

***NATIONAL WEATHER SERVICE INSTRUCTION 10-330***

***APRIL 6, 2021***

***Operations and Services***

***Marine and Coastal Weather Services, NWSPD 10-3***

***OCEAN AND GREAT LAKES ICE SERVICES***

**NOTICE:** This publication is available at: <https://www.weather.gov/directives/>.

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March 23, 2021

Allison Allen  
Director

Date

Analyze, Forecast and Support Office

## Ocean and Great Lakes Ice Services

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## **1 Introduction**

This instruction describes the National Weather Service (NWS) Alaska Sea Ice Program (ASIP), Great Lakes Ice Services, and U.S. National Ice Center services.

## **2 NWS Alaska Sea Ice Program Services**

Sea ice analysis and forecast products are produced routinely throughout the year by the NWS ASIP based out of the Anchorage Weather Forecast Office (WFO) for the waters surrounding Alaska. Lake ice, river ice, and icebergs, or glacier ice detached from glaciers and floating in seawater, are excluded.

ASIP products are used by many entities around the state of Alaska and nationally for the safety of navigation and community strategic planning. The list of users includes academia and research institutions, local and state federal agencies, resupply barges, coastal subsistence hunters, gold dredgers, fisheries, and the general public.

## **3 NWS Alaska Sea Ice Program Products**

### **3.1 Sea Ice Forecast**

A 5-day Sea Ice Forecast text product will be issued three times a week on Mondays, Wednesdays, and Fridays.

#### **3.1.1 Mission Connection**

The Sea Ice Forecast is an alphanumeric product that provides a description of the current sea ice conditions and a forecast of changes to the pack ice, marginal ice zone, shorefast ice extent and sea ice free waters surrounding Alaska for the 5-day period. The Sea Ice Forecast is critical for decision support to users and partners planning safe navigation through waters routinely impacted by sea ice movement. This product is intended to provide information to assist in the protection of life and property and enhance the nation's economy.

### **3.2 Sea Ice Outlook**

The Sea Ice Outlook is a text product issued on the fourth Thursday of every month and covers the 3-months following the issue date. For instance, the January Sea Ice Outlook will include sea ice outlook information through the end of April.

#### **3.2.1 Mission Connection**

The objective of the outlook is to provide a 3-month sea ice outlook based on climate patterns and trends, current upper ocean and sea ice conditions, and historical sea ice conditions. This provides guidance for long-range decision support services for a diverse user base including commercial, government, and private users.

### **3.3 Graphic Products**

Daily issued graphic analysis products include the Sea Ice Concentration Analysis for the full ASIP domain, the Sea Ice Stage Analysis for the full ASIP domain, and the Sea Surface Temperature Analysis for the full ASIP domain. All color sea ice analysis maps are issued in

World Meteorological Organization (WMO) standard color format and meet international standards. A 5-Day Sea Ice Forecast will be issued Monday, Wednesday and Friday. Graphic products will be consistent with the concurrent Sea Ice Forecast text product. The ASIP and the NWS Ocean Prediction Center (OPC) will confer with the U.S. National Ice Center (USNIC) on difficult sea ice analyses and forecasts. The OPC will use the USNIC generated sea ice data on appropriate products and services. Products are available via various means of dissemination such as the Internet, File Transfer Protocol (ftp) email, and Marine Radio Facsimile Broadcast.

### **3.3.1 Ice Analysis**

A graphical analysis of the sea ice concentration and sea ice stage over the waters surrounding Alaska include Cook Inlet, and the Bering, the Chukchi, and Beaufort Seas. The domain of the analysis has a western boundary of 175E and the US Exclusive Economic Zone (EEZ) near the Western Aleutian Islands, a northern boundary of 80N, an eastern boundary of 135W, and a southern boundary of 50N. These graphics are produced daily in WMO standard color and grayscale charts for marine radiofax.

#### **3.3.1.1 Mission Connection**

The Ice Analysis graphical products depict sea ice concentrations, and thickness. NWS issues these Ice Analysis charts daily to assist the diverse user base making decisions and planning activities in the ice-covered waters surrounding Alaska. The information is critical for vessels to plan a safe route through waters routinely impacted by sea ice movement. This product is intended to provide information to assist in the protection of life and property and enhance the nation's economy.

#### **3.3.1.2 Cook Inlet Ice Analysis**

Detailed graphical analysis, produced daily, of the sea ice concentration and sea ice stage over the waters of the Cook Inlet.

### **3.3.2 Sea Surface Temperature Analysis**

A daily analysis, and graphical depiction of sea surface water temperatures for the areas surrounding Alaska, which includes the latest sea ice coverage.

#### **3.3.2.1 Mission Connection**

The Sea Surface Temperature Analysis is a graphic depicting sea surface temperature contours for the waters surrounding Alaska. NWS issues the product daily to provide sea surface temperature information to a diverse user base ranging from fishing vessels to the US Coast Guard. The product complements the suite of sea ice graphics issued for this region. The Sea Surface Temperature Analysis product is intended to provide information to assist in the protection of life and property and enhance the nation's economy.

### **3.3.3 Five Day Sea Ice Forecast**

A graphical 5-day forecast, produced by 3:30 PM Monday, Wednesday, and Friday, on expected changes to the ice pack, the marginal ice zone, the shorefast ice extent, and sea ice free conditions for waters surrounding Alaska.

### **3.3.3.1 Mission Connection**

The 5-Day Sea Ice Forecast is a graphic depicting forecast sea ice conditions over the waters surrounding Alaska valid at the day five period. The 5-Day Sea Ice Forecast is issued routinely and updated when necessary to serve as a decision support tool.

## **4 Marine Weather Statement**

Ice also forms in various bays and coastal areas of the 48 contiguous states. NWS may use Marine Weather Statements (MWS) to alert mariners of such conditions in their marine area if, in the forecaster's judgment, they may be hazardous to shipping.

### **4.1 Mission Connection**

MWS' provide the public with detailed marine weather information describing non-severe, but potentially hazardous conditions and provide information for a variety of conditions not covered by warnings or routine forecasts. WFOs should issue an MWS if, in the forecaster's judgment, ice conditions are forecast to be hazardous to shipping.

## **5 Great Lakes Ice Services**

Great Lakes ice services provide lake ice observations, forecasts, outlooks, and advisories during the months when ice cover on the lakes and their connecting passages impacts shipping, usually between December and April.

## **6 Great Lakes Products**

### **6.1 Great Lakes Ice Outlook**

During the ice season, WFO Cleveland will issue a 5-day ice forecast and advisory product on Monday, Wednesday, and Friday between 4 p.m. and 5 p.m. local time. The forecast will have a detailed ice discussion with a description of the formation, deterioration, coverage and movement of the ice fields, including a general description of the impact expected on shipping, shipping channels and access to ports. The ice outlook also includes a summary of the maximum forecast winds and wind direction for points on each lake for the next 60 hours as well as forecast high and low temperatures for selected port cities for the next 5 days. Supplemental data will include normal temperatures, accumulated freezing degree days, and observed ice conditions. The WFO will provide links to correlate graphical forecasts as well as supporting graphics from the Great Lakes Environmental Laboratories (GLERL) and USNIC. All forecast data should be pulled from the National Digital Forecast Database to ensure consistency.

#### **6.1.1 Mission Connection**

The Great Lakes Ice Outlooks are alphanumeric products that provide analysis, forecast, and climatological information pertaining to ice in the waters of the Great Lakes. They are critical for vessels in planning a safe route through waters routinely impacted by ice movement. These products are intended to provide information to assist in the protection of life and property and enhance the nation's economy.

## **6.2 Freeze-up Outlooks**

### **6.2.1 Great Lakes Freeze-Up Outlook**

For lakes above Lake Ontario, WFO Cleveland will issue a freeze-up outlook during the first and third week of each month from November through December depending on existing ice conditions. The outlook indicates if ice conditions are expected to occur earlier, later, or at the normal times over the lakes and should be consistent with the 30- and 90-day outlooks of the USNIC. The Outlook should include supporting data, such as selected water temperatures from water intakes and from National Oceanic and Atmospheric Administration (NOAA) data buoys.

### **6.2.2 Outlook for Freeze-up on the St. Lawrence River**

WFO Buffalo will issue an outlook for freeze-up on the St. Lawrence River at Massena, NY, during the first and third week of each month from November through December depending on existing ice conditions. The WFO may issue updates if, in the forecaster's judgment, conditions significantly differ from the current outlook. The outlook should be consistent with 30- and 90-day outlooks of the USNIC.

### **6.2.3 Great Lakes Break-up Outlook for the Opening of Navigation**

WFO Cleveland will issue this outlook once in the spring on or before March 15. This outlook should include a summary of current ice thicknesses and a listing of dates when shipping is expected to be able to navigate an area without icebreaker assistance across all the lakes.

## **7 The U.S. National Ice Center (USNIC)**

The USNIC is a joint multi-agency center comprising the U.S. Navy's Naval Meteorology and Oceanography Command, the U.S. Coast Guard's Office of Waterways and Ocean Policy and NOAA's Ocean Prediction Center (OPC) Ice Services Branch (ISB). The USNIC provides global to tactical scale ice and snow products and services to meet U.S. national interests. Products include global sea ice analysis, forecasts, and outlook; Great Lakes ice information; and products for the northeast U.S. waters affected by ice. Publicly available USNIC products are on the USNIC website (<https://usicecenter.gov/>).

