrador Coast had areas of new ice as well. It was not until after the first week of January that a continuous band of grey (10-15 cm) and new ice would lie along the coast from Mid Labrador to just south of Black Tickle along the South Labrador Coast. There was also new ice south along the South Labrador Coast in the Strait of Belle Isle at this time as well as in sheltered bays along the northeastern part of the Newfoundland coast. There was less ice at this time than would be normal for this time of year as is seen on the departure from normal concentration chart for January 9 shown in figure 31 below.



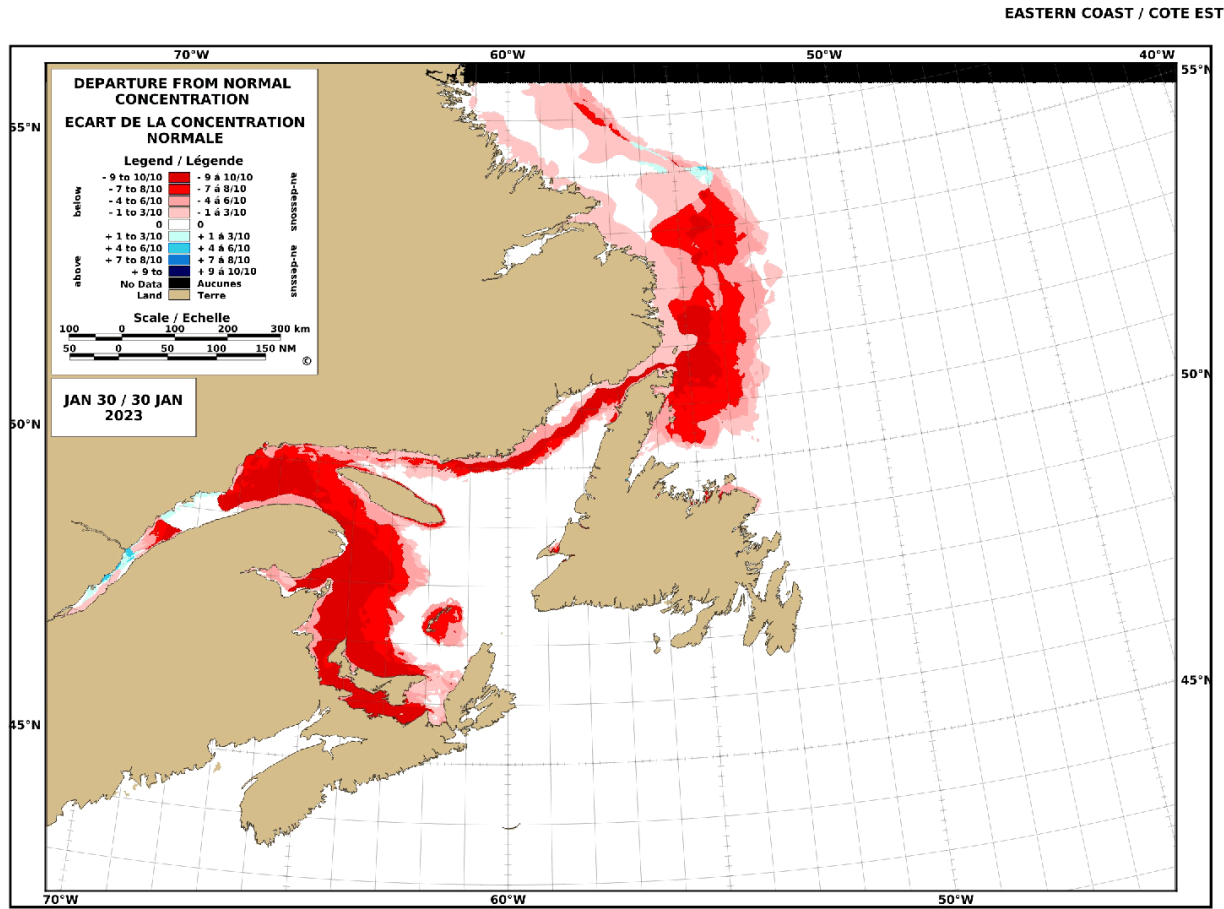
STATISTICS BASED UPON 1991-2020
 LES STATISTIQUES BASÉES SUR 1991-2020

Figure 31: Departure from Normal Chart. Red indicates areas with less ice than is usually present, Blue indicates areas with greater ice coverage that is normally present.

North of Cartwright the sea ice started to thicken along the shore becoming mainly grey ice (10-15 cm) and grey-white ice (15-30 cm) as well it began to extend farther offshore so that by the end of January the mid Labrador Coast had near normal coverage of sea ice though southern areas were still well behind climatological normal values.

Ice coverage along the Labrador Coast started at 1.8% ice covered on January 1st, less than a third of the climatological value of 6.2%. This represented ice conditions 2 weeks behind normal at the beginning of January. This was probably due to a combination of warm temperatures in December as well as several storms. Ice growth remained sluggish all of January reaching 6.3% ice coverage on the 15th of January.

Colder air temperatures during the end of January led to an acceleration in ice production and on January 31st the month ended with an ice coverage of 12.5% just above half the normal value of 20%. See Figure 41 showing the weekly ice coverage for the 2022-2023 season in the Southern Labrador Sea.



STATISTICS BASED UPON 1991-2020
 LES STATISTIQUES BASÉES SUR 1991-2020

Figure 32: Departure from Normal Chart. Red indicates areas with less ice than is usually present, Blue indicates areas with greater ice coverage that is normally present.

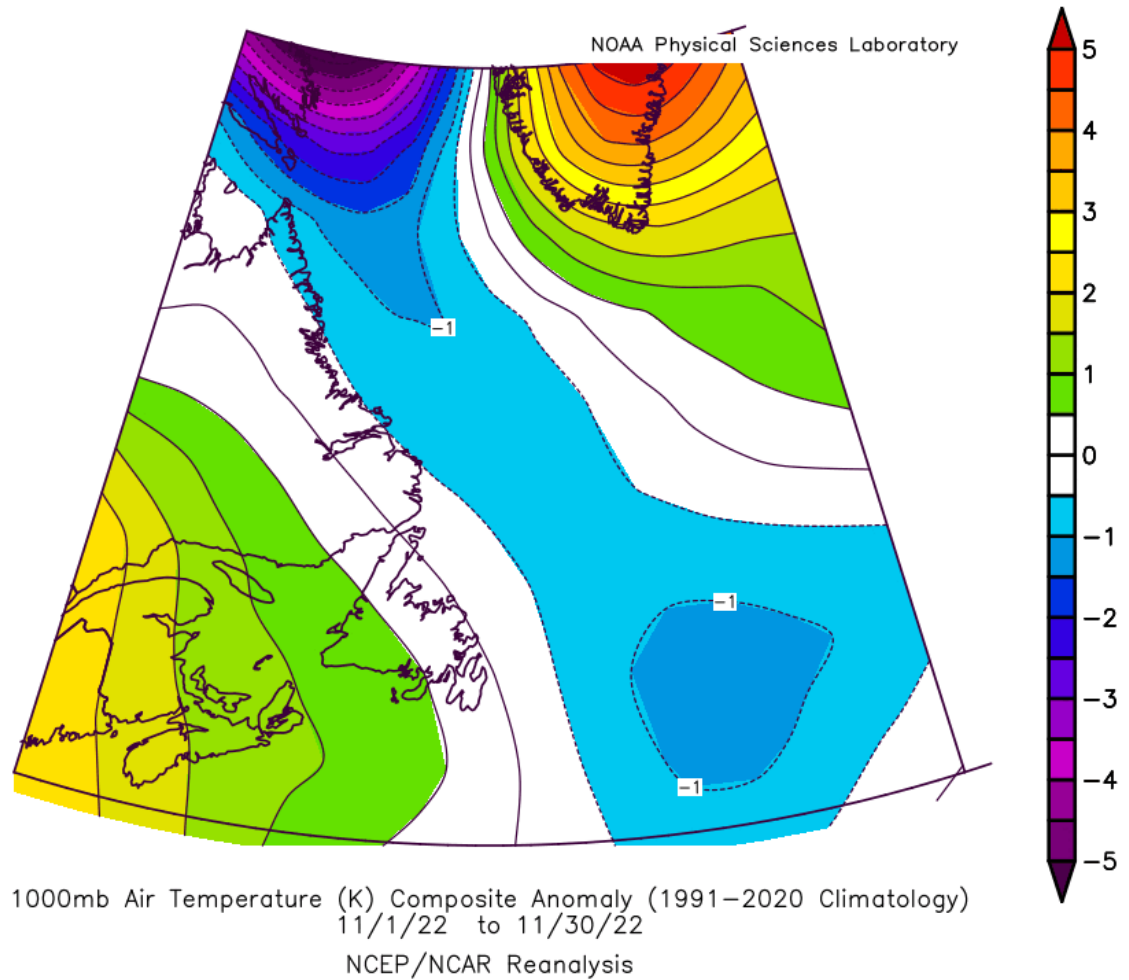


Figure 33: Surface Air Temperature Anomaly – November 1-30, 2022.

After the slightly slower than normal start to the 2022-23 season sea ice concentrations along the Labrador coast started trending very much like those of the average concentration shown in Figure 41 below which shows the weekly ice coverage for the 2022-2023 season in the Southern Labrador Sea.

On the 19th of February ice coverage was almost 25% which is slightly higher than the average for the period of near 22.5%. The month ended with about 24% ice cover over South Labrador which was slightly above the normal value. February saw temperatures below normal values as seen in figure 34 below showing the temperature anomaly in February. One can see temperatures 3-4 degrees colder than are the normal. The ice pack thickened to be predominantly first-year ice (>30cm) in the central and eastern section and a mix of grey-white (15-30 cm) and first-year ice along the coast. Ice coverage along the mid and southern Labrador coast ended the month at 22.5%, equaling the climatological median of 22.2. The combination of colder than normal temperatures for the month of February as well as ice moving southwards along the Labrador Coast from Northern Labrador increased the concentration to near normal and overcoming the below normal concentrations of ice early in the season due to warmer air temperatures at that time causing a slower than normal start to the season.

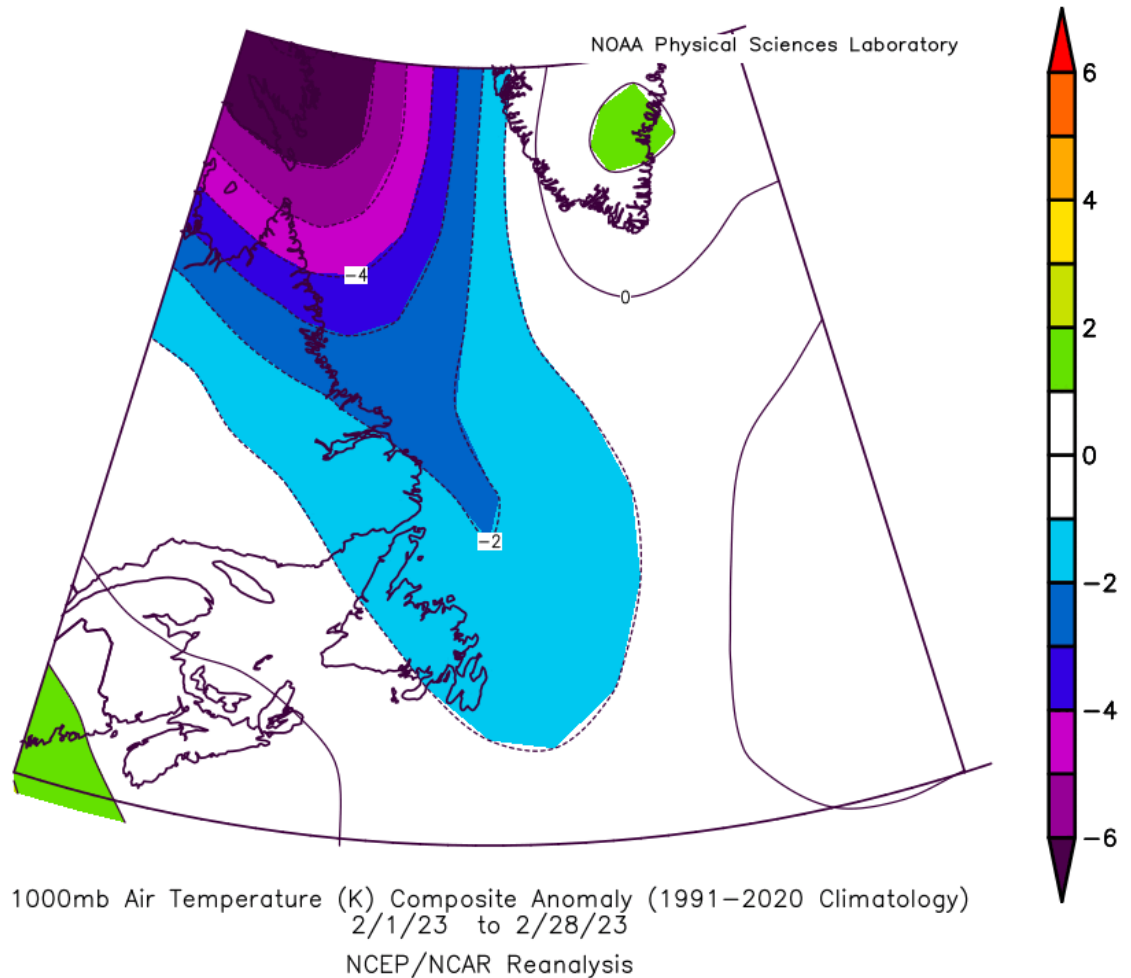


Figure 34: Surface Air Temperature Anomaly – February 1-28, 2023.

