



Environment and
Climate Change Canada

Environnement et
Changement climatique Canada

Seasonal Summary

Eastern Canada

Winter 2017-2018

By The



Canadian Ice Service
Le service canadien des glaces

Summary for the East Coast

The winter 2017-2018 ice season was marked by two separate phases in ice growth and destruction, which often is not a particularly unusual sequence of events. The timing of these periods was however notable, as ice growth advanced faster than usual in the first half of the season in portions of the East Coast, whereas destruction in general began quickly at the peak of the season and ice coverage dropped precipitously as a result. The spatial distribution of ice cover also was important in the time period covering the start of the season until late February 2018. Regional differences in ice cover often were balanced out and weekly ice coverage statistics masked the true nature of the sea ice state.

A rapid commencement to the winter was experienced in the western sector of the Gulf of St. Lawrence as anomalously cold surface air temperatures reached the estuary and central portion of the Gulf by mid-December 2017. This period of intense cold lasted into mid-January 2018, and ice spread through the estuary and southward into Northumberland Strait. However this was countered by a lack of significant ice along the Labrador Coast, with well below normal ice concentrations throughout this region into mid-January 2018. Above average surface air temperatures emanating from the northern Labrador Coast region extended southward into Newfoundland waters and depressed the ice growth in this sector. East Coast ice coverage values trended near normal from the season start in late November to mid-January despite these wide differences in regional ice extents.

Accumulation of sea ice slowed to near-normal through the second half of January and into February 2018 as a near-normal temperature regime settled over the East Coast. A notable departure from this normal extent was observed in the Northeast Arm, keeping Gulf ice coverage slightly below the normal seasonal values. A key element of the ice state at this point in time was the recorded predominant stage of development. In particular, the ice in the Gulf of St. Lawrence was observed to be at a stage of development typically one category below the climatological value expected by late February. The absence of widespread first-year ice in the southern Gulf and grey-white ice in the central Gulf and near Anticosti Island would play a role in the rapid ice destruction to follow in March. Newfoundland and Labrador waters would experience moderated reductions in ice cover despite the stormy March conditions as the predominant ice types observed in February were in line with the climatology.

Steep losses in ice concentration and extent began early in March 2018, at a point in time when seasonal peaks in ice coverage are expected. A series of winter storms would pummel Atlantic Canada this month with strong winds, heavy precipitation, and significant fluctuations in surface air temperature. The first storm at the beginning of March diminished the ice that was located in the central Gulf and southern estuary, as well as along the eastern ice edge in Newfoundland waters. Additional thinning of the ice within the pack was noted particularly in the Gulf near Anticosti Island. A second storm arriving at the end of the first week of March led to an additional dramatic drop in ice presence. Ice was now well below normal extents across nearly all of the Gulf of St. Lawrence and in eastern Newfoundland waters. Remaining sea ice was heavily compressed into the western section of the Gulf and along northeastern Newfoundland by strong northeasterly winds, and open/bergy water conditions predominated in much of the Gulf and Newfoundland regions. The impact of these winds was less significant further northward along the Labrador Coast as the storm tracked southeast of this region. A recovery of ice coverage was prevented for the remainder of March due to two more storms that visited the East Coast. A mid-March event and another during the third week of the month maintained the distribution and compression of the ice that was earlier noted.

The destructive nature of March had implications for the rest of the season. The lack of significant ice in Newfoundland limited a vital source of ice for the Northeast Arm via the Strait of Belle Isle. Lower than normal ice amounts were analyzed in this area through the end of the season. Ice deficits in the Newfoundland and Labrador sector stabilized after the month of March but did not recovery appreciably. Instead, the decay of sea ice halted and extents returned to near normal

values by late April. This slowdown was driven by colder than normal temperatures over Quebec and Labrador and generally near normal air temperatures over the coastal waters.

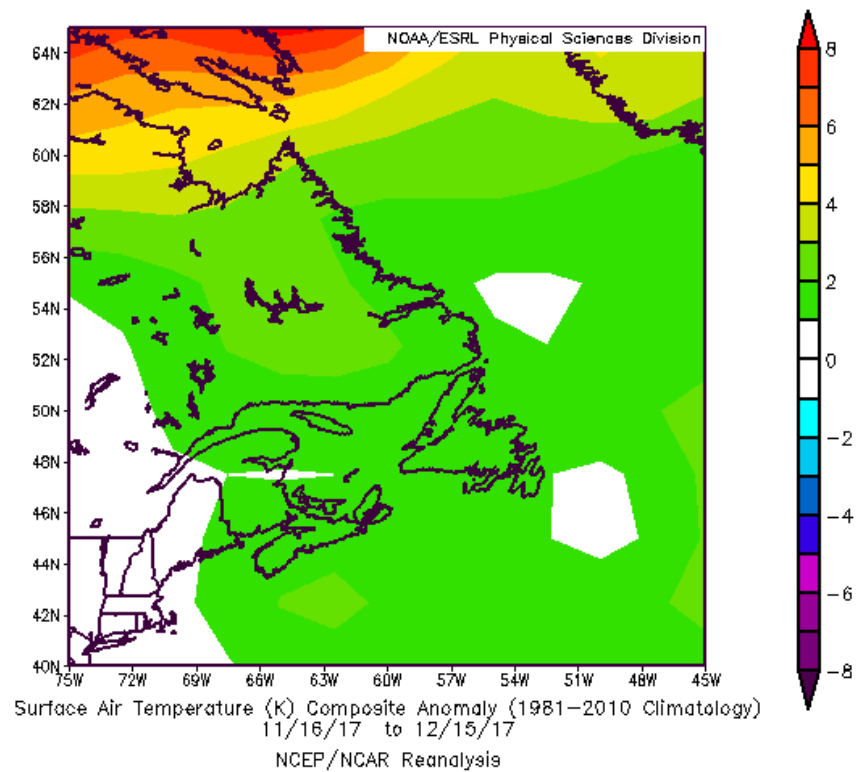


Figure 1: Surface Air Temperature Anomaly 16 November 2017 to 15 December 2017.

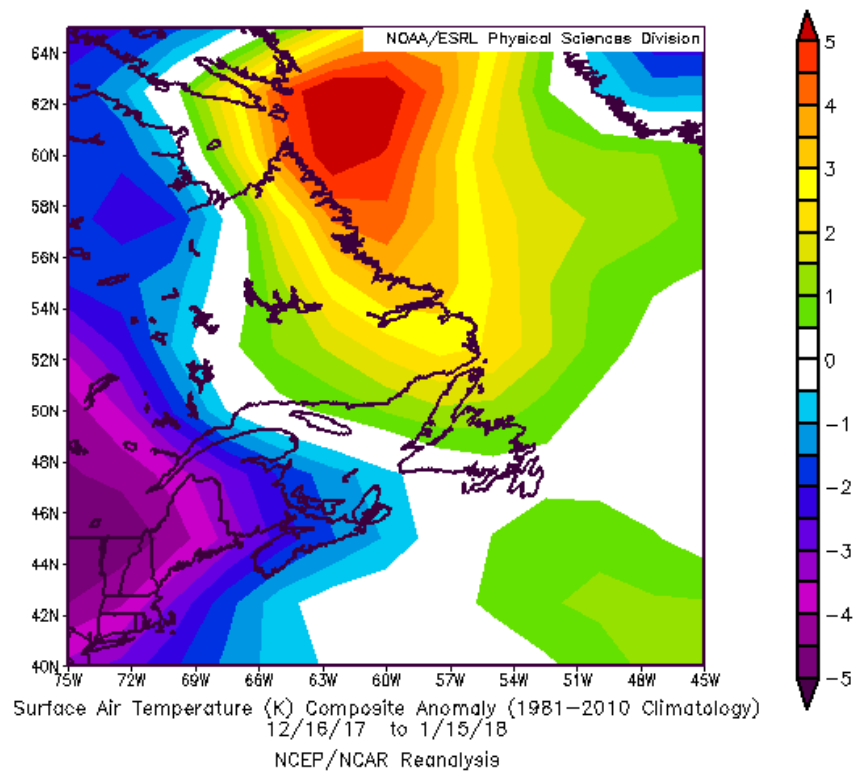


Figure 2: Surface Air Temperature Anomaly 16 December 2017 to 15 January 2018.

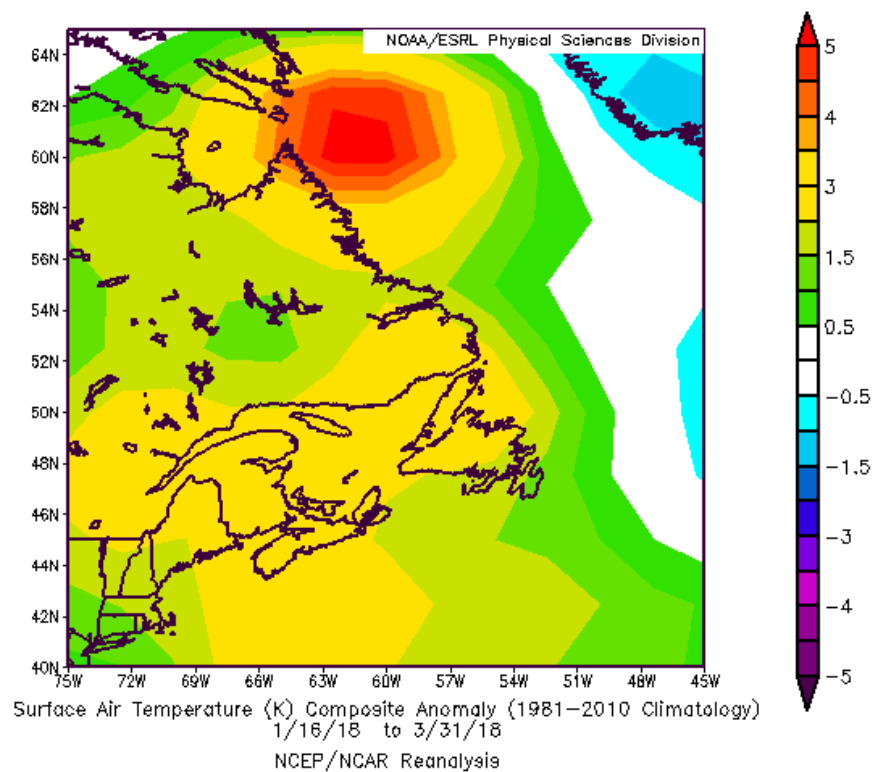


Figure 3: Surface Air Temperature Anomaly 16 January 2018 to 31 March 2018.

