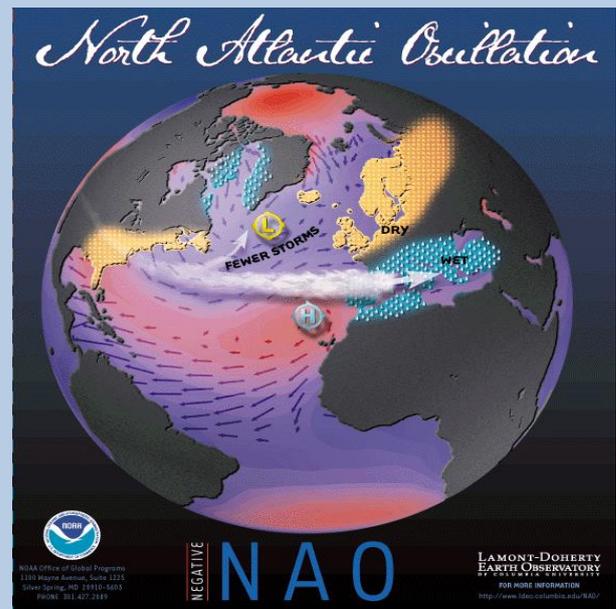
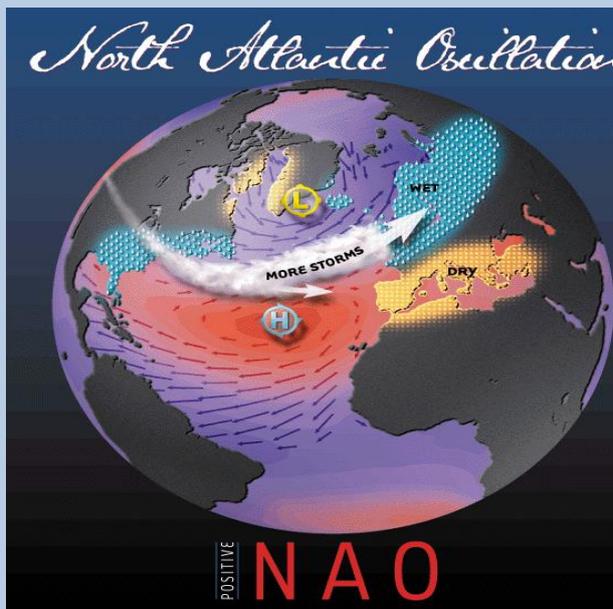


The 2017 Ocean Climate Status Summary for NAFO S. A. 1-6, Large Scale Forcing

General Climate Indicators within the NAFO Convention Area: NAO, SST, Air Temperature, and Ice cover.

Oceanographic conditions in NAFO waters are to a large degree determined by the strength of the winter atmospheric circulation over the Northwest Atlantic, measured by the NAO Index.

The North Atlantic Oscillation (NAO) index as defined by Rogers (1984) is the difference in winter (December, January and February) sea level atmospheric pressures between the Azores and Iceland.



A high (positive phase) NAO index occurs from an intensification of the Icelandic Low and Azores High and conversely when the NAO is strongly negative.

A positive NAO generally favours strong northwest winds, cold air and sea temperatures and heavy ice conditions on the NL Shelf regions.

Graphics from <http://www.ldeo.columbia.edu/NAO> by Martin Visbeck

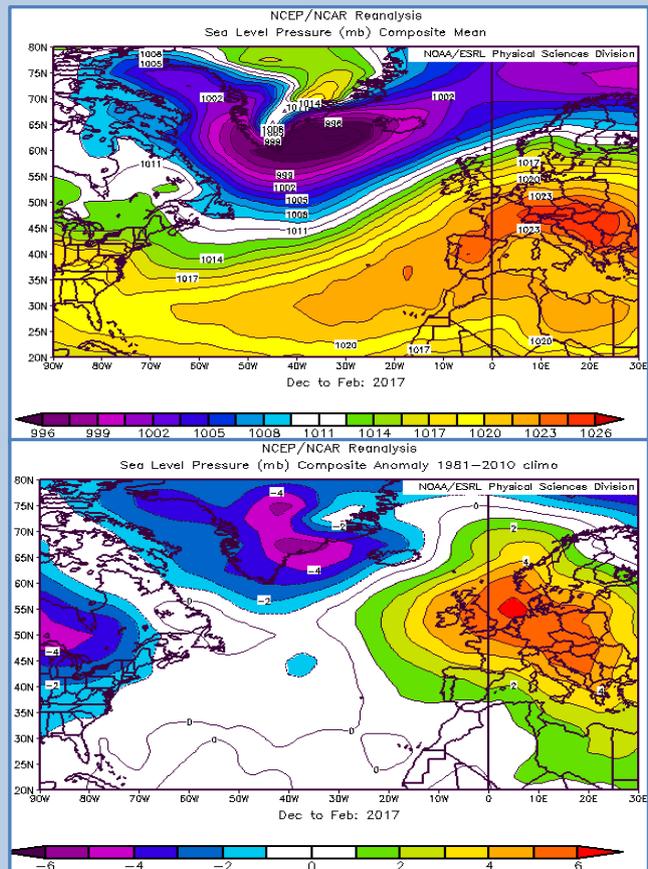
THE 2017 NAO INDEX

Winter sea level atmospheric pressure (SLP) was below normal across the northern areas while the Azores High was above normal but displaced eastward over the European Continent.

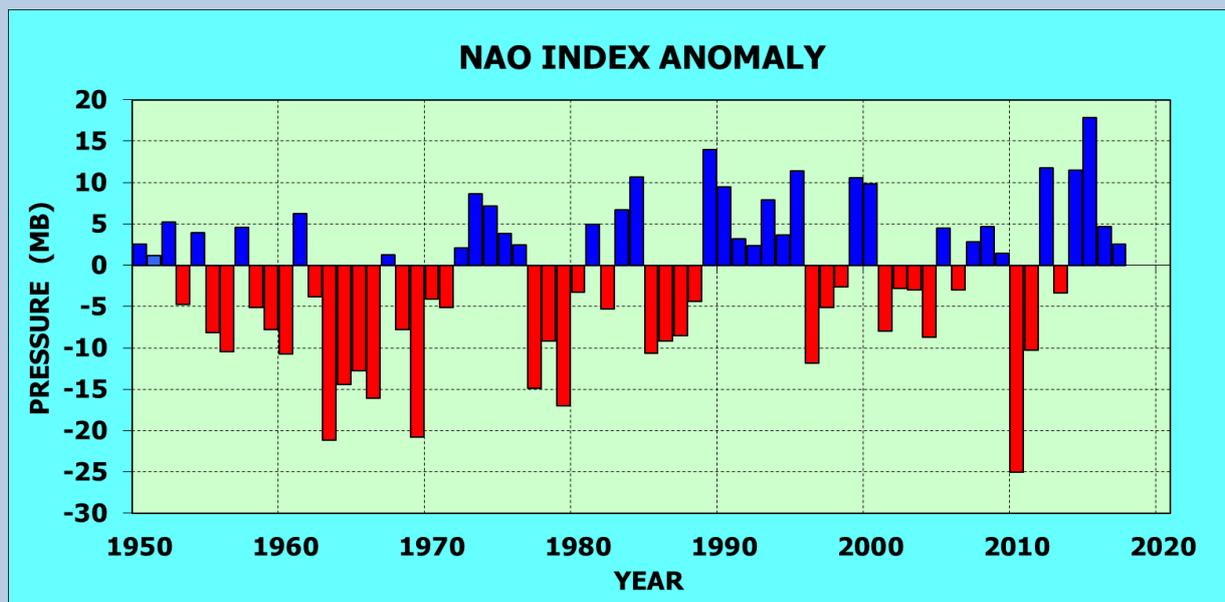
This resulted in a weak positive NAO index during 2017.

