

Canadian Ice Service

Statement regarding

2007 Arctic Minimum Summer Sea Ice Extents

(August 29, 2007)



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The Issue

On August 9, 2007, news articles were released reporting that the Northern Hemisphere sea ice area broke the record for the smallest ice area coverage in recorded history.

According to the Cryosphere Today website (<http://arctic.atmos.uiuc.edu/cryosphere/>):

The new record came a full month before the historic summer minimum typically occurs. There is still a month or more of melt likely this year. It is therefore almost certain that the previous 2005 record will be annihilated by the final 2007 annual minima closer to the end of this summer. In previous record sea ice minima years, ice area anomalies were confined to certain sectors (N. Atlantic, Beaufort/Bering Sea, etc.). The character of 2007's sea ice melt is unique in that it is dramatic and covers the entire Arctic sector. Atlantic, Pacific and even the central Arctic sectors are showing large negative sea ice area anomalies.

The August 10, 2007 summer update for the entire Arctic Ocean, issued by the Colorado Center for Astroynamics' **Arctic Regional Ice Forecasting System** (ARIFS – <http://ccar.colorado.edu/arifs/>) at the University of Colorado says the following:

... we are now forecasting a 92% chance of setting a new record minimum this year (less than 5.57 million square kilometers).

The ice pack declined rapidly in July, and based on data available July 31, 2007, the **ARIFS model is forecasting...**

- a 92% chance that the 2007 minimum Arctic sea-ice extent will set a new record low (less than 5.57 million square kilometers).
- a 98% chance that the 2007 minimum Arctic sea-ice extent will be lower than last year's minimum ice extent (5.87 million square kilometers).
- a virtually certain chance that the 2007 minimum Arctic sea-ice extent will rank within the five lowest years on record (less than 6.05 million square kilometers).

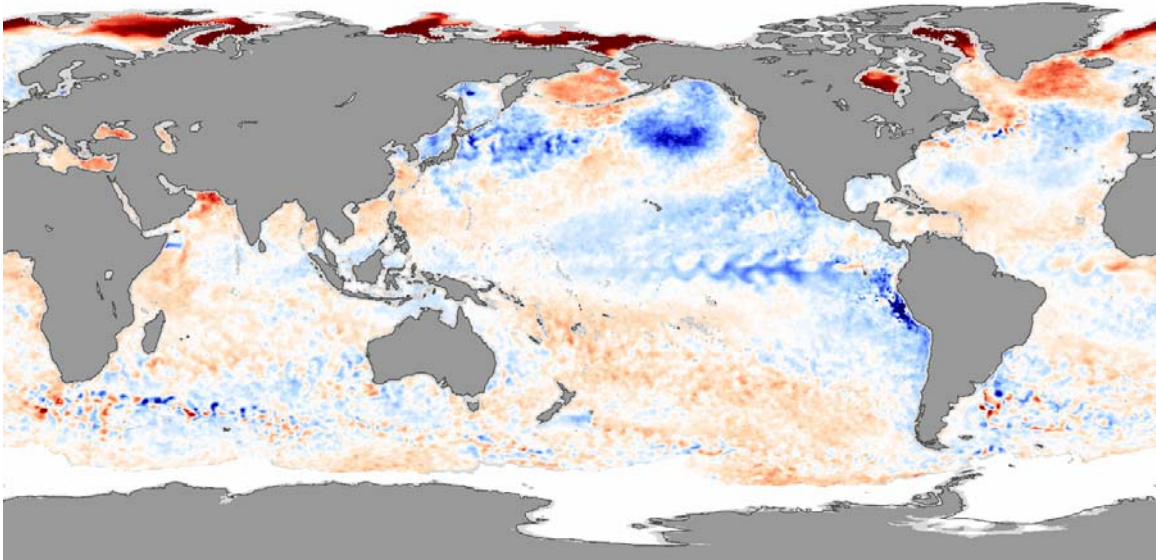
This forecast is based largely on below normal sea-ice extent in July, especially in the western Arctic (see Figure 3 below) and above-normal air temperatures over the Arctic.

See also:

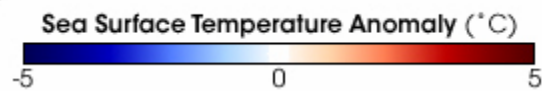
http://nsidc.org/news/press/2007_seaiceminimum/20070810_index.html.

It should be noted that the primary melt-back and loss of sea ice in the Arctic Ocean is occurring on the Russian side of the Arctic Ocean. This year, there are also strong negative sea ice anomalies in the East Siberian and Chukchi Seas related to warmer than

normal sea surface temperatures (SSTs). These warmer than normal SSTs are partially related to warm Pacific ocean water entering the area through the Bering Strait and partially due to the ice-albedo feedback, where reduced sea ice allows for increased absorption of solar radiation by surface ocean waters, leading to further melting of sea ice.



July 28 - August 4, 2007



(http://earthobservatory.nasa.gov/Newsroom/NewImages/images.php3?img_id=17732).