Ice that was moving southward into the mid Labrador Coast by the end of February had formed in Davis strait at the start of the season when temperatures over Davis Strait were several degrees colder than normal and sea ice started to form in that area 4-6 weeks ahead of the normal period thus allowing it to thicken that much longer. This ice can be seen as an area of first-year ice (>30 cm) that has a trace of old ice just off the Mid Labrador Coast after the third week of February.

The ice coverage declined sharply in March as seen in figure 41 which shows the weekly ice coverage for the 2022-2023 season in the Southern Labrador Sea. This decrease in the ice coverage was due to a series of low-pressure systems that would position themselves southeast of the Labrador coast with winds pushing the sea ice southwestwards towards the coast. This anomalous easterly wind flow continued for most of the month of March and can be seen in figure 35 below.

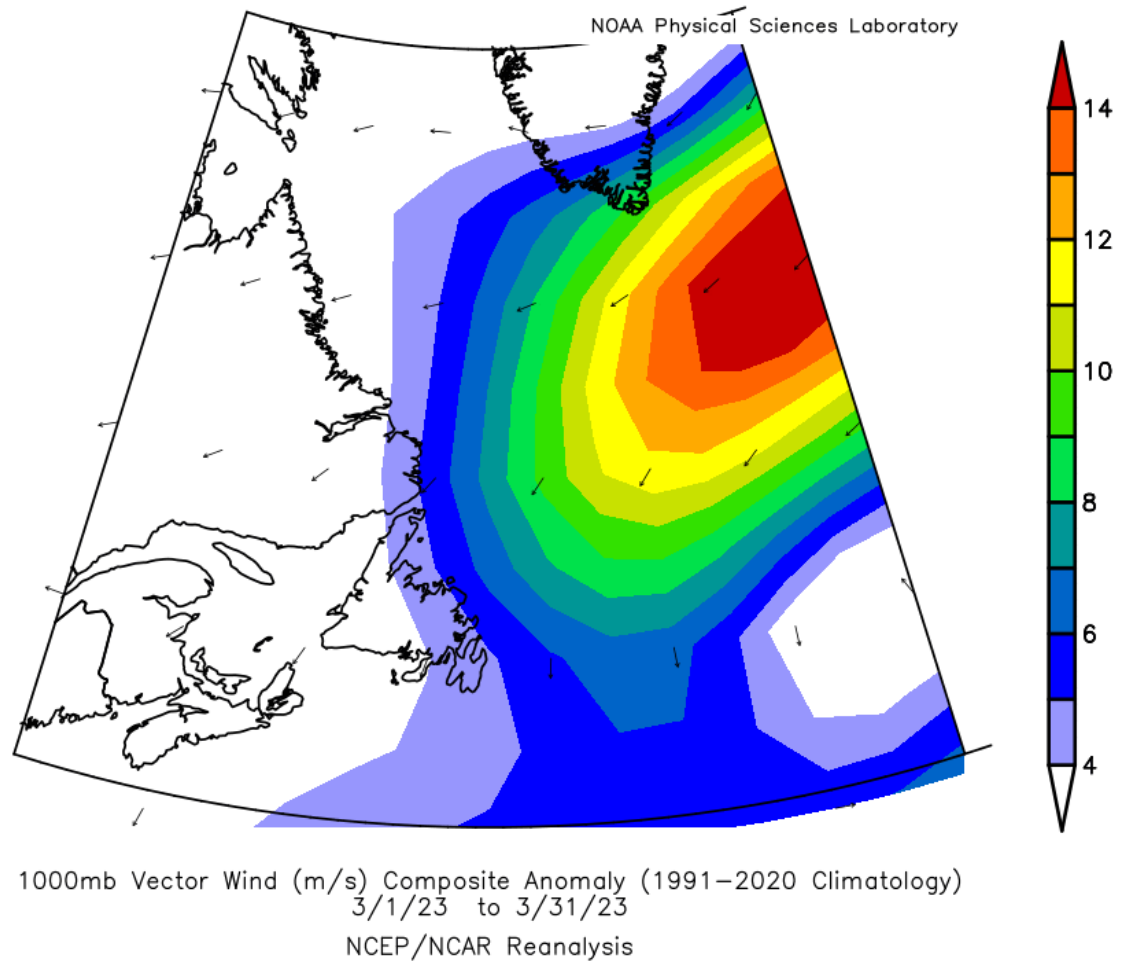
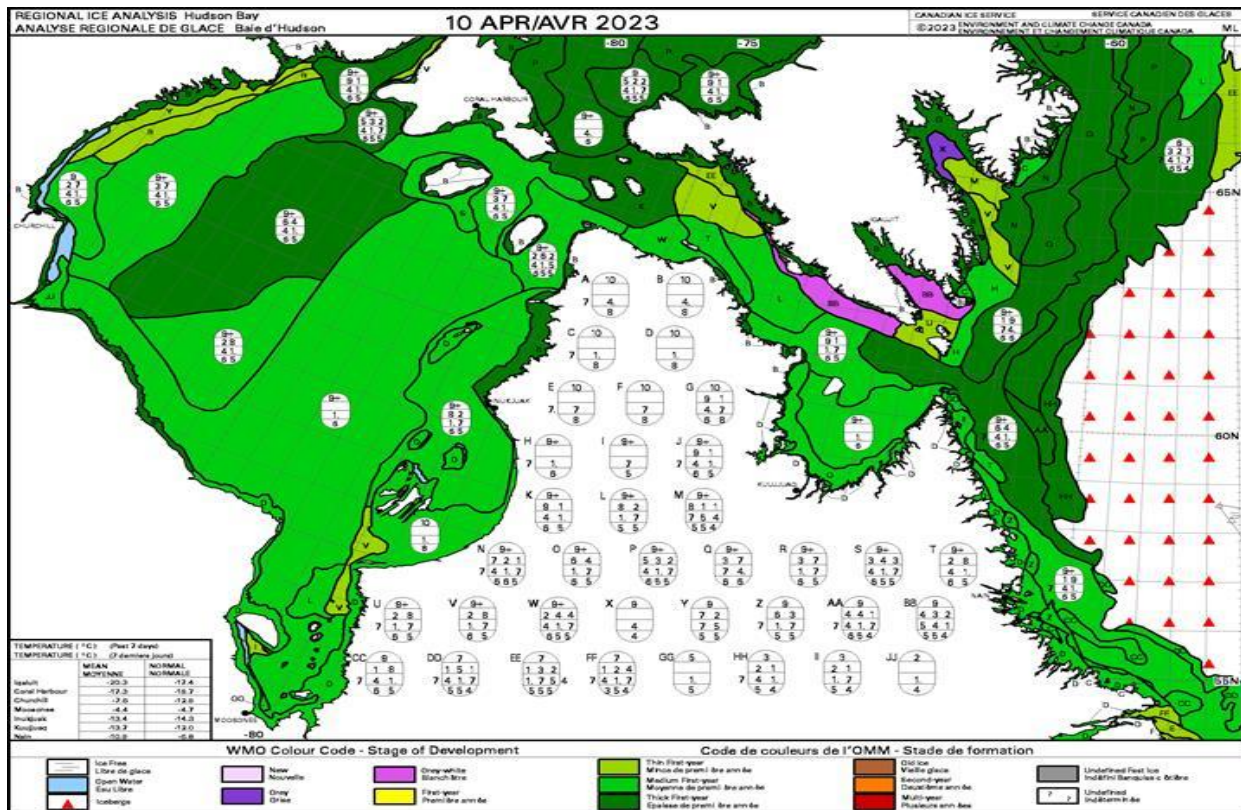


Figure 35: Surface wind Anomaly – March 1-31, 2023.

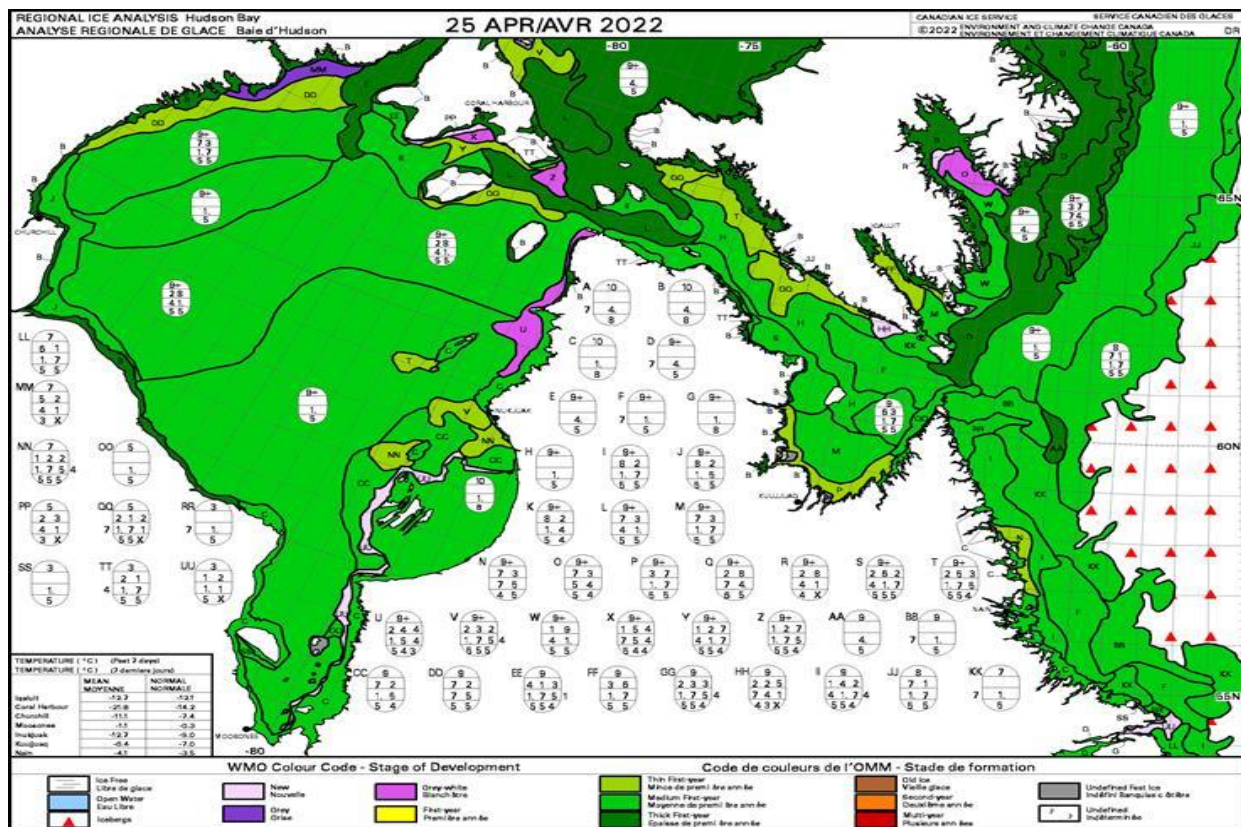
Lower than normal ice coverage in March along the Labrador coast was due to persistent northeasterly winds pushing and keeping the ice near the coast and thus covering less spatial area than normal. This general coastwards push of the ice by the winds has continued into April. Mean wind direction is shown by the red arrows in figure 35 above which shows that during March the winds were anomalously onshore whereas normally the predominant direction is offshore.

March started with near 22.5% ice coverage at the beginning of the month equal to the normal value of 23%. As the ice continued to become compacted against the coast with the easterly winds ice coverage dropped to 9% by mid-month which was half the normal of 22% and increased only slightly to 11% ice coverage at the end of March while normally about 19% ice coverage is expected at the end of March off the southern Labrador Coast.

Ice that had formed in Davis Strait at the start of the season in that area during September 2022 when temperatures over Davis Strait were colder than normal by several degrees and sea ice there had started to form 4-6 weeks ahead of normal reached the South Lab coast in April 2023. That ice is subsequently 4-6 weeks thicker than normal as well.



