

Prepared by the North American Ice Service

**A collaboration of the Canadian Ice Service and
the National/Naval Ice Center**

4 December 2008

**Seasonal Outlook
Great Lakes
Winter 2008-2009**



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Great Lakes

WINTER 2008-2009

Introduction

This outlook of the expected pattern, timing, and the extent of ice growth attempts to identify areas and periods where conditions should be more or less favourable than normal. It has been developed through an analysis of the oceanographic and meteorological parameters for the summer and the fall proceeding the ice season. These conditions are compared with earlier years, the December wind and temperature forecasts plus the seasonal temperature outlook. A prediction of the ice regime is then produced. **It should be noted that significant variations of these conditions will have an impact on the timing and extent of ice formation.**

Throughout the winter, this outlook will be updated by a twice monthly issue of 30-day forecasts. These forecasts will also indicate the beginning of the spring break-up process throughout the area. Daily radio broadcasts of ice charts and forecasts will be made to support ongoing operations in the various areas where ice affects marine activity. For more information regarding the broadcast schedule, please consult the following Canadian Coast Guard web site (Appendix B - General information from the Canadian Coast Guard).

<http://www.ccg-gcc.gc.ca/mcts-sctm/ramn/docs/aa.ae/index.htm#part5>.

General Seasonal Outlook

Above normal temperatures generally characterized the summer of 2008 except near normal over Lake Ontario and Lake Superior. In September and October near normal temperatures were reported except above normal in Lake Superior. A return to warmer than normal temperatures was observed over all of the Great Lakes during the first half of November but that trend was reversed during the second half when colder than normal temperatures were the norm. ENSO (El Nino or La Nina) will not be a factor this winter season as it remains in a neutral state.

Colder than normal temperatures are generally forecast over the Great Lakes area for the month of December. For the rest of the winter months the long range temperature forecast is calling for slightly above normal temperatures.

The surface water temperature anomalies over the Great Lakes on November 26 are depicted in Figure 3. Water temperatures were near normal over Lake Superior, Lake Michigan and Lake Ontario but slightly below in the other lakes.

At the beginning of December new and thin lake ice has already formed in Black Bay, western Nipigon Bay, Chequamegon Bay as well as in shallow bays along the St Mary's River. Isolated patches of new lake ice were also present along the northern shore in Thunder Bay. Otherwise at the beginning of December ice free conditions generally prevail except open water along some sections of the shore.