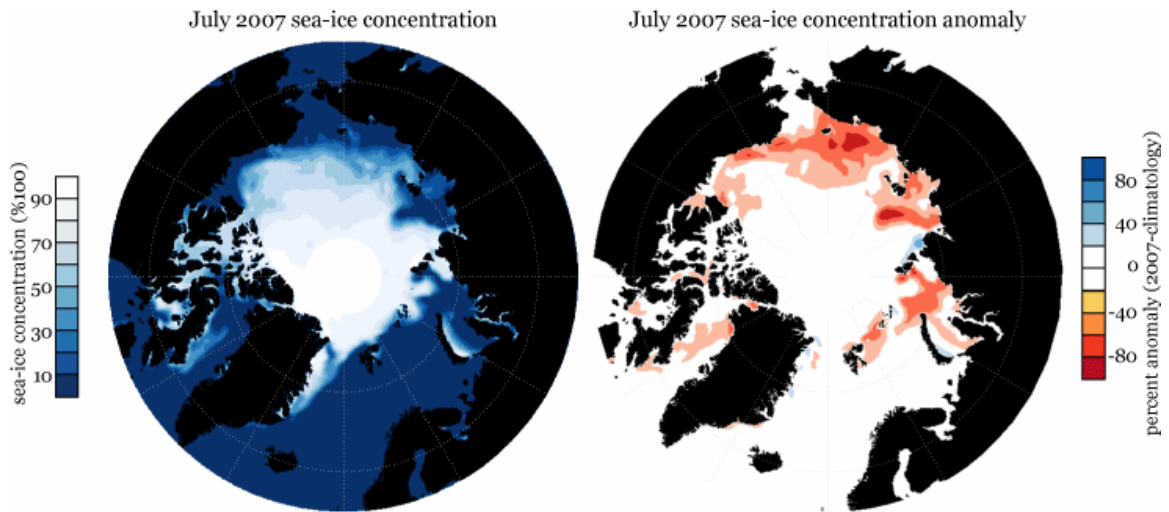


Figure 3. July 2007 sea-ice concentration and sea-ice concentration anomaly (i.e., the difference between 2007 and the 1979 - 2006 average July sea ice concentration).

(http://ccar.colorado.edu/arifs/pan_arctic.html).

The Canadian Arctic

Because of Arctic Ocean circulation patterns (related to Arctic atmospheric circulation patterns), sea ice naturally tends to “pile up” against the Canadian Arctic islands, on the eastern side of the Beaufort Sea and along the north Ellesmere Island and Greenland coasts. This is where the oldest and thickest sea ice in the Arctic is found, as well as the few remaining Arctic ice shelves.

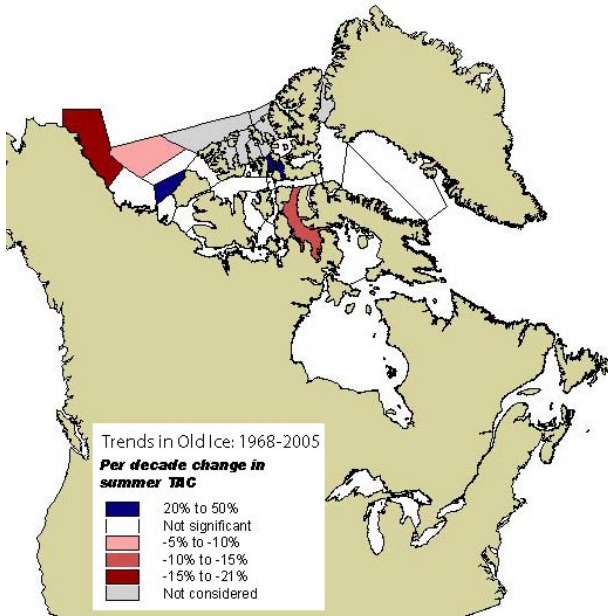
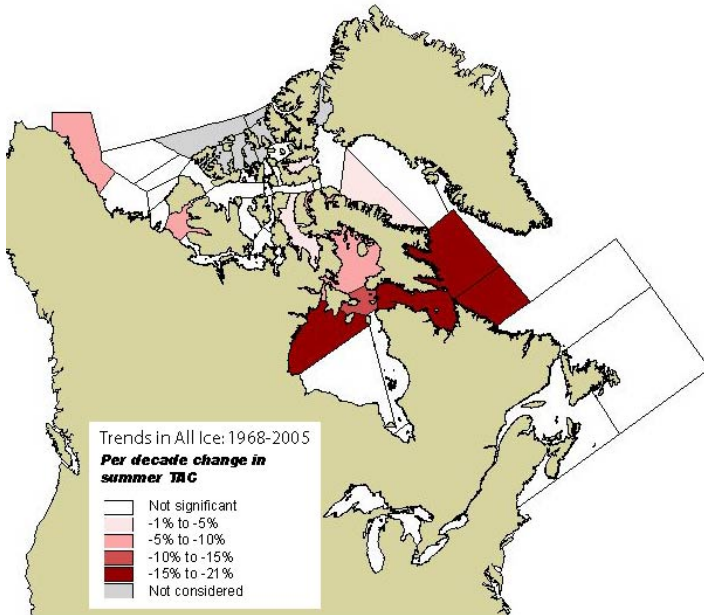


(<http://www.aquatic.uoguelph.ca/oceans/ArcticOceanWeb/Currents/maincur.htm>).

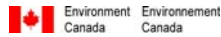
For this reason, Arctic sea ice is expected to disappear last in Canadian Arctic waters, even though the age and thickness of the sea ice have decreased even in these areas. For a model animation of this, see <http://seaice.apl.washington.edu/IceAge&Extent/>. For the associated research article, see Rigor, I.G. and J.M. Wallace. 2004. “Variations in the age of Arctic sea-ice and summer sea-ice extent.” *Geophysical Research Letters*, **31**, L09401, doi:10.1029/2004GL019492. This article can be found on the following website: (<http://seaice.apl.washington.edu/IceAge&Extent/Rigor&Wallace2004.pdf>).

While the Arctic Ocean as a whole is showing a 1979–2005 satellite-derived September sea ice extent trend of -8.4% per decade, there are differences in regional trends (Meier, W.N., J. Strove and F. Fetterer. 2007. “Whither Arctic Sea Ice? A clear signal of decline regionally, seasonally and extending beyond the satellite record.” *Annals of Glaciology*, **46**, 428–434).