When we compare this year's chart figure 36 above with last year's chart figure 37 below, we see that even though the chart below is two weeks later in the season that the thicker ice was not as far south as it is this year. Darker green on Map. This is due, as stated above to the early start to the ice season in Davis Strait of about 4-6 weeks.



By comparing the two charts above that last year even two weeks later in the season on April 25th 2022, figure 37, the thicker ice (dark green on the charts above) would remain farther north. However, this year on April 10th, 2023, above, can see that there is greater amounts of thick ice (dark green) and that it has moved southwards to enter South Labrador Waters after the second week of April (see figure 36).

Several storms which compacted the ice along the coast accounted for the reduced ice coverage in late March with ice coverage on March 26th near 12% or just above half of the seasonal normal of 18%. By April 9th with this thicker ice drifting southwards from Northern Labrador Sea and with the onshore push of the anomalous easterly winds easing the sea ice extent increased eastwards along the southern coast, which increased the ice coverage steadily from April 10th to the end of April. See figure 41 the weekly ice coverage for the 2022-2023 season in the Southern Labrador Sea chart below.

April started with 12.5% ice coverage well below the average ice coverage of 19% however by the 10th of April ice coverage had increased to 16% equal to the average ice coverage for this time along the South Labrador Coast. This was due to the easterly flow that predominated during March becoming a strong southerly flow during April which in addition to no longer compressing the ice along the Labrador coast brought ice from northern Labrador south into the area thus increasing the total amount of ice. The dip in ice coverage in March and the subsequent bounce back to normal ice coverage in April is clearly seen on the chart for this season's weekly ice coverage, figure 41 below.

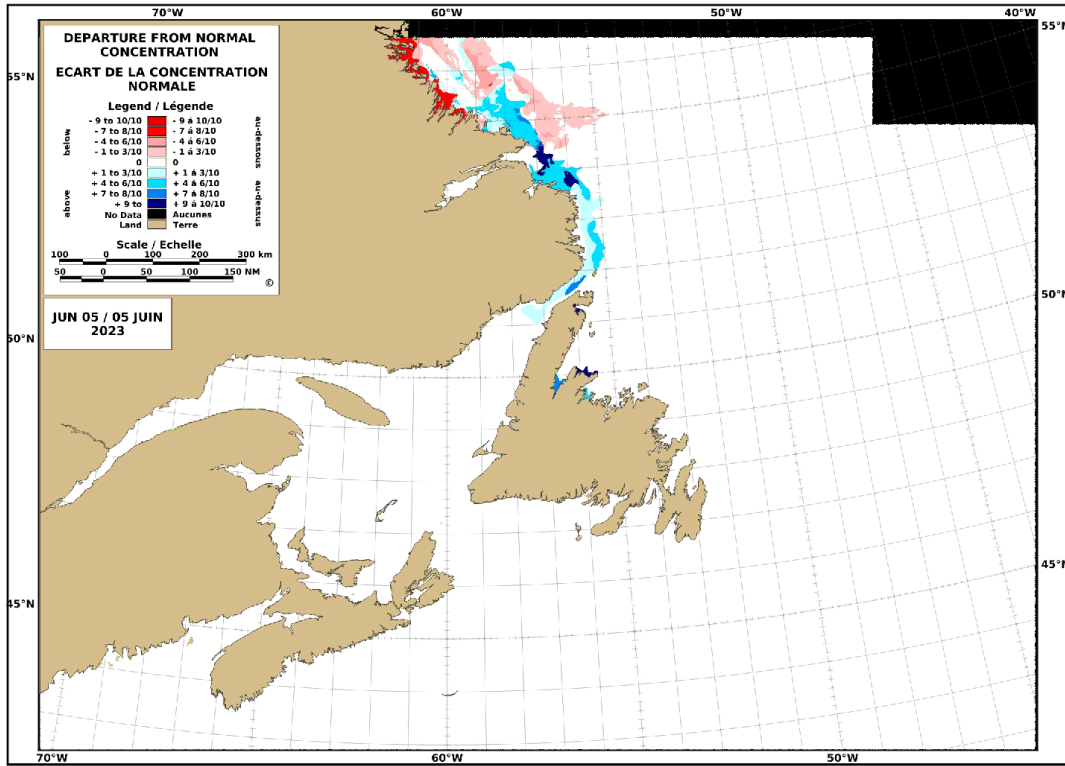
Finally, April ended with ice concentrations of 16% slightly higher than the normal 15% for this end of April.

Air temperatures remained near normal along the Labrador Sea for the month of May. The ice coverage declined during May following pretty much the historically normal trend. Ice coverage at the start of May was 14% about equal to the historical normal value for the start of May of 12.5% and it ended May with an ice coverage equal to the historically normal amount of ice cover for the end of May of 5%.

The spring temperatures in May also significantly reduced ice coverage in Lake Melville, leaving only small areas of ice in the southern and eastern portions of the lake by the start of the third week of May.

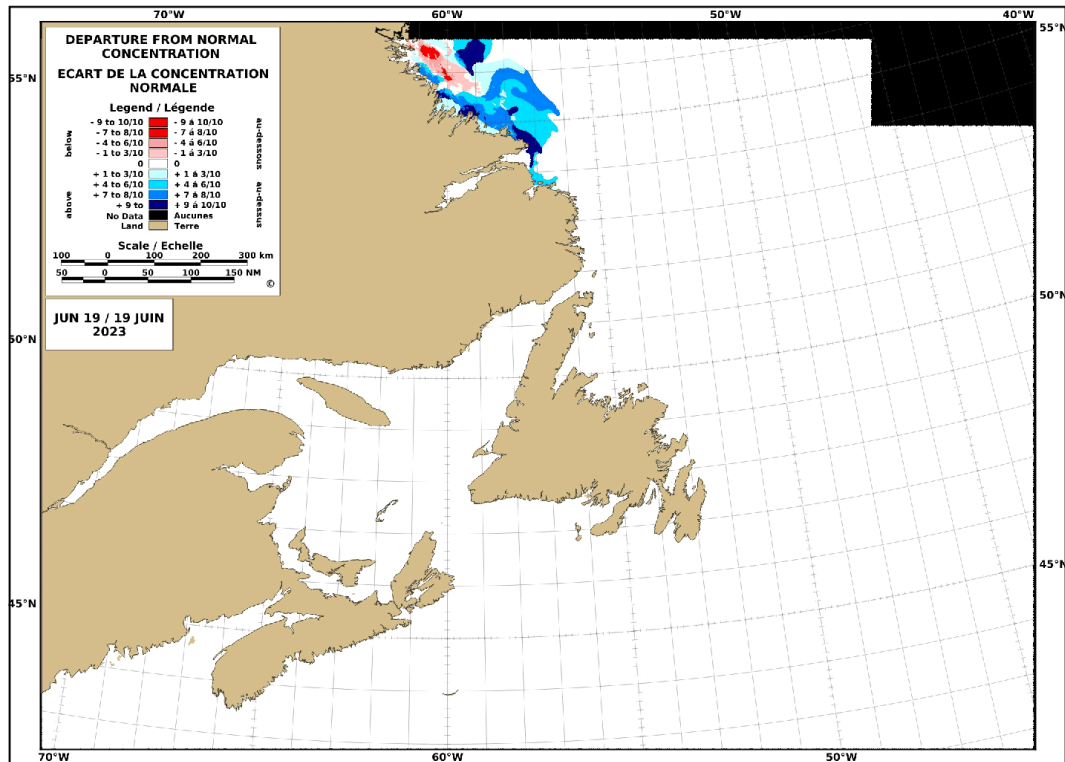
The anomalous southerly winds did pack the ice along the north facing parts of the coast from Black Tickle northwards.

The spring melt resumed in June as air temperatures continued to rise and winds remained generally light over the Labrador Sea allowing for a more broad, less concentrated ice pack. The larger ice pack absorbed more of solar radiation thus allowing the warmer temperatures to melt the ice pack more efficiently.



STATISTICS BASED UPON 1991-2020
 LES STATISTIQUES BASÉES SUR 1991-2020

Figure 38: Departure from Normal Concentration for June 5th from 1990-2020
 Red shows missing ice, Blue is extra ice compared to normal.



STATISTICS BASED UPON 1991-2020
 LES STATISTIQUES BASÉES SUR 1991-2020

Figure 39: Departure from Normal Concentration for June 19th from 1990-2020
 Red shows missing ice, Blue is extra ice compared to normal.

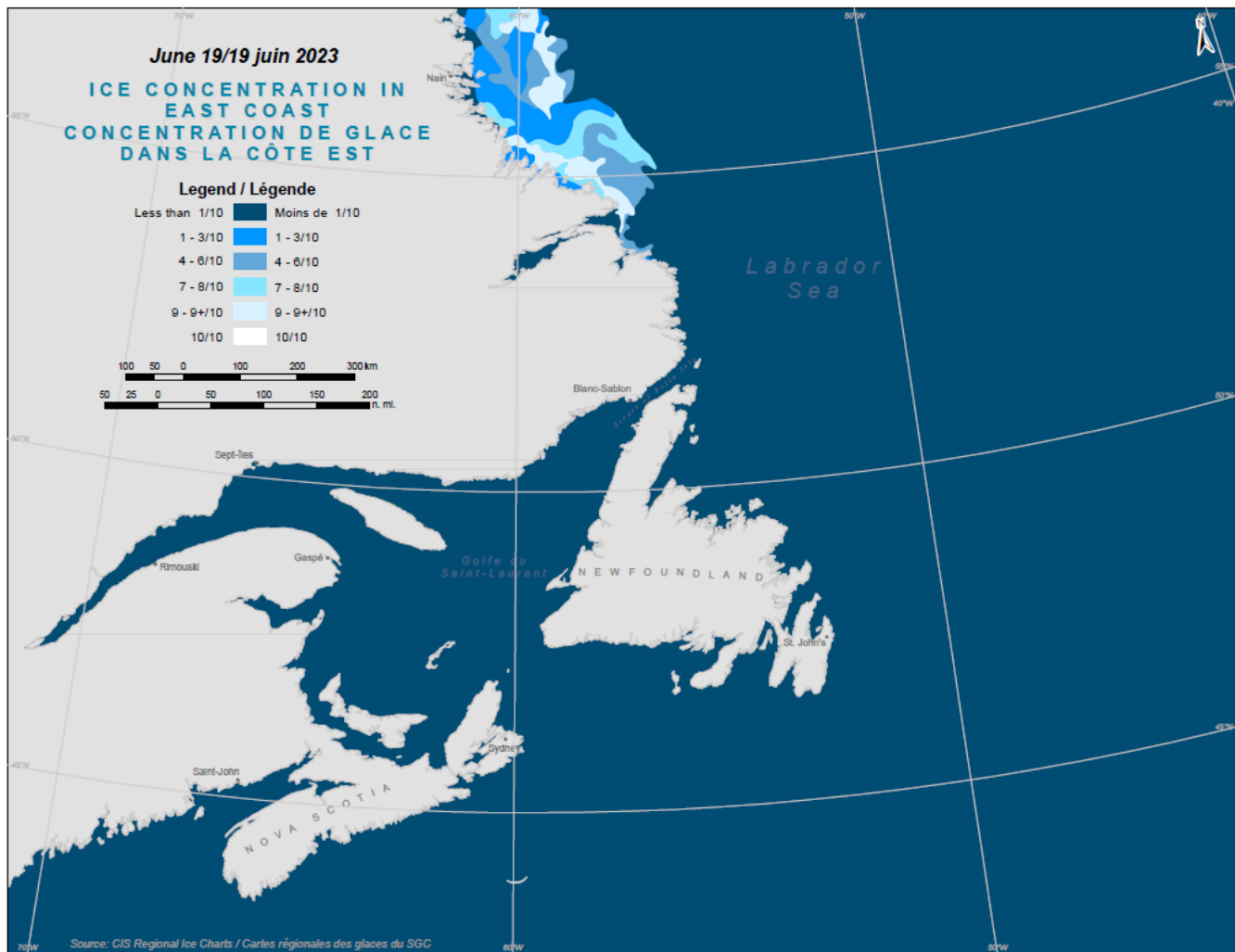


Figure 40: East Coast Concentration in tenths of ice, June 19th, 2023

June started the month with about 5% ice coverage which is equal to the historical amount of ice coverage. The amount of ice coverage did not follow the normal trend off the South Labrador Coast this year and steadily decline to be less than 1% by the end of the month before completely melting in early July. The ice coverage remained almost steady at about 4% for the month of June, see concentration anomaly chart figures 38 and 39 above. This was due to more and thicker ice that flowed south this year (see discussion for April above) and this thicker ice would take longer to melt.