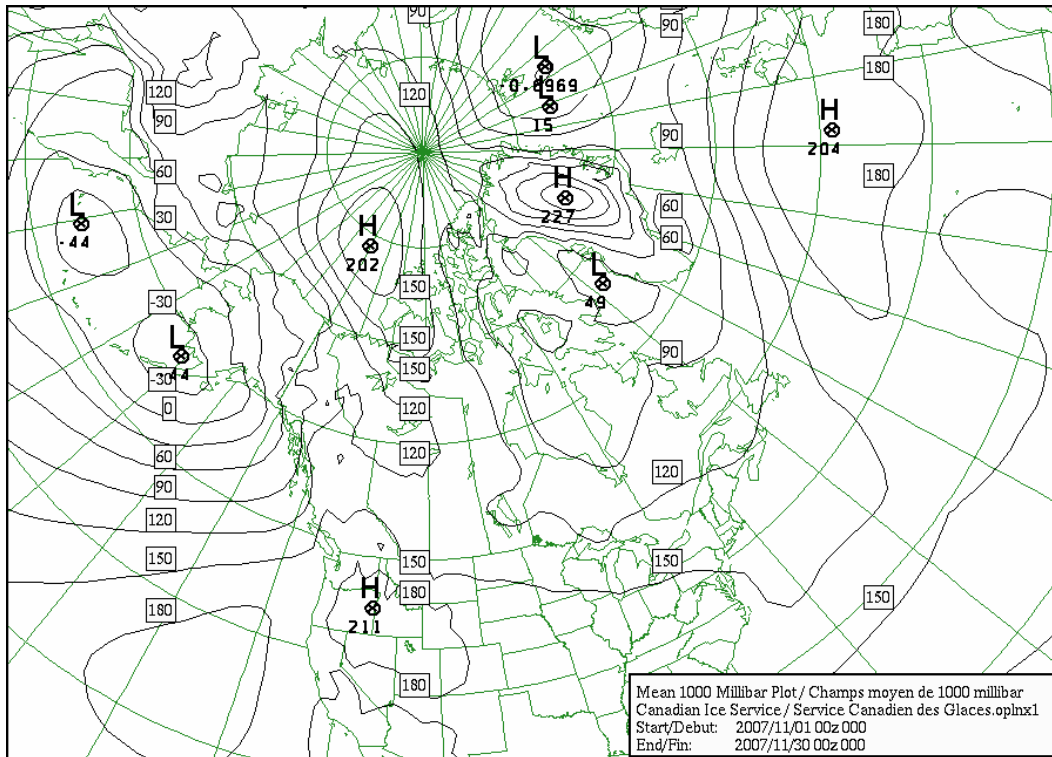


Figure 1: 1000 mbs pressure pattern – November 2008

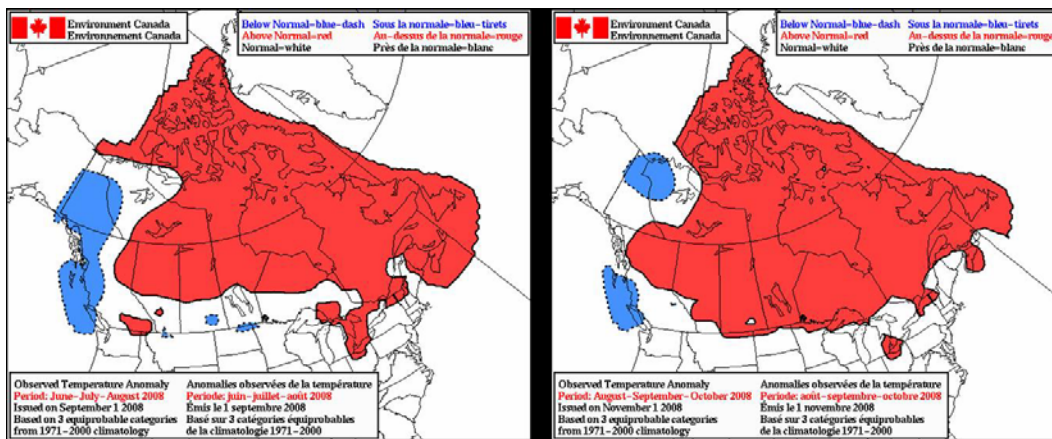


Figure 2: Temperature anomaly, June to August and September to October

Table 1: Departure from normal temperatures – November 2008

	Normal Temperatures	Observed	Departure
Duluth	-2.4	-1.4	1.0
Thunder Bay	-2.9	-1.6	1.3
Gore Bay	1.6	1.7	0.1
Sault Ste Marie	0.5	1.4	0.9
Chicago	4.4	4.3	-0.1
Wiar-ton	2.6	2.3	-0.3
Windsor	4.6	4.2	-0.4
Buffalo	4.6	4.6	0.0
Toronto	3.1	3	-0.1
Trenton	2.5	2.5	0.0
Average	1.9	2.1	0.2