Images provided by the NOAA/ESRL Physical Sciences Division, Boulder Colorado from their Web site at:

<http://www.esrl.noaa.gov/psd>

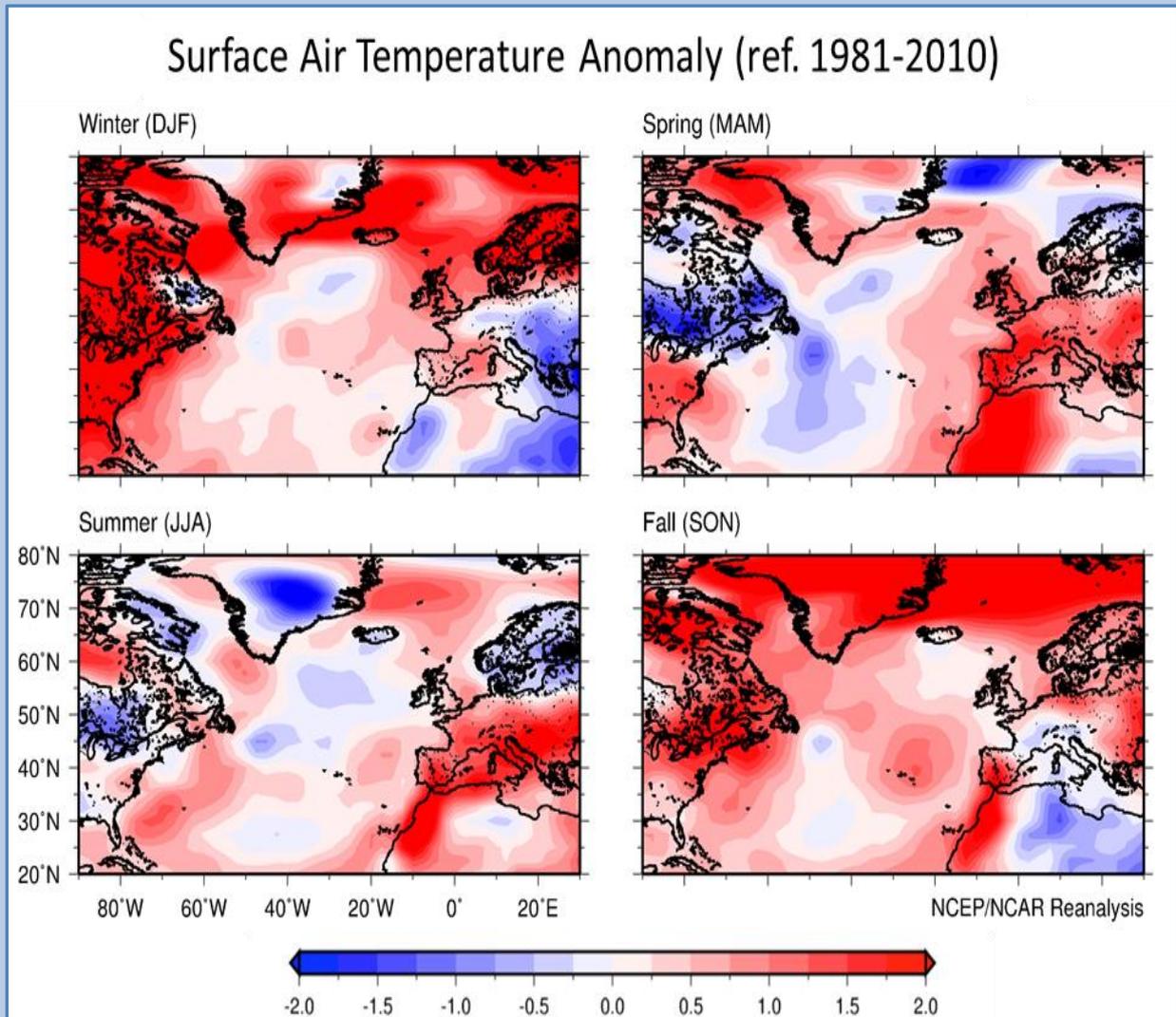


The North Atlantic Oscillation index returned to a strong positive state during 2014 and increased further in 2015 to a 120 year record high. In 2017, it decreased to slightly above normal and combined with spatial shifting of the SLP fields, the outflow of arctic air masses to the NAFO Area during the winter decreased over the previous year.



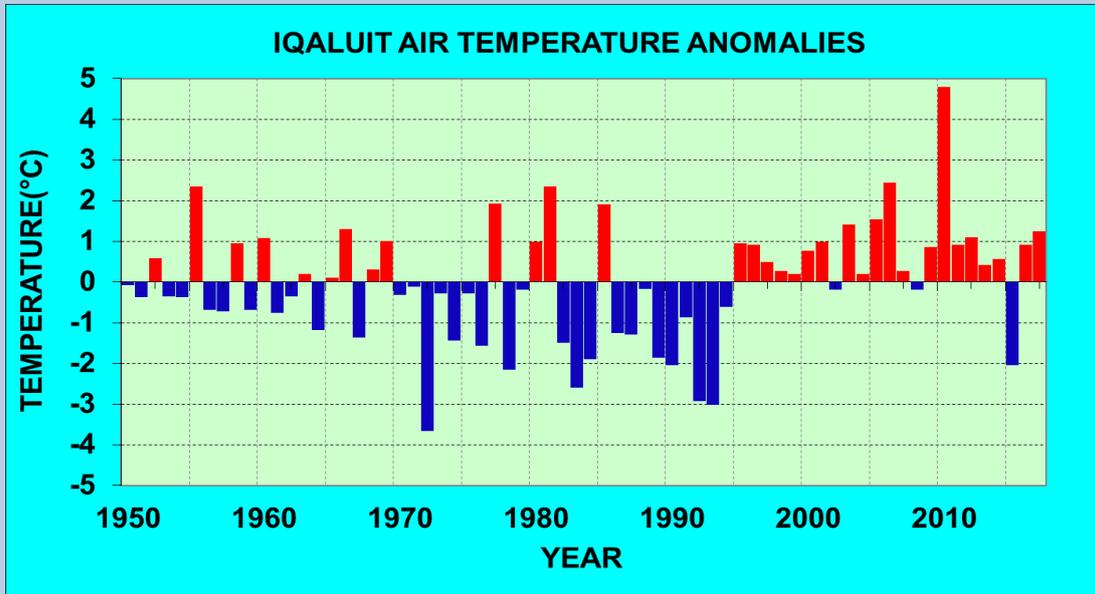
North Atlantic 2017 Air Temperatures

Seasonal air temperatures were above normal over much of the NAFO Convention Area in 2017, particularly during winter and fall periods.

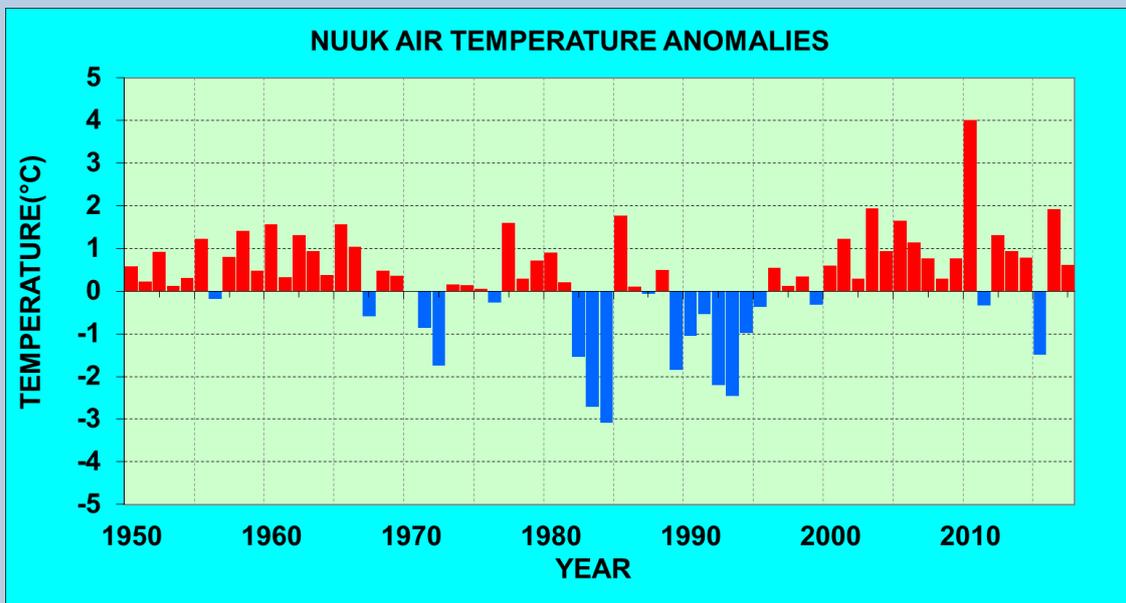


Site Specific Air Temperatures Trends

Annual mean air temperature anomalies in NAFO Sub-Area 0 (Iqaluit) increased from 2.2°C below normal in 2015 to 1.3°C above normal in 2017.