By the end of June, 4% ice coverage remained in Southern Labrador Waters east and north Emily Harbour. This represented an ice coverage several times greater than the long-term median of 0.7% for the end of June.

The transport of sea ice from the north would not end until the first week in July at which time no further ice would enter the region for the rest of the season. The last of the ice melted of the South Labrador Sea on July 11th when the last ice patches of ice east of Makkovik disappeared.

The TAC for the 2022-2023 South Labrador Sea ice season was 7.5% below the long-term median of 10.0%.

This places the 2021-2022 ice season as the 9th lowest on record since the 1968-1969 season.

**Single Season: Weekly Ice Coverage for the season
2022/23, Weeks: 1112-0723**



**Une saison: Couverture des glaces hebdomadaire pour la
saison 2022/23, Semaines: 1112-0723**

CIS EC Southern Labrador Sea /
CIS EC Sud de la mer du Labrador

Area / Aire : 617,550 km²

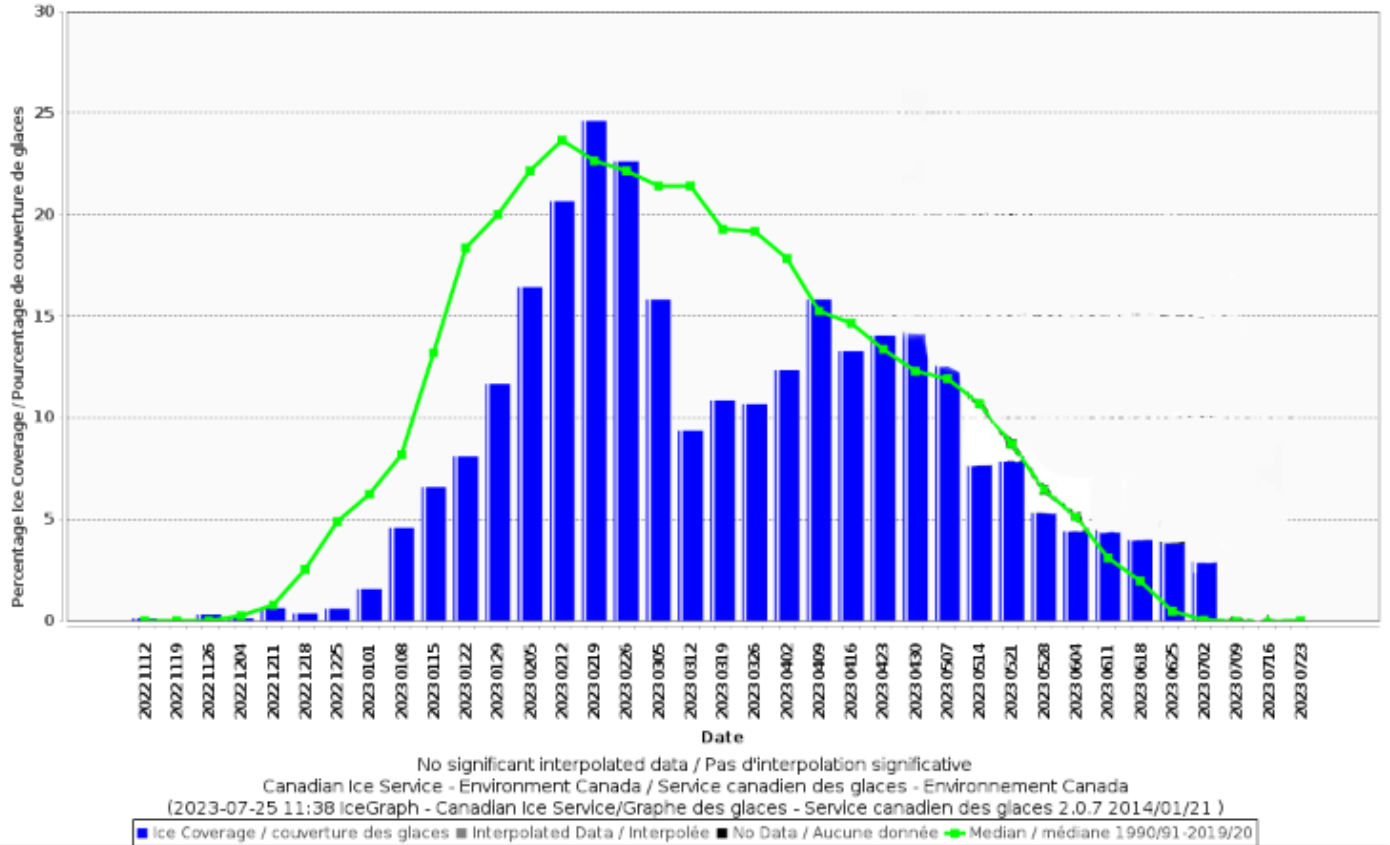


Figure 41: Weekly Ice Coverage for the 2022-2023 Season in the Southern Labrador Sea.

**Historical Total Accumulated Ice Coverage (TAC) for
the weeks 1112-0723, seasons:1968/69-2022/23**



**Total accumulé de la couverture des glaces historique
(TAC) pour les semaines 1112-0723,
saisons:1968/69-2022/23**

CIS EC Southern Labrador Sea /
CIS EC Sud de la mer du Labrador

Area / Aire : 617,550 km²

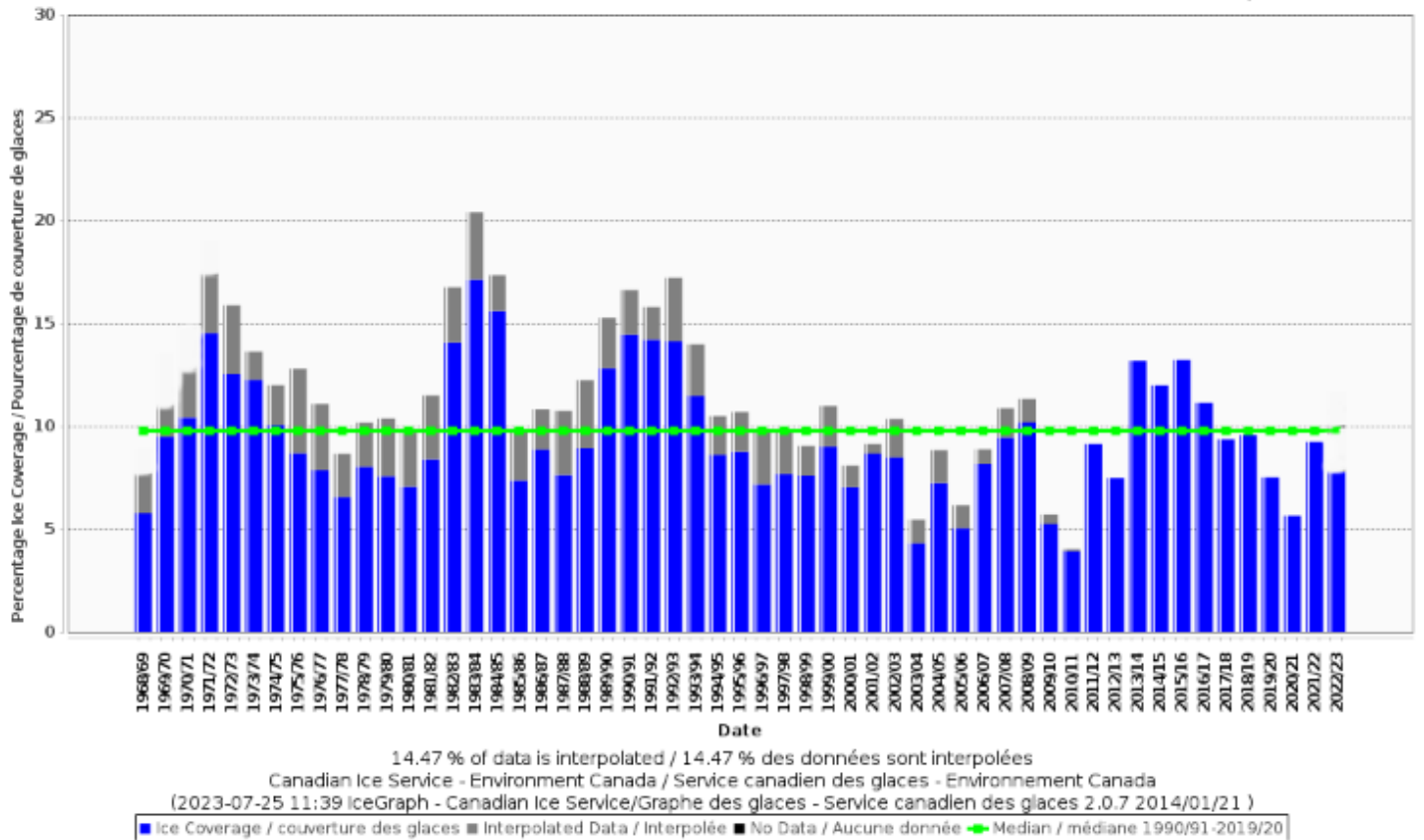


Figure 42: Historical Total Accumulated Ice Coverage for the Southern Labrador Sea by Season, 1968/69-2022/23. The TAC for the 2022-2023 South Labrador Sea ice season was 7.5% below the long-term median of 10.0%. This places the 2021-2022 ice season as the 9th lowest on record since the 1968-1969 season.

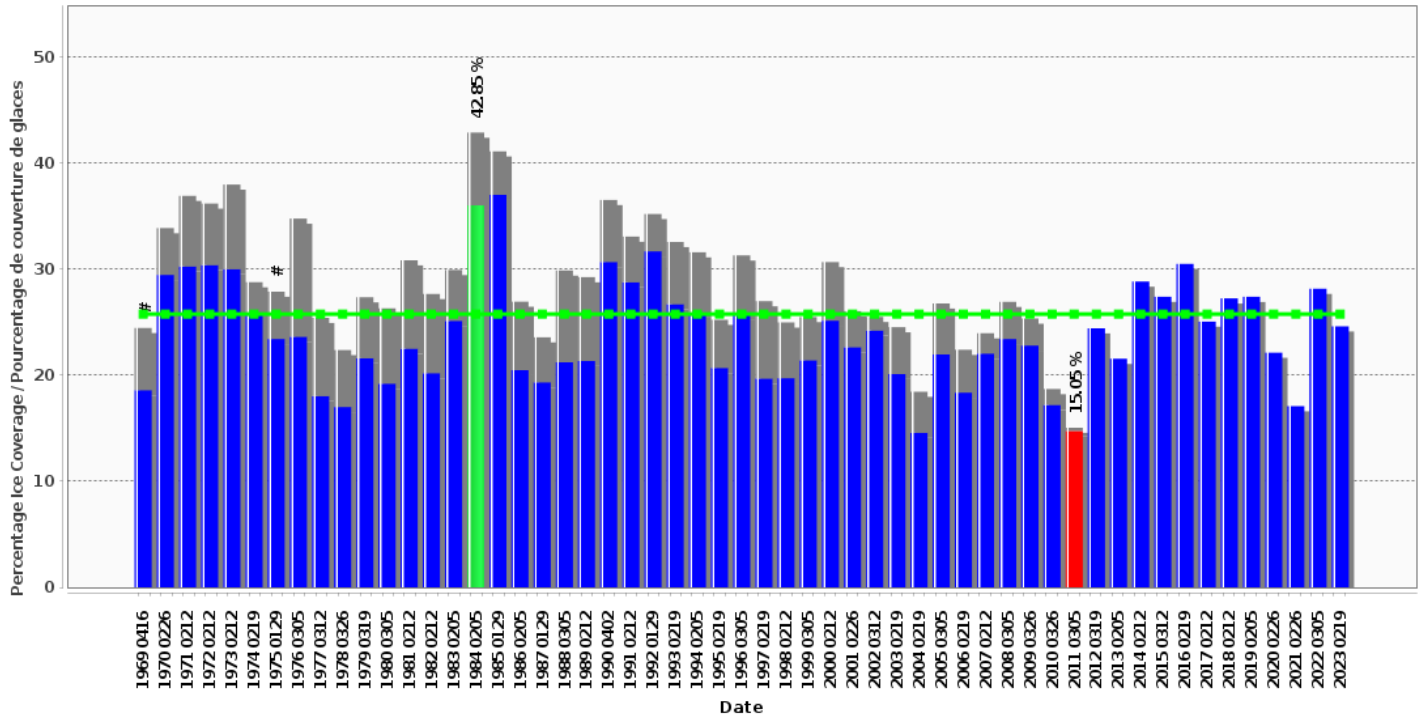
**Maximum Ice Coverage for the weeks 1112-0723, seasons:
1968/69-2022/23**



**La couverture maximale de glace pour les semaines
1112-0723, saisons: 1968/69-2022/23**

CIS EC Southern Labrador Sea /
CIS EC Sud de la mer du Labrador

Area / Aire : 617,550 km²



14.48 % of data is interpolated / 14.48 % des données sont interpolées

Canadian Ice Service - Environment Canada / Service canadien des glaces - Environnement Canada

(2023-07-25 11:39 IceGraph - Canadian Ice Service/Grphe des glaces - Service canadien des glaces 2.0.7 2014/01/21)

■ Ice Coverage / couverture des glaces ■ Interpolated Data / Interpolée — Median / médiane 1990/91-2019/20 ■ Lowest / Le plus bas: 2011 0305 - 15.05%

■ Highest / Le plus haut: 1984 0205 - 42.85% # Earliest and latest weeks the maximum occurred in the period /

Semaines le plus tôt et le plus tard dans la période lorsqu'on a atteint le maximum

Figure 43: Maximum Ice Coverage in the Southern Labrador Sea by Season, 1968/69-2022/23
Maximum coverage occurred on February 19th, 2023.