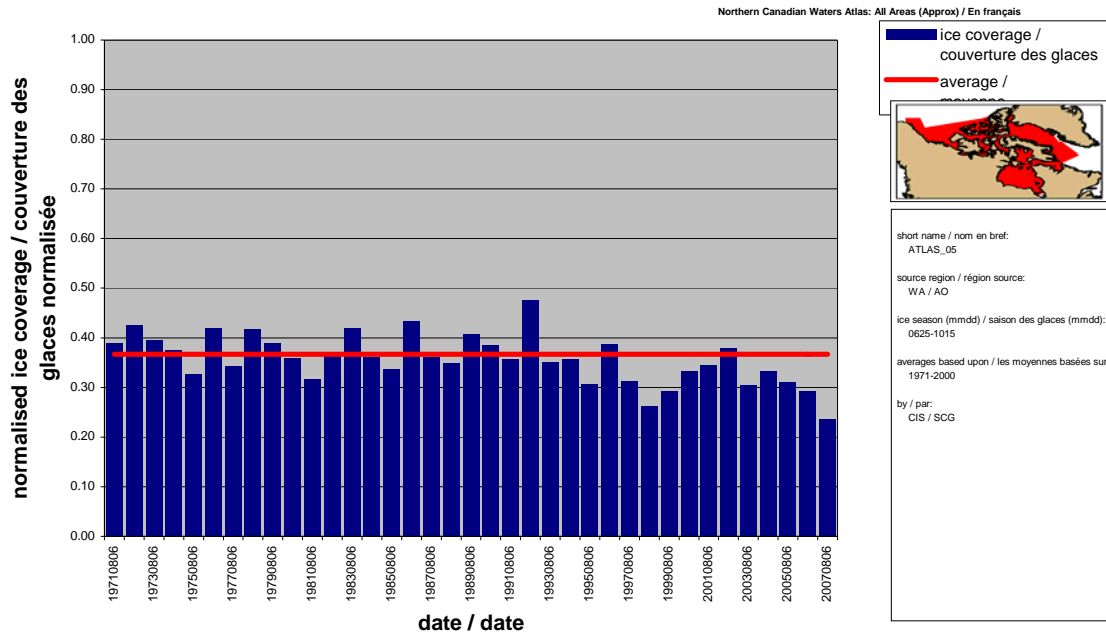
- Sea ice trend studies for the Canadian Arctic indicate that while some areas show significant negative trends, many areas do not yet display detectable trends. (Source: Tivy, A., S. Howell, B. Alt, J. Yackel, S. McCourt and T. Carrieres. 2006. “Trends and variability in summer sea ice cover in Canada’s Arctic and sub-Arctic regions, 1968–2005.” A joint University of Calgary–Canadian Ice Service poster presented at the 2006 annual American Geophysical Union meeting.)



- For the Canadian Arctic as a whole (including the southern Beaufort Sea, the Canadian Arctic Archipelago, Baffin Bay and Hudson Bay), ice coverage on August 6, 2007, was smaller than it was on August 6, 1998 (the previous record year—see graph below). However, the September minimum has not yet been reached and it is difficult to predict whether the record will be maintained to that date.



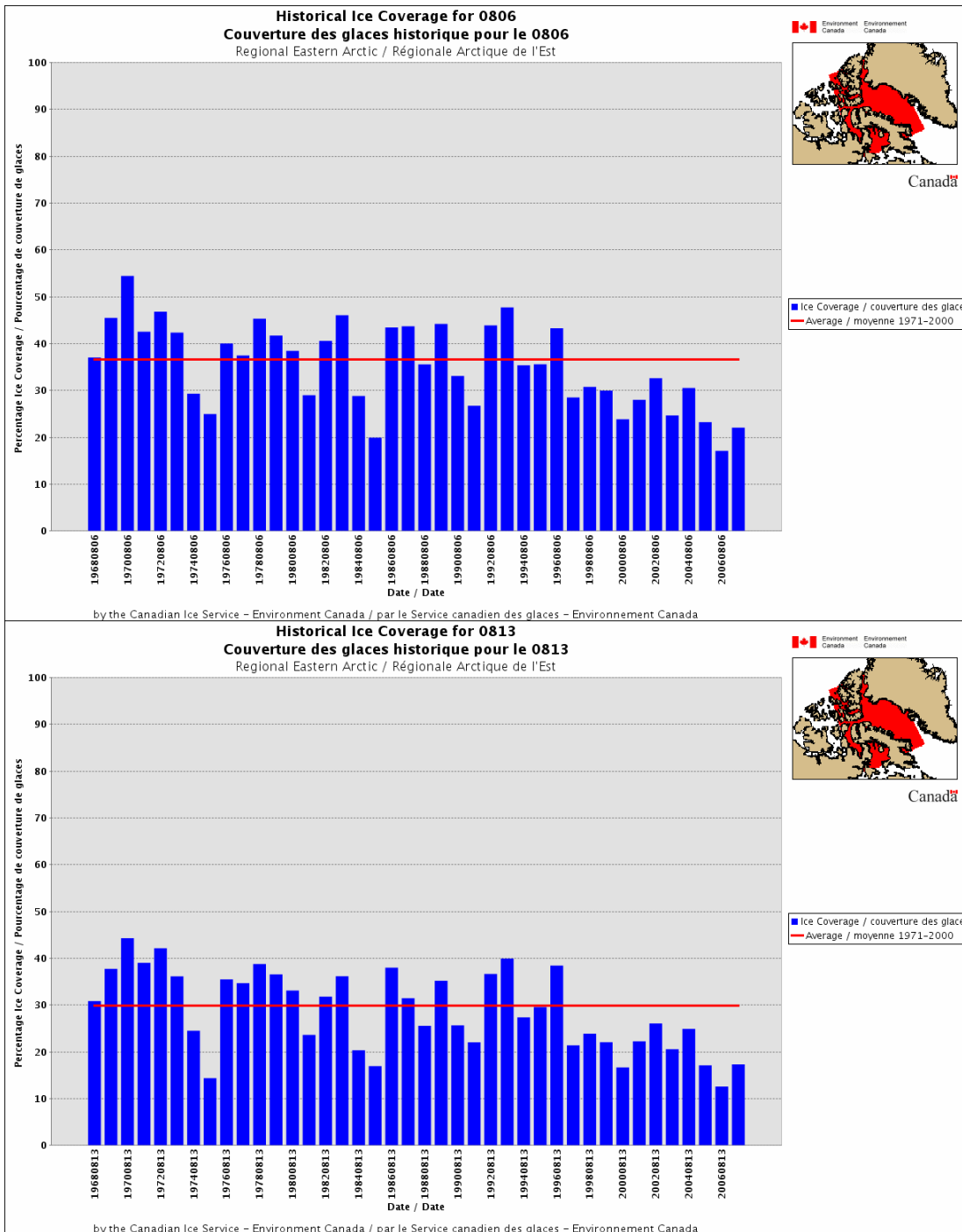
Historical Ice Coverage for 0806 / Couverture des glaces historique pour le 0806