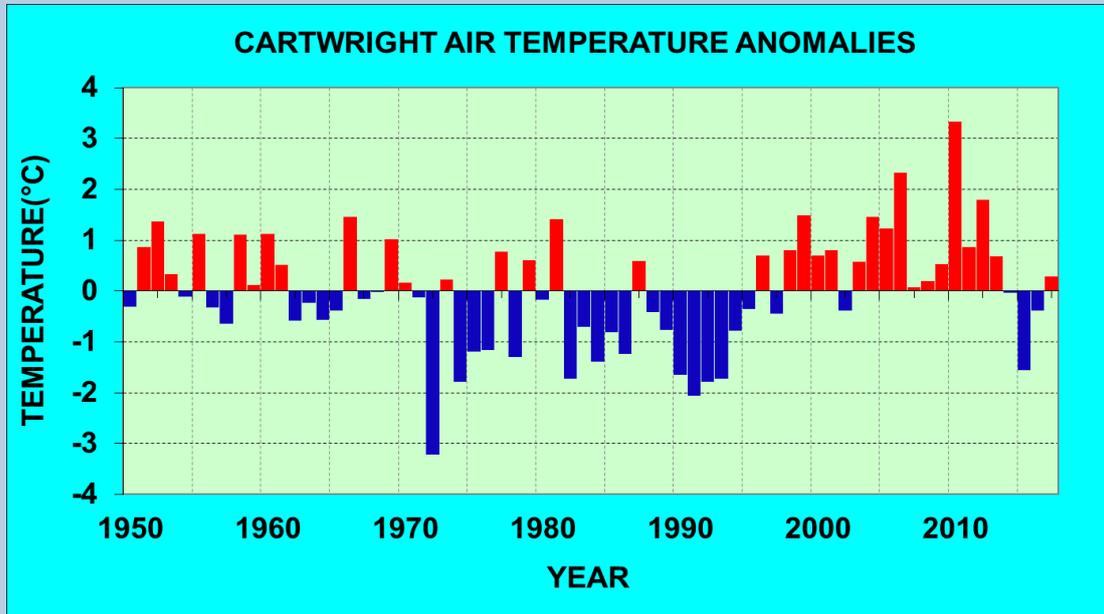


Annual mean air temperature anomalies in NAFO Sub-Area 1 (Nuuk) increased significantly from 1.5°C below normal in 2015 to near 2°C above normal in 2016, the 3rd highest in the series and remained at 0.6°C above normal in 2017.

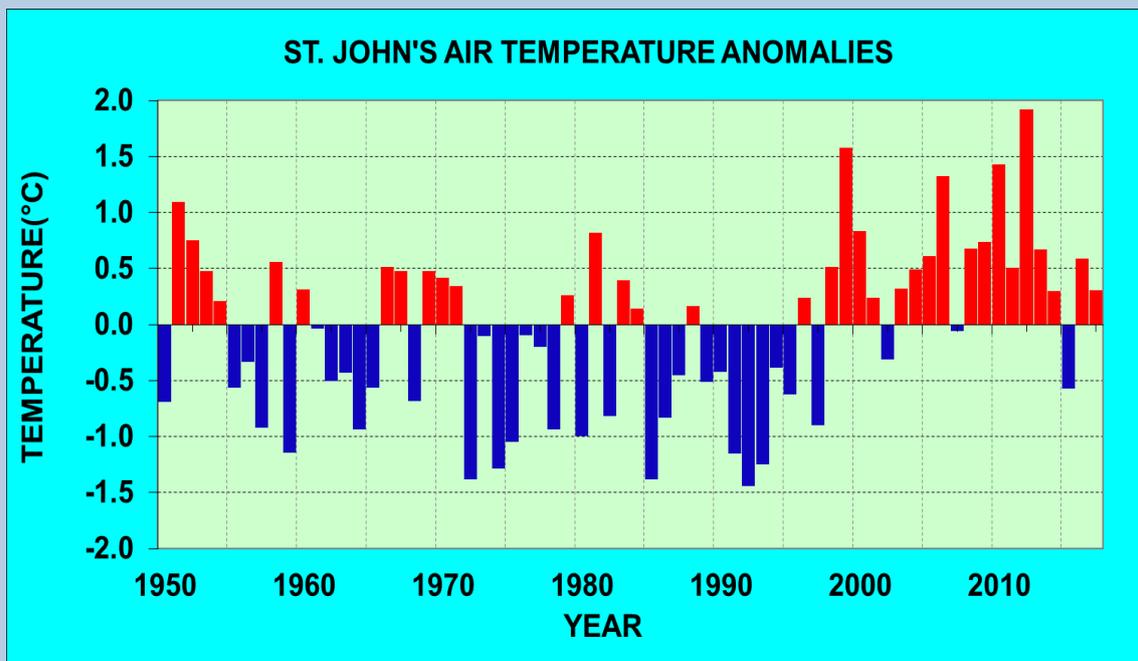


Site Specific Air Temperatures Trends

Annual mean air temperature anomalies in NAFO Sub-Area 2 on the Labrador Coast (Cartwright) increased from 1.5°C below normal in 2015, to about 0.3°C above normal in 2017.

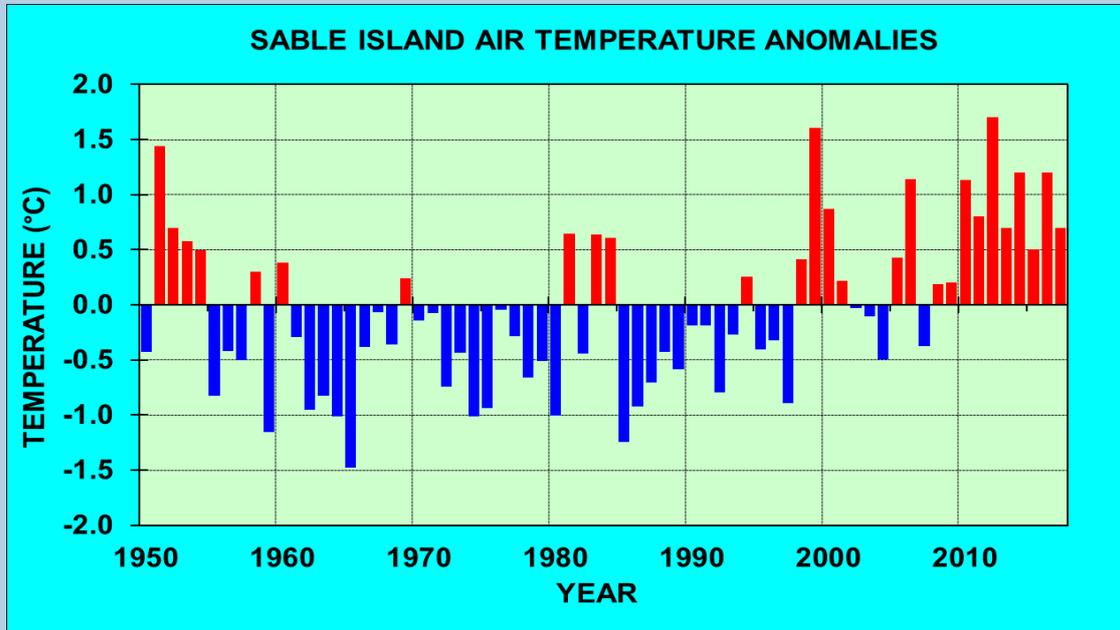


Annual mean air temperature anomalies in NAFO Sub-Area 3 on the Newfoundland Coast (St. John's) were at a record high near 2°C above the long-term mean in 2012 but decreased to 0.6°C below the long-term mean in 2015. In 2017, air temperatures were about 0.3°C above normal.