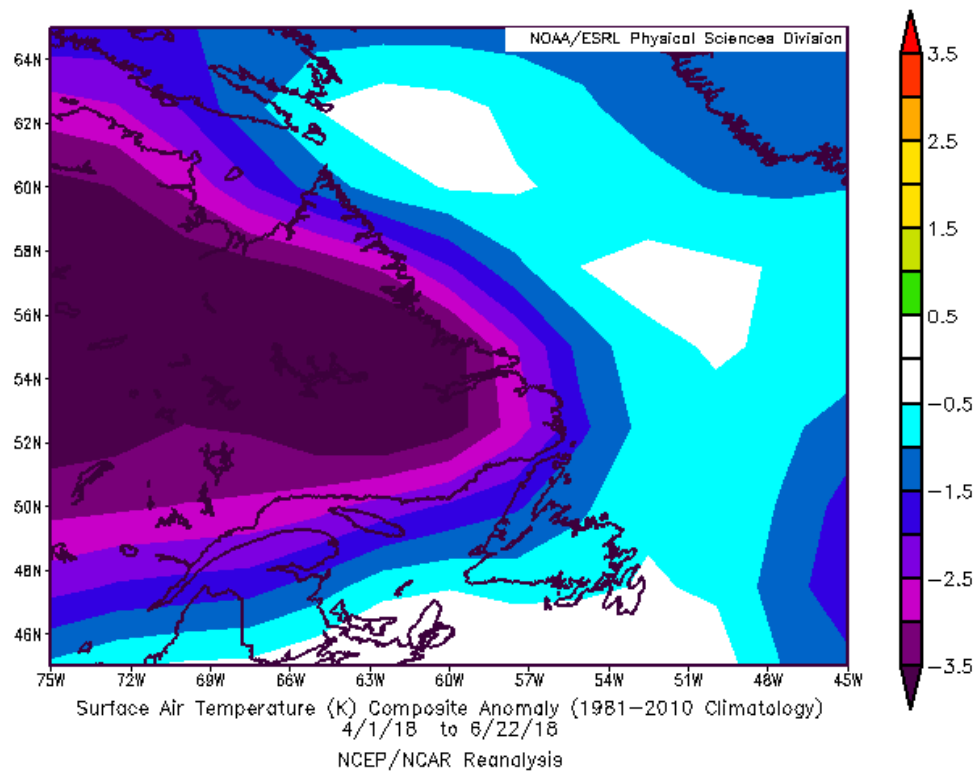


Figure 4: Surface Air Temperature Anomaly 1 April 2018 to 22 June 2018.

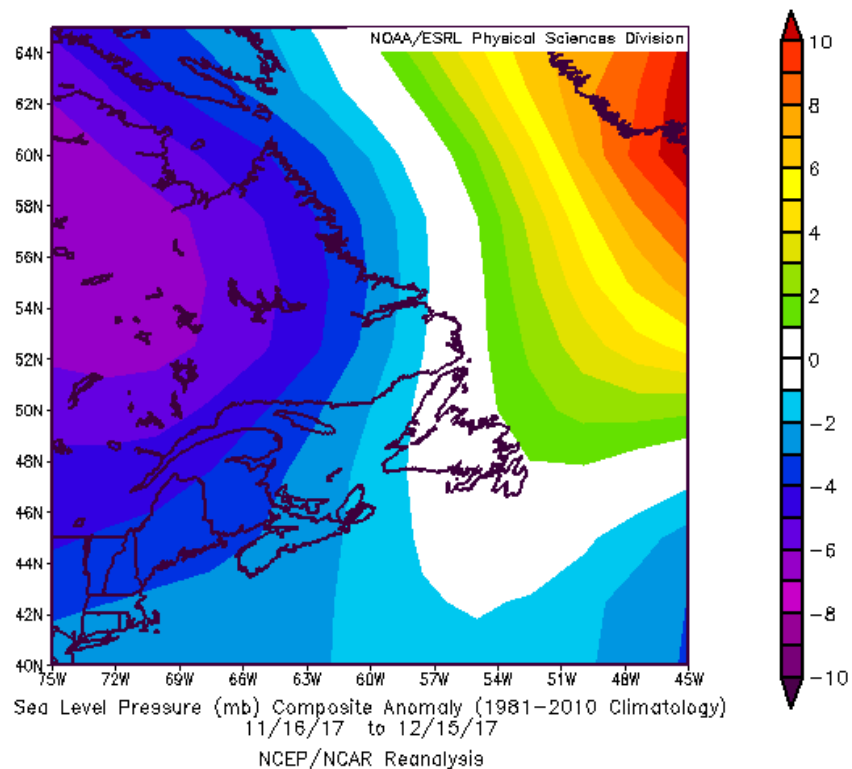


Figure 5: Sea Level Pressure Anomaly 16 November 2017 to 15 December 2017.

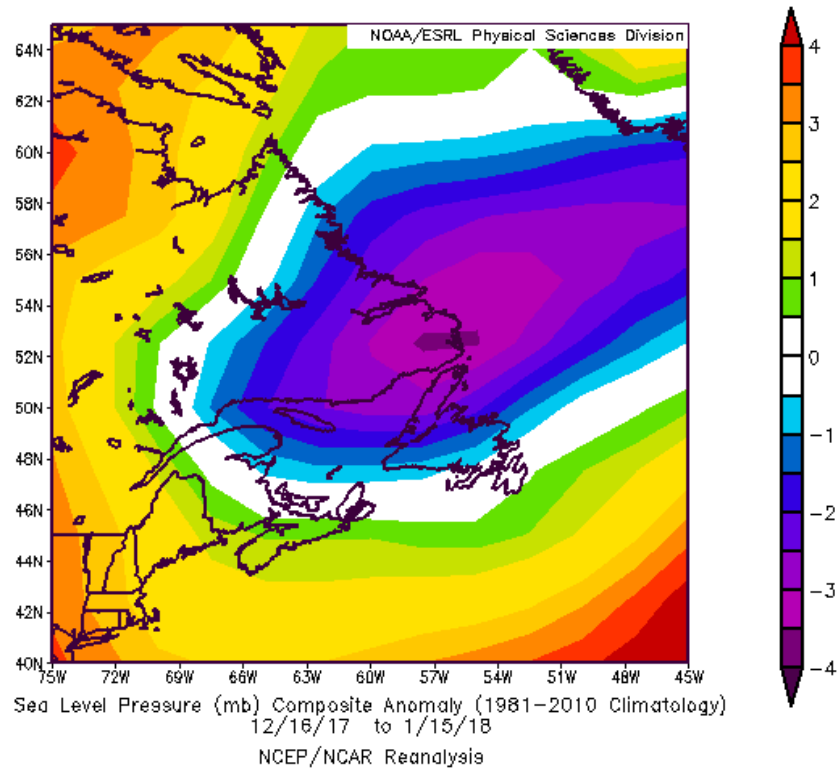


Figure 6: Sea Level Pressure Anomaly 16 December 2017 to 15 January 2018.

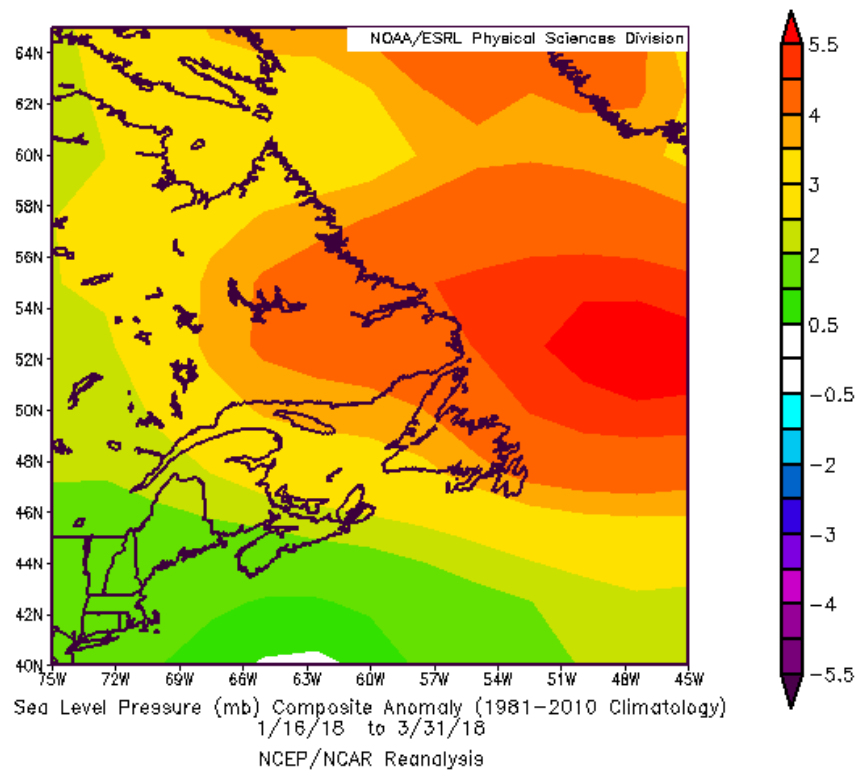


Figure 7: Sea Level Pressure Anomaly 16 January 2018 to 31 March 2018.