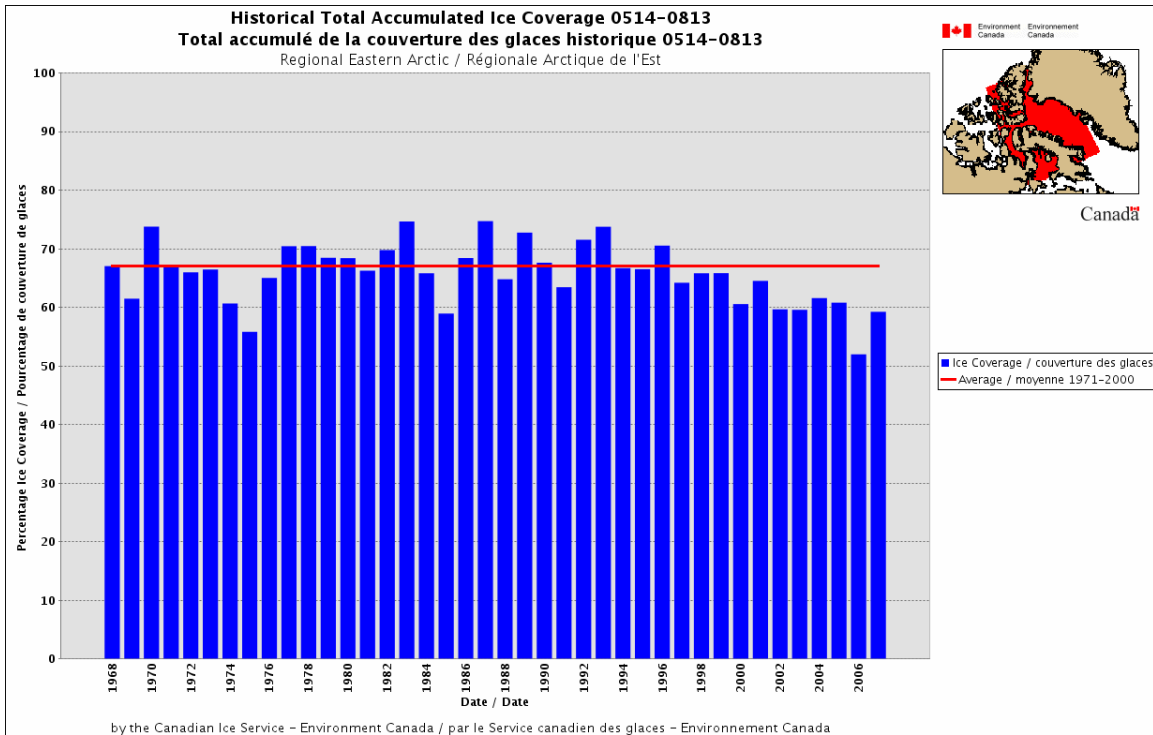
If Hudson Bay is excluded from the picture, however, as it is not truly part of the Arctic Ocean, 2007 ice coverages are not less than previous records set in 1998 (Western Arctic) and 2006 (Eastern Arctic).

Eastern Arctic

- In the Canadian Eastern Arctic, the weekly ice coverage in early August 2007 was not less than that found in early August of other years. While a decreasing trend in ice coverage can be visually detected in the graphs below from 1996 onwards, the ice coverage for both the weeks of August 6 and August 13, 2007, was greater than that which occurred in 2006.