### **7.1 Mission Connection**

The mission of the USNIC is to provide global, strategic, tactical, and operational ice products and services to meet requirements of U.S. national interests and U.S. government agencies. Users include academia and research, local and state federal agencies, and the public. Uses include asset allocation, safety of navigation, mission planning, protection of life and property, and enhancing the nation's economy.

### **7.2 U.S. National Ice Center Products**

This section identifies OPC ISB ice products and services. A full USNIC list of products generated at the Center, including detailed descriptions, is available in the USNIC's Product Catalog (<https://usicecenter.gov/Catalog>).

### **7.3 Great Lakes Region**

ISB, in conjunction with the Canadian Ice Service (CIS), produces various analysis and outlook products throughout the Great Lakes ice season (~November-May). ISB covers the Great Lakes, including all connecting waterways, bays, and inlets (e.g., Lake St. Clair and the Niagara River).

### **7.3.1 Great Lakes Periodic Products**

#### **7.3.1.1 North American Ice Service (NAIS) Great Lakes 15 & 30 Day Outlook**

NWS issues a regional outlook during the Great Lakes ice season depicting forecast ice concentration and stage of development. It is issued on the 15<sup>th</sup> and the last day of each month in .PDF. The outlook contains text description and corresponding graphics. See:

<https://usicecenter.gov/Products/GreatLakesOutlook>.

#### **7.3.1.2 North American Ice Service Seasonal Outlook**

NWS issues this outlook in early December. It depicts eastern and western Great Lakes expected ice concentration and stage of development throughout the season. See:

<https://usicecenter.gov/Products/GreatLakesOutlook>.

#### **7.3.1.3 North American Ice Service Seasonal Summary**

This report summarizes the Great Lakes ice season. The report is issued after the completion of the season in .PDF. See: <https://usicecenter.gov/Products/GreatLakesOutlook>.

#### **7.3.1.4 Daily Great Lakes Products**

NWS categorizes Great Lakes ice conditions into three properties: ice concentration, ice stage of development (thickness), and ice floe size. Ice conditions are determined using near real-time high-resolution imagery and available environmental observations. ISB is responsible for the analysis Tuesday through Thursday and CIS is responsible for the analysis Friday through Monday. The daily analysis is saved as a shapefile. See:

<https://usicecenter.gov/Products/GreatLakesCharts>.

#### **7.3.1.5 NAVigational TeleX (NAVTEX)**

USNIC provides the Lake Michigan NAVTEX, which consists of a brief text description of ice conditions and forecasted ice hazards issued as a radio broadcast. The Great Lakes NAVTEX is broadcast by the CIS. The NWS posts the USNIC prepared NAVTEX for Lake Michigan at:

<https://tgftp.nws.noaa.gov/data/raw/fz/fzus81.kwbc.txt>.

#### **7.3.1.6 Gridded Ice and Ice Edge Analysis**

Great Lakes ice analysis reformatted into a GRIB (GRIdded Binary) file which includes total ice concentration. It is derived from daily analysis. See:

<https://usicecenter.gov/Products/GreatLakesData>.

#### **7.3.1.7 ASCII Grid Files**

Great Lakes ASCII grid files of ice concentration at 3 resolutions: 1.275km, 1.8km, and 2.25km. Derived from daily analysis. See: <https://usicecenter.gov/Products/GreatLakesData>.

#### **7.3.1.8 North American Ice Service Graphic Charts**

Graphic charts in both black and white, and with color format are produced for the Eastern and Western Great Lakes region daily. Additional charts, to include an additional color chart, stage

of development chart, and Quality Assurance (QA) chart, are produced for CIS. See: <https://usicecenter.gov/Products/GreatLakesCharts>.

#### **7.3.1.9 ASCII List File**

Posted only to NOAA's Product, Distribution and Access system, a 1km resolution of Great Lakes ice concentration and thickest ice type. Derived from daily analysis.

#### **7.3.1.10 KMZ**

KMZ file displaying ice concentration and containing additional ice information in Sea Ice Grid (SIGRID) format. See <https://usicecenter.gov/Products/GreatLakesData>.

#### **7.3.1.11 U.S. Coast Guard (USCG) District 9 Maritime Domain Awareness**

A Graphical depiction of ice concentration and stage of development provided to USCG D9 for decision support and asset allocation. It is currently provided on Sunday, Tuesday, and Thursday throughout the Great Lakes ice season, but can be adjusted based on USCG operational needs. See: <https://usicecenter.gov/Products/GreatLakesCharts>.

### **7.4 Mid-Atlantic Region**

When significant ice is present in the Chesapeake and Delaware Bays, Chesapeake and Delaware Canal, and the Potomac River, USNIC will issue a seasonal analysis of ice concentration and other ice products.

#### **7.4.1 Mid-Atlantic Seasonal Ice Analysis**

Ice concentration analysis covering the Chesapeake and Delaware Bays, Chesapeake and Delaware Canal, Potomac, and the coast between the southern edge of the entrance to Chesapeake Bay and northern edge of the entrance to Delaware Bay. Both a graphic chart and KMZ are produced every weekday while ice is expected or observed in the analysis region. See: <https://usicecenter.gov/Products/MidAtlanticHome>.

#### **7.4.2 Mid-Atlantic Forecast**

Text forecast for ice concentration in the Chesapeake and Delaware Bays. Produced every Monday while ice is expected or observed in the analysis region. See: <https://usicecenter.gov/Products/MidAtlanticOutlook>.

### **8 Northern Hemisphere Interactive Multi-sensor Snow and Ice Mapping System (IMS)**

IMS is a twice-daily analysis of the current snow and ice cover for the Northern Hemisphere. It is produced using a combination of the highest quality/resolution imagery combined with environmental observations, giving it more precision and detail over automated products using low resolution sources. Produced in GeoTiff and GRIB2 formats at 1km and 4km resolution and ASCII format at 1km, 4km, and 24km resolutions. See: <https://usicecenter.gov/Products/ImsData>.



## **8.1        IMS Snow Depth**

Posted only to NOAA's Product, Distribution and Access system, this report is a twice-daily automated analysis of snow-depth. It is produced in GRIB2 format at 4km resolution. See: <https://usicecenter.gov/Products/ImsData>.

## APPENDIX A -Examples of Alaska Sea Ice Program Graphic Products

### Alaska Sea Ice Program Graphic Products

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### Examples of NWS Alaska Sea Ice Program Products

FZAK80 PAFC 292200  
ICEAFC

Sea Ice Advisory for Western and Arctic Alaskan Coastal Waters  
National Weather Service Anchorage Alaska  
200 PM AKDT Wednesday 29 July 2020

FORECAST VALID. Monday 3 August 2020

ANALYSIS CONFIDENCE.. High to moderate

SYNOPSIS ..Low pressure will weaken as it remains generally over the Chukchi and Beaufort Seas through Saturday, then move off to the northeast through Monday.

-Beaufort Sea-  
-Chukchi Sea-  
PKZ500-Western U.S. Arctic Offshore-  
PKZ505-Central U.S. Arctic Offshore-  
PKZ510-Eastern U.S. Arctic Offshore-

Ice covered.

-Chukchi Sea-  
PKZ230-Cape Beaufort to Point Franklin-

The main sea ice edge extends from near Utqiagvik to 72N 159.8W to 71.5N 161.7W to 72.5N 165.3W to 72N 170.4W to 70.9N 171.7W and continues in Russian waters. The ice edge is mainly open water.

FORECAST FOR THE CHUKCHI SEA (Days 1 through 5)...Generally westerly winds will persist through Saturday, then become northerly through Monday. The ice edge will mainly move eastward to southward 20 to 30nm through Monday with gradual melting continuing.

-Beaufort Sea-

PKZ235-Point Franklin to Cape Halkett-

PKZ240-Cape Halkett to Flaxman Island-

PKZ245-Flaxman Island to Demarcation Point-

The main ice edge extends from near Demarcation Point to 70.1N 142.3W to 70N 137W and continues in Canadian waters. The ice edge is mainly open water.

FORECAST FOR THE BEAUFORT SEA (Days 1 through 5)...Winds will generally be southwesterly through Friday, then may become westerly then northerly Saturday through Monday. Sea ice will drift northeastward up to 20nm through Friday, then drift back toward the Alaska coastline Saturday through Monday with gradual melting continuing.

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### **Example of Alaska Sea Ice Program Sea Ice Outlook**

FZAK30 PAFC 222322

ICOAFC

Sea Ice Outlook for Western and Arctic Alaskan Coastal Waters

National Weather Service Anchorage Alaska

321 PM AKDT Wednesday 22 July 2020

...JULY 2020 MONTHLY SEA ICE OUTLOOK...

Break-up accelerated through the month of July. The Bering Sea became ice free as remaining ice around St. Lawrence Island melted. The Chukchi Sea coast of Alaska also became sea ice free during the month of July. Away from the coast, the ice edge melted and pushed back westward as the Alaska coastal current brought warmer sea surface temperatures from the Bering Strait region. Very little ice remains along the Russian coast with the main pack ice north of Wrangel Island in the Beaufort Sea, warm water coming from the Mackenzie River Delta continues to slowly push open water westward. Shorefast ice along the north slope coast is no longer present. However, thick first year ice and multi-year ice in the area has been slow to melt. The remaining pack ice within navigational waters between Utqiagvik and Point Oliktok has melted to marginal ice zone conditions.