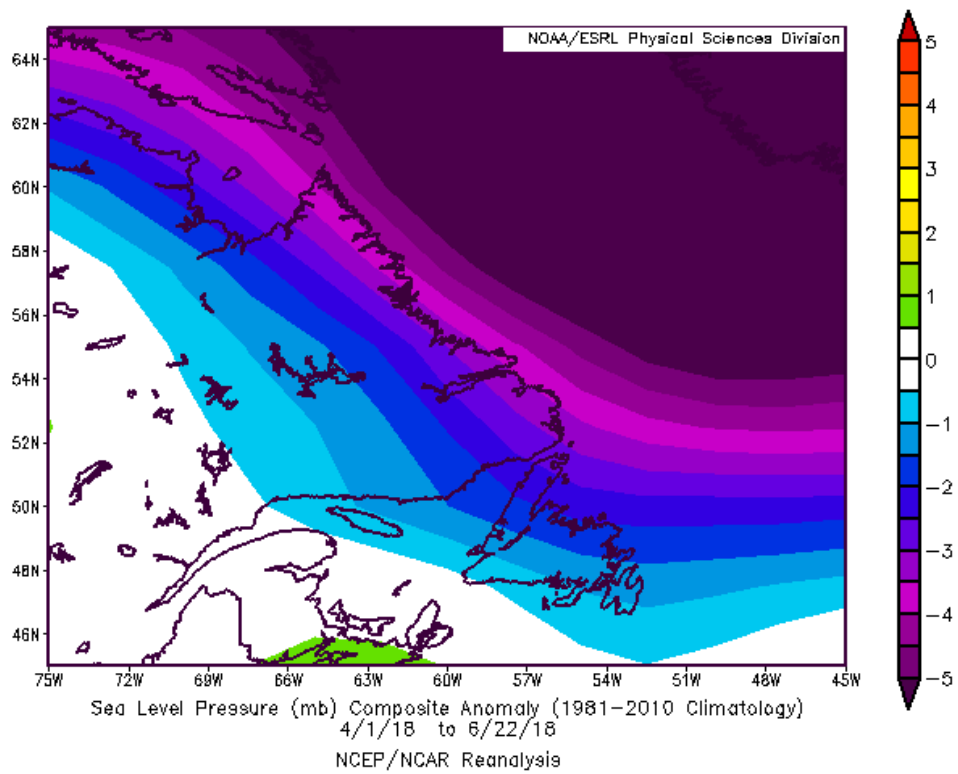


Figure 8: Sea Level Pressure Anomaly 1 April 2018 to 22 June 2018.

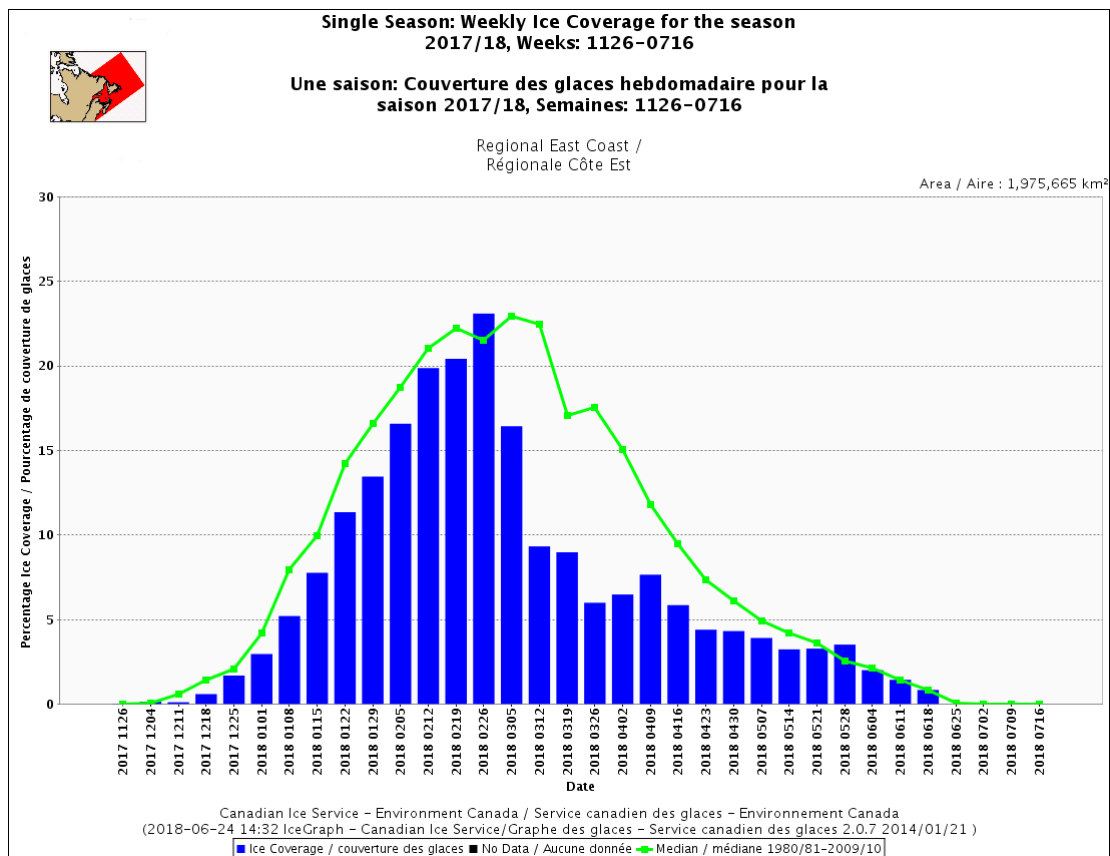


Figure 9: East Coast Weekly Ice Coverage for the 2017-18 winter season.

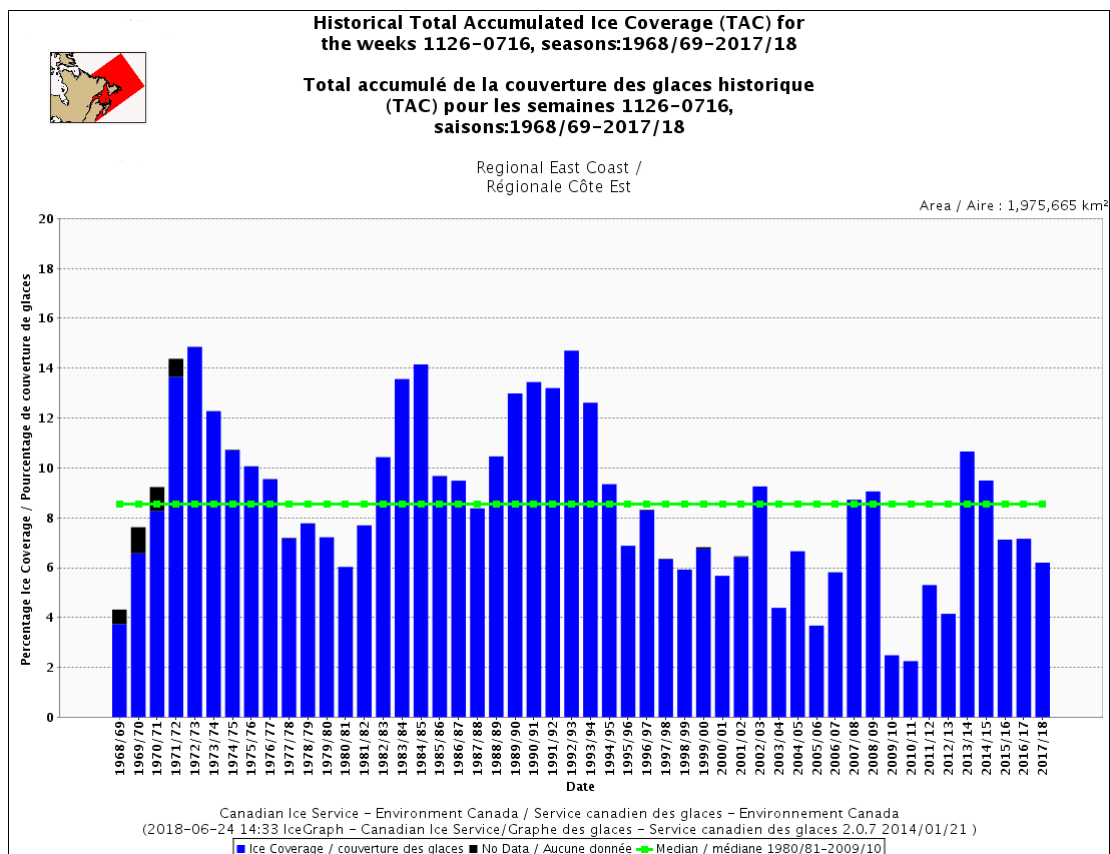


Figure 10: East Coast Historical Total Accumulated Ice Coverage by season, 1968-2018.

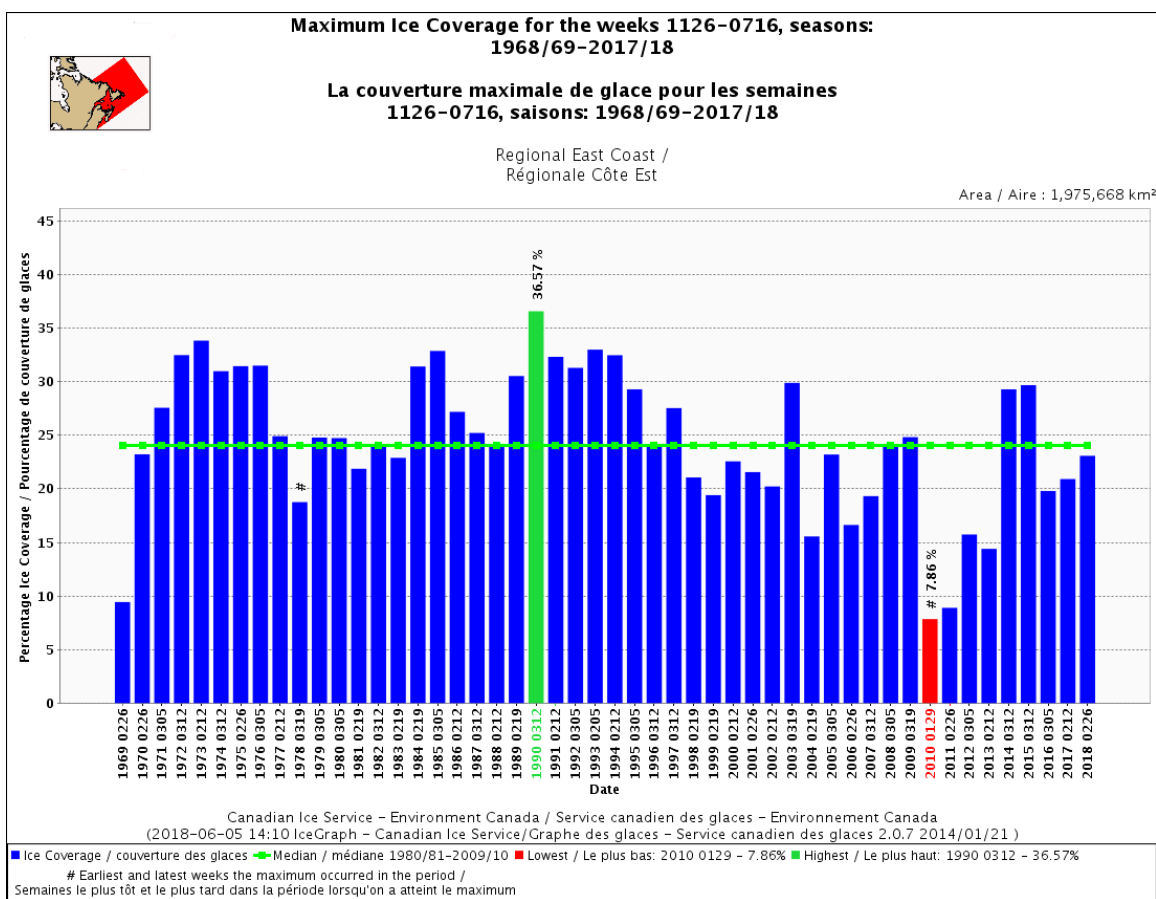


Figure 11: East Coast Historical Maximum Ice Coverage by season, 1968-2018.