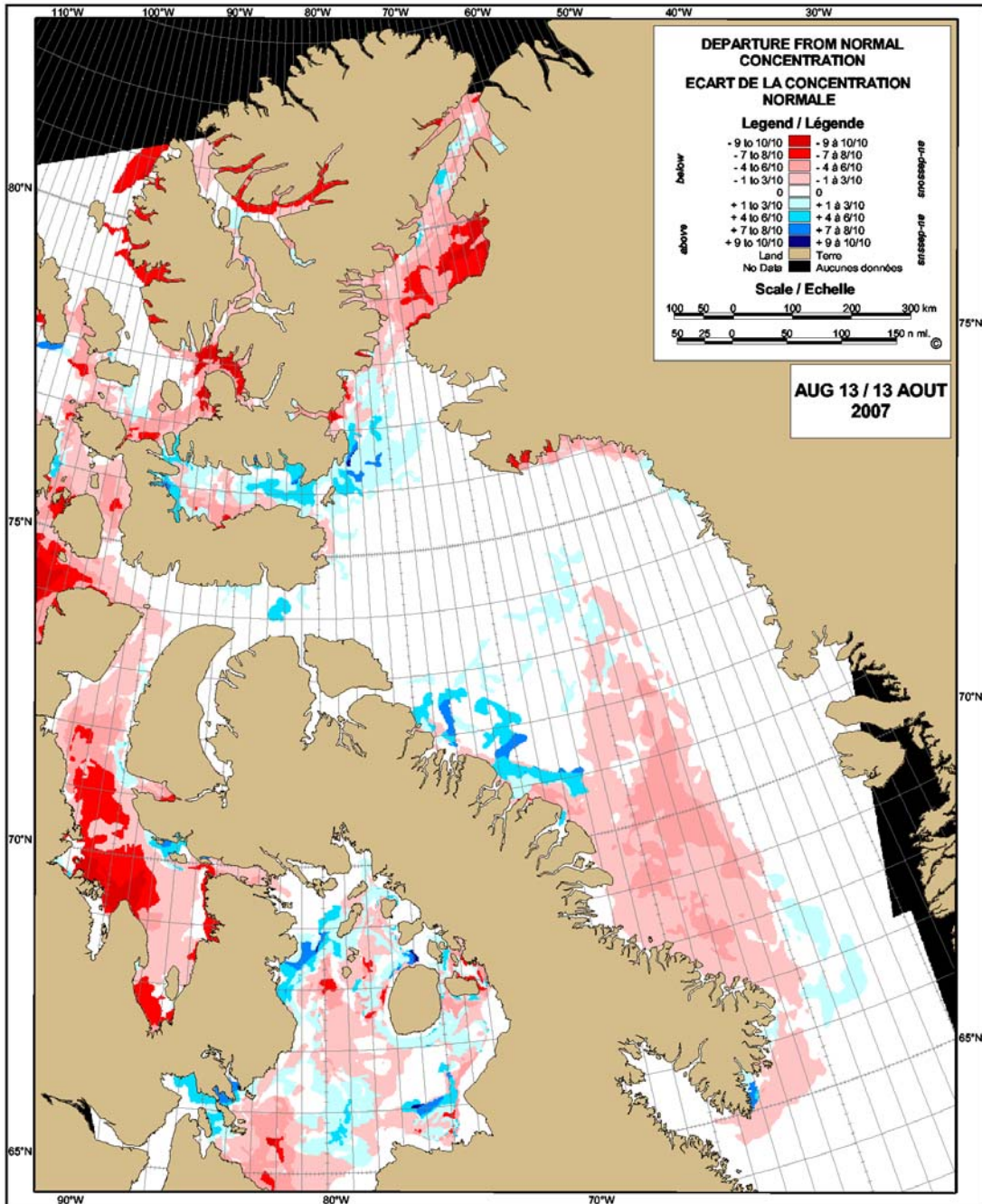


The total accumulated ice coverage graph for the period May 14–August 13 also indicates that 2007 totals will not be less than those of 2006 (although they continue to be less than the 1971–2000 normal).



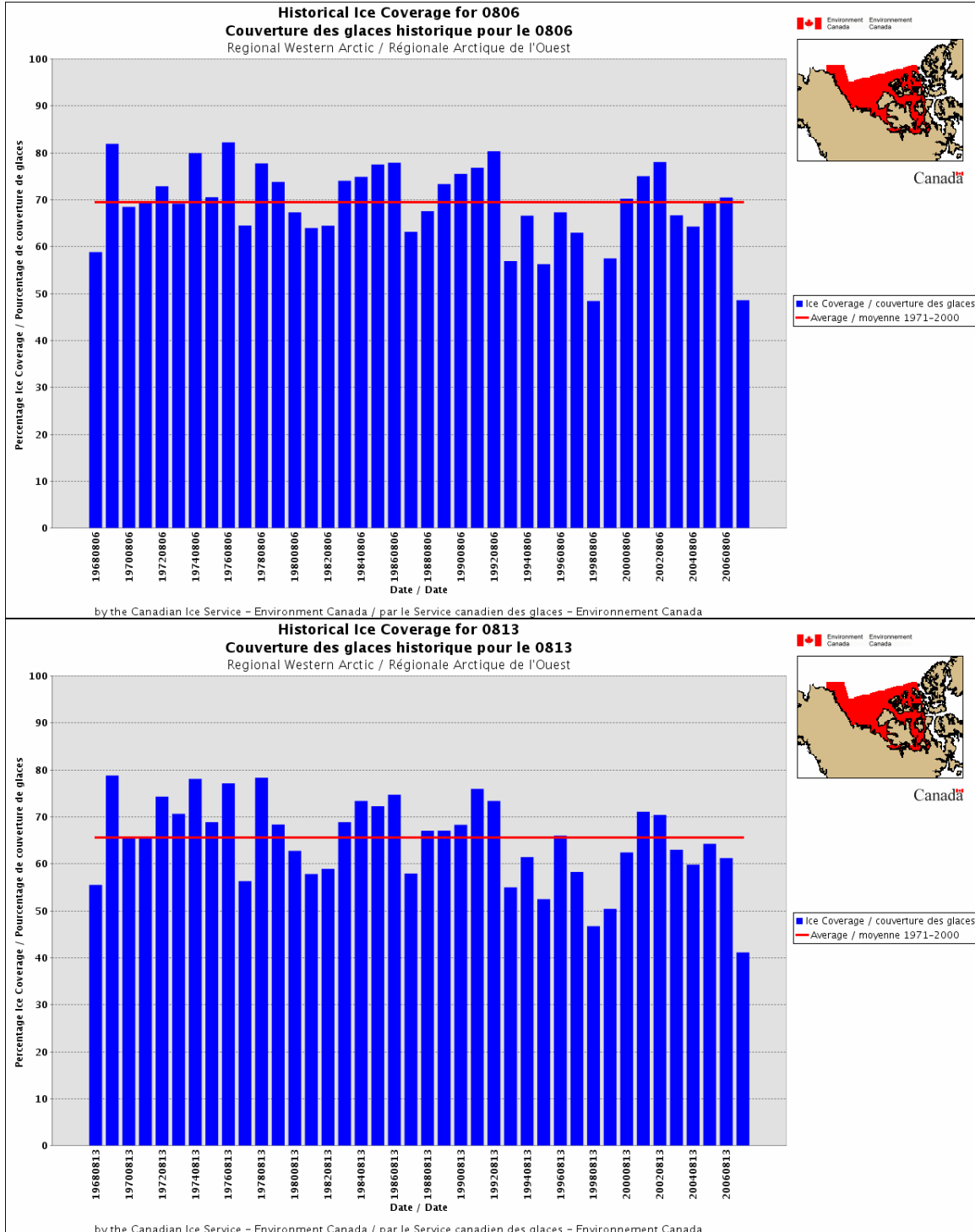
This is likely because the ice in Nares Strait (between Ellesmere Island and Greenland) did not consolidate this past winter, allowing greater than normal amounts of thick multi-year ice to pass from the Arctic Ocean into Baffin Bay, Jones Sound and Davis Strait. This ice takes longer to melt than thinner first-year ice.