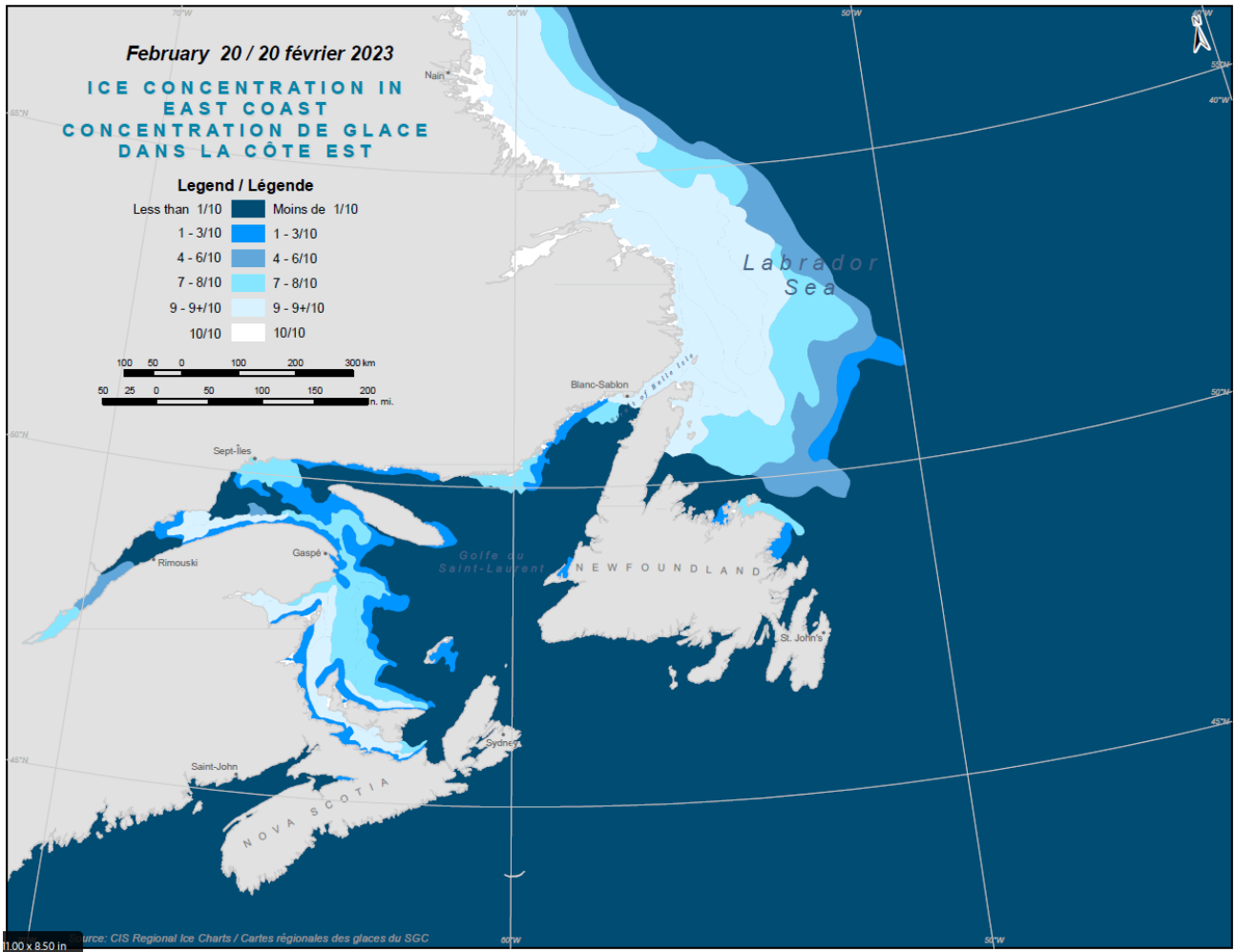


Figure 43b: Ice Concentration Chart for week of February 20th.
Maximum coverage occurred on February 19th, 2023.

East Newfoundland Waters

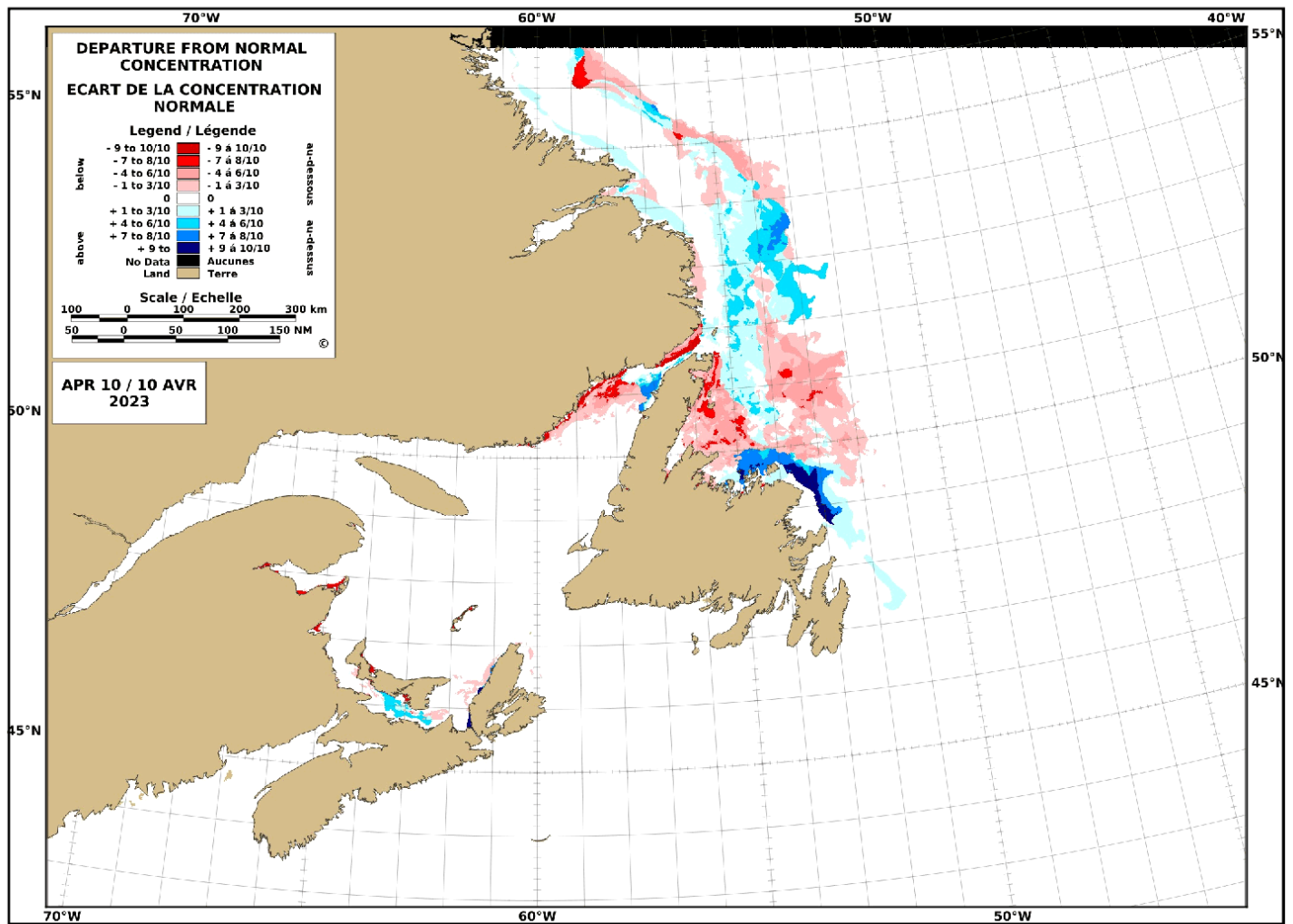
No measurable amount of ice was recorded in December for the east Newfoundland waters, which is typical for the time of year. Sea ice in the East Newfoundland Waters started January 2023 with almost no ice coverage. There were a few strips of new ice in sheltered bays within the Northern Peninsula. By the second week small amounts of ice were also found in sheltered bays along the north shore. There was no other ice in Newfoundland waters for January which is very typical as the climatological median of ice remains below 0.1% for this month. The first significant amounts of sea ice were recorded just north of the tip of the Northern Peninsula on the last day of the month, January 31st as thin ice drifted near the tip of the peninsula from the South Labrador Coast. By months' end ice coverage remained near 0.1 to 0.2% or below the long-term median of 1.8%.

Sea ice in the East Newfoundland Waters started February with almost no ice coverage. By the second week colder temperatures and ice flowing southwards from Labrador increased the ice concentration quickly from almost no ice to almost half of the normal amount of ice 4% while the average is near 8%. With continued colder than normal temperatures for the rest of the month February ended with near 8.6% ice coverage for East Newfoundland Waters which was equal to the normal amount ice coverage expected. This was the first time that the ice coverage matched the climatological normal during the 2022-2023 East Newfoundland Waters ice season which had seen less ice coverage than normal until this time. During the last week of February thicker ice which was predominately first-year ice (>30 cm) moved south into Newfoundland Waters from South Labrador.

Newfoundland Waters became covered in predominately first-year ice at the start of March reaching the peak ice coverage for the 2022-23 season in the East Newfoundland Waters on March 5th with almost 12% ice coverage which is higher than the normal coverage of near 10%. Just before the start of the second week of March a storm off the coast of Newfoundland brought strong northeasterly winds that pushed the ice onto the shores of Newfoundland. Persistent onshore winds during March would push the ice onto the coast, see figure 35 above which shows the anomalous winds during this period. The first-year ice (30-70 cm) would lie along the coast of Newfoundland from St. Anthony along the coast to Fogo Island causing difficult ice conditions in these areas due to the heavy ice coverage.

The series of storms to the east of Newfoundland during March which brought northeasterly winds and compacted the ice along the coast of Newfoundland caused the ice coverage to become reduced in area with concentrations on March 12th of 5% or near half of the seasonal normal of 10%. The compacted ice extended along the eastern Newfoundland coast south to St Johns.

This thick ice along the coast would though only covering about half the areal coverage that was normal for the time of year would remain in place until the second week in April when medium (70-120 cm) and thick (>120 cm) first-year ice would flow into the area from Labrador.



STATISTICS BASED UPON 1991-2020
LES STATISTIQUES BASÉES SUR 1991-2020

Figure 44: Departure from Normal Concentration for June 19th from 1990-2020
Red shows missing ice, Blue is extra ice compared to normal.

During the last week in April this thicker ice would be pushed against the eastern coast of the Northern Peninsula by strong northeasterly winds and would cause difficult ice conditions from Newfoundland northwards along the Labrador Coast as well.

Sea ice in the East Newfoundland Waters started May as it ended April with thick first-year ice packed along the coast of the Northern Peninsula. Persistent northeast winds would keep the ice against the coast until after the second week in April when the ice started moving off the coast except for the northern tip of the Northern Peninsula north of St Anthony where it remained against the coast until after the third week of April.

By the end of the month only some patches of ice were left in the northern section which is expected as by the end of May the average ice coverage for the East Newfoundland Waters is nearly 3%. However, some patches of thick first-year ice remained along parts of the coast near St Anthony and east of Baie Verte.