As we look forward through the remainder of break-up and into initial freeze-up in October, we expect break-up to continue to be faster than average over the last 20 to 30 years, but still slower than the past couple years. While there is relatively little multi-year sea ice in the Chukchi Sea, there is a considerable amount of multi-year sea ice that will likely slow down break-up somewhat in the Beaufort Sea. Air temperatures across much of Alaska are

expected to continue to be above average through October, aiding in another faster than usual break-up this summer and slower than average freeze-up in October.

Detailed information can be found in each pertinent section below.

**...BREAK-UP OUTLOOK FOR THE CHUKCHI SEA...**

From Icy Cape to Utqiagvik west to 170W, sea ice free conditions for the season during the first week of August.

North and west of Point Barrow to 75N and 170W is expected to reach 3 tenths concentration during the first week of September and be sea ice free for the season by the middle of September. However, some melting north of this area is likely to occur before this area is sea ice free due to a lack of multi-year sea ice between approximately 74N and 79N.

**...BREAK-UP OUTLOOK FOR THE BEAUFORT SEA...**

For navigational waters from Point Barrow to Cape Halkett, sea ice is expected to reach 3 tenths concentration by the first week of August and become sea ice free for the season by the third week of August.

For navigational waters from Cape Halkett to Flaxman Island, sea ice is expected to reach 3 tenths concentration during the first week of August and be sea ice free for the season during the second week of August.

For navigational waters from Flaxman Island to Demarcation Point, sea ice free conditions are expected by the second week of August.

While the southern Beaufort Sea is expected to become sea ice free south of at least 72N or 73N this season, whether or not sea ice melts back to 75N before the end of August will be highly dependent on weather patterns as well as water and atmospheric temperatures in that region this summer. It is most likely that the western Beaufort Sea will melt back quite a bit farther north than the eastern Beaufort Sea as there is much thicker sea ice in the eastern portion. If the Beaufort Sea does become sea ice free to 75N this season, it will likely be during late September or early October.

**...FREEZE-UP OUTLOOK FOR THE BEAUFORT SEA...**

Ice growth will first begin within the pack during the last week of September or first week of October.

Ice forming near the freshwater river deltas and behind barrier islands will likely start by the last week of September but could delay to the first half of October if colder air is slower to arrive.

The first new sea ice along the Beaufort Sea coast beyond barrier islands and up to 20nm offshore is expected during the first half of October. Seven tenths coverage is expected for this area during the 2nd half of October.

For Demarcation Point to Utqiagvik to 75N, ice growth is expected within the pack and expanding south of the pack by the first half of October. Merging with coastal ice is expected during the 2nd half of October.

**...FREEZE-UP OUTLOOK FOR THE CHUKCHI SEA...**

For Icy Cape to Utqiagvik the first new sea ice formation is expected along the coast during the first half of October. Seven tenths concentration is expected within navigational waters during the second half of October.

For the navigational waters around Point Barrow, seven tenths concentration is expected during the second half of October.

For Point Hope to Icy Cape, the first ice along the coast is expected during the first half of October. Greater than 3 tenths concentration within navigational waters is expected during the second half of October. Greater than 7 tenths concentration could happen by the last week of October but is more likely in November.

For the Chukchi Sea from Utqiagvik to 75N and 170W, the first new sea ice within the pack is expected by the middle of October.

For Kotzebue Sound the first sea ice is expected during the 2nd half of October. Three tenths concentration could happen during the last week of October.

For navigational waters from Cape Krusenstern to Point Hope, the first new sea ice could form by the last week of October, but is more likely in November.

For Wales to Espenberg to 20nm offshore, the first new sea ice is expected by the second half of October.

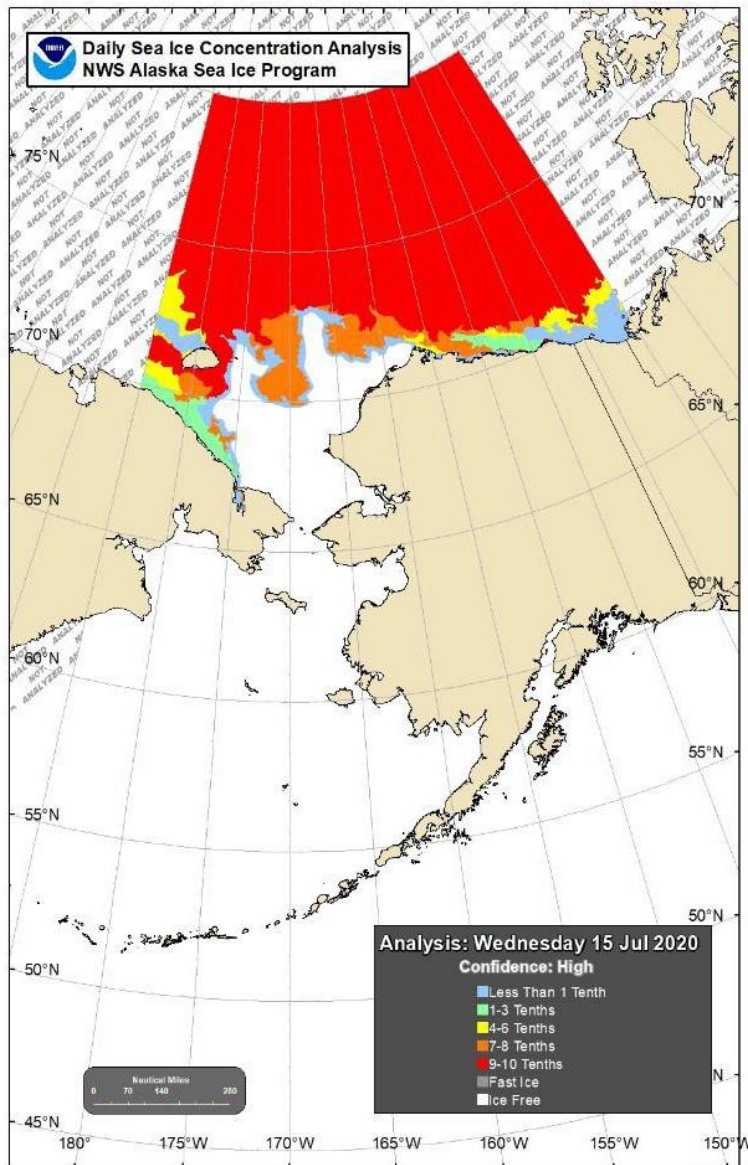
**...FREEZE-UP OUTLOOK FOR THE BERING SEA...**

The first sea ice within Norton Sound is expected during the second half of October within the protected waters of Norton Bay and Golovin Bay, but could be delayed to November based on prevailing weather.

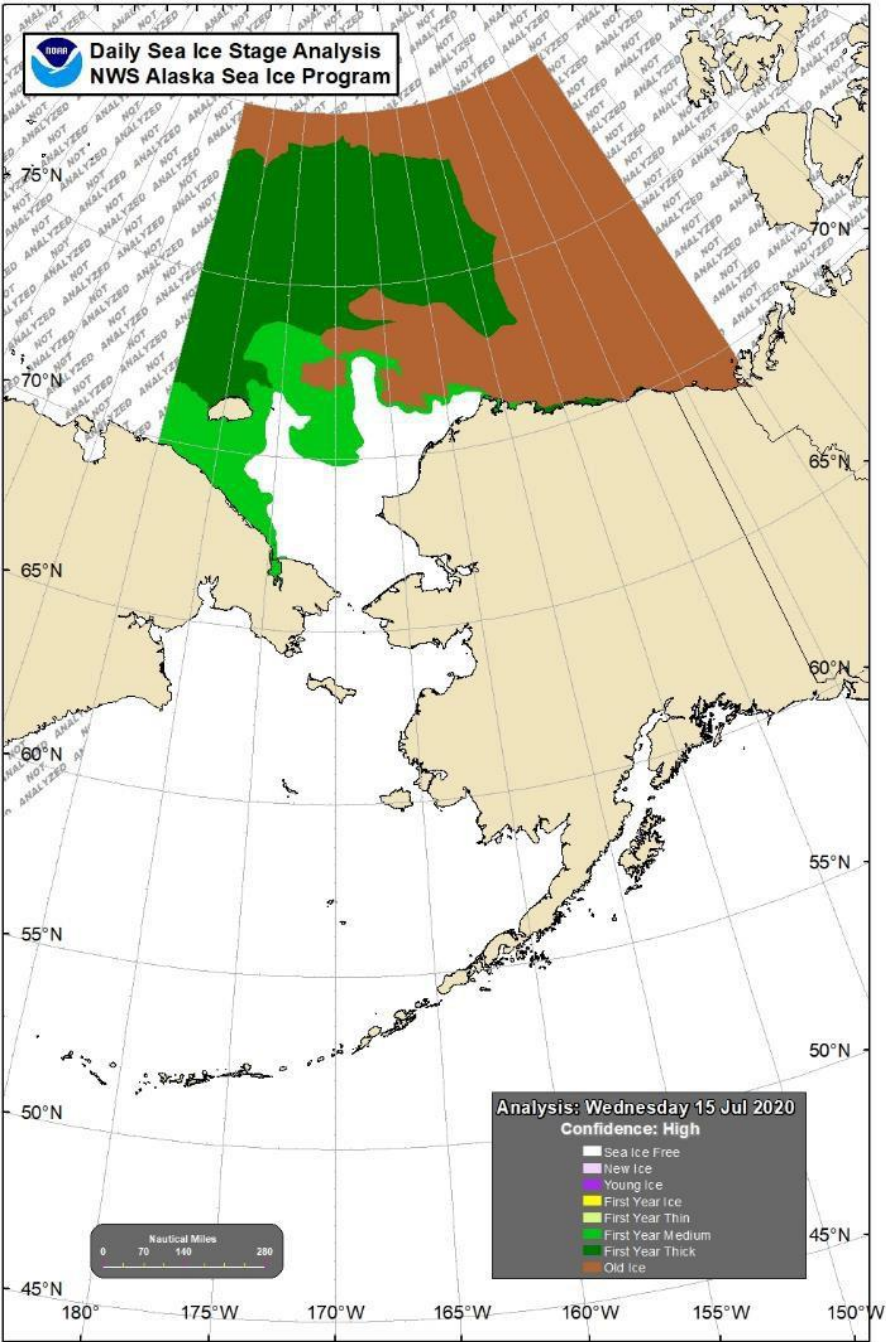
The first sea ice in the Yukon-Kuskokwim Delta could happen by the end of October but is more likely during November.