The August 13, 2007 departure from normal concentration chart indicates areas of greater than normal amounts of sea ice (blue) in Baffin Bay and Jones Sound, related to this influx of multi-year ice through Nares Strait this past winter and spring.

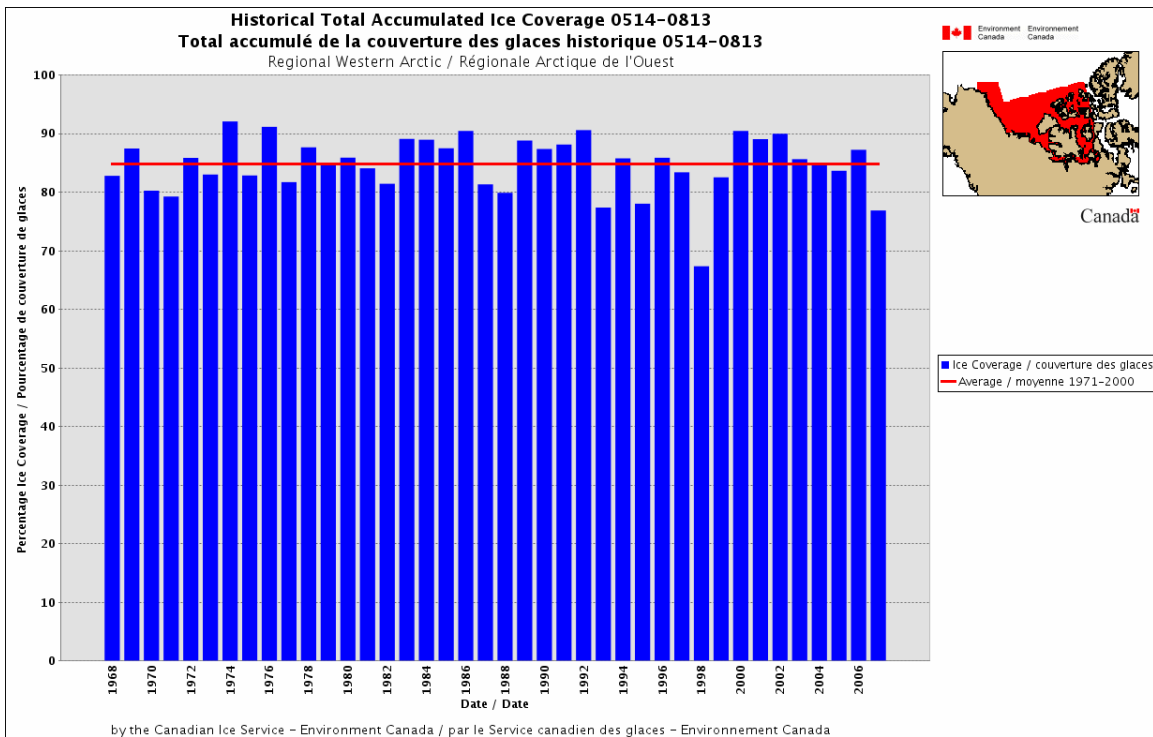


Western Arctic

- In the Canadian Western Arctic, the ice coverage for the week of August 6, 2007, was comparable to that of August 6, 1998 (the previous record minimum year), while the ice coverage for the week of August 13, 2007, was less than that of August 13, 1998.



The total accumulated ice coverage graph for the period May 14–August 13, however, indicates that 2007 totals will likely be greater than those of 1998 (although they continue to be less than the 1971–2000 normal total ice coverage).



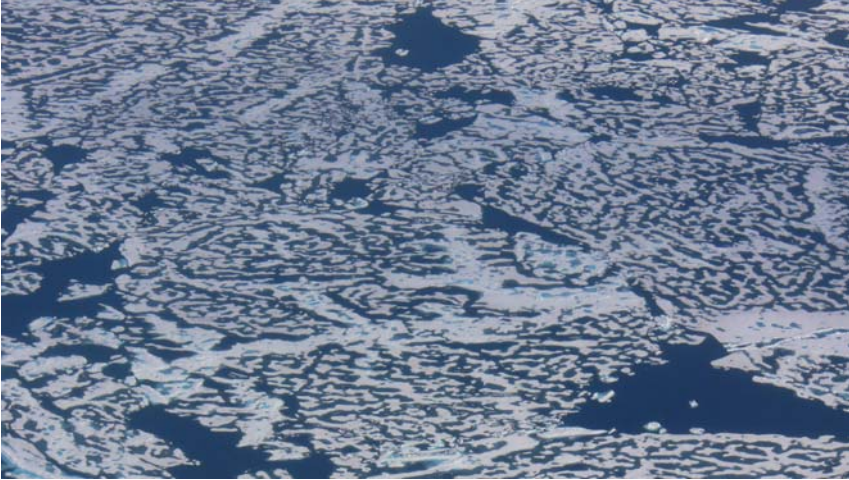
Additionally, ice reports from Canadian Coast Guard ship *Louis St. Laurent* (in the central Beaufort Sea near 80N during the weeks of August 6 and 13, 2007), indicate lower than normal amounts of **thick multi-year ice** in this area this year. They also observe that the encountered second-year and multi-year ice appears to be “rotten” or in an advanced state of melt. (The following images were taken by C-GCFR, a Canadian Coast Guard aircraft, on August 11, 2007, for Canadian Ice Service operational purposes).