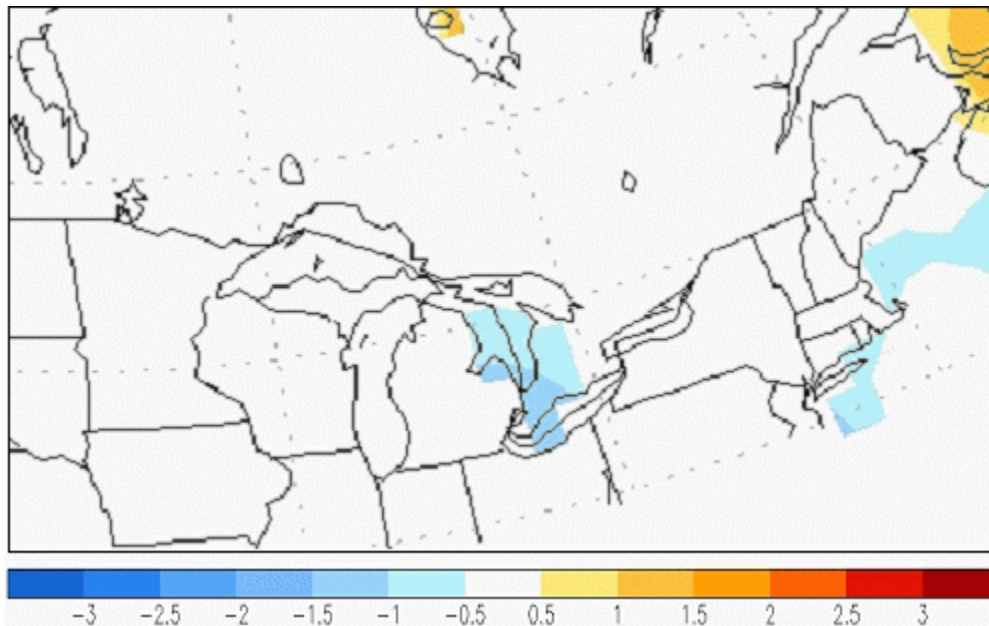


Figure 3: Water temperature anomalies – 26 November

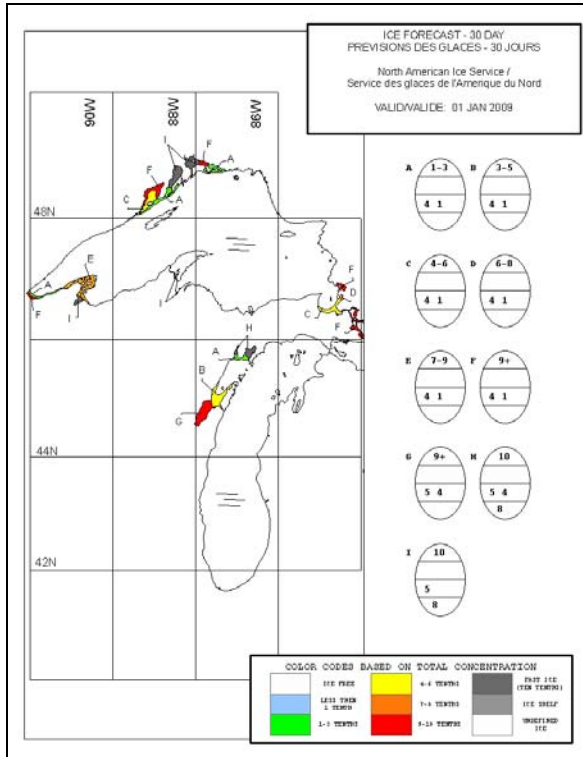


Figure 4: Expected ice conditions - Western Great Lakes - 1 January 2009

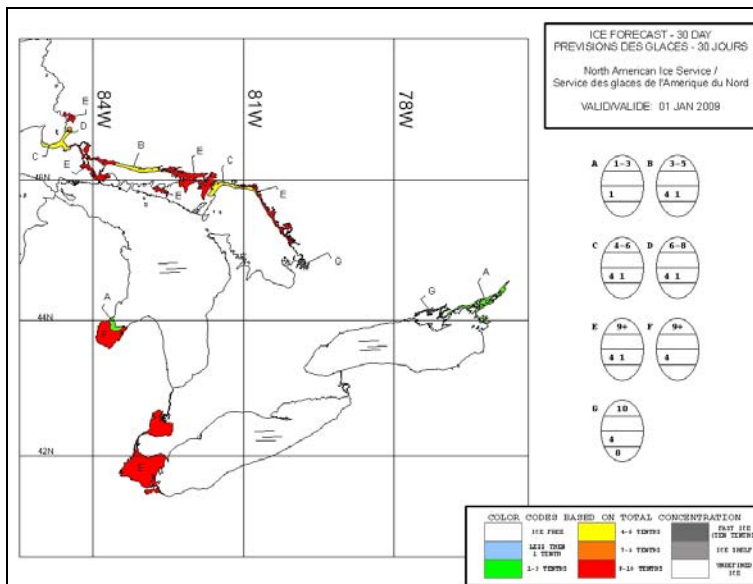


Figure 5: Expected ice conditions - Eastern Great Lakes - 1 January 2009

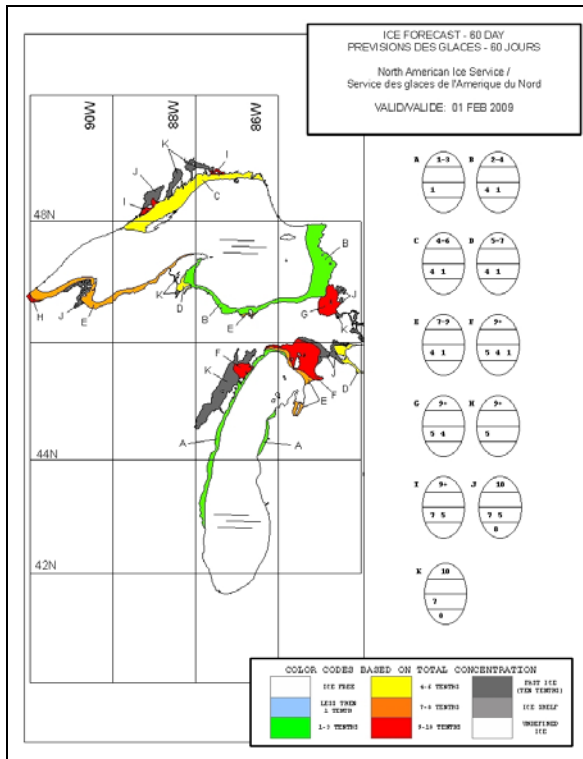


Figure 6: Expected ice conditions - Western Great Lakes - 1 February 2009

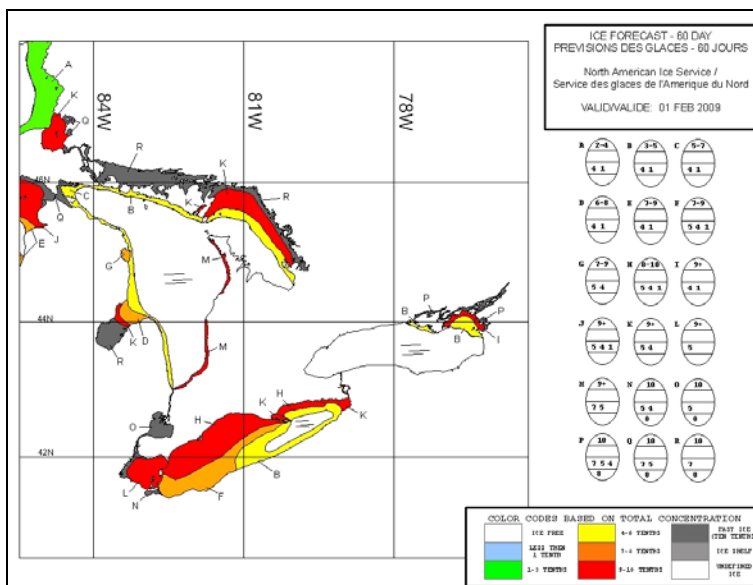


Figure 7: Expected ice conditions - Eastern Great Lakes - 1 February 2009

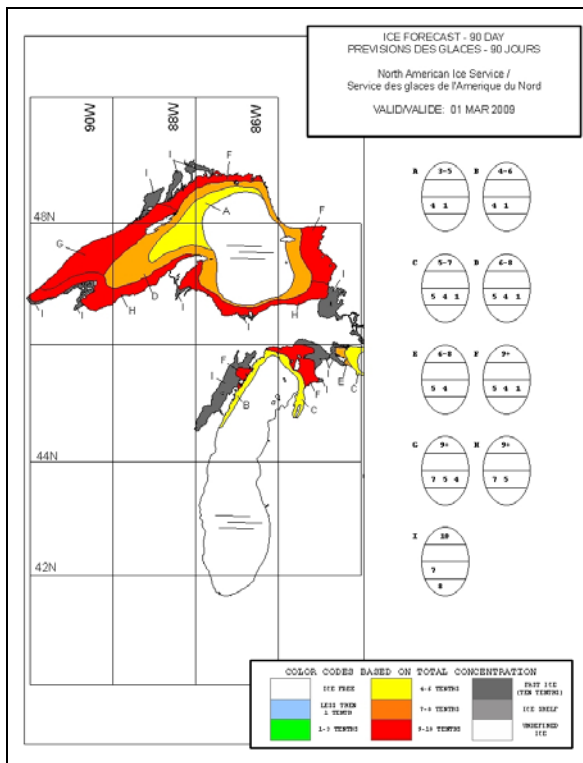


Figure 8: Expected ice conditions - Western Great Lakes - 1 March 2009

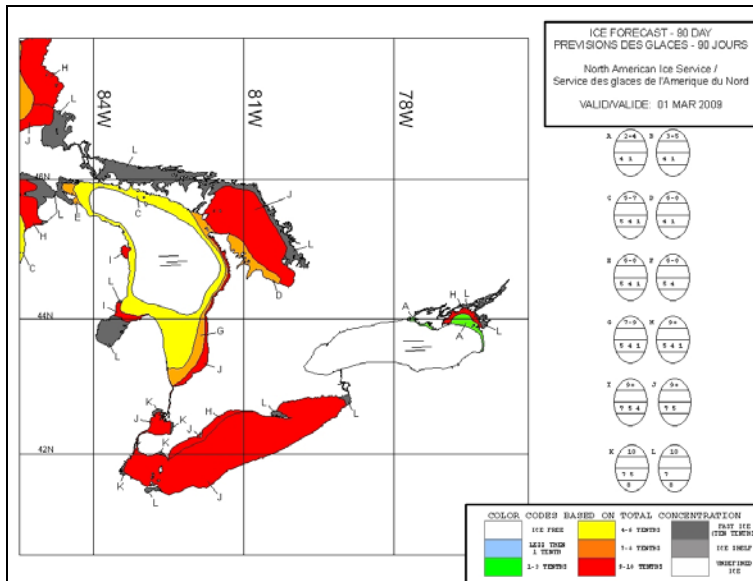


Figure 9: Expected ice conditions - Eastern Great Lakes - 1 March 2009

Lake Superior

Near the end of November the water temperatures was near normal in Lake Superior (Figure 3). Below than normal air temperatures are generally expected during the month of December.