Gulf of St Lawrence

2017-2018 Season temperatures and weather: November to June.

The start of the season was near normal with respect to both surface air temperature and sea level pressure. A break from this pattern emerged in mid-December 2017 as anomalous low pressure developed over the southern Labrador Coast, ushering westerly to northwesterly winds into the Gulf. These winds account for the resolved temperature anomalies for mid-December to mid-January 2018. A near normal band of temperature was observed in the central Gulf, with a colder than normal area to the west and a warmer than normal region to the northeast. Peak cold anomalies reached -2.5°C and warm anomalies approached 2.5°C .

Near normal was again the tendency across the Gulf from mid-January to the end of March generally. Sea level pressure and surface air temperature followed the climatological normals for the most part during this timeframe, with a notable exception in sea level pressure during the month of March 2018. Anomalous low pressure centred south of Nova Scotia along the eastern United States seaboard maintained persistent northeasterly flow. Episodes of intense winds associated with four separate major winter storms affected the Gulf during this phase, reinforcing the anomaly pattern.

A deep anomalous area of low pressure developed over the eastern Canadian Arctic for the remainder of the East Coast ice season. This supported northwesterly winds over Labrador and northern Quebec, pushing colder than normal air temperature values across the northwestern Gulf. A maximum negative anomaly of -3.0°C was observed in the estuary. This pattern tapered off to

become near normal over the southeast sector of the Gulf as the influence of the low pressure anomaly diminished over this region.

December ice conditions:

Near mid-month sea ice was detected in the western section of the estuary, quickly followed by isolated bays and inlets along the New Brunswick coast and the north shore of Quebec. This new ice quickly transitioned to predominantly grey ice in the third week of the month and bands of new ice appeared along the southern coast of Chaleur Bay and New Brunswick. This ice formation was approximately two weeks in advance of the climatological median, driven by anomalous cold air temperatures blanketing the region. Ice expanded to cover the estuary from Cap-Chat and westward and a significant portion of Chaleur Bay shortly before Christmas 2017. As well, a narrow band of new ice stretched along the Quebec coast and the first ice of the season was identified near the Magdalene Islands. Near the end of the month anomalous ice cover was observed in Northumberland Strait and along the coast of the Gaspé Peninsula, composed of a mixture of new and grey ice. Rapid growth continued in the final days of the month as the first significant areas of grey-white ice were analyzed in southern Chaleur Bay, western Northumberland Strait and over the southern section of the estuary. Ice now encompassed all of Prince Edward Island except for the eastern coast, and new ice was actively spreading across Gaspé Passage.

January ice conditions:

The western Gulf of St. Lawrence would sustain faster than normal ice growth for the first half of the month, with widespread predominantly grey ice covering the western section of the estuary and southward from Gaspé Passage to Northumberland Strait and the waters east of Prince Edward Island. An expansion of grey-white ice was noted along the western coast of Prince Edward Island as well due to persistent westerly winds compressing and mechanically thickening the ice. This compression also led to the first observations of thin first-year ice, again along the western Prince Edward Island coast and in southern Chaleur Bay. New ice in the extreme eastern section of the Bay of Fundy was consistently analyzed from the beginning of the month, but the extent was limited to these confines by the extreme tidal range of the bay. A notable absence of ice was recorded in the Northeast Arm as only low concentrations of new and grey ice were present by mid-month.

The intense cold period that began in mid-December 2017 began to relent as near normal temperatures returned to the region. Accordingly, sea ice formation slowed both in extent and thickness, a vitally important development for events to follow. By late January predominantly grey-white ice populated the southern estuary and southward into southern Chaleur Bay and to the eastern coast of Prince Edward Island and the Magdalene Islands. A transition to predominantly thin first-year ice took place in Northumberland Strait at this point, and significant grey and grey-white ice now infiltrated the region between Prince Edward Island and Cape Breton Island. Low concentrations of grey and grey-white ice were being exported out of the Gulf via Cabot Strait, a moderately unusual event relative to the 30-year climatology. New and grey ice was sparsely present in Jacques Cartier Passage, but the most prominent deficit of sea ice was again in the Northeast Arm. New and grey ice was observed in the nearshore environment along the Quebec coast and in the extreme northeastern section, but a lack of ice from eastern Anticosti Island to the Newfoundland coast near Pointe Riche was most noticeable. This was a major departure from the median climatological conditions.

February ice conditions:

Near normal ice concentrations were observed in the western section of the Gulf through February, whereas the Northeast Arm continued to display a major lack of seasonal ice. A modest degree of variability was present during this period but the tendency overall was to see continued

growth in time. During the first week of the month, grey and grey-white ice expanded along the Quebec coast between Anticosti Island and the Northeast Arm. Thin first-year ice was prevalent within the pack ice along the Gaspé Peninsula and the New Brunswick coast, as well as near the western coast of Cape Breton Island. The anomalous presence of ice in Cabot Strait persisted and predominantly grey-white with some thin first-year ice eventually reached Sydney by mid-month.

Climatologically the Gulf reaches its seasonal maximum ice cover in late February or early March and this year was no exception. At the end of February 2018 the peak ice cover was achieved, with a value of 40.62% being recorded. This maximum agrees well with the median maximum ice cover of 41.82% which is historically met a week later in early March. Due to recent storms however, vast areas of ice were destroyed ahead of this maximum ice cover being registered. Preconditioned ocean waters permitted the quick reestablishment of grey and grey-white ice through the central Gulf but accounted for notable differences between the observed stage of development and the climatologically expected stage of ice growth. Northumberland Strait and the area west of Cape Breton Island in particular lacked significant quantities of thin first-year ice, instead seeing predominance of grey-white throughout the region. Similarly the central Gulf still contained areas composed of up to one third grey ice, below the usual distribution of grey-white and thin first-year ice. Although the seasonal ice maximum was in general near normal, spatial variability across the Gulf was noteworthy. The western Newfoundland coast experienced below normal ice conditions from Pointe Riche to Port aux Basques, maintaining the pattern observed throughout the season in the Northeast Arm. Ice destruction in the second half of February in the estuary led to unrecoverable losses, whereas ice in Cabot Strait continued to be exported southeastward and contributed to the anomalous presence of ice in this sector.

March ice conditions:

A dramatic collapse in sea ice extent took place early in March 2018. This period was marked by four impressive winter storms that affected the Gulf of St. Lawrence and directly led to the destruction of vast areas of sea ice. All four systems were comparable in that they exhibited strong northeasterly wind regimes that would account for the stable distribution of the sea ice after the passage of each storm.

The first major low pressure system to affect the Gulf arrived at the beginning of the month and drove a drop in ice coverage of nearly 50% in one week. A second storm enhanced the destruction further, again cutting in half the ice cover by mid-month. Open water was found throughout the central Gulf, Northeast Arm and southern estuary. Heavily compressed thin first-year ice remained along the eastern coast of Cape Breton Island and the Magdalene Islands, while deformed grey-white and thin first-year ice was lodged against the eastern coast of Prince Edward Island, western Chaleur Bay and the New Brunswick coast. Narrow bands of grey and grey-white ice remained over the northern half of the estuary and along the Quebec coast. Climatologically, the first half of March is the timeframe for maximum ice extents. However, these two major winter storms coupled with thinner ice than normal in the Gulf led to a serious deficit in sea ice cover.

Losses of ice stabilized for the remainder of the month but any recovery was stalled due to two more winter storms targeting the Maritimes. Their passage near mid-March and in the third week of the month limited the ability of the ocean to regenerate any appreciable ice coverage. Ice thickening in the last vestiges of the ice over the western Gulf did proceed, as predominantly thin first-year ice was analyzed near Prince Edward Island and in Chaleur Bay. The steady northeasterly winds did provide a source of medium first-year ice into the Strait of Belle Isle during this phase but the movement of this ice westward was limited to Pointe Riche.

April - May - June ice conditions:

Ice anomalies naturally declined for the remainder of the season as the climatology soon

matched the lack of ice within the central Gulf. The estuary saw the last ice melt during the first week of April, followed by ice along the Quebec coast in the second week. The lingering ice in the western Gulf and Cabot Strait was unusual in its elevated concentration and clearing was one to two weeks slower than normal. Eastern Northumberland Strait transitioned to open water after mid-month, and then the last ice near Cape Breton Island and Chaleur Bay disappeared before the end of April. The Strait of Belle Isle was predominantly bergy water at the end of the month leaving the last significant mobile ice to melt from the western portion of Northumberland Strait at the beginning of May. Fast ice along the New Brunswick and Quebec coasts melted by mid-May, bringing the ice season to a close in the Gulf. Despite the normal start to the season across the Gulf of St. Lawrence, the precipitous drop in ice coverage in March yielded an overall below normal total accumulated ice coverage (TAC). TAC measured 8.39%, well below the median of 12.65% and only a slight increase from the previous year (6.85%).