76N 150W



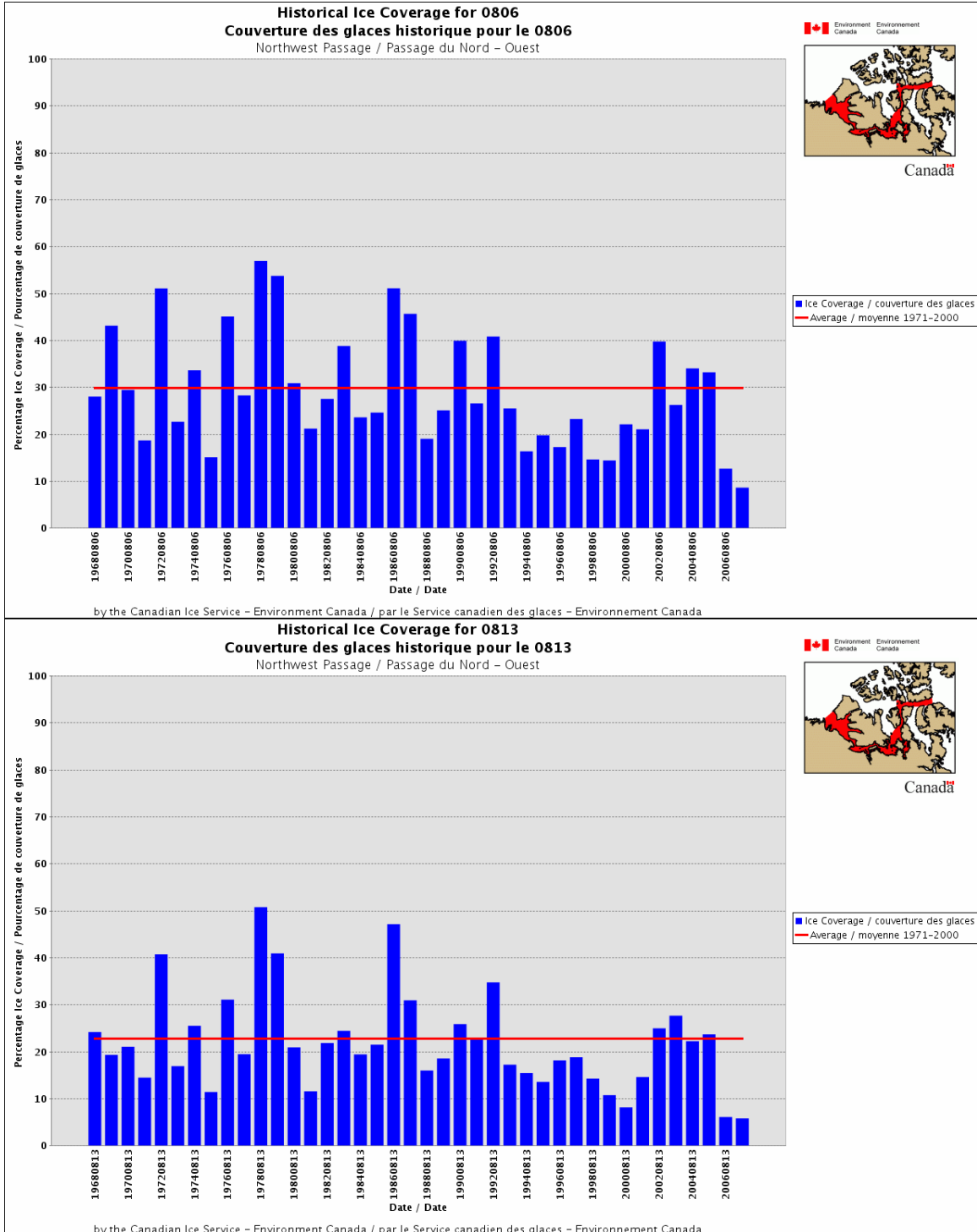
78N 150W



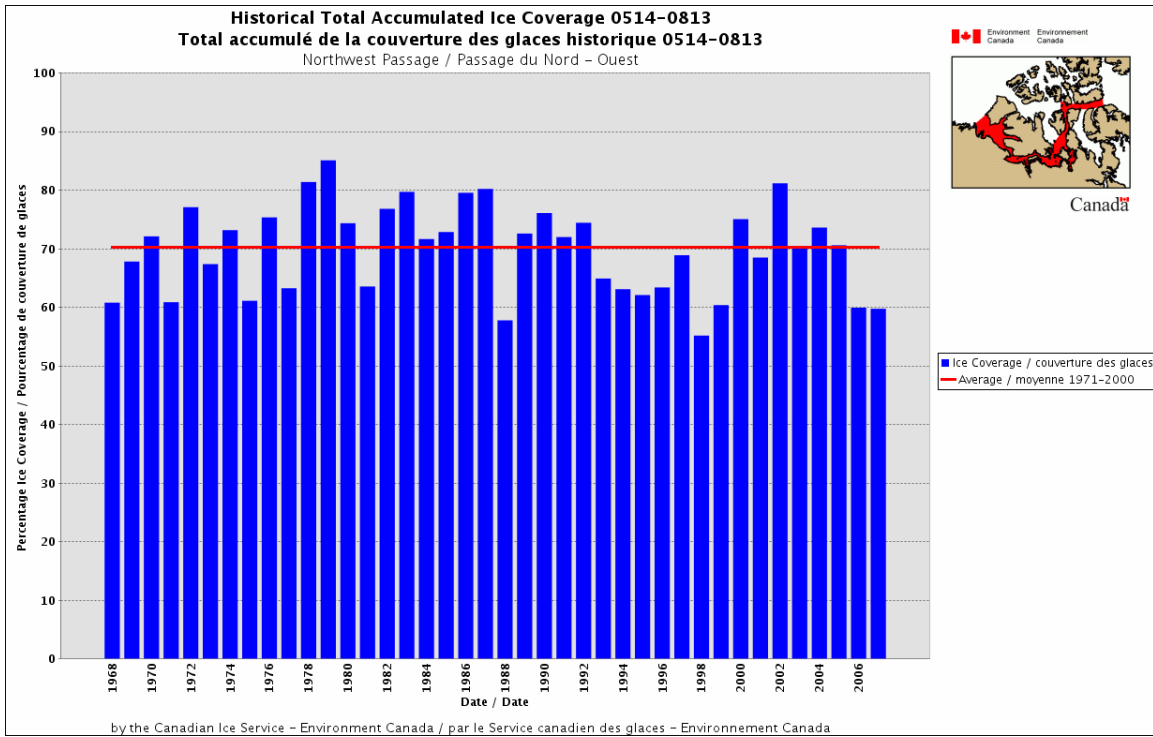
78N 150W

Northwest Passage

- In the Northwest Passage, the ice coverage for the weeks of August 6 and August 13, 2007, was less than that observed during the same two weeks for all other years in the Canadian Ice Service records (i.e., since 1968).



The total accumulated ice coverage graph for the period May 14–August 13, however, indicates that the 2007 total will likely still be greater than that of 1998 (although it continues to be less than the 1971–2000 normal total ice coverage).



Summary

Studies of the trend in sea ice extent for the Canadian Arctic indicate that while some areas show significant negative trends, many areas do not yet display detectable trends.

The often-cited previous record-year for the September sea ice minimum across the entire Arctic, that of 2005, was NOT a record minimum sea ice year in the Canadian Arctic.

The 2005 record minimum was primarily due to a loss of sea ice along the Russian Arctic coast. The 2007 summer minimum sea ice extent (now the new record) is due to a continued loss of ice in Russian Arctic coastal seas. This record loss of ice is now extending from the East Siberian and Chukchi Seas towards the Alaskan coast and is beginning to impact the Beaufort Sea.

While less than normal, present 2007 total sea ice coverage in the Western Arctic and the Northwest Passage is not less than that observed in 1998.

Total 2007 ice coverage in the Eastern Arctic is presently less than that of 1998, but not less than that of 2006, due to greater than normal amounts of thick multi-year ice that entered the area through Nares Strait in the winter and spring.