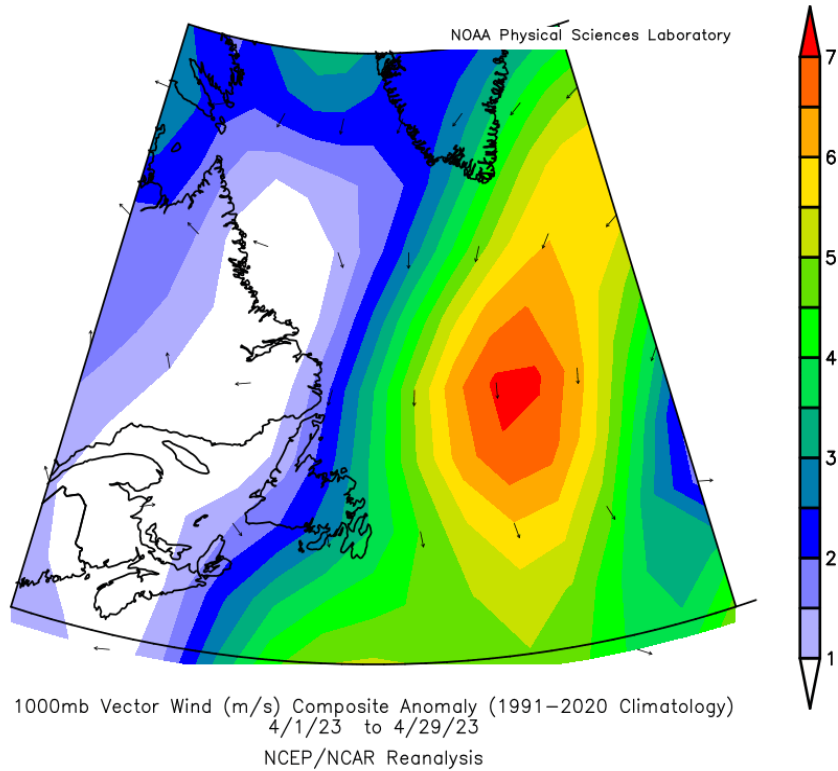


Figure 45: Surface wind Anomaly –April 1-29, 2023. This figure shows the onshore winds during the month of April. Winds are usually northwesterly and not onshore however several storms east of Newfoundland caused an anomalous wind direction average for the month of April that was northerly and thus onshore.

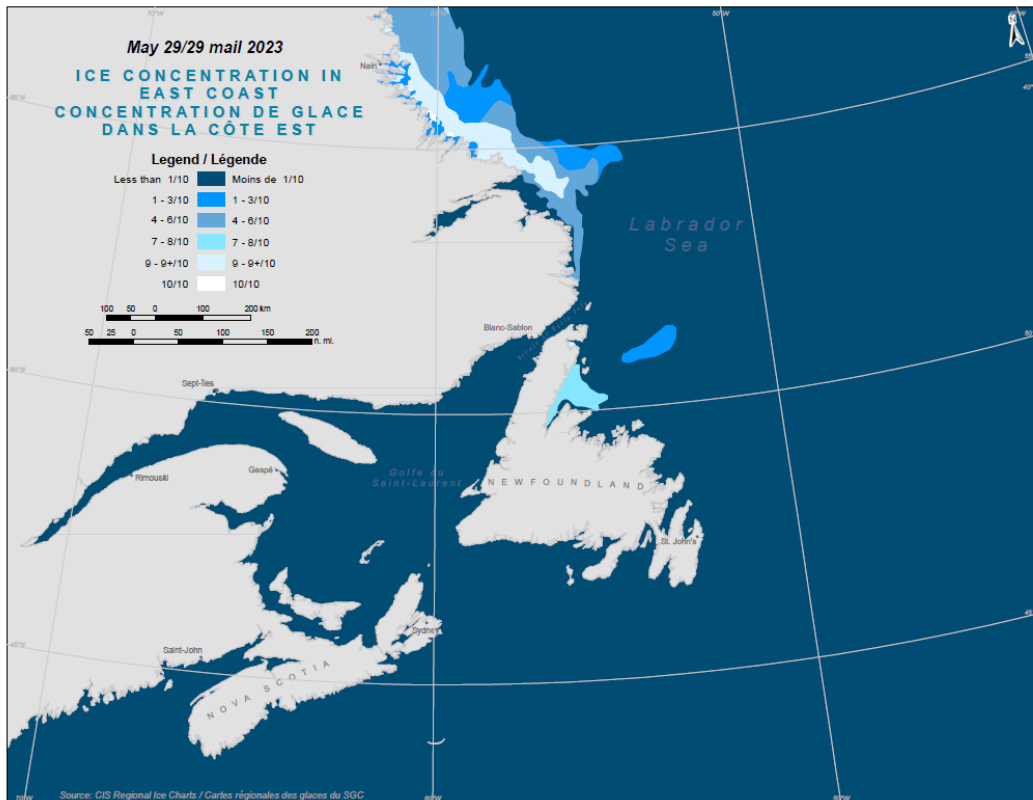
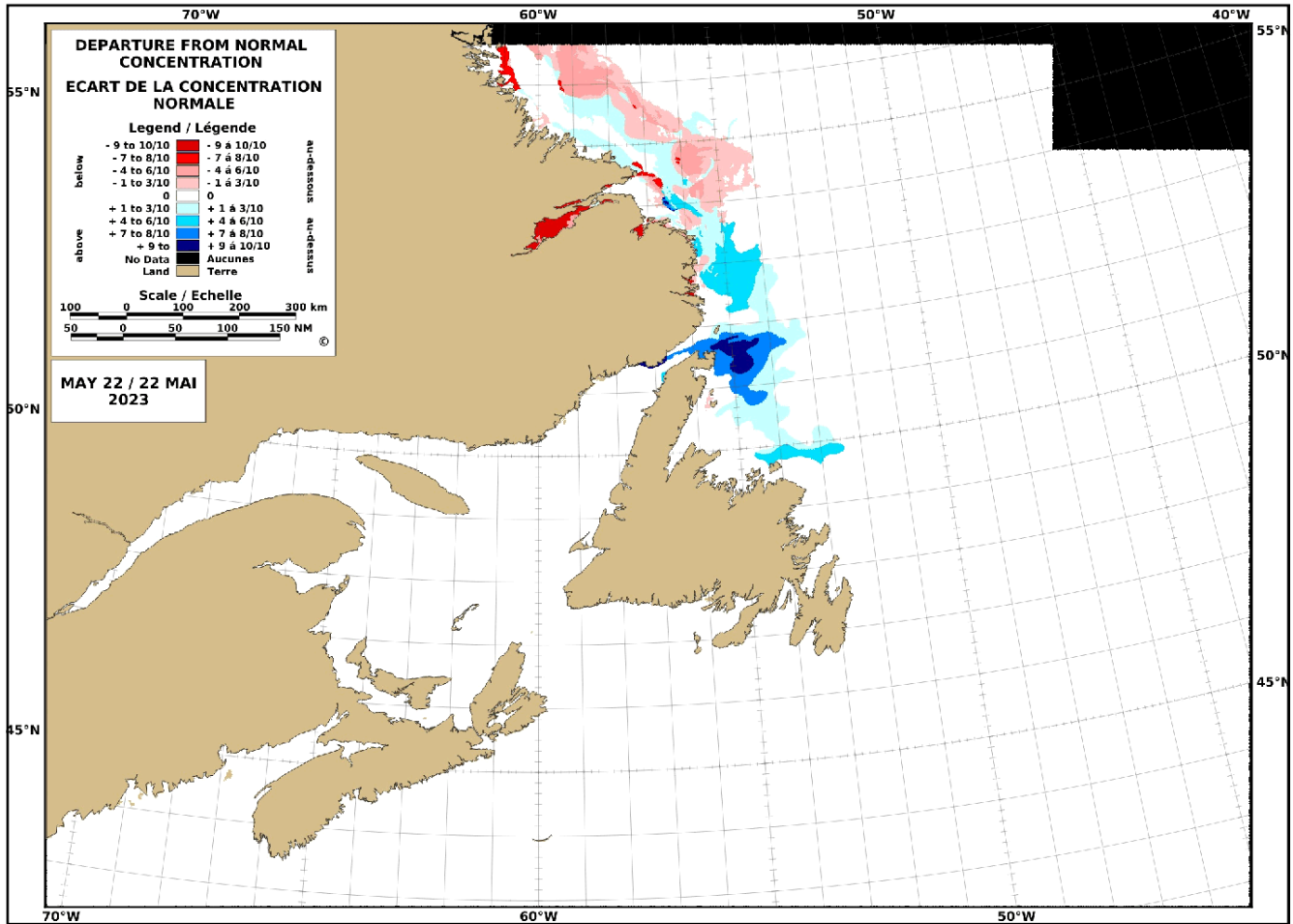


Figure 46: East Coast Concentration in tenths of ice, May 29th, 2023

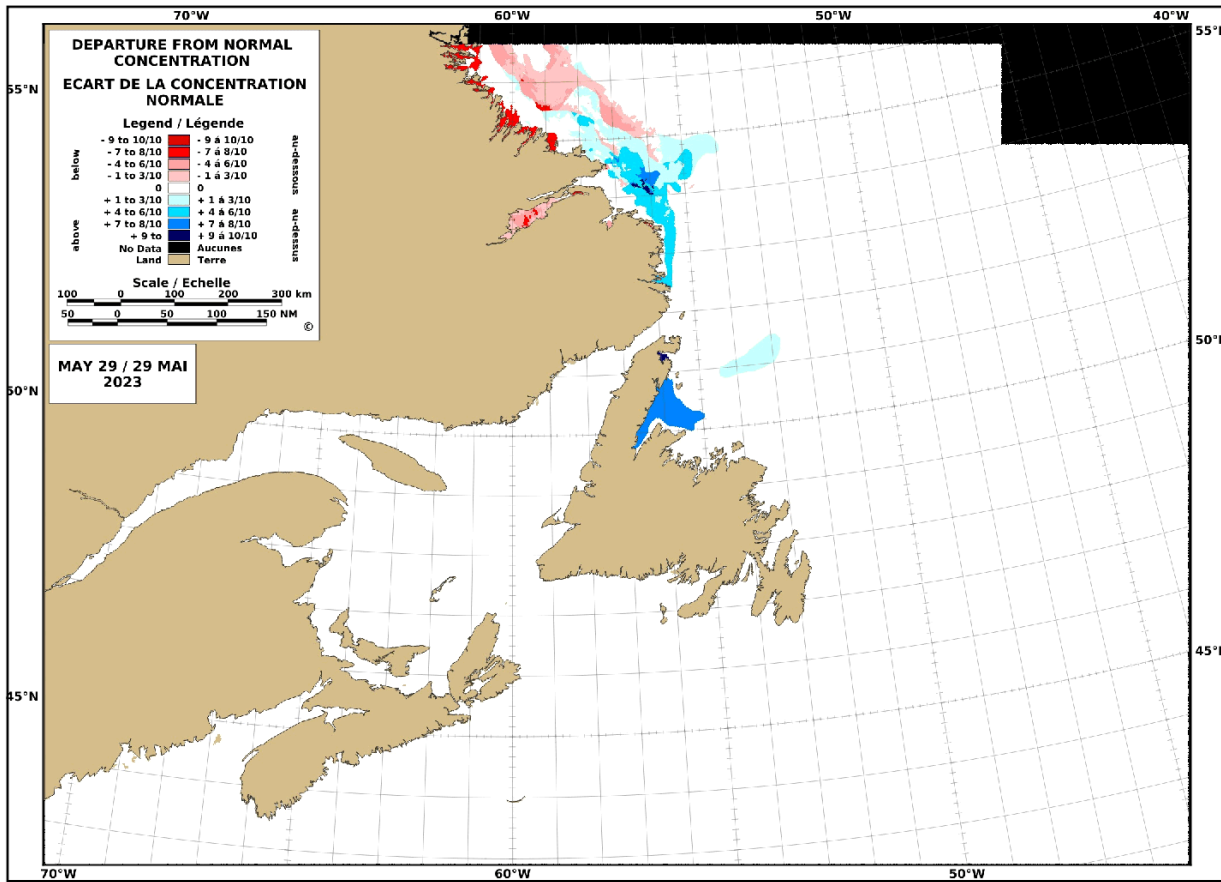
Looking at the departure from normal chart in figure 47 and 48 below we can see that the ice that in northern Newfoundland Waters and just off the Southern Labrador Coast has lasted longer into the season than is normal as the ice is usually melted by mid to late May in these regions. This 'extra' ice which is present this year is shown as **blue** in the departure from normal charts figures 47 and 48 below. Lake Melville lost its ice coverage earlier than normal this year and this is seen as the red color in the departure from normal charts below. The ice in Lake Melville ice formed late in the season this year due to warm temperatures and being thinner than normal due to persistent warm temperatures this year melted earlier than usual.