At the beginning of December thin lake ice has already developed in Black Bay, western Nipigon Bay, Chequamegon Bay and in shallow bays along the St-Mary's River. Isolated patches of new lake ice were also present along the northern shore of Thunder Bay. Black Bay, Chequamegon Bay and western Nipigon Bay will be consolidated a few days before Christmas Day. New and thin lake ice will develop in Thunder Bay, around the Apostle Islands, near Duluth and in the shallow bays in eastern Whitefish Bay during the last week of the year. At the end of December St Mary's River will be covered with mostly thin lake ice. Otherwise at that time open water or ice free will prevail. Figure 4 indicates the expected ice conditions on January 1st, 2009.

Near to slightly above normal temperatures are forecast for January and February for Lake Superior. With a slightly earlier than normal freeze-up and near to slightly above normal temperatures ice extent and thicknesses at the end of the winter should be close to the long term average. The ice in Black Bay and Nipigon Bay will reach the thick lake ice stage during the first week of 2009. Ice in Thunder Bay will further expand and at mid-January medium and thick lake ice will be covering the bay. In addition fast ice will develop along most of its shore during the second week of the month. At mid-January thin lake ice will be found in Whitefish Bay, along much of the southern shore as well as along the northern shore east of Grand Marais. St Mary's River and the Apostle Islands area will become consolidated with medium and thick lake ice during the first and second week of January, respectively. Ice will further develop during the second half of January. The band of ice along the southern shore of Lake Superior will expand offshore especially west of Keweenaw Peninsula. Not much change in the band along the northern shore except for a little seaward expansion. In these bands thin lake ice will be predominant except medium lake ice along the southwestern shore of the lake. The ice in Whitefish Bay will thicken to reach the medium lake ice stage and the fast ice in Thunder Bay will expand to cover most of the bay during the last week of the month. The expected ice cover for February 1st is shown in Figure 6.