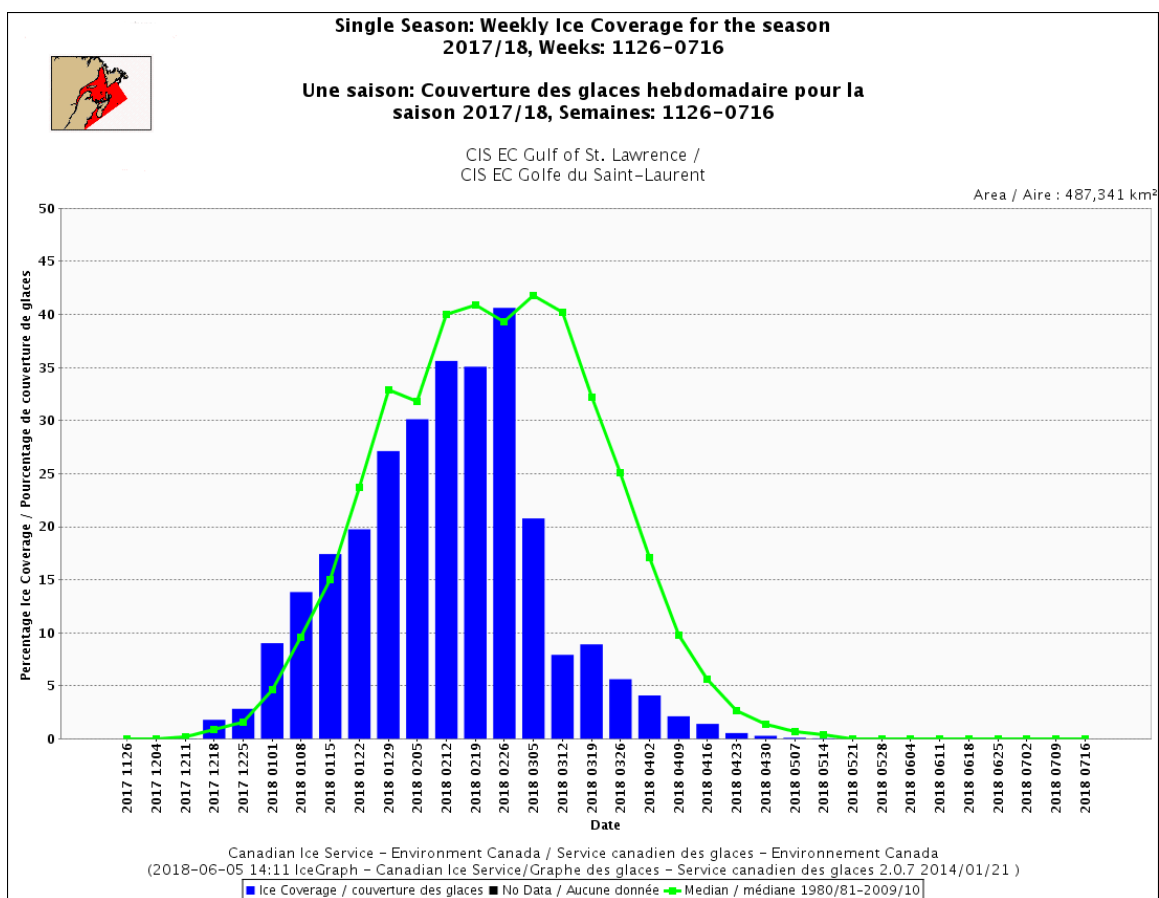


Figure 12: Weekly Ice Coverage for the 2017-2018 season in the Gulf of St. Lawrence.

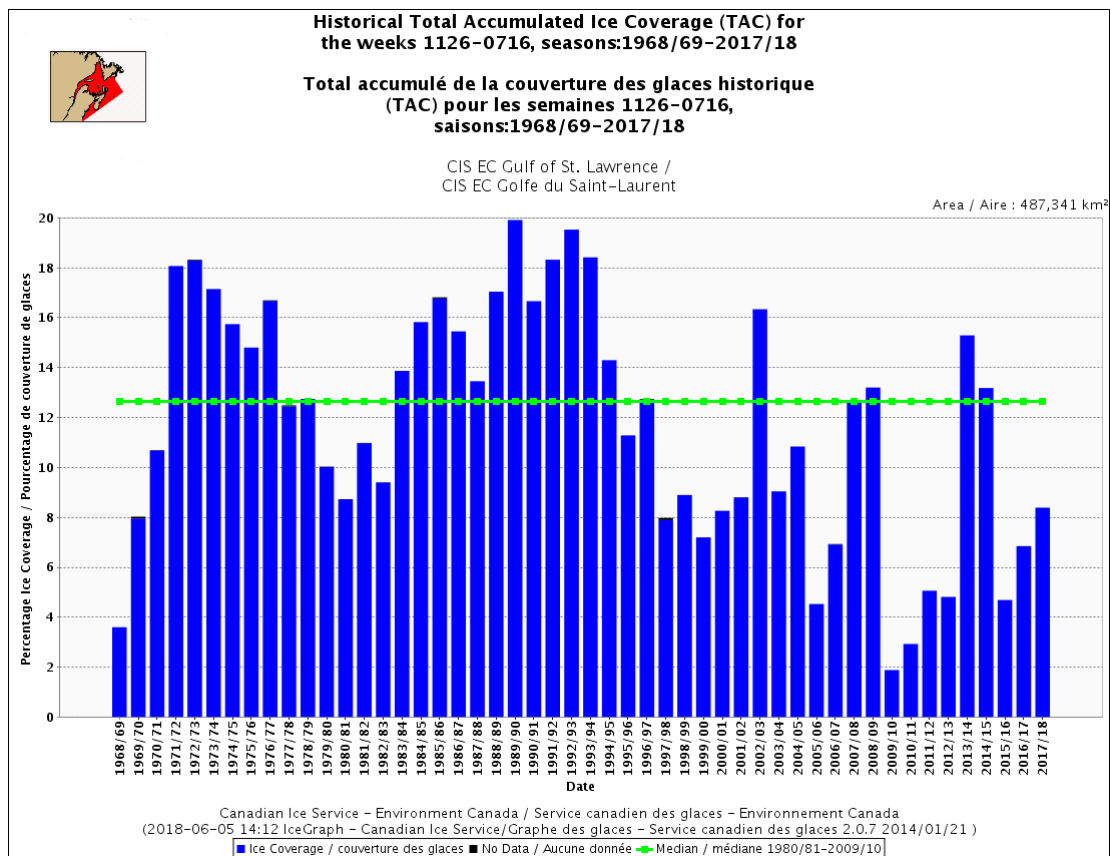


Figure 13: Historical Total Accumulated Ice Coverage for the Gulf of St. Lawrence by season, 1968-2018.

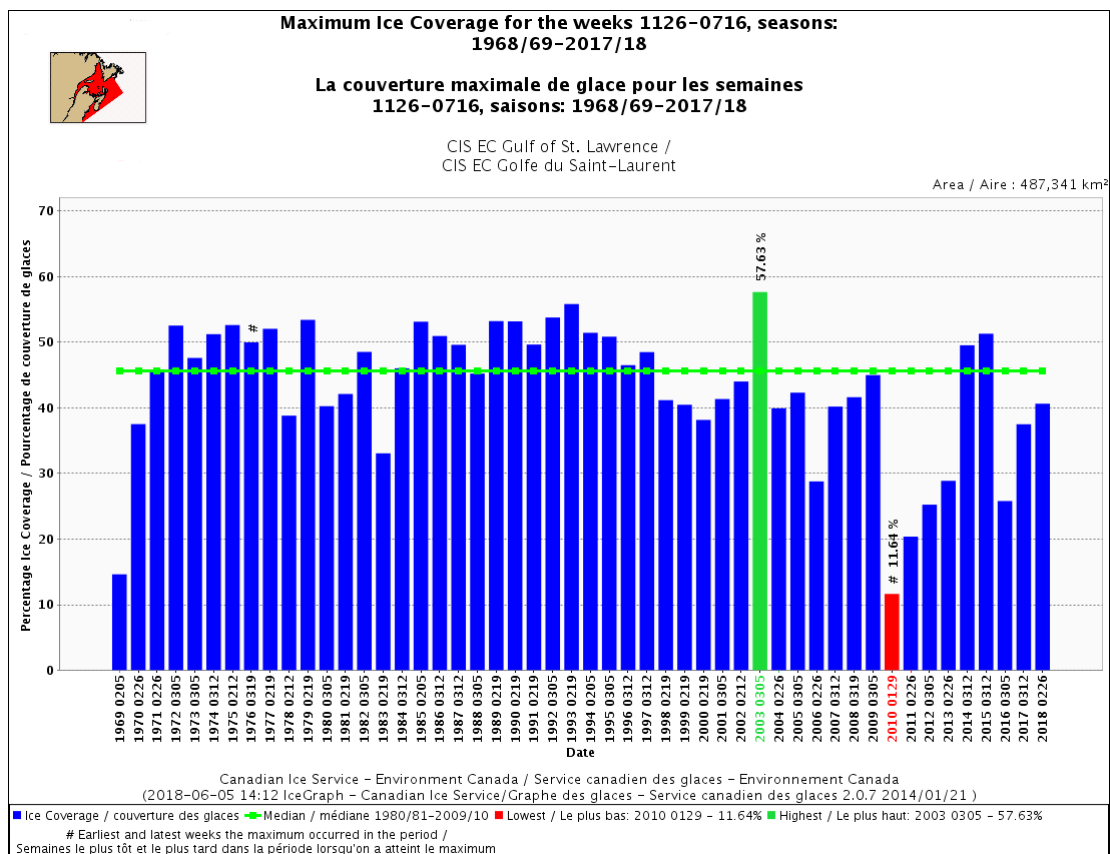


Figure 14: Maximum Ice Coverage in the Gulf of St. Lawrence by season, 1968-2018.