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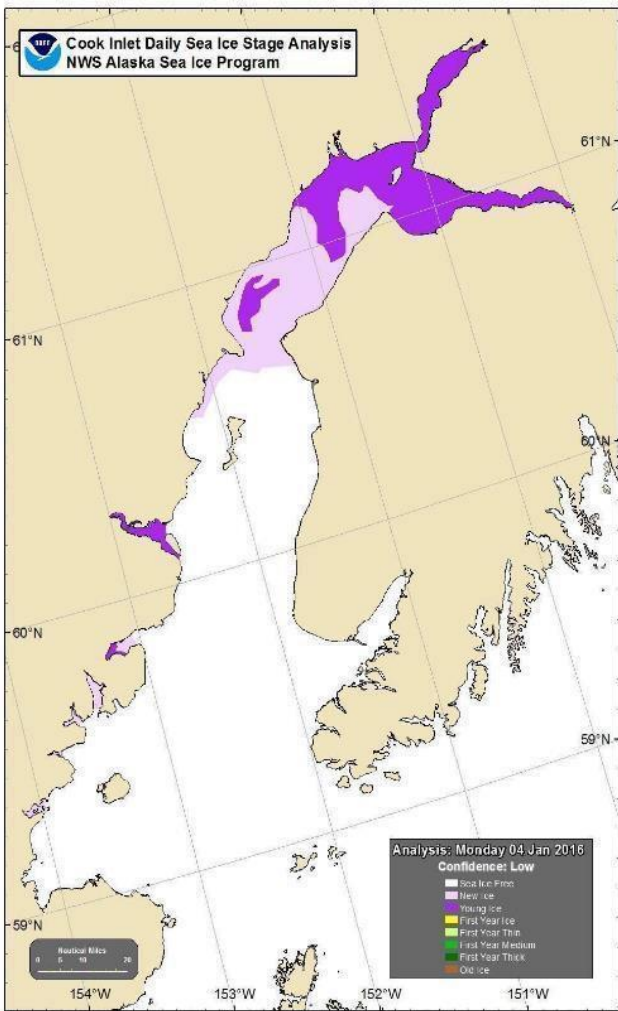
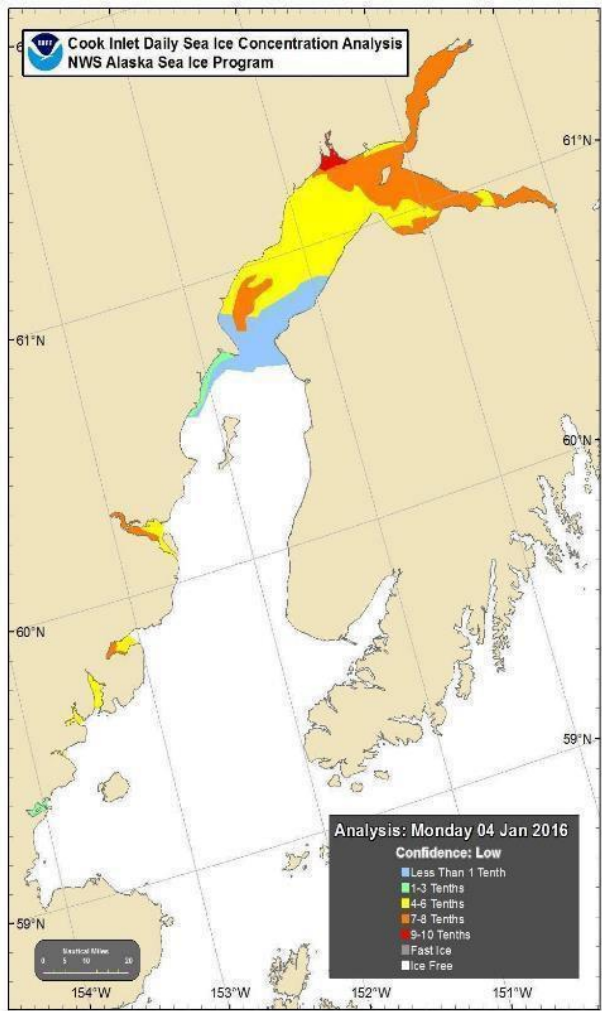
## Sea Ice Concentration Analysis