The band of ice along the shores of Lake Superior will continue to expand and at mid-February will extend to about 10 to 25 miles offshore except just north of Michipicoten Bay where it will be narrower. Medium and thin lake ice will be found inside the band except for thick lake ice along the southwestern shore. Whitefish Bay will become consolidated with thick lake ice near mid-February. At that time the central section of the lake will remain mostly open water. Ice will

further expand during the last two weeks of February. Thin and medium lake ice will invade the central portion of the lake west of the Keweenaw Peninsula during the third week of the month. At the end of February medium and thick lake ice will prevail along the southern shore while thinner ice will be found along most of the northern shore. At that time consolidated thick lake ice will be present in Whitefish Bay and Thunder Bay while the eastern central section of the lake remains open water. The maximum ice extent is normally reached during the first week of March. The expected ice cover for March 1st is illustrated in Figure 8.

Assuming near normal temperatures in March, break-up will proceed at its near normal pace.

Lake Michigan

Near normal water temperatures have been reported in Lake Michigan in late November (Figure 3). Air temperatures for December are forecast to average below normal for the first half of the month but near normal for the second half.

Patches of new lake ice will develop in Little and Big Bay de Noc as well as in southern Green Bay during the first weekend of December. Little new ice development is expected during the second week of December. During the third week of the month Little and Big Bay de Noc will become consolidated with thin and medium lake ice. At the end of December the section of Green Bay south of Sturgeon Bay will be covered with thin and medium lake ice. Otherwise, at the end of 2008, open water to ice free will prevail in the rest of Green Bay and in Lake Michigan. Figure 4 indicates the expected ice conditions on January 1st, 2009.

The seasonal forecast indicates near to above normal temperatures for January and February. The ice in southern Green Bay will gradually spread northward and cover the entire bay by the end of the first week of 2009. At mid-January consolidated thick lake ice will be found south of Sturgeon Bay while mobile medium lake ice prevail further north. At that time Little and Big Bay de Noc will be consolidated with thick lake ice. Ice will start to develop in the northeast end of Lake Michigan, near the entrance to the Straits of Mackinac, during the first week of January and at mid-month the area east of Beaver Island, including Little Traverse Bay, will be covered with thin lake ice. At that time the rest of Lake Michigan will be open water to ice free except for the occasional formation of new lake ice along the western shore. The consolidated ice in Green Bay will further expand and by the end of the third week of January only the entrance to the bay will remain mobile. The ice in the northeast end of the lake will expand to just southwest of Beaver Island and thicken to medium lake ice. The Straits of Mackinac itself will become consolidate with medium and thick lake ice during the last week of January. New and thin lake ice will form along

sections of the shore of the lake and in Grand Traverse Bay. Otherwise Lake Michigan will be open water except ice free in the central section. The expected ice cover for February 1st is illustrated in Figure 6.

During the first half of February, the ice in the northeast section of Lake Michigan will expand to about 15 miles southwest of Beaver Island. As well the consolidated ice near the Straits of Mackinac will expand significantly. Patchy thin lake ice will persist along the shore of the lake and in Grand Traverse Bay. Break-up will start during the second half of February and most of the thinner ice along the shore of the lake and in Grand Traverse Bay will melt before the end of the month. Little change is expected in Green Bay and in the northeast section of the lake during the last two weeks of February. Figure 8 indicates the expected ice conditions on March 1st, 2009.

With generally near normal temperatures forecast for the month of March clearing will occur as per normal.

Lake Huron and Georgian Bay

Slightly colder than normal water temperatures were observed over Lake Huron and Georgian Bay in late November (Figure 3). Colder than normal air temperature is forecast for the first half of December but a return to near normal values is expected for the second half.

New lake ice will develop along the shore in Saginaw Bay, and in shallow bays along the northeastern shore of Georgian Bay during the first weekend of December. Ice will develop in shallow bays in the North Channel during the third week of December and spread in the rest of the channel, except the central section, during the last week of the year. Saginaw Bay will be mainly ice covered with thin lake ice near Christmas Day. New and thin lake ice will form in the approaches to Midland and Sturgeon Bay just before Christmas Day and will become consolidated a week later. Otherwise at the end of December, ice free will prevail in the rest of Lake Huron except open water along the shore. The expected ice cover for January 1st is illustrated in Figure 5.