Newfoundland and Labrador Waters

2017-2018 Season temperatures and Weather: November to mid-June

Near normal patterns of temperature and sea level pressure presided over the region from mid-November to mid-December 2017 before being overtaken by a warmer than normal phase with anomalous low pressure situated over eastern Labrador. Mean atmospheric low level flow from mid-December to the middle of January 2018 was southwesterly over Newfoundland waters and the southern Labrador coast, supporting the above normal temperature regime. Warm anomalies reached up to 4.0°C along the mid-Labrador coast during this period.

Close to normal conditions returned after the middle of January and continued through the end of March 2018. Sea level pressure anomaly fields also indicated a relatively normal phase, as typical seasonal northwesterly winds affected the Newfoundland and Labrador waters. The sea ice melt period typical of April to the mid-June was affected by a colder than normal mass of air located over Quebec that moderated temperatures immediately along the Labrador coast. A value of 2.5°C below normal was observed but a near normal zone was noted in northeast Newfoundland waters as the influence of the anomaly diminished rapidly with distance from Quebec. A broad and deep sea level pressure anomaly associated with this cold pool was established over the eastern Canadian Arctic, supporting enhanced northwesterly winds into the forecast region.

November ice conditions:

As is often the case, the first ice of the season developed in the western extreme of Lake Melville near mid-month and gradually spread along the southern shore of the lake over the course of the rest of the month. Bergy water and ice free conditions dominated over the majority of the region with isolated patches of new ice forming near Cartwright by the end of November.

December ice conditions:

Slow ice growth was the distinguishable trend for Labrador and Newfoundland waters in December 2017. Freeze up in Lake Melville and along the Labrador coast was approximately two weeks delayed, thanks in part to the warmer than normal temperatures. Only shortly before Christmas 2017 did extensive new and grey sea ice begin to form along the mid-Labrador coast and over Lake Melville. In the last week of the month this ice spread south of Cartwright but the width of the coastal ice was much less than the climatological median, particularly from Cape Harrison and southwards. Some consolidation of ice was visible in the extreme eastern and western section of Lake Melville, but this again constituted a marked delay with respect to the climatology of nearly half a month. Grey-white ice settled into the eastern half of Lake Melville at the very end of the month when one would expect to see thin first-year ice across the basin.

January ice conditions:

The first half of January trended similarly to December with anomalously low sea ice coverage along the Labrador coast, and now also into northern Newfoundland waters. During the first week of the month grey-white ice became established as the predominant ice type in Lake Melville and from Groswater Bay and northward. A progressive movement and expansion of ice southward during this period saw new and grey ice arrive at the Strait of Belle Isle as well. By mid-month the grey-white ice in the mobile pack ice reached the southern tip of the Labrador coast and the Strait of Belle Isle had filled with new and grey ice. The first elements of thin first-year ice were analyzed north of Cape

Harrison, a relatively normal occurrence with respect to the climatology. Ice remained mobile in the central section of Lake Melville and was predominantly grey-white, now indicating a delay in freeze up and thickening of approximately a month. Offshore ice extent was roughly only 50% of the climatological median value according to the 30-year climatology. Sea ice coverage was approximately 50 nautical miles from shore along the southern Labrador coast at a time when the sea ice often extends up to 100 nautical miles from the coast.

A quickening in the rate of sea ice formation would ensue during the second half of January 2018 along the Labrador coast and a near normal state of coverage developed. The absence of predominantly thin first-year ice near Cartwright and northward was the most important departure from climatological conditions, as mainly grey-white ice populated the sector. Consolidation of the ice within Lake Melville finally happened shortly after mid-month and the majority of the ice reached the thin first-year stage at this point as well. Further south, lower than normal concentrations of ice would be the main narrative in northeast Newfoundland waters. Sea ice had reached the Grey Islands by month end but climatologically ice typically should be nearing the northeastern Newfoundland coast. Ice was also a stage of development below normal from the southern Labrador coast to the Grey Islands, with grey ice in place of the expected grey-white.

February - March – April ice conditions:

February 2018 supported the peak ice cover conditions in both the southern Labrador Sea and Newfoundland waters. By mid-month the maximum ice cover of 27.23% was hit in the southern Labrador Sea, slightly above the median value of 24.32% for the same week climatologically. Two weeks later by the end of the month, the peak ice coverage for the season was achieved for Newfoundland waters at 13.72%, again slightly higher than the climate normal maximum of 11.11% for the region. Ice arrived behind the normal schedule along the northeast Newfoundland coast, delayed by approximately two weeks with respect to the climate normal. At the end of the month ice extended further eastward than usual, reaching 46°N 48°W. Predominantly thin first-year ice pushed southward by the second week of February offshore of Battle Harbour, improving the agreement with the climatology from the previous month. As well, the first important amounts of medium first-year ice appeared offshore of Groswater Bay shortly before the end of the month.

A drastic reduction in sea ice was experienced in early March 2018, as four consecutive significant winter storms would affect the region. The loss of ice in the southern Labrador Sea was mitigated by the storm tracks being somewhat south of the area and by the presence of thin first-year ice in ample quantities. The first major retraction occurred in the first week of the month as the ice edge moved from the previously noted maximum to 50°W just east of Bonavista. The next storm visiting the region further impacted the edge and pushed it again westward back to 50°W. Major compression of surviving ice along the eastern coast of the Northern Peninsula was observed during this period, with grey ice quickly thickening to grey-white and thin first-year. After mid-March and the passage of the third low pressure system, widespread medium first-year ice was analyzed in northeast Newfoundland waters and northward along the Labrador coast. This ice also infiltrated the Strait of Belle Isle due to the persistent northeasterly winds associated with these storms. In the final days of March after all the storms had left the Atlantic Canada region, a narrow band of medium and thin first-year ice was compressed within 30 nautical miles of the coastline in general. Ice coverage was now well below seasonal as ice extents of up to 160 nautical miles offshore are expected during the end of March time period, while measured extents were only 50% of this value.

April's colder than normal temperature regime would lessen the rate of ice decrease and return the cover to a near normal pattern by the end of the month. Minor changes would be noted in this period including the arrival of a trace of old ice near Groswater Bay at mid-month. The first elements of thick first-year ice would develop in the pack ice along the southern Labrador coast early in April and gradually became the predominant ice type in the second week. Lesser amounts of thick first-year ice formed in Newfoundland waters at this time as well but extensive quantities only were

detected here due to the southward flow of pack ice from Labrador waters in the second half of April. An early clearing of the Strait of Belle Isle also ensued, with the final elements of ice melting completely by the end of April.

May to mid-June ice conditions:

Near normal ice conditions at the start of May transitioned to above normal by late in the month. Lingering ice in northeast Newfoundland would steadily melt until bergy water conditions overtook the region in the third week of May but the trace amounts of old ice along the Labrador coast would continue to progress southwards. This trace in the first-year ice pack would again return to the Strait of Belle Isle in late May and remain in moderate concentrations until shortly after mid-June. This pattern of slower than normal ice melt was also observed in Lake Melville where open water conditions would not be recorded until the third week of June, approximately three weeks later than normal. Sea ice melt along the Labrador Coast was a week slower than the median climatological conditions for the remainder of June, with significant first-year ice with a trace of old ice still present north of Groswater Bay by the end of the month. TAC for the 2017-2018 season in the southern Labrador Sea was near normal at 10.13% and below normal at 2.13% for the east Newfoundland waters.

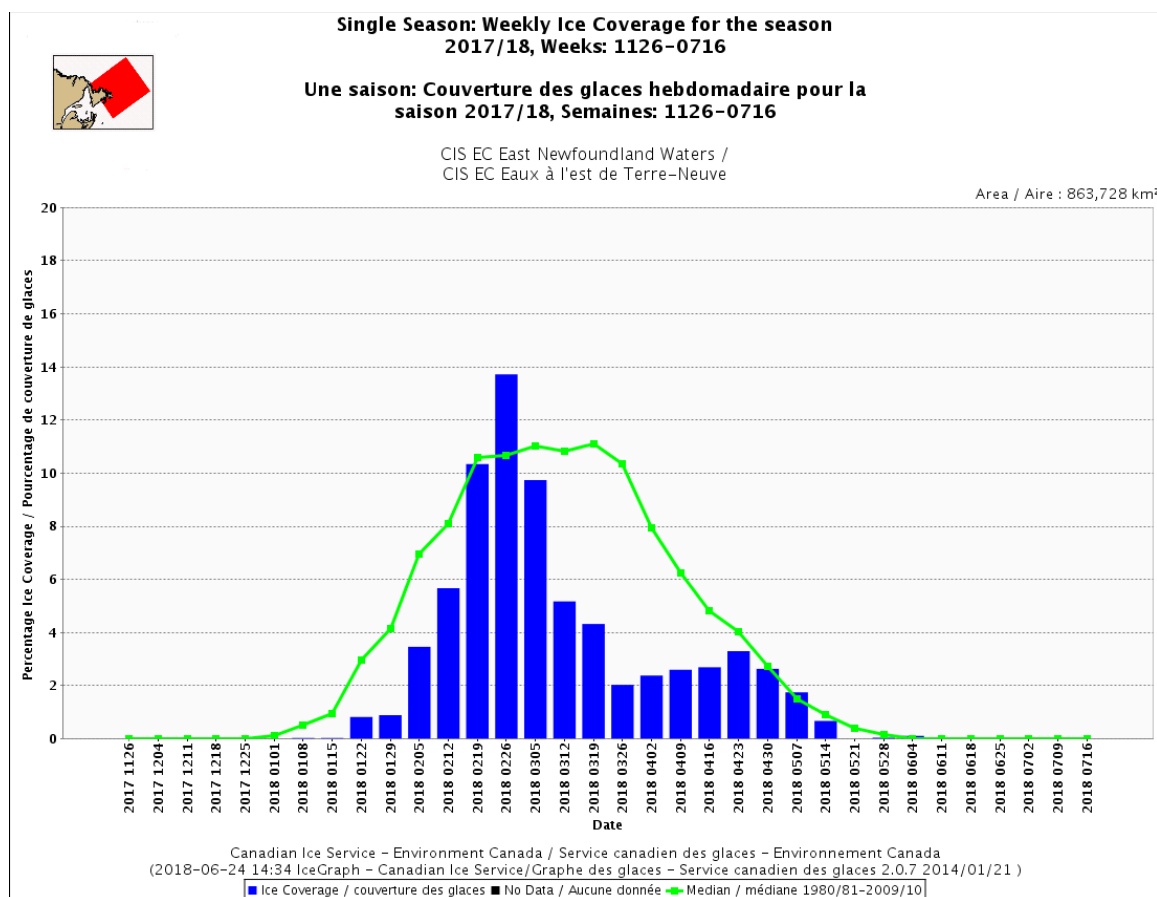


Figure 15: Weekly Ice Coverage for the 2017-2018 season in East Newfoundland Waters.