Sea Ice Stage Analysis

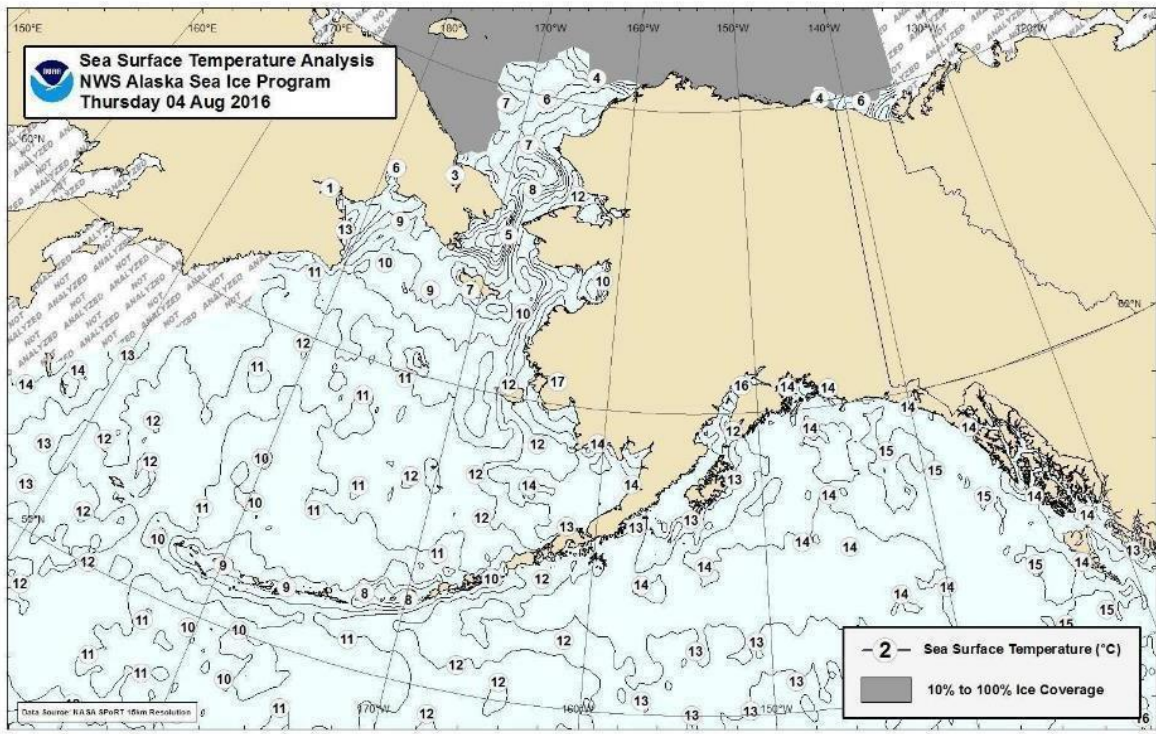


Cook Inlet Sea Ice Concentration and Stage Analysis

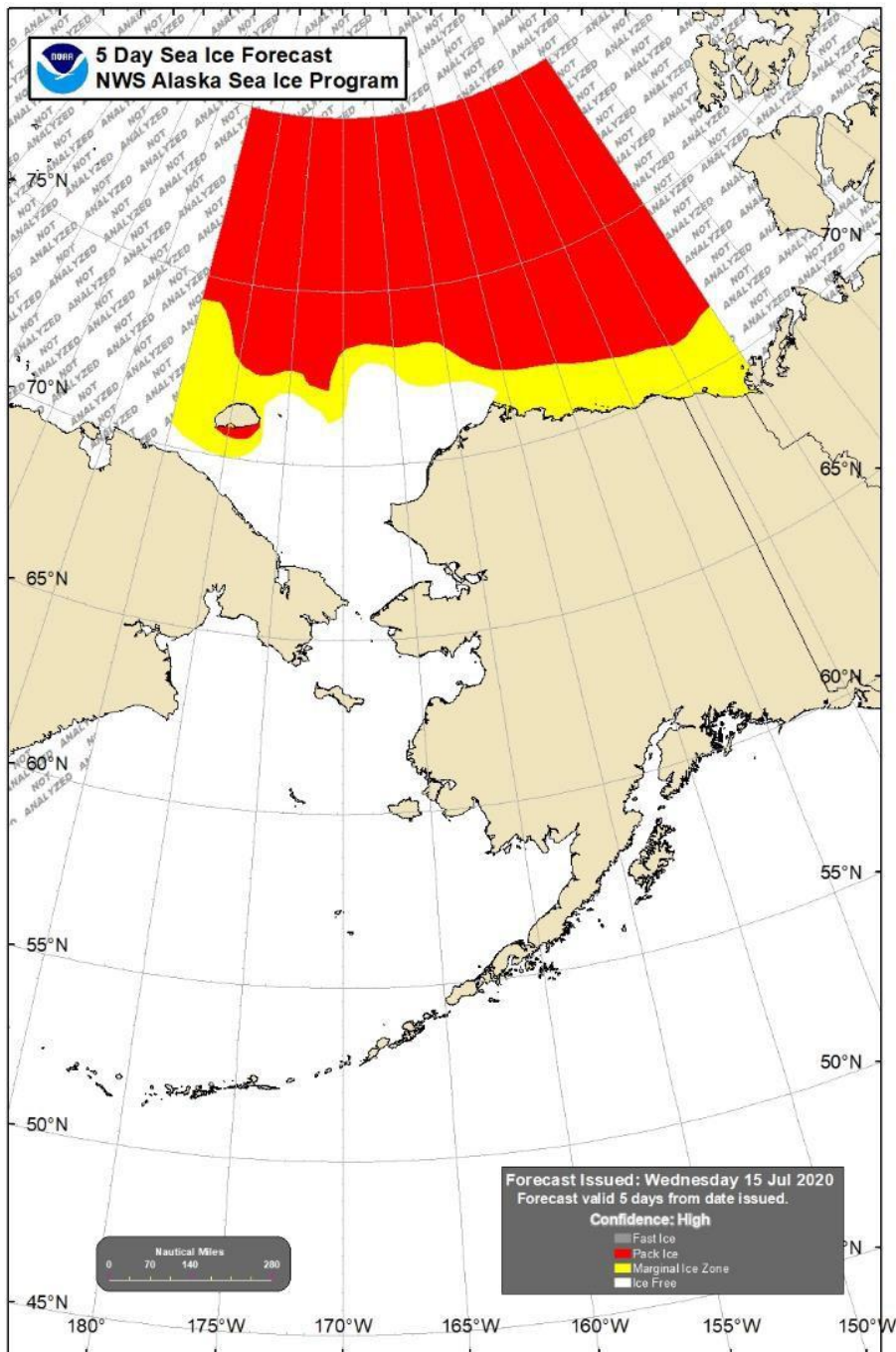




Sea Surface Temperature Analysis



## Five Day Sea Ice Forecast



## APPENDIX B - Examples of Great Lakes Products

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### Great Lakes Ice Outlook

FZUS81 KCLE 282249  
ICELIO

Great Lakes Ice Outlook  
National Weather Service Cleveland Ohio  
448 PM EST Fri Feb 27 2020

Active Watches...Warnings.. and Advisories on the Great Lakes can be Found at:  
<https://www.weather.gov/greatlakes/>.

#### 5 Day Ice Discussion...

Moderate ice growth is expected to continue through early next week across all of the great lakes as unseasonably cold arctic high pressure remains in place across the northern states. Temperatures will average 10 to 30 degrees below normal with night time low temperatures well below zero at times. The coldest air will begin to shift east of the great lakes by mid week next week.

Little open water will exist except on Lake Michigan and Lake Ontario. Any navigation elsewhere will require ice breaker assistance. Any ice breaking tracks will experience rapid refreezing.

The Great Lakes Ice Analysis Products can be Found at:  
<https://usicecenter.gov/Products/GreatLakesCharts>  
and  
<https://www.glerl.noaa.gov/data/ice/#currentConditions>.

#### Temperature Forecasts for Selected Cities (Low High Each Day):

Location	03/01	03/02	03/03	03/04	03/05	03/06
Duluth	-14 -2	-26 3	-22 6	-9 12	-2 17	7 23
Marquette	0 6	-10 7	-8 8	-5 13	1 19	11 25
Green Bay	5 14	-4 9	-9 11	-6 16	1 21	9 29
Milwaukee	16 21	10 17	5 16	4 19	9 23	16 30

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Chicago	20 25	12 20	7 17	4 19	9 25	16 33
Muskegon	11 25	6 14	2 13	-3 17	5 21	13 31
Alpena	8 18	-3 11	-4 9	-5 15	2 18	9 28
Detroit	13 32	11 17	7 16	2 20	6 23	13 29
Toledo	15 32	12 18	8 16	-1 22	5 30	14 30
Cleveland	16 34	15 19	11 17	4 20	8 29	18 32
Buffalo	5 36	17 18	7 15	5 15	8 24	12 28

A full Graphical Forecast of Great Lakes Forecast Temperatures can be found at:

<https://www.weather.gov/greatlakes/>

Maximum Forecast Wind at Each Site for the 12 Hour Fcst Period:

Location	Tonight	Saturday	Sat Ngt	Sunday	Sun Ngt
West Superior	310/10	300/10	300/10	290/10	250/16
Mid Superior	210/16	320/16	320/14	300/10	270/16
East Superior	200/18	310/18	320/18	300/10	280/14
North Michigan	200/16	330/16	320/16	360/10	320/06
South Michigan	180/16	320/16	330/16	010/10	070/08
North Huron	160/12	300/12	310/14	310/12	310/08
Mid Huron	160/12	170/12	290/10	340/12	340/08
South Huron	140/14	180/10	230/10	360/15	340/10
West Erie	140/10	200/10	240/10	350/14	020/10
East Erie	110/06	180/06	230/12	340/12	360/06
Central Ontario	150/16	170/16	190/14	310/20	340/10

A full Graphical Forecast of Forecast Winds on the Great Lakes can be found at:

<https://www.weather.gov/greatlakes/>

### Ice Observations Based on U.S. Coast Guard Reports

-----  
The Coast Guard at Duluth Reported 100 Percent Coverage with a Thickness of 28 Inches.

The Coast Guard Cutter Katmai Bay in the Lower Saint Marys River Reported 90 Percent Coverage of Ice from Pt. Aux Frenes to Sweets Point with 18 Inch Thickness.

Freezing Degree Day Accumulations at Selected Stations Compared to Normal Calculated on Fri May 23:

Location	Date	Normal	Current
-----			
Duluth, MN	Feb 27	1689	2467
Marquette, MI	Feb 27	1468	2178

**NWSI 10-330 APRIL 6, 2021**

Sau_S_Mar, MI	Feb 27	1183	1884
Green Bay, WI	Feb 27	1136	1910

**NWSI 10-330 APRIL 6, 2021**

Milwaukee, WI	Feb 27	616	1281
Chicago, IL	Feb 27	498	1171
Muskegon, MI	Feb 27	389	877
Alpena, MI	Feb 27	924	1678
Detroit, MI	Feb 27	383	998
Toledo, OH	Feb 27	387	1027
Cleveland, OH	Feb 27	194	604
Buffalo, NY	Feb 27	512	961

Normal Temps for Selected Locations Around the Great Lakes for Fri February 28:

LOCATION	HIGH	LOW
-----		
Duluth, MN	30	12
Marquette, MI	30	14
Green Bay, WI	30	12
Milwaukee, WI	38	23
Chicago, IL	42	25
Muskegon, MI	38	23
Alpena, MI	30	12
Detroit, MI	41	24
Toledo, OH	42	24
Cleveland, OH	42	26
Buffalo, NY	38	23

Note That All Web Sites Should be Entered in Your Browser Lower Case.  
\$\$

**St. Lawrence Freeze Update Outlook**

FZUS81 KBUF 172041  
ICEFBO

St. Lawrence Freeze Update Outlook  
National Weather Service Buffalo NY  
341 PM EST Sat Dec 17 2020

The Date of the First Freeze Up of the St. Lawrence River near Massena New York is forecast to be January 7th, 2012.  
\$\$

**Great Lakes Freeze Up Outlook**

FZUS81 KCLE 012055 RRA  
ICEFBO

Great Lakes Freeze Up Outlook  
National Weather Service Cleveland OH  
400 PM EST Wed 1 Nov 2020

Freeze Up in the Bays and Harbors around Lake Superior and Northern Lake Michigan will occur a little earlier than normal this year. Freeze up around Southern Lake Michigan and Northern Lake Huron will occur around the normal times while freeze up around Lake Erie and Southern Lake Huron is expected to be later than normal this winter.

The Thirty Day Outlook for November is for temperatures to average below normal around the Lakes Region.