The long range temperature forecast for the months of January and February indicates near to slightly above normal temperatures. Ice will rapidly spread in the rest of Saginaw Bay and the North Channel during the first week of 2009 and both areas will be mostly consolidated with thick lake ice a week later. New and thin lake ice will develop in the Straits of Mackinac and its approaches early in the New Year and will thicken to thin with some medium lake ice by mid-January. A band of new and thin lake ice will gradually develop along the northeast coast of Georgian Bay and at mid-January will extend to about 10 to 15 miles offshore. Otherwise open water to ice free in the rest of the lake except for

narrow bands of new and thin lake ice right along the shore. Ice will continue to develop in Georgian Bay and at the end of the January the northeastern half of the bay will be covered with thin and medium lake ice. At that time southwestern Georgian Bay will be mainly open water except for medium lake ice present in the shallow bays. The ice in the Straits of Mackinac and its approaches will thicken to mostly thick lake ice and the area south and west of Bois Blanc Island will consolidate a few days before the end of January. At that time a band of mostly thin lake ice will exist along the western shore of Lake Huron. Along the eastern shore of the lake a narrow band of mostly medium and thick lake ice will be present. Open water will prevail in the center of the lake. The expected ice cover for February 1st is illustrated in Figure 7.

Little change is expected in the approaches to the Straits of Mackinac during the first half of February as ice there remains consolidated. In the northwestern end of Lake Huron thin lake ice will develop within 20 miles east of Bois Blanc Island. Ice in Georgian Bay will continue to develop and at mid-February medium with some thick lake ice will cover the bay almost entirely except for thinner and looser ice along the southwestern shore. Bands of thin lake ice along the western shore and medium and thick lake ice along the eastern shore of Lake Huron will persist. The band of ice along the shore of Lake Huron will expand slightly during the second half of February. Thick and medium lake ice will be predominant along the southern and eastern shores of the lake while thin and medium lake ice predominate along the western shore. Open water will prevail in the central section of the lake north of Point Clark. The maximum ice extent is normally reached during the last week of February. The expected ice cover for March 1st is illustrated in Figure 9.

With near normal temperature forecast for the month of March break-up will follow its normal pattern.

Lake Erie and Lake St Clair

Water temperatures near the end of November were slightly below normal over Lake Erie (Figure 3). Below normal air temperatures are generally forecast for the month of December.

During the first half of December, new lake ice will occasionally form along the shores of Lake St Clair and the Western Basin but will get destroyed rapidly in strong wind events. Otherwise generally open water to ice free conditions will prevail in Lake St Clair and Lake Erie at mid-month. Ice will start to develop in Lake St Clair and in the Western Basin around Christmas Day and by year's end these areas will be covered with thin lake ice. Otherwise at that time, ice free will prevail in Lake Erie except open water along the shore. The expected ice cover for January 1st is illustrated in Figure 5.

The temperatures over Lake Erie for January and February are expected to be near to slightly above normal. The ice in the Western Basin and in Lake St Clair will thicken to medium lake ice during the second week of 2009. Patchy new lake ice will form along the northern shore of Lake Erie, just east of the Western Basin and in Long Point Bay during the first half of January. Otherwise, at mid-month, the rest of the lake will be ice free except open water along the shore. The ice will develop rapidly in Lake Erie during the second half of January and at month's end most of the lake, as well as the Western Basin, will be covered with medium lake ice. The exception is in the southeastern section where open water or loose ice conditions will generally prevail. Lake St Clair will be consolidated with medium lake ice at the end of January. The expected ice cover for February 1st is illustrated in Figure 7.

During the first half of February Lake Erie will remain almost entirely covered with medium with some thick lake ice except for coastal leads developing in offshore wind events. At mid-February thick lake ice, mostly consolidated, will be predominant in the eastern end of the lake as well as in the Western Basin and in Lake St Clair. In general thinner ice will be found right along the northern shore of Lake Erie. Little change is expected during the third week of February as Lake Erie remains covered with medium and thick lake ice. Signs of break-up will appear especially in Lake St Clair during the last week of the month. The maximum ice extent is normally reached shortly after mid-February.

With generally near normal temperatures for March, ice melt will follow closely its normal pattern. The expected ice cover for March 1st is illustrated in Figure 9.

Lake Ontario

At the end of November water temperatures were generally near normal (Figure 3). Air temperatures over Lake Ontario are forecast to be below normal during the first half of December, climbing to slightly above during the second half.