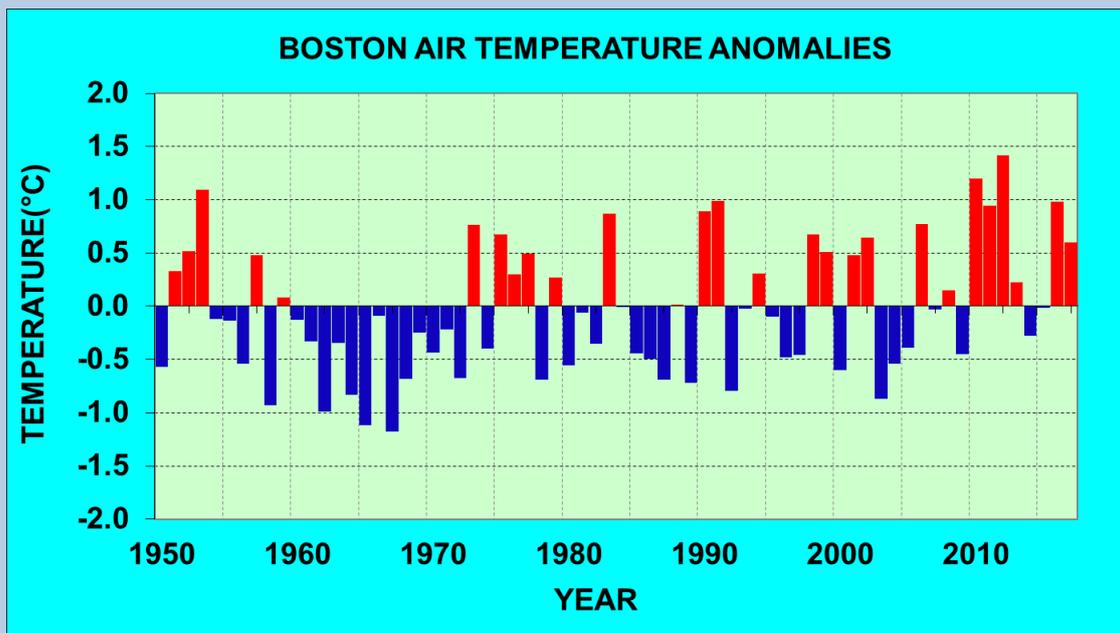


Site Specific Air Temperatures Trends

Annual mean air temperatures in NAFO Sub-Area 4 (Sable Island) were at a record high of 1.7°C above normal in 2012 and have remained above normal by about 0.7°C in 2017.



Annual mean air temperatures in NAFO Sub-Area 5 on the northeast USA Coast (Boston) were 1.4°C above normal in 2012, a record high, decreased to near-normal values in 2013-2015, but increased again in 2016 to near 1°C above normal and remained at 0.6°C above normal in 2017.

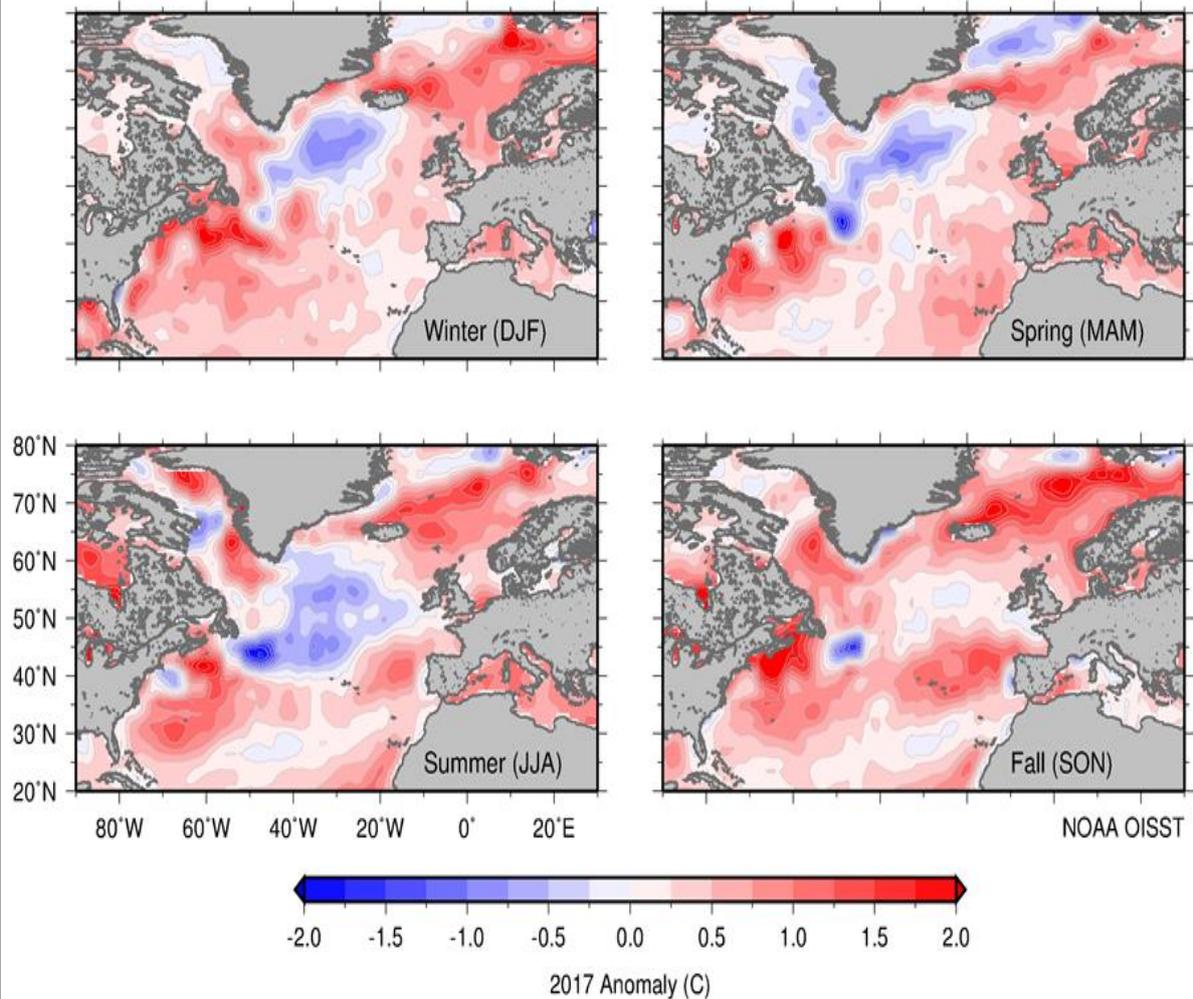


North Atlantic 2017 Sea Surface Temperatures

Seasonal sea surface temperatures (SST) in 2017 varied by season but were mostly above normal, particularly in southern regions.

The most significant negative SST anomaly occurred in the offshore areas including the Flemish Cap region.