Annual Harbor Water Temperatures Compared to Previous Years:

	2000	1999	1998	1997	1996	1995	1994
Duluth	46	42	45	46	48	46	43
Sault Ste. Marie	48	48	46	46	50	46	44
Chicago	50	53	54	50	NA	NA	NA
Muskegon	54	54	56	47	56	52	48
Alpena	51	49	51	47	49	45	44
Detroit	54	52	55	50	54	51	46
Cleveland	61	59	61	55	57	53	52
Buffalo	55	57	57	54	55	50	49

Annual Water Temperatures for the Mid Lake Areas as received from NOAA Data Buoys Compared to Previous Years:

	2000	1999	1998	1997	1996
Lake Superior					
West	44	42	43	45	45
North Central	43	43	44	44	42
East	43	46	44	45	44
Lake Michigan					
North	50	53	54	54	51
South	55	52	55	54	48
Lake Huron					
North	49	51	50	49	49
South	52	50	53	50	50

Lake Erie

West 55 NA 60 54 55

Garnet Nov 2000

## Great Lakes Break Up Outlook

FZUS81 KCLE 052055 RRA  
ICEFBO

Great Lakes Break-up Outlook  
National Weather Service Cleveland OH  
400 Pm Est Mon 5 Mar 2020

The Following are the Latest Annual Ice Thickness Reports:

Duluth	13 Inches
Marquette	12 Inches
Whitefish Bay	15 Inches
St. Marys River	14-20 Inches
Green Bay	
Escanaba	30 Inches, Remainder of Bay No Reports
Straits Mackinac	12 Inches
Saginaw Bay	8 Inches
Lake St. Clair	6-8 Inches
Western Lake Erie	6-10 Inches
Buffalo	20 Inches

Following are Expected Dates When Ice Conditions Become such that High Powered Vessels can Transit Without Icebreakers:

Duluth	April 20
Marquette	April 12
Whitefish Bay	April 16
St. Marys River	April 13
Green Bay	
Escanaba	April 7
Remainder of Bay	April 10
Straits of Mackinac	April 8
Grand Traverse Bay	March 20
Saginaw Bay	March 31
Southern Lake Huron	March 25
Lake St. Clair	March 28
Western Lake Erie	March 31
Buffalo	April 22

Brown Mar 2001



**Marine Weather Statement Example**

FZUS73 KDTX 072113

MWSDTX

LHZ421-070300-

Marine Weather Statement

National Weather Service Detroit/Pontiac MI

413 PM EST Sun 7 Jan 2020

... ICE RAPIDLY DEVELOPING IN SAGINAW BAY...

A frigid arctic high arrived a day earlier than expected across Lake Huron. Temperatures below zero have caused extensive ice growth around Bay City according to the United States Coast Guard hindering shipping into that port. Shippers in the Bay City area should be alert and contact the Coast Guard for assistance and instructions.

This statement will be updated at 10PM EST tonight.

\$\$

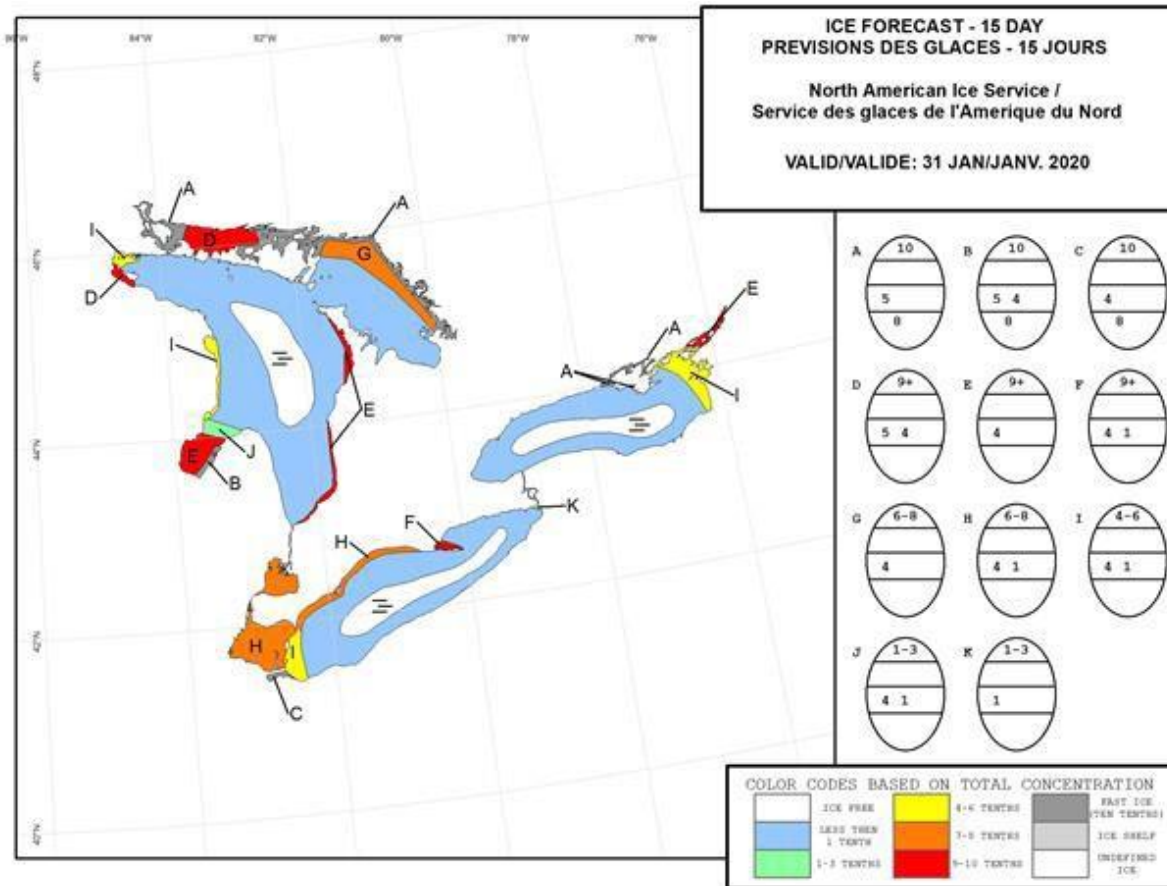
## APPENDIX C - Examples of U.S. National Ice Center Products

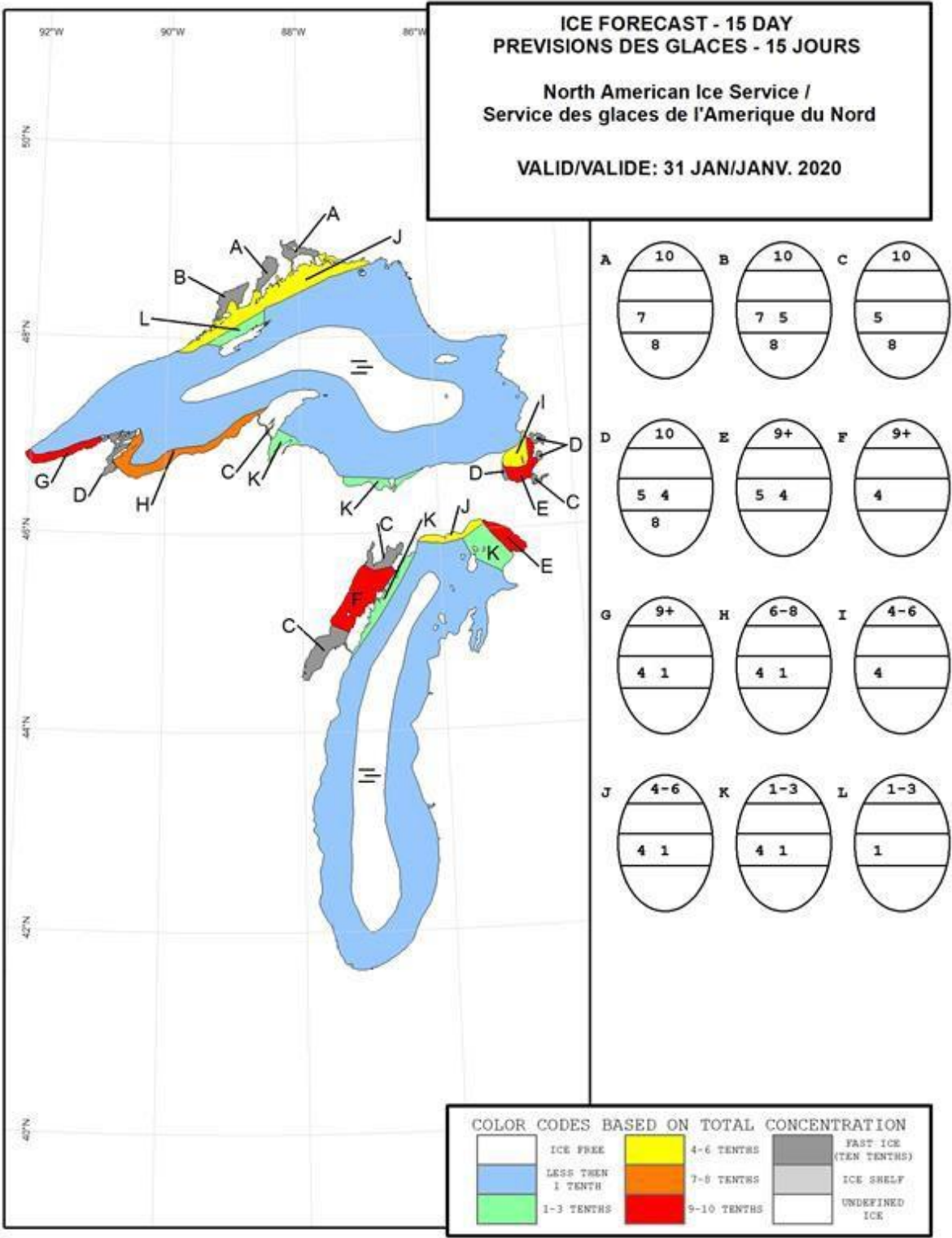
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Great Lakes 15 Day Outlook (two graphics)	C-2
Great Lakes 30 Day Outlook (two graphics)	C-4
North American Ice Service Seasonal Outlook (two graphics)	C-6
North American Ice Service Seasonal Summary	C-7
Daily Great Lakes Products	C-8
Great Lakes ice conditions (two graphics)	C-8
NAVTEX	C-10
ASCII Grid Files	C-11
1.275km, 1.8km, and 2.25km. Derived from daily analysis.	C-11
ASCII List File	C-12
KMZ file displaying ice concentration and containing additional ice information in Sea Ice Grid (SIGRID) format.	C-13
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## Great Lakes Region