During the first half of December ice free conditions will prevail over the entire area. New lake ice will start to develop in Bay of Quinte during the third week of December and thicken to consolidated thin lake ice near the end of the year. At that time ice free will predominate in Lake Ontario except for open water along the north-eastern shore. Patches of new lake ice will occasionally form in the western section of the Seaway. The expected ice cover for January 1st is illustrated in Figure 5.

Near to slightly above normal temperatures are forecast for January and February over Lake Ontario. Ice will gradually develop in the western end of the Seaway and along the shore in the northeast end of the lake during the first half of January. At mid-January consolidated medium lake ice will predominate in the Seaway and in Bay of Quinte while thin lake ice prevails right along the northeast shore of the lake. Otherwise ice free conditions will exist in Lake Ontario except open water in the northeast section. During the second half of January the ice in the northeast end of Lake Ontario will expand to about 20 miles offshore. Also new and thin lake ice will develop along the southwestern shore of Prince Edward County. The ice in Bay of Quinte and in the western section of the Seaway will reach the thick lake ice stage during the last week of January. At the end of January the rest of Lake Ontario will be ice free except open water along the shore. The expected ice cover for February 1st is illustrated in Figure 7.

The ice in the northeast end of Lake Ontario will expand only slightly during the first two weeks of February and at mid-month will cover an area northeast of a line from Prince Edward Point to about 10 miles east of Oswego. Narrow bands of new lake ice will occasionally form elsewhere along the shore and ice free will persist in the central section of the lake. Little change is expected during the second half of February as it is normally the time that break-up starts. The expected ice cover for March 1st is illustrated in Figure 9.

With near normal temperatures forecast for the month of March, break-up should follow a near normal trend.

Appendix

Appendix A - Stages of Development of Lake Ice

For more information on this section, please refer to the following web link on the Canadian Ice Service web site:

<http://ice-glaces.ec.gc.ca/App/WsvPageDsp.cfm?ID=11040&LnId=78&Lang=eng>

or the one at the National Ice Center web site:

http://www.natice.noaa.gov/egg_code/index.html

Appendix B - General information from the Canadian Coast Guard

General information regarding transmission times for bulletins and charts from various radio broadcast stations:

http://www.ccg-gcc.gc.ca/eng/CCG/MCTS_Radio_Aids

Appendix C - WMO (World Meteorological Organization) Colour Code

Information regarding the ice chart colour code using the WMO standard could be found at the links below:

<http://ice-glaces.ec.gc.ca/App/WsvPageDsp.cfm?ID=11500&LnId=19&Lang=eng>

<http://www.natice.noaa.gov/sigrid/index.htm>

Appendix D - Ice Services for Canadian Great Lakes Waters

In Canada, ice services are provided to shipping, fishing and in-lake operators by a co-operative effort of Environment Canada and the Department of Fisheries and Oceans. Department of Fisheries and Oceans, through the Canadian Coast Guard, provides icebreaker services and operates a seasonal Ice Operations Office at Sarnia. Canadian Ice Service of the Atmospheric Environment Service (division of Environment Canada) is responsible for gathering and generating ice information services and forecasts.

The following forecasts are issued:

Great Lakes Ice Hazard Bulletin (FICN19): A general ice description of conditions in each of the Great Lakes and, if required, a warning of hazardous ice conditions for the next 36 hours.

Twice-a-week Ice Analysis Charts and Regional Ice Chart covering a larger area are issued by the North American Ice Service. The Great Lakes Ice Analysis Charts are issued in two sections: the western portion of the Great Lakes which includes Lake Superior and Lake Michigan and the eastern portion of the Great Lakes which includes Lake Huron, Lake St Clair, Lake Erie and Lake Ontario. In addition to the distribution outlined in Appendix B, ice forecasts and bulletins and the Seasonal Outlook are available from the Canadian Ice Service website (<http://ice-glaces.ec.gc.ca>) and the National Ice Center website (<http://www.natice.noaa.gov/products/gl-ches/index.htm>). The seasonal outlook is issued once yearly then updated twice monthly by 30-day forecasts.

For further information concerning these services please contact
Canadian Ice Service by phone (613) 996-1550, facsimile (613) 947-9160 or e-mail at:

cis-scq.client@ec.gc.ca.

Or

National Ice Center by phone (301) 394-3100, facsimile (301) 394-3200 or e-mail at:

liaison@natice.noaa.gov