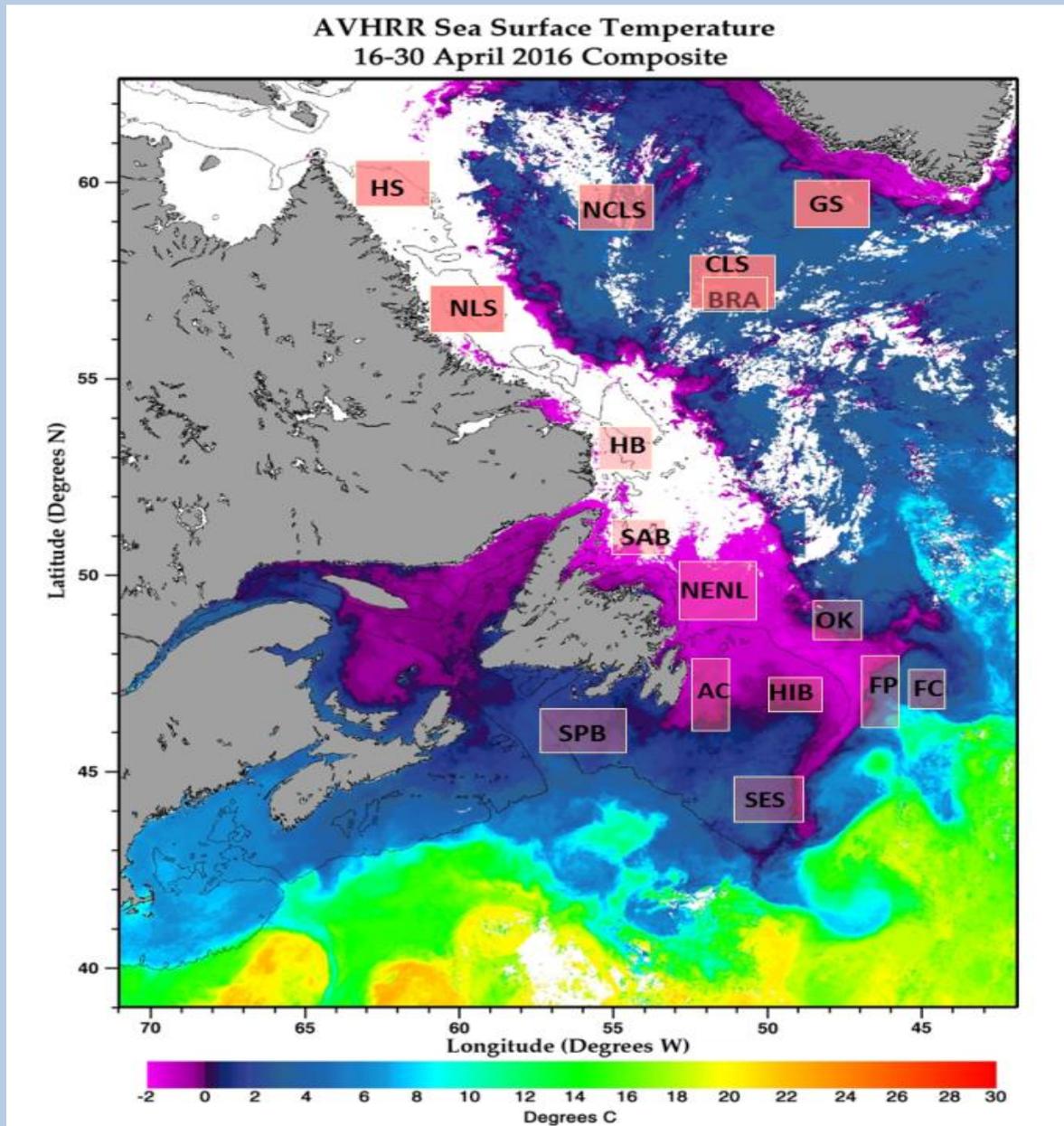
Sea Surface Temperature Anomaly (NOAA, OISST)



Sea surface temperature anomaly derived from the NOAA's Optimum Interpolation (OI) SST product available at:

<http://www.esrl.noaa.gov/psd/data/gridded/data.noaa.oisst.v2.html>

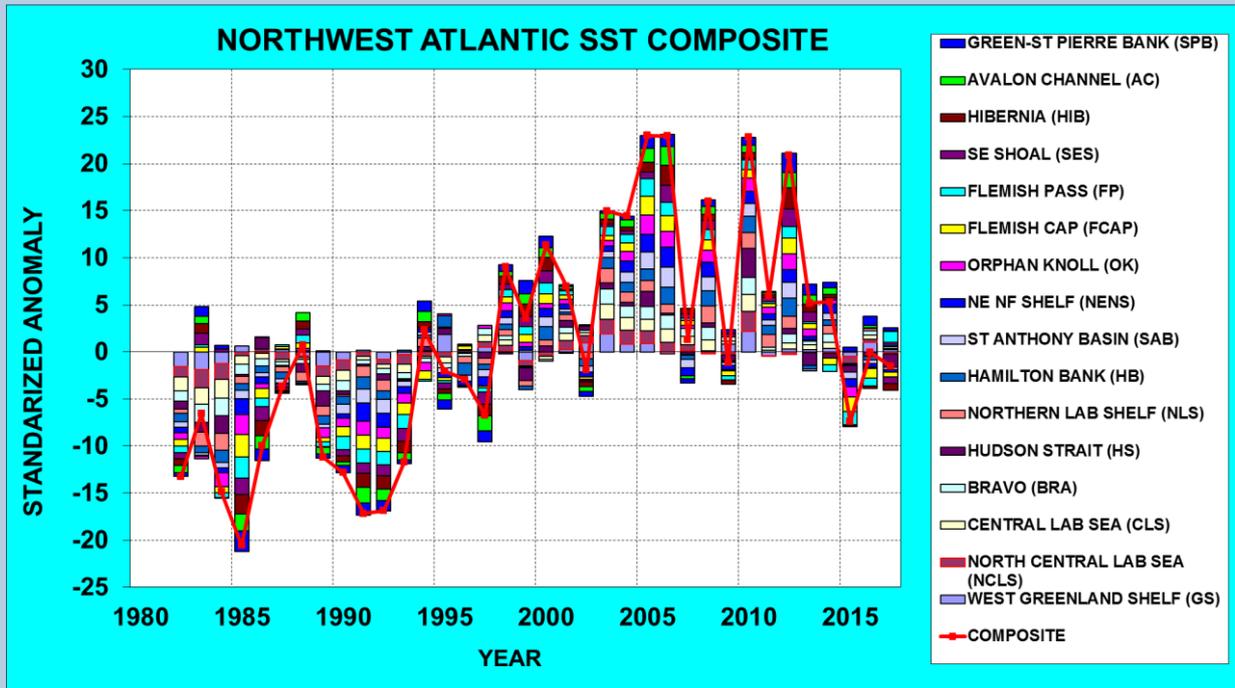
Area Specific Sea Surface Temperatures Trends



SST Data from the Pathfinder 5.2 series plus recent NOAA AVHRR Data provided by Marine Ecosystem Section, Bedford Institute of Oceanography.

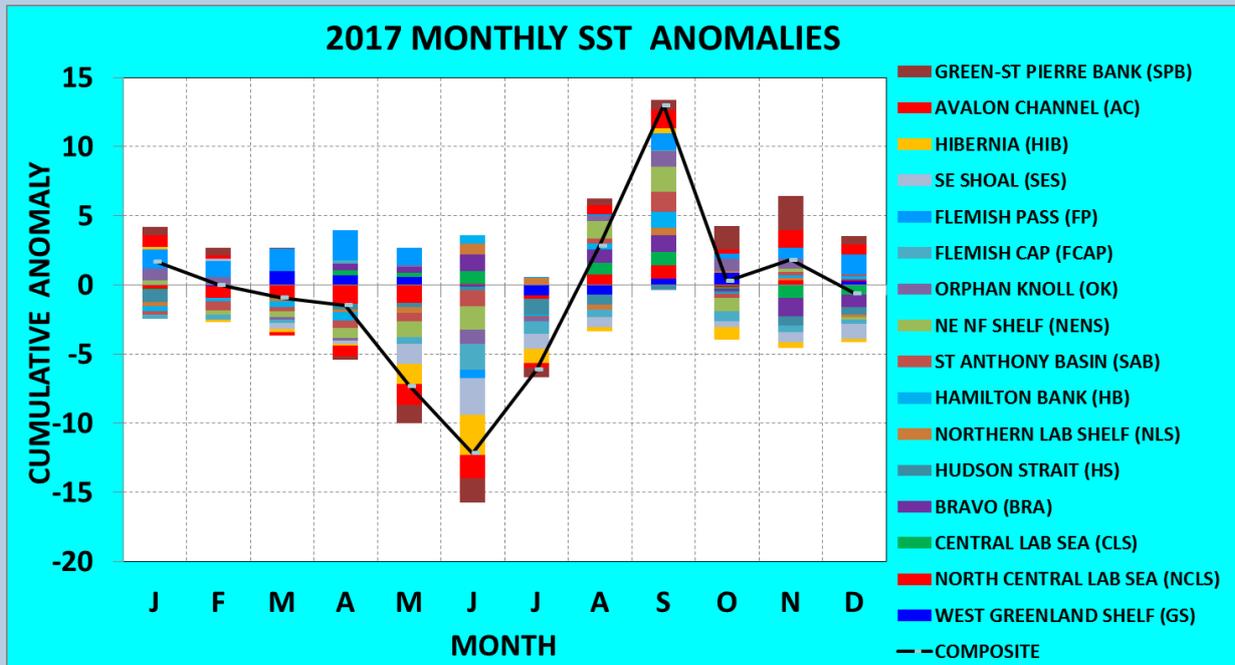
Long Term Sea Surface Temperature Trends

Sea Surface Temperatures are experiencing a recent decreasing trend since 2012 throughout the NAFO Convention Area.