EASTERN COAST / COTE EST



STATISTICS BASED UPON 1991-2020
 LES STATISTIQUES BASÉES SUR 1991-2020

Figure 47: Departure from Normal Concentration for May 22nd from 1990-2020
 Red shows missing ice, Blue is extra ice compared to normal



STATISTICS BASED UPON 1991-2020
LES STATISTIQUES BASÉES SUR 1991-2020

Figure 48: Departure from Normal Concentration for May 29th from 1990-2020 Red shows missing ice, Blue is extra ice compared to normal

The last of the ice in Newfoundland waters would melt along the coast near Baie Verte just after the third week of June. This is long after the last of the ice stopped moving south from Labrador into Newfoundland waters which was near the 27th of May and a couple weeks later than the normal time the last ice has melted in Newfoundland Waters.

The TAC for the 2022-23 East Newfoundland Waters was 1.5% which is below the long-term median of 2.6%. The 2022-23 season ended as the 45th lowest on record since records started during the 1968-69 season.

**Single Season: Weekly Ice Coverage for the season
2022/23, Weeks: 1112-0723**



**Une saison: Couverture des glaces hebdomadaire pour la
saison 2022/23, Semaines: 1112-0723**

CIS EC East Newfoundland Waters /
CIS EC Eaux à l'est de Terre-Neuve

Area / Aire : 853,961 km²

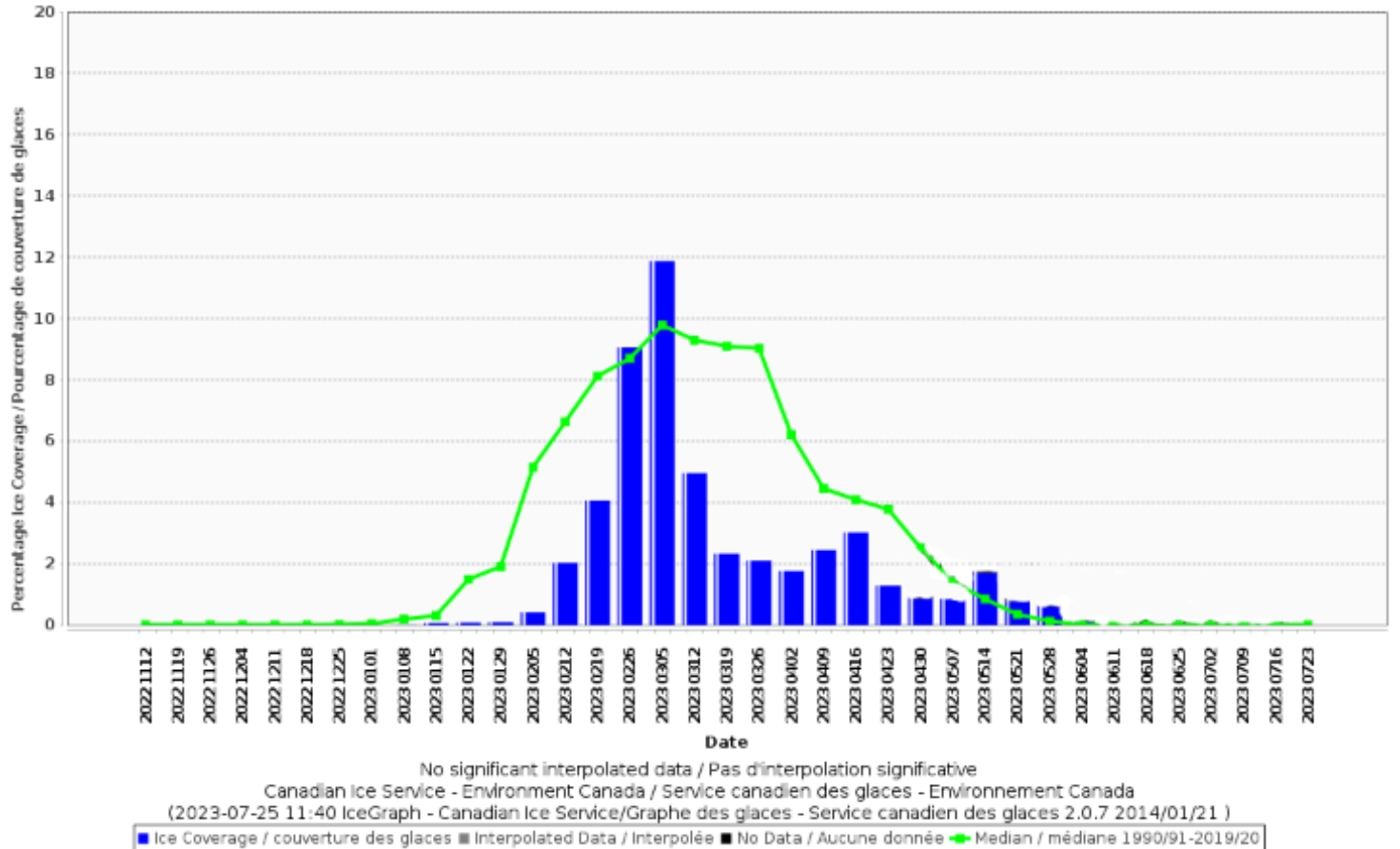


Figure 49: Weekly Ice Coverage for the 2022-2023 Season in Newfoundland

Historical Total Accumulated Ice Coverage (TAC) for the weeks 1112-0723, seasons:1968/69-2022/23

Total accumulé de la couverture des glaces historique (TAC) pour les semaines 1112-0723, saisons:1968/69-2022/23

CIS EC East Newfoundland Waters /
CIS EC Eaux à l'est de Terre-Neuve

Area / Aire : 853,961 km²

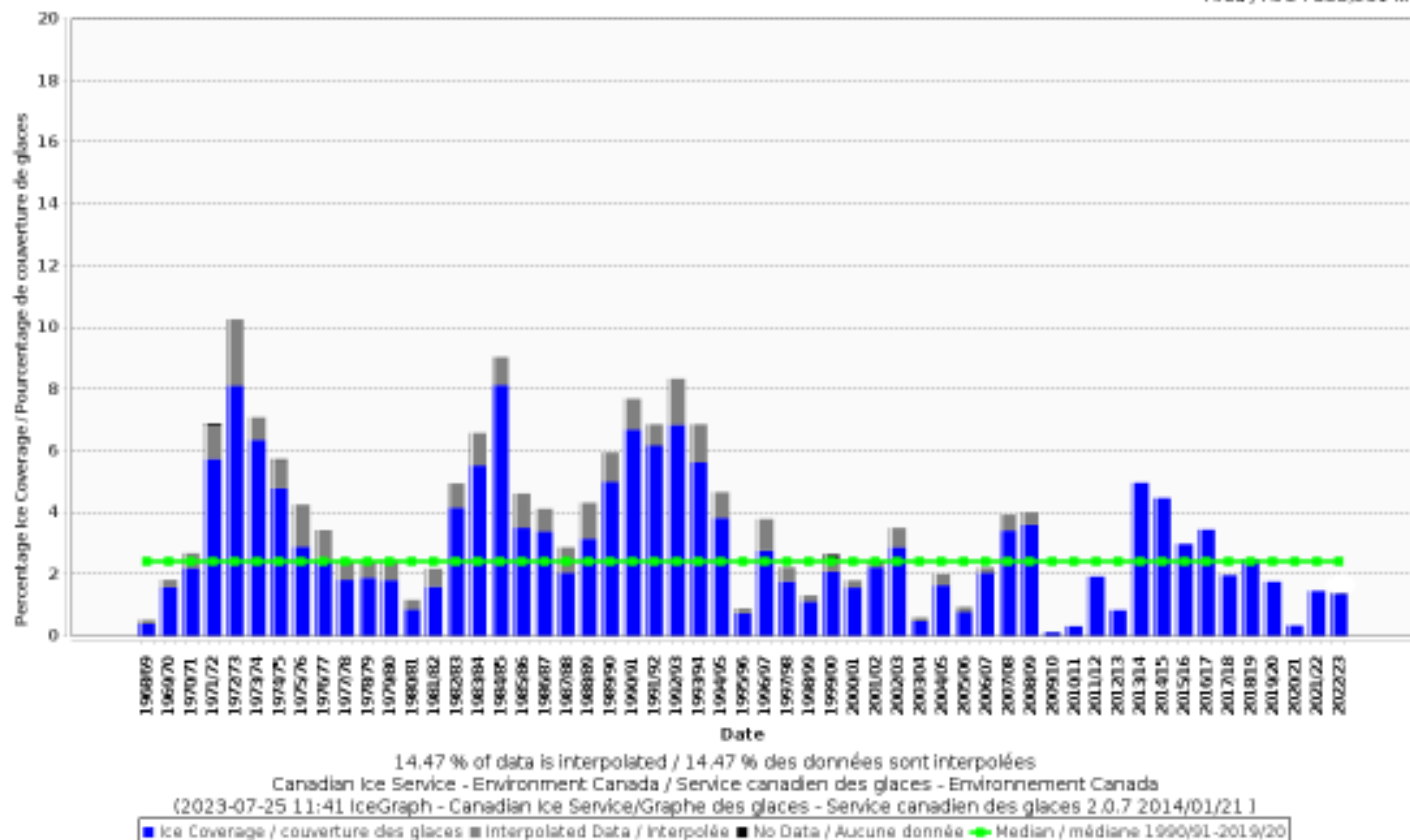


Figure 50: Historical Total Accumulated Ice Coverage Newfoundland Waters by Season, 1968/69-2022/23

**Maximum Ice Coverage for the weeks 1112-0723, seasons:
1968/69-2022/23**



**La couverture maximale de glace pour les semaines
1112-0723, saisons: 1968/69-2022/23**

CIS EC East Newfoundland Waters /
CIS EC Eaux à l'est de Terre-Neuve

Area / Aire : 853,961 km²

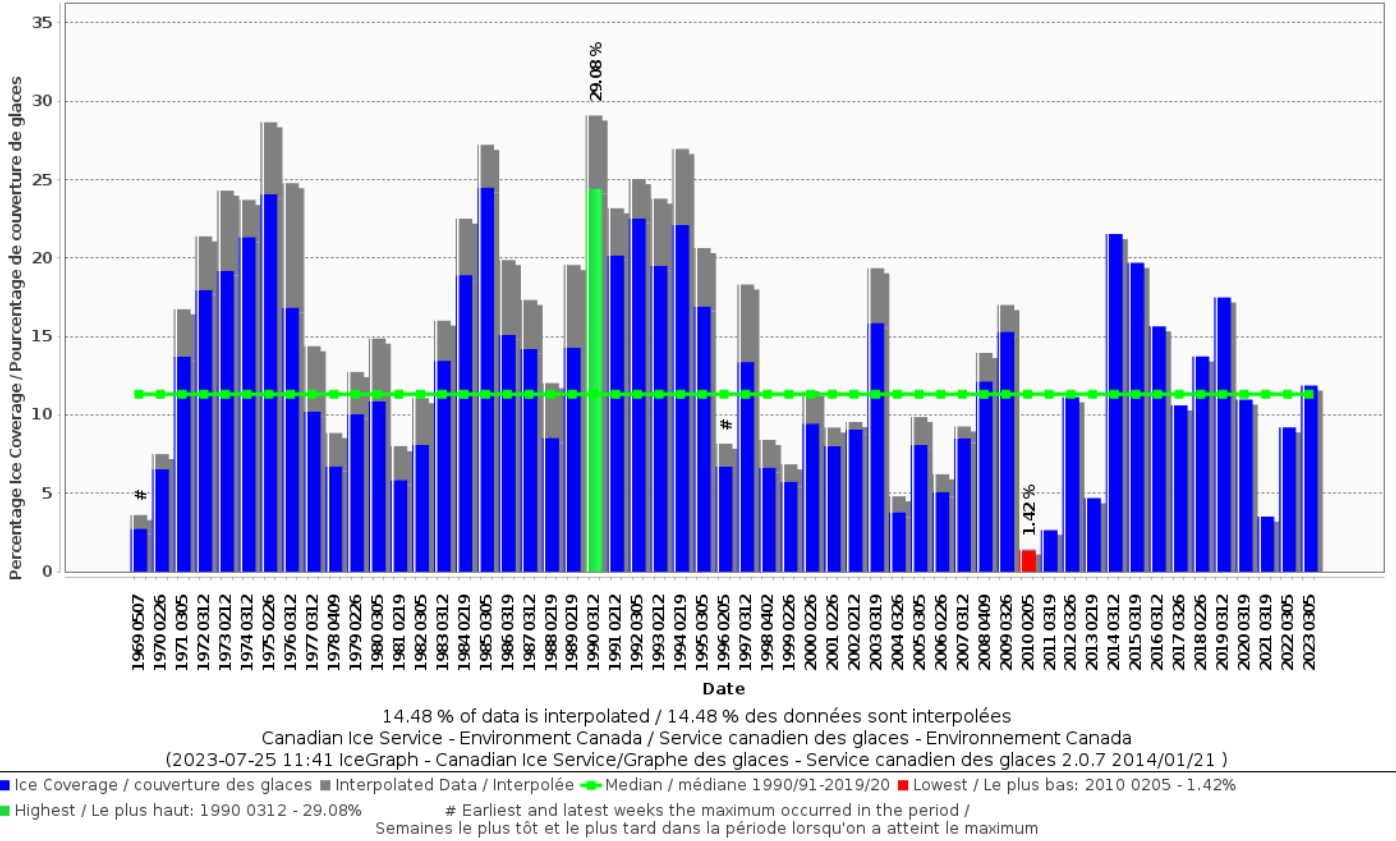


Figure 51: Maximum Ice Coverage in Newfoundland waters by Season, 1968/69-2022/23.
Maximum coverage occurred on March 5th, 2023.