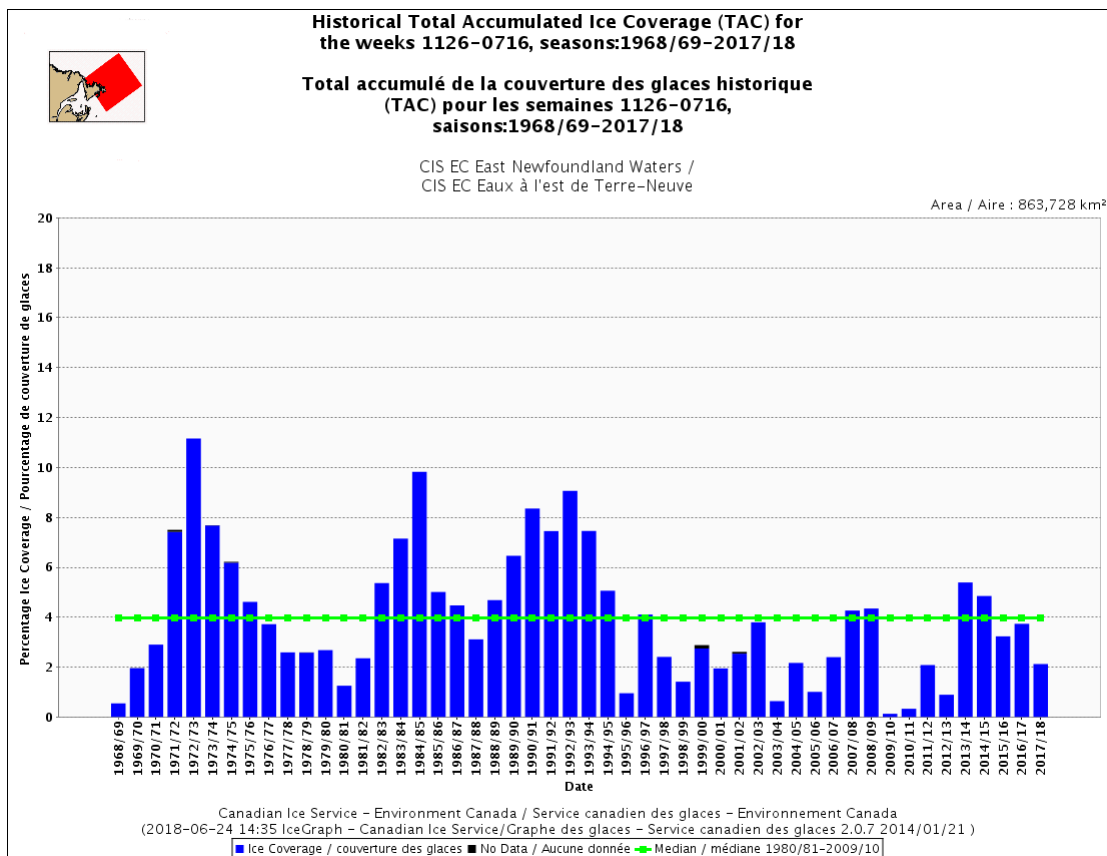


Figure 16: Historical Total Accumulated Ice Coverage for the 2017-2018 winter season in East Newfoundland Waters.

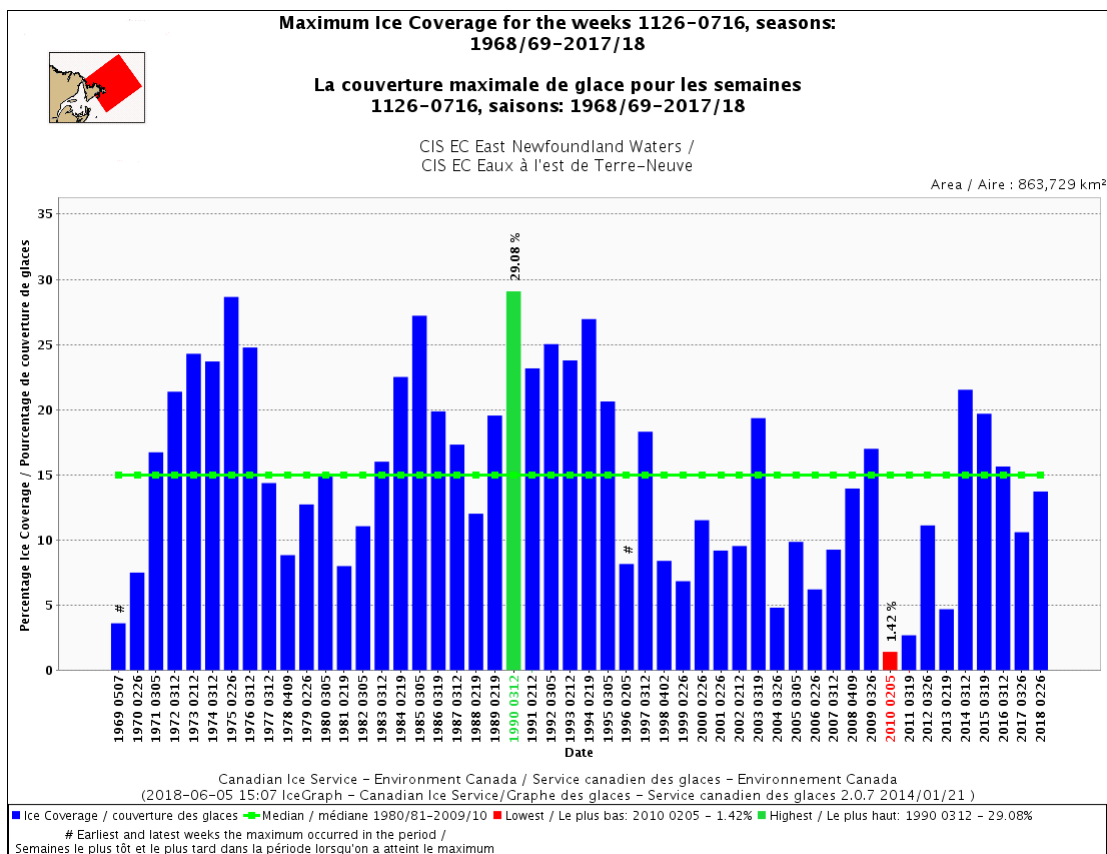


Figure 17: Maximum Ice Coverage in East Newfoundland Waters by season, 1968-2018.

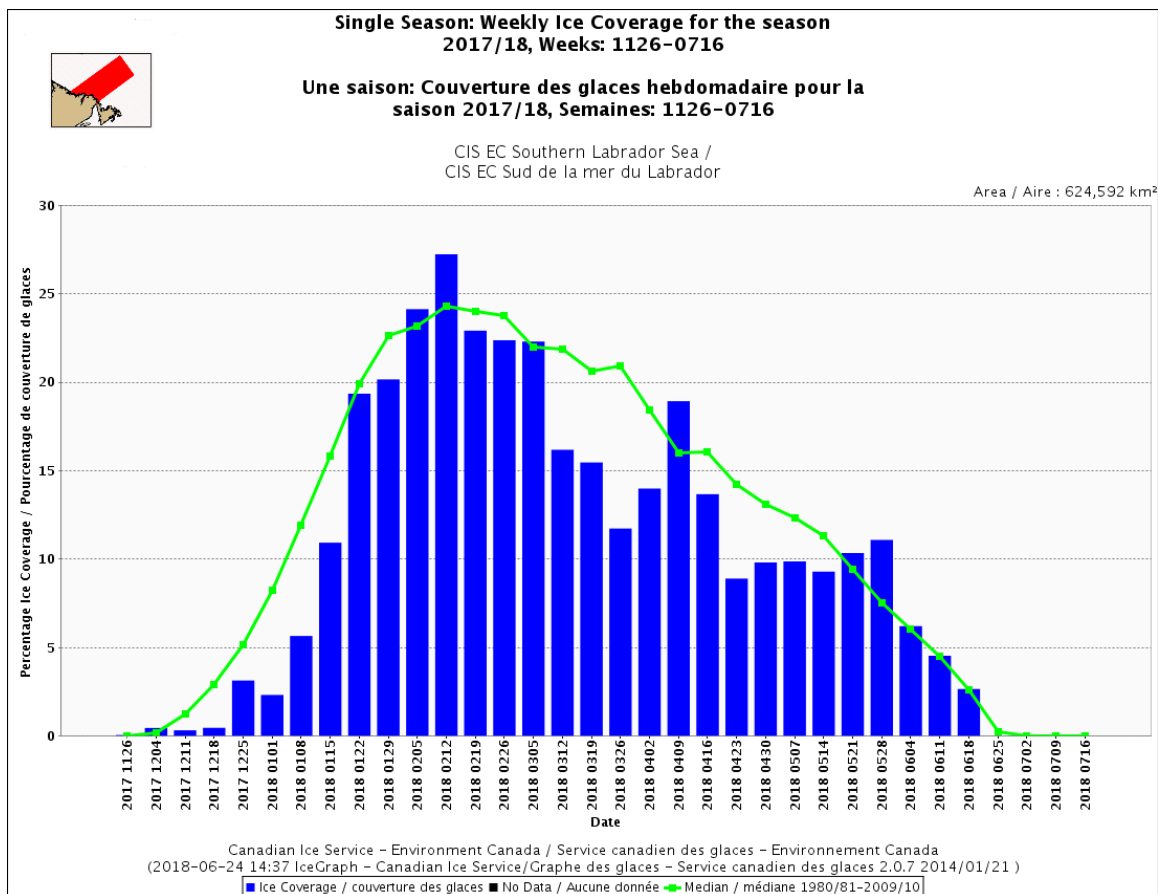


Figure 18: Weekly Ice Coverage for the 2017-2018 season for the Southern Labrador Coast.