MONTHLY SST FOR 2017

A significant negative anomaly in Sea Surface Temperatures occurred during the spring of 2017.



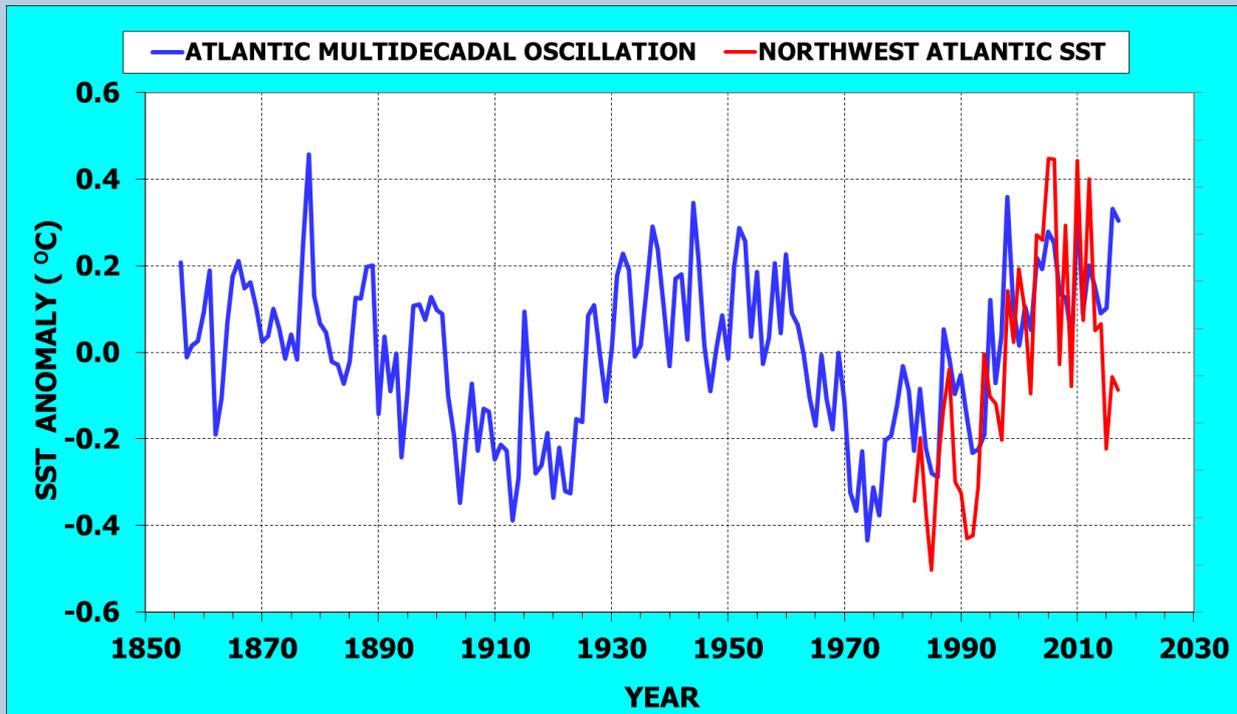
Atlantic Multi-Decadal Oscillation

The Atlantic Multi-Decadal Oscillation continued in a positive state in 2017 however, SST in much of the NAFO Convention Area show a recent decreasing trend.



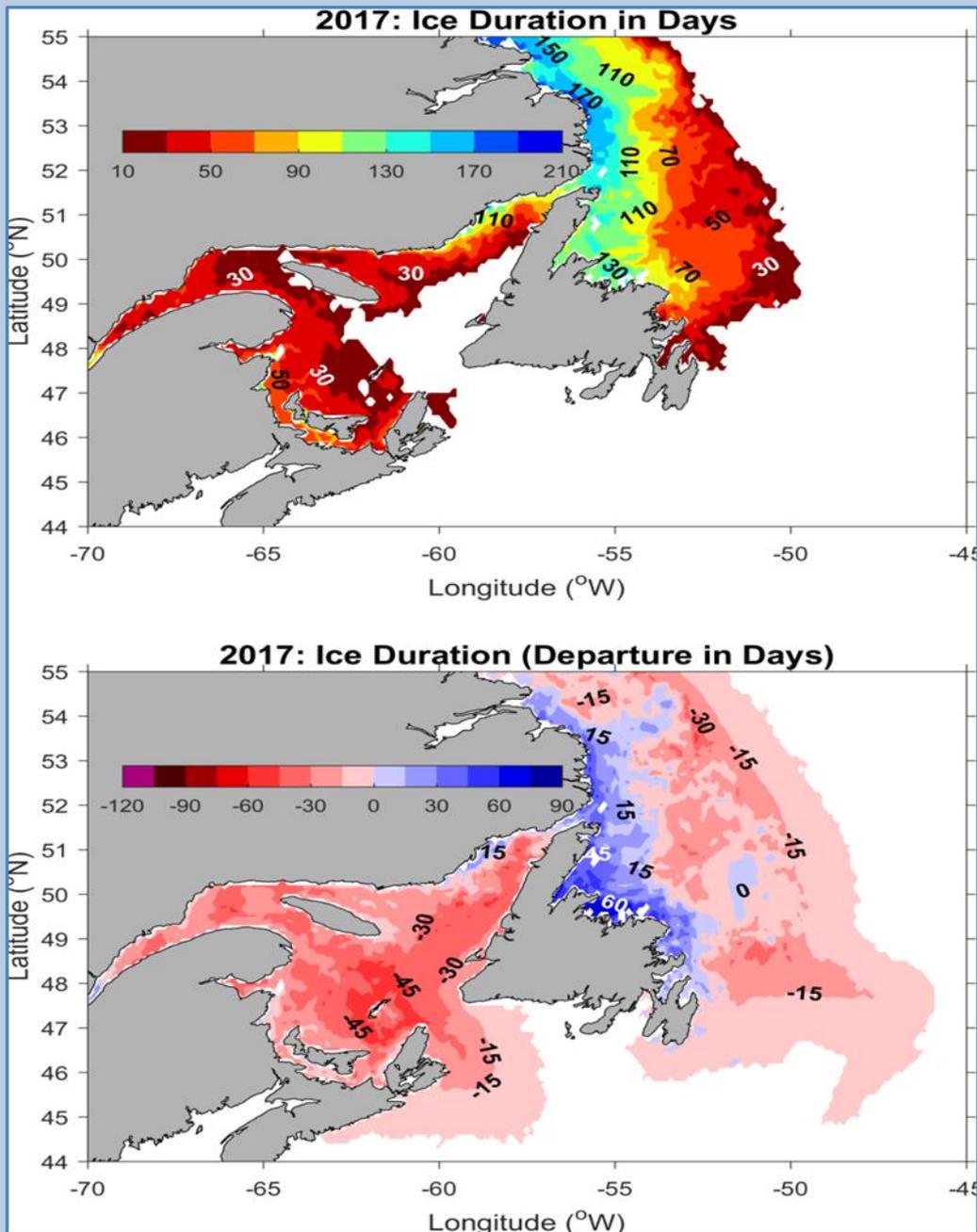
The Atlantic Multi-decadal Oscillation (AMO) is a climate cycle in sea surface temperature (SST) of the North Atlantic Ocean exhibiting annual, decadal and multi-decadal frequencies.