### Great Lakes 15 Day Outlook (two graphics)

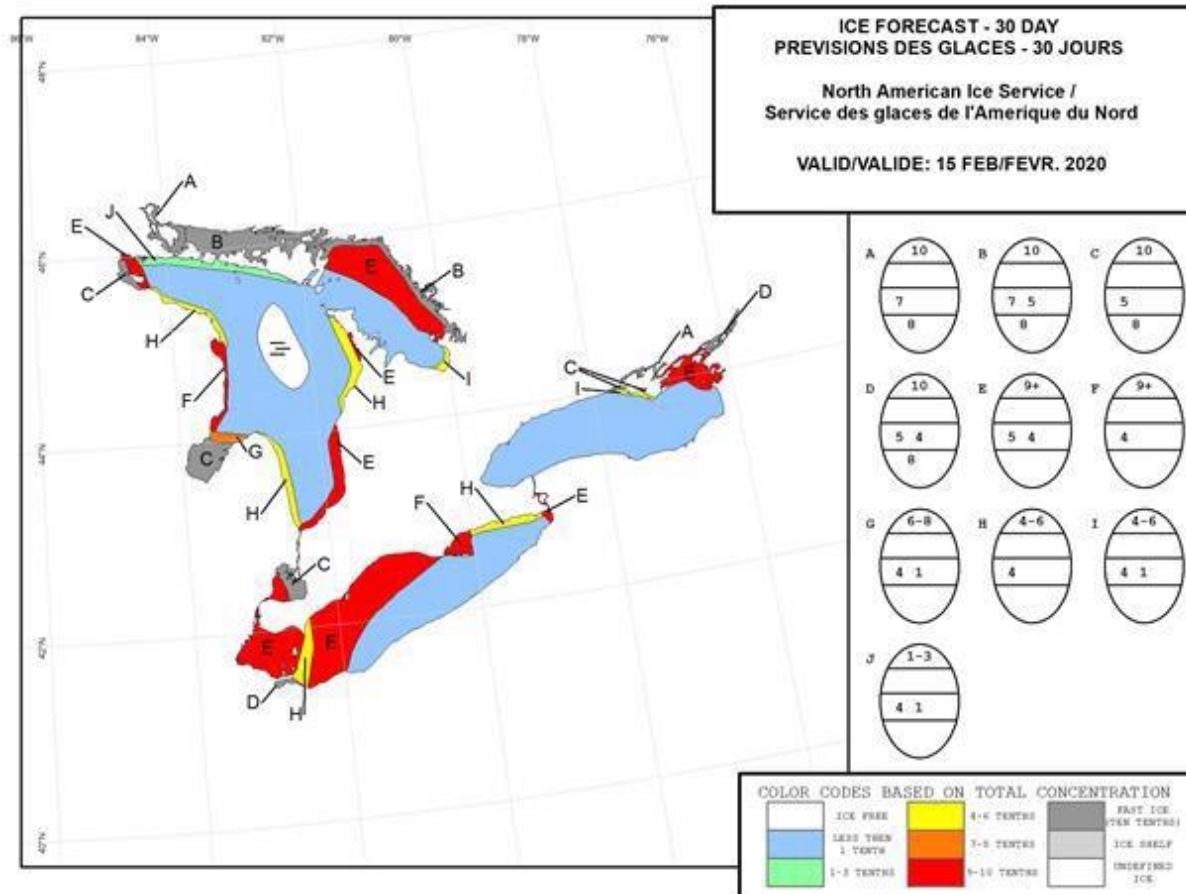
<https://usicecenter.gov/Products/GreatLakesOutlook>

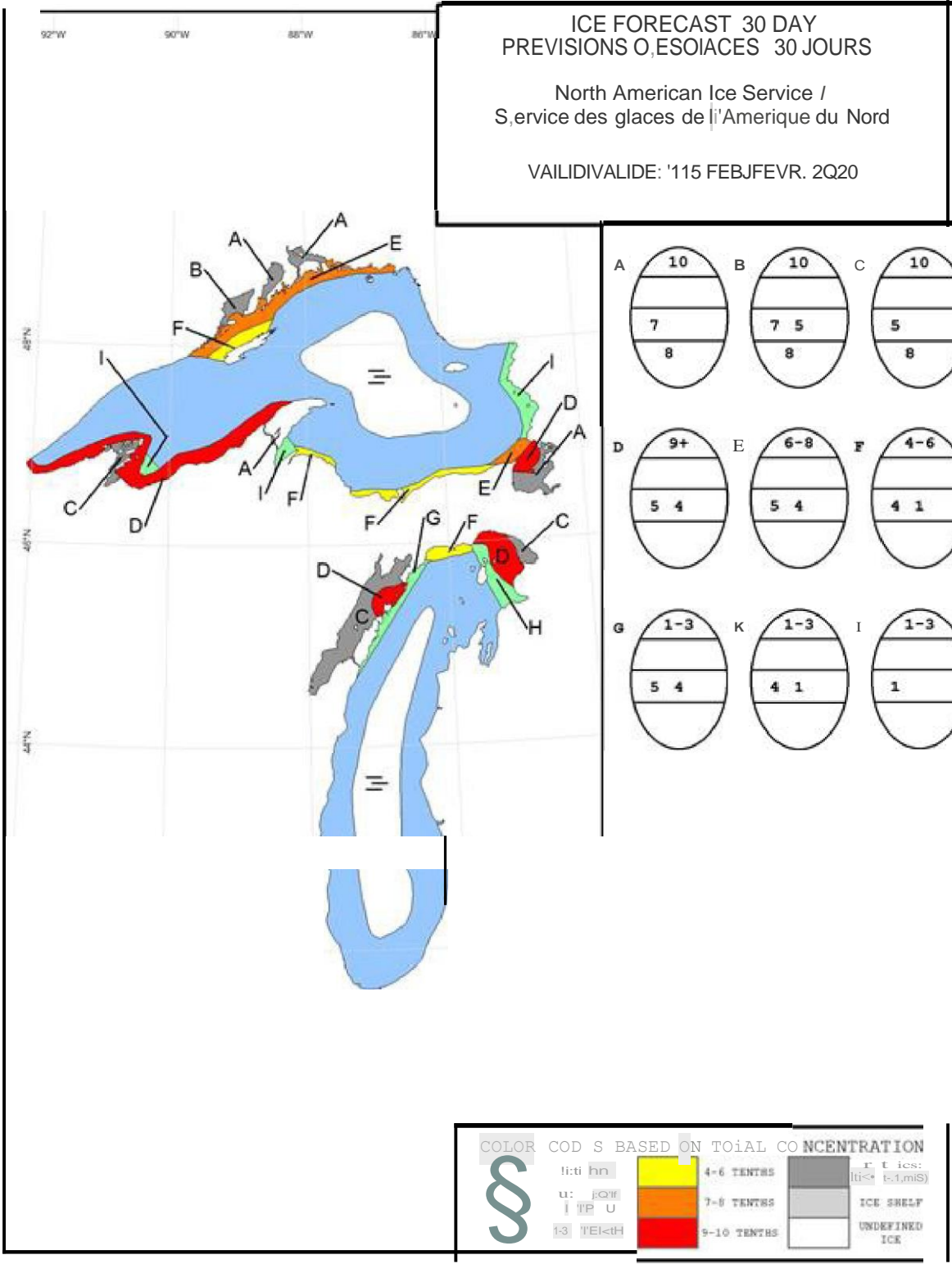




Great Lakes 30 Day Outlook (two graphics)