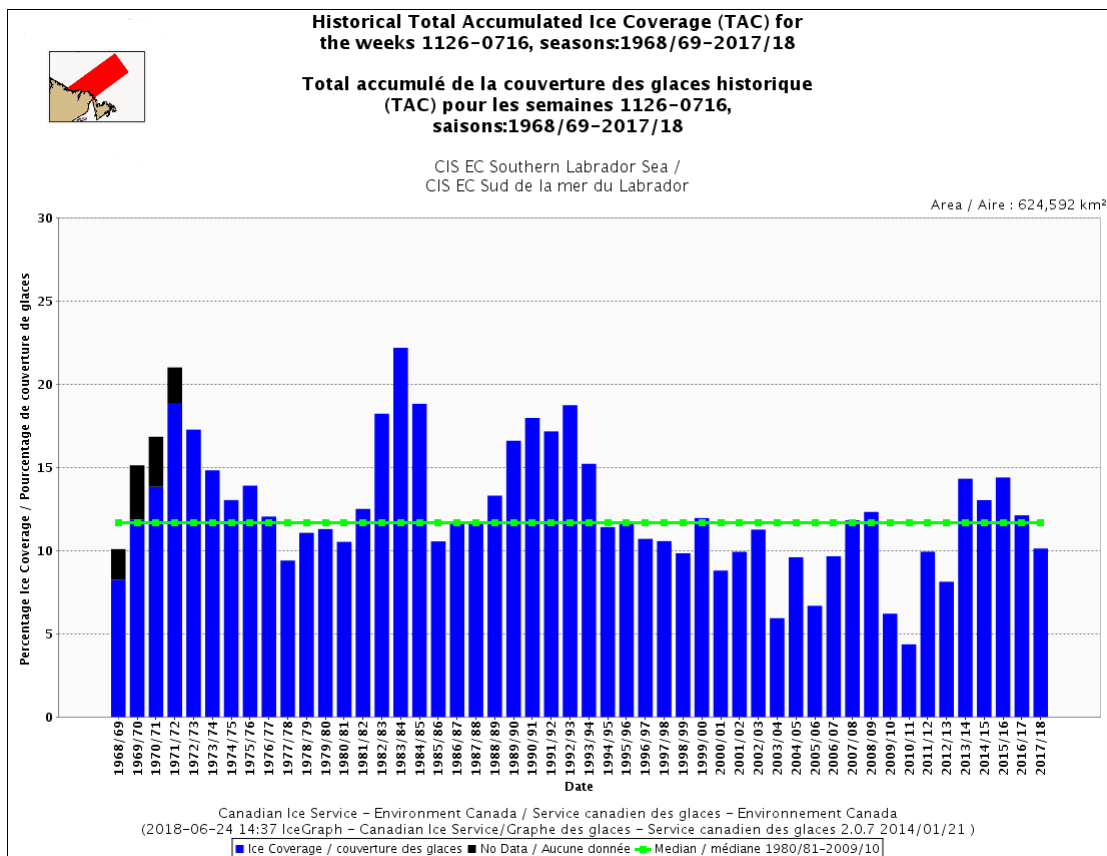


Figure 19: Historical Total Accumulated Ice Coverage along the Southern Labrador Coast by season, 1968-2018.

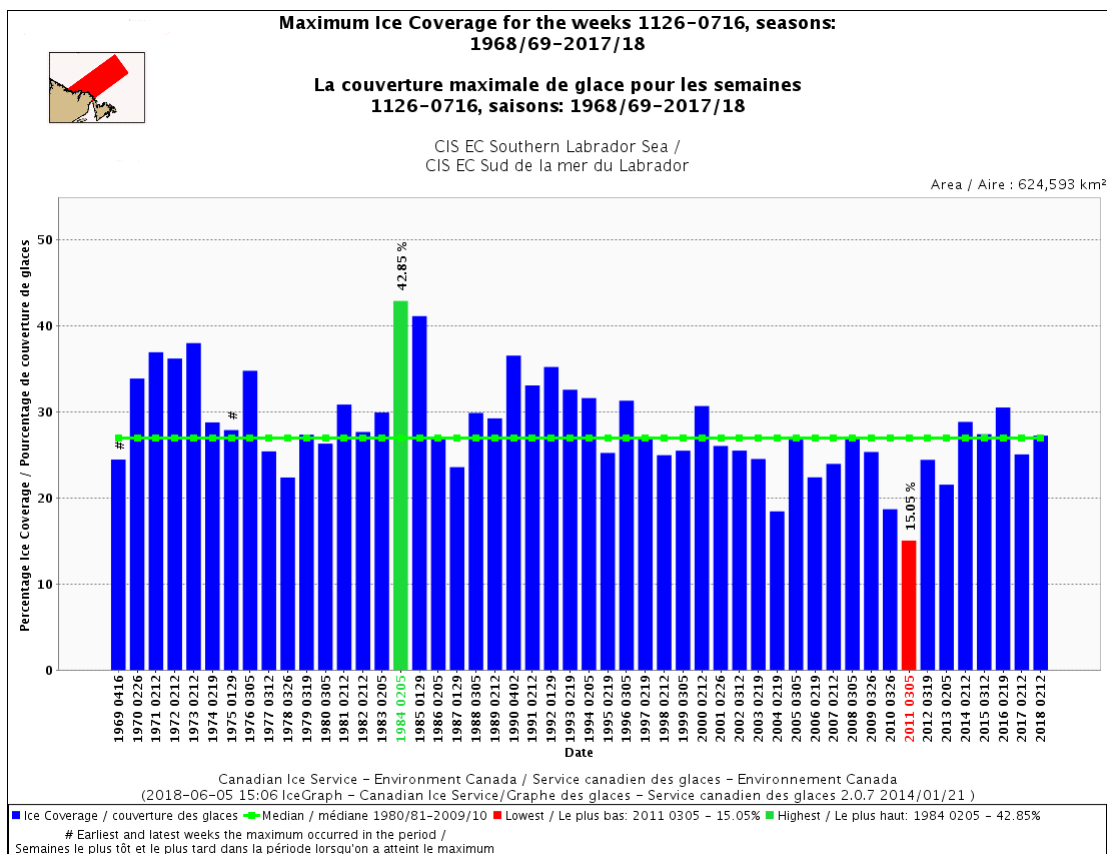


Figure 20: Maximum Ice Coverage in the Southern Labrador Sea by season, 1968-2018.

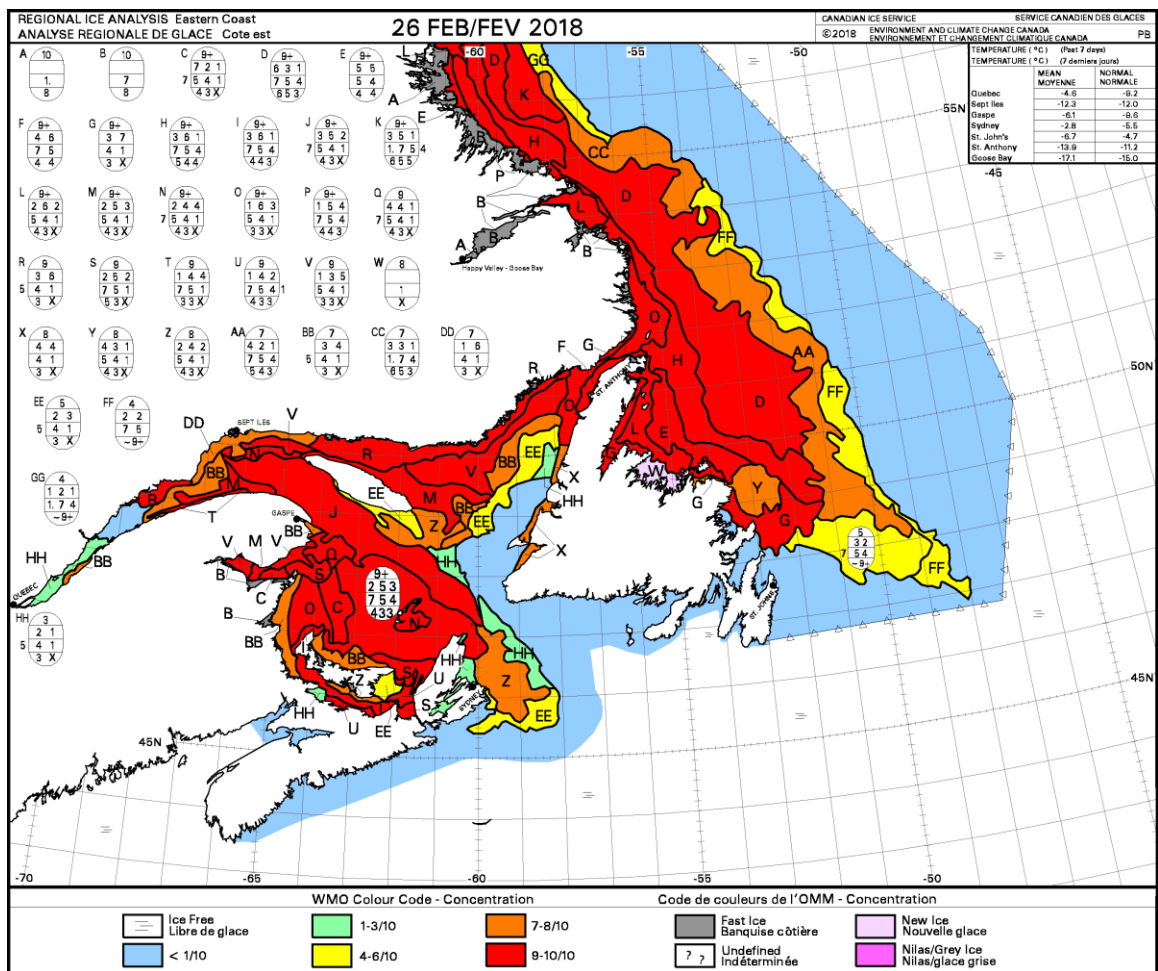


Figure 21: Maximum Ice Cover, Eastern Coast Regional Ice Chart – 26 February 2018.