AMO data series available at:
<https://www.esrl.noaa.gov/psd/data/timeseries/AMO/>



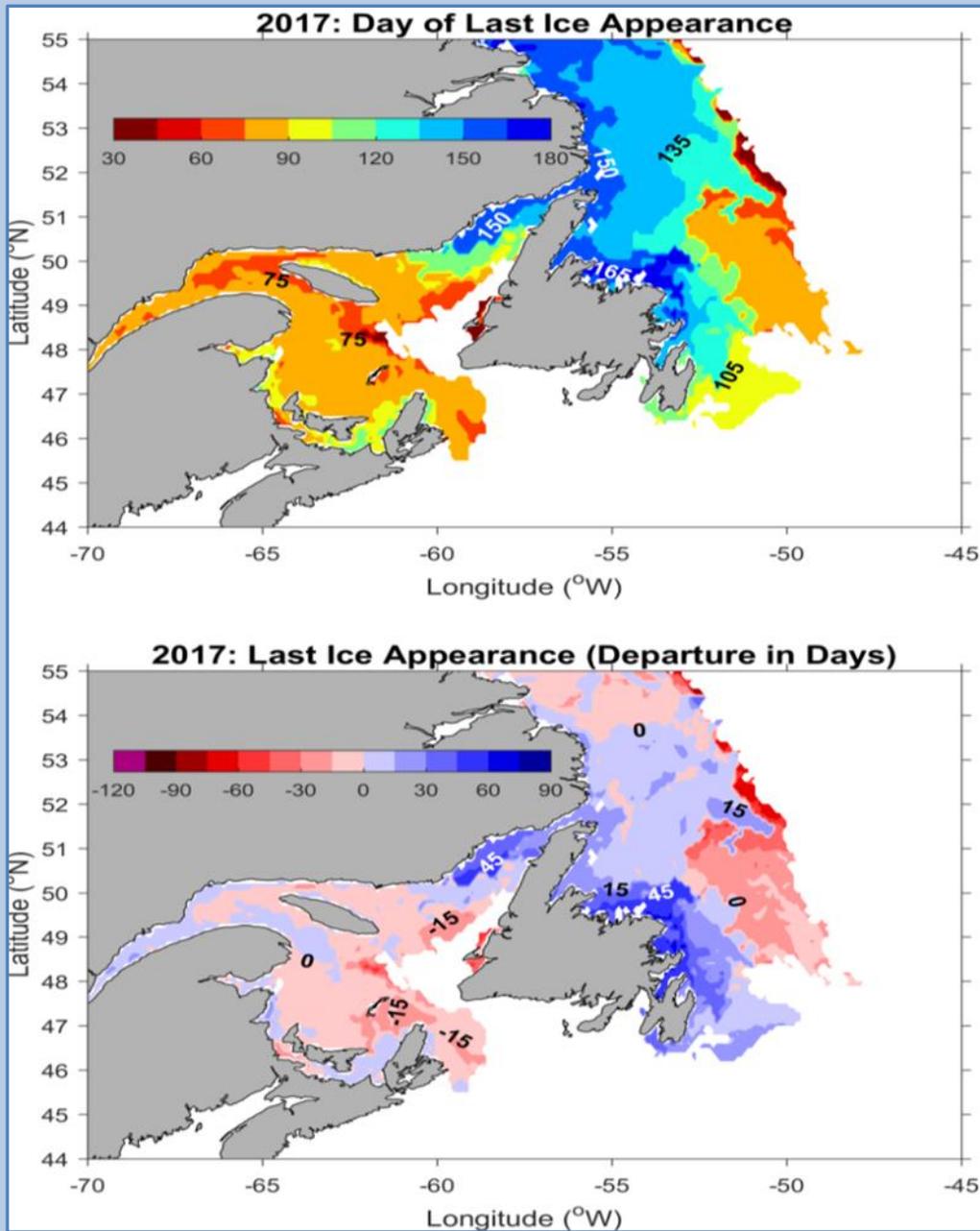
Atlantic Canada Sea Ice During 2017

Sea-Ice was present from 130 to 170 days on the northeast coast and southern Labrador which was 15-60 days longer than normal in some inshore regions. In the offshore regions duration was shorter than normal.



Atlantic Canada Sea Ice During 2017

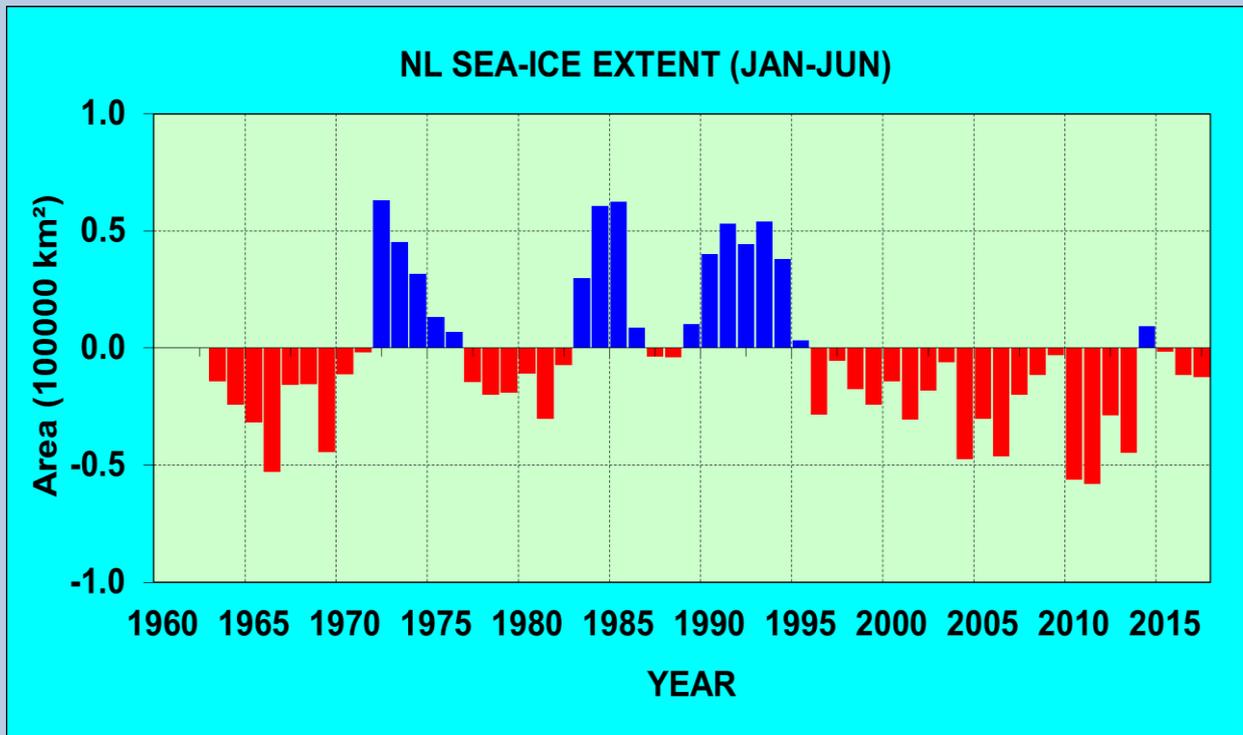
Sea-Ice disappeared from the Northern Grand Bank in mid-April (day 105) and from Northeast Coast in mid-June (day 165). In the inshore regions sea ice departure was 15-45 days later than normal inshore.



Long Term Trends in Sea Ice Extent on the NL Shelf Regions

Sea ice extent during 2014 on the Newfoundland and Labrador Shelf was slightly above the long term mean, the first time since 1995.

In 2016 and 2017 however, it decreased again to lighter than normal sea conditions.