Environment Canada is predicting a warmer than normal fall in the Arctic. Additionally, sea surface temperatures in the southern Beaufort Sea and Baffin Bay continue to be warmer than normal (3–5°C above normal – see www.osdpd.noaa.gov/PSB/EPS/SST/climo.html). As a result, freeze-up in these areas could be significantly delayed, indicating that 2007 may well set record minimum ice extents in the Canadian Arctic.

Even if 2007 does not set a new record minimum sea ice extent for the Canadian Arctic, there is no doubt that this is a year of very low sea ice coverage. The departure from normal concentration charts for early-mid August show mainly less than normal concentrations.

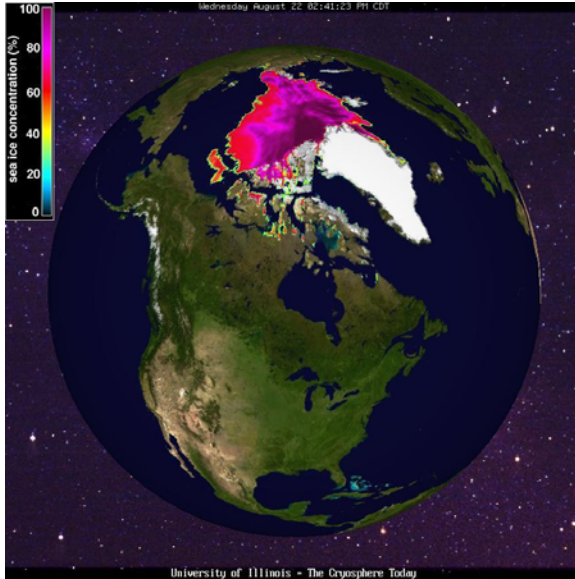
Additionally, ice reports from the Canadian Coast Guard Ship *Louis S. St. Laurent* (in the central Beaufort Sea near 80N the weeks of August 6 and 13, 2007), indicated lower than normal amounts of **multi-year ice** in this area this year. They also observed that the encountered second-year and multi-year ice appears to be “rotten” or in an advanced state of melt.

Additional Notes

- Note that the ice coverage graphs presented in this briefing can now be user-generated by anyone, using the new Ice Graph Tool on the Canadian Ice Service’s Web page: <http://ice.ec.gc.ca/IceGraph/IceGraph-GraphdesGlaces.jsf?id=11874&lang=eng> .

- It is also important to note that the news releases regarding Arctic minimum sea ice extents were based on passive microwave sensor data, which does not detect low ice concentrations as accurately as active microwave sensors do, due to lower image resolution. For this reason, ice extents analyzed with the passive microwave data (as presented on the Cryosphere Today website) will appear smaller than those analyzed by the Canadian Ice Service (which uses Radarsat data). Compare the following August 22, 2007 ice concentration analysis charts for the southern Beaufort Sea area:

Chart derived from passive microwave sensor data:



Canadian Ice Service charts derived from Radarsat imagery (active microwave sensor data):