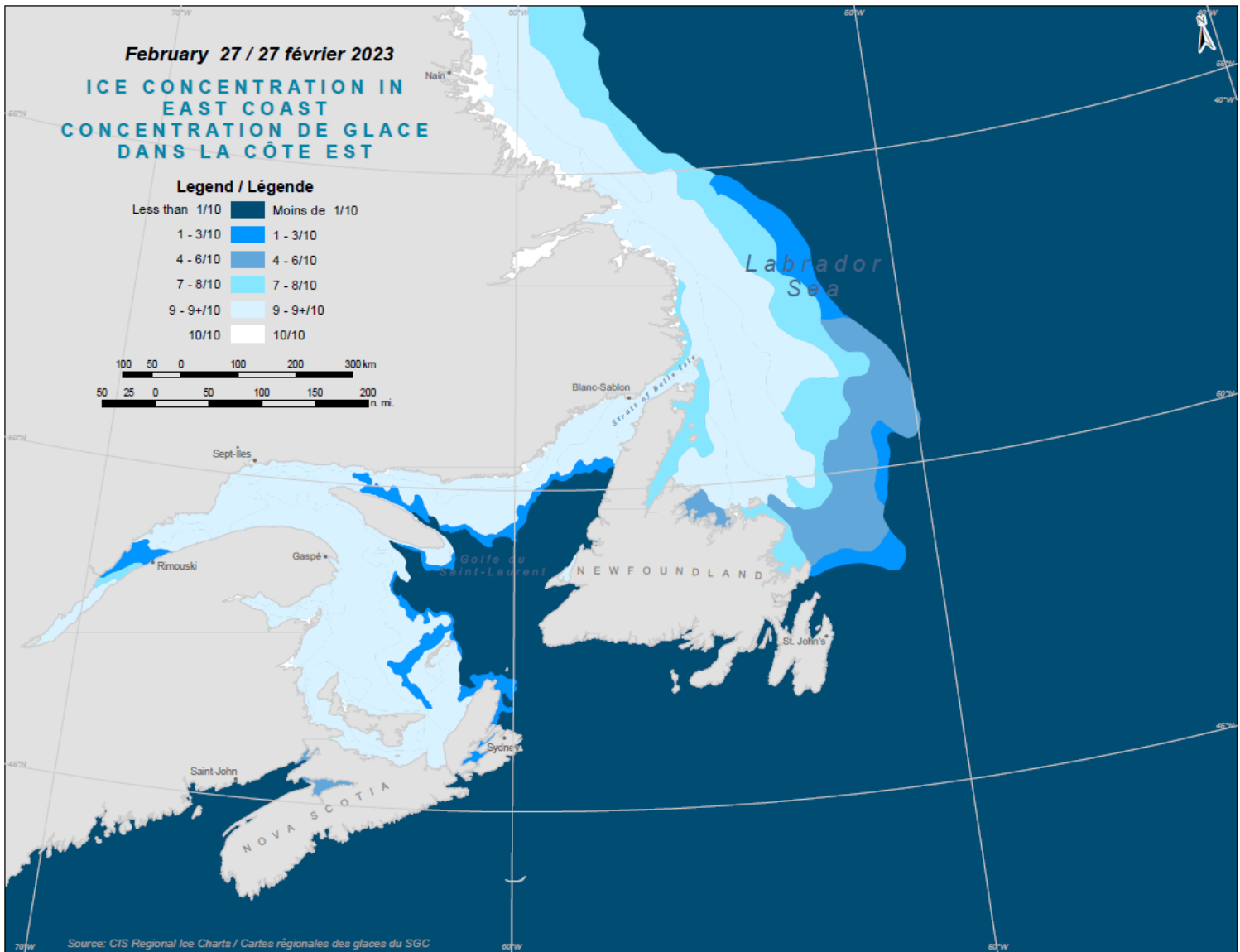


Figure 52a: Maximum Ice Cover for the 2022-23 season from Eastern Coast Regional Ice Chart – February 27th, 2023.

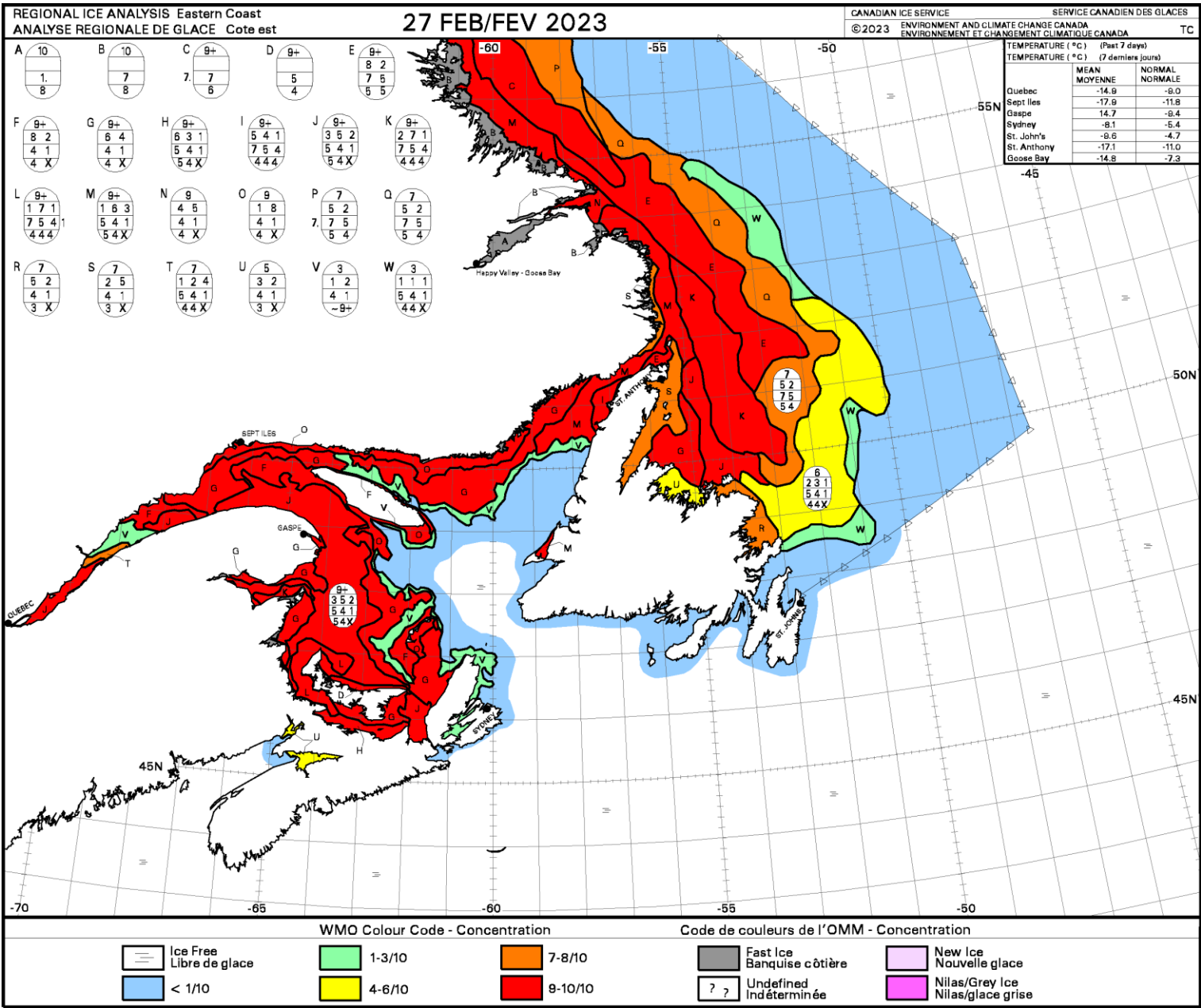


Figure 52b: Maximum Ice Cover for the 2022-23 season from Eastern Coast Regional Ice Chart – February 27th, 2023.

Sea surface temperature anomalies for various times in the 2022-23 season.

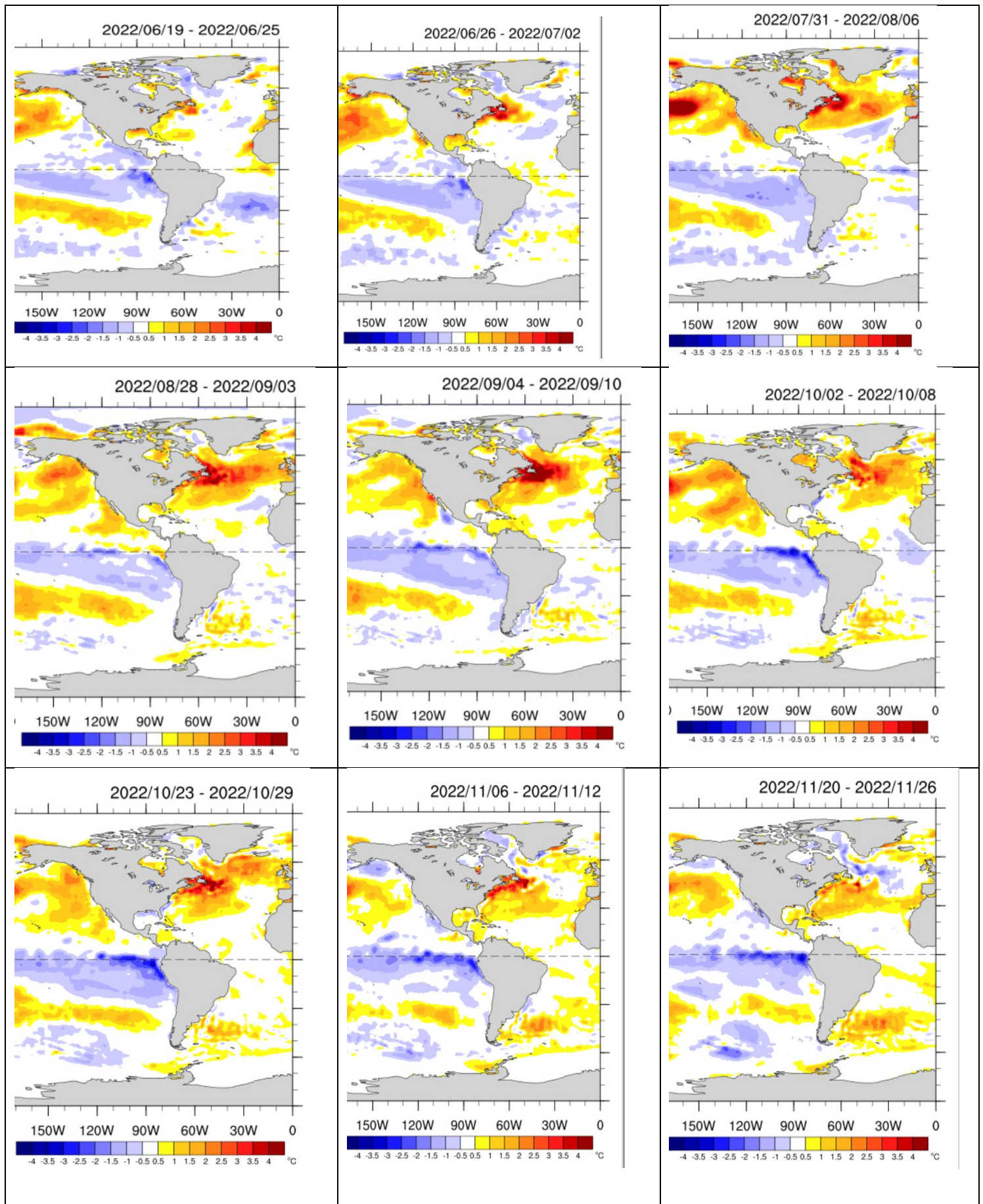


Figure 53: Sea Surface Temperature Anomalies. Courtesy of NOAA Physical Sciences Laboratory.

Notes:

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

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 time period).

Good indication of average ice conditions during the winter. Good for year-to-year comparison.

NCEP/NCAR Reanalysis charts and Sea surface temperature anomalies 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