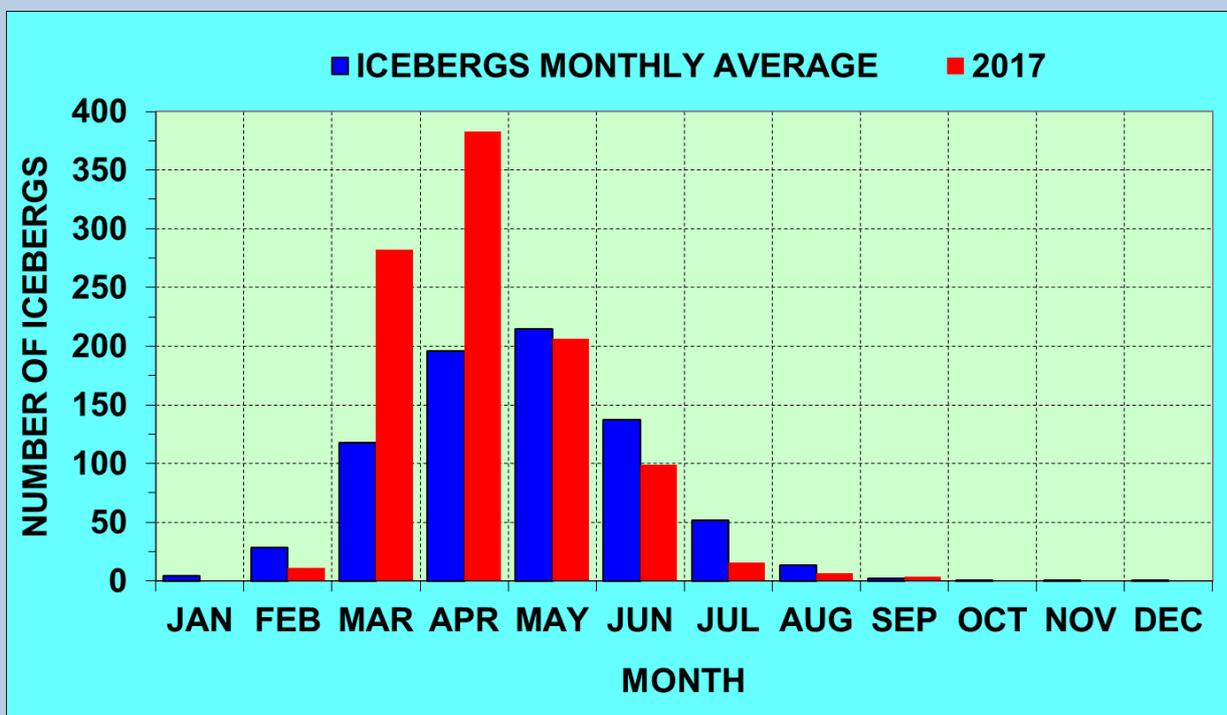
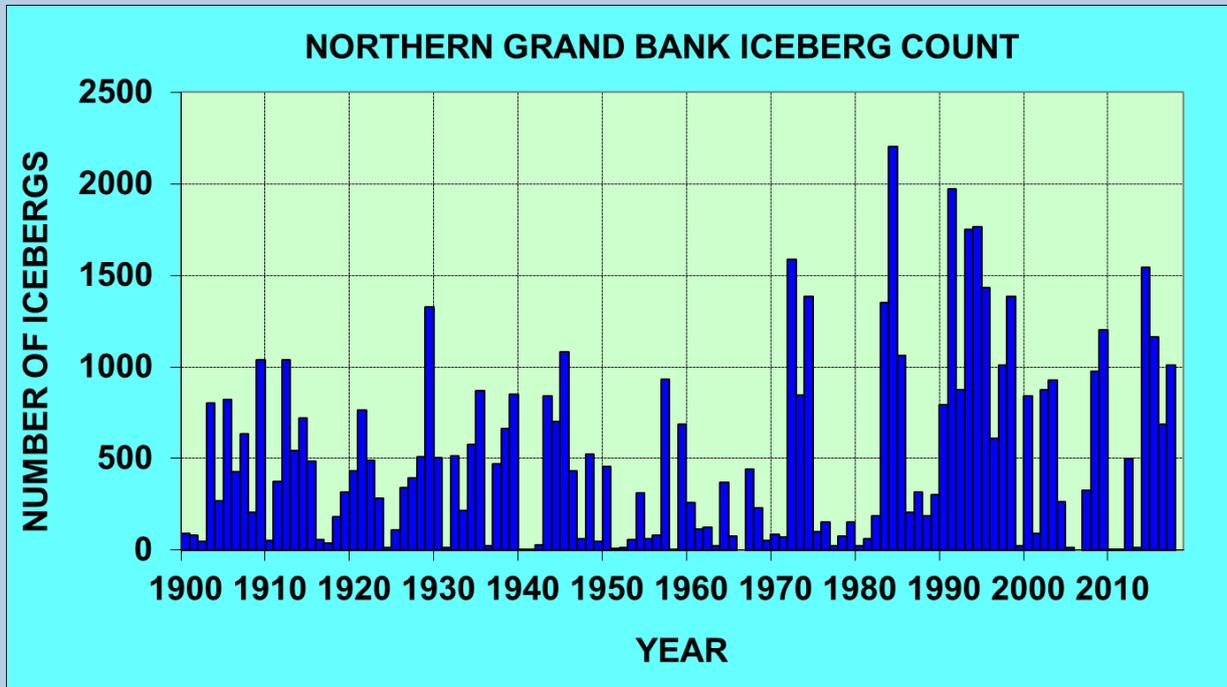


Sea-Ice extent data courtesy of I. Peterson, Bedford Institute of Oceanography.

Long Term Trends in the Number of Icebergs Crossing 47°N

In 2017 there were 1008 icebergs detected south of 48°N on the Northern Grand Bank, an increase over the 687 observed in 2016.

The highest number of icebergs normally occurs in May (over 200). In 2017 however, March and April had 282 and 383, respectively.



Data courtesy of the International Ice Patrol, US Coast Guard.

Highlights for 2017

- **The North Atlantic Oscillation index (NAO), a key indicator of climate conditions over the North Atlantic and much of the NAFO convention area, remained in a weak positive phase in 2017. As a consequence, arctic air outflow in the northwest Atlantic during the winter months moderated in 2017, compared to that in 2015 when the NAO was at a record high.**
- **The annual mean air temperature at Nuuk in West Greenland was 0.6°C above the long term mean (1981-2010) in 2017.**
- **Surface air temperatures over much of the Labrador Sea were above normal, particularly during the winter (1.6 SD) and through the fall period.**
- **Annual air temperatures over Labrador (at Cartwright) were slightly above normal (0.3°C, 0.2 SD) and over Newfoundland (at St. John's) they were near normal at 0.3°C.**
- **Overall, 2017 ranked as the 9th warmest year (air temperature) in the 117 year time series for the Scotian Shelf and Gulf of Maine. Air temperature anomalies were positive at all 6 sites examined ranging from 0.5°C (0.8 SD) above normal at Boston to 1.0°C (1.3 SD) above normal at Shearwater.**
- **Air temperatures were also warmer than average over the north eastern United States (NEUS) continental shelf, with enhanced positive anomalies in winter and fall period, similar to conditions in 2016.**
- **Sea ice extent on the NL shelf increased substantially during the winter of 2014, with the first positive (higher than normal extent) anomaly observed in 16 years, it was about normal in 2015 but returned to slightly below normal conditions in 2016 (-0.3 SD) and 2017 (-0.4 SD).**
- **There were 1008 icebergs detected south of 48°N on the Northern Grand Bank in 2017, slightly above the long term mean of 767 by 0.4 SD.**
- **Ice coverage and volume on the Scotian Shelf in 2015 were above the average, unlike the preceding four years (2010-2013) which had extremely low coverage and volume. In 2016 and again in 2017, sea ice was almost entirely absent from the Scotian Shelf.**

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E. Colbourne, J. Holden, S. Snook, S. Lewis, F. Cyr, D. Senciall, W. Bailey and J. Higdon. 2018. Physical Oceanographic Environment on the Newfoundland and Labrador Shelf in NAFO Subareas 2 and 3 during 2017. NAFO SCR. Doc. 2018/009. Serial No. N6793.

D. Hebert and R. G. Pettipas. 2018. Physical Oceanographic Conditions on the Scotian Shelf and in the eastern Gulf of Maine (NAFO Divisions 4V, W, X) during 2017. NAFO SCR. Doc. 2018/049. Serial No. N6844.



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