<https://usicecenter.gov/Products/GreatLakesOutlook>





**North American Ice Service Seasonal Outlook**  
<https://usicecenter.gov/Products/GreatLakesOutlook>

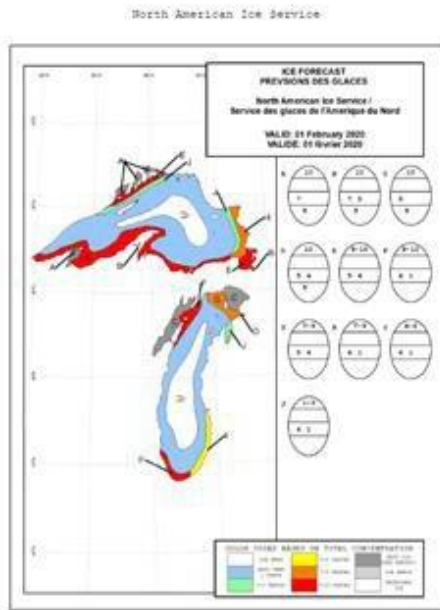


Figure 2. Expected ice conditions – western Great Lakes – 1 February 2020

Seasonal Outlook - Great Lakes - Winter 2019-2020

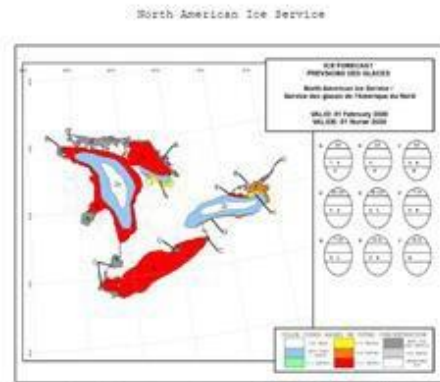


Figure 8. Expected ice conditions – eastern Great Lakes – 1 February 2020

Seasonal Outlook - Green Lake - Winter 2019-2020

# North American Ice Service Seasonal Summary

<https://usicecenter.gov/Products/GreatLakesOutlook>

## Seasonal Summary

Great Lakes  
Winter 2019-2020



By the North American Ice Service

## Summary for the Great Lakes

The 2019-2020 Great Lakes ice season can be summarized by a well below normal ice cover, below normal ice thickness, and below normal extent. The well below normal ice cover was driven by warmer than normal temperatures across the Great Lakes basin for the winter season. Although the year started similar to the previous season (2018/19) with ice formation in mid-November and early December, there was a significant divergence in the weather by the the end of December. Widespread across the Great Lakes basin, average daily temperatures were on the scale of 3-4 degrees Celsius above normal in January, usually the time of year when we see significant expansion of the ice cover.

The total accumulated ice coverage (TAC) for the past season (for the historical weeks of 4 December to 4 June) was 4.8%. This is the 5<sup>th</sup> lowest TAC on record since the 1972/73 season and the lowest since the 2015/16 season.

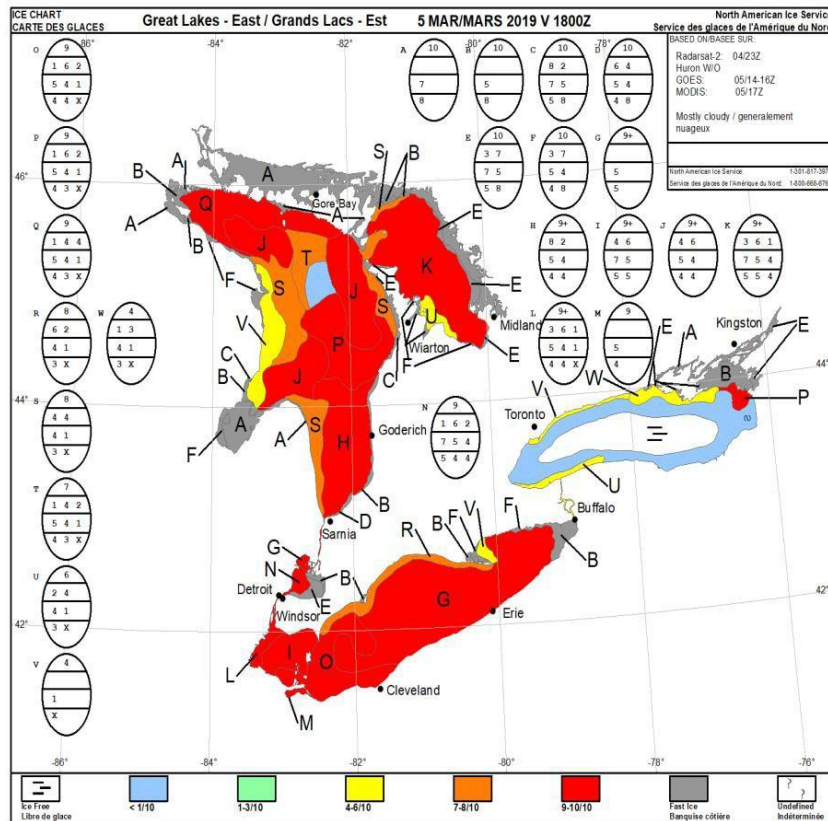
Peak ice coverage on the Great Lakes occurred in the week of February 19<sup>th</sup> 2020, 3 weeks before the climatological normal for peak ice. The ice coverage at the time was 18.6%, less than half the amount of the climate median peak of 39.8%. The peak of 18.6% is the 6<sup>th</sup> lowest maximum extent of ice since the 1972/73 season. The record low maximum ice extent continues to be 11.6% occurring in the 2011-2012 season.

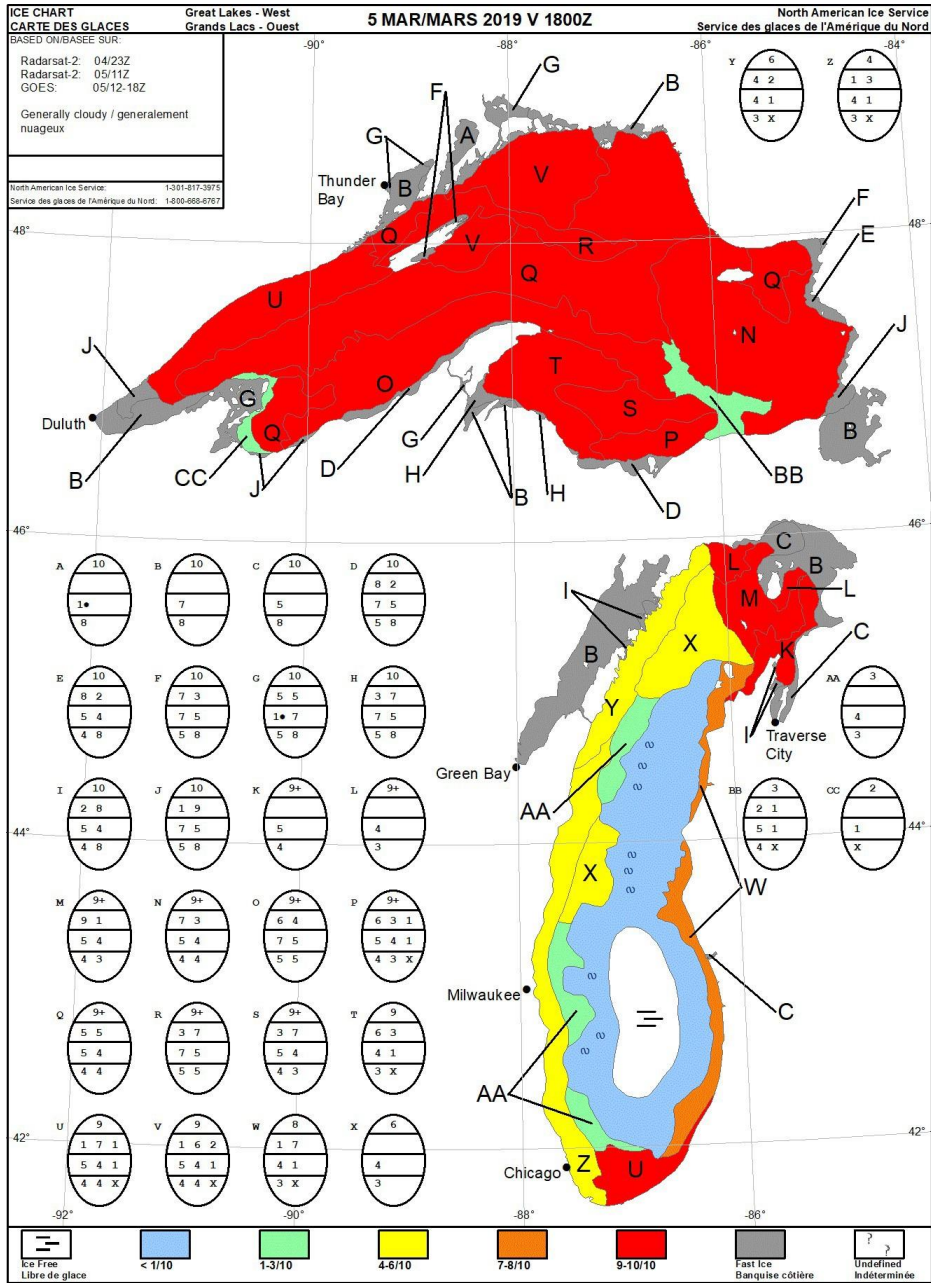
Lake Erie specifically set a new record low TAC of 1% , the lowest on record since the 1972/73 season.



## Daily Great Lakes Products

**Great Lakes Ice Conditions:** Ice concentration, ice stage of development (thickness), and ice floe size. Graphic charts for the east and west Great Lakes: Black and white and concentration charts in addition to color, stage of development, and QA charts provided to CIS (two graphics). The World Meteorological Organization (WMO) system for sea ice symbology, more frequently referred to as the “Egg Code”, is explained within the Canadian Ice Service’ Manual of Ice (MANICE), found at: <https://www.canada.ca/en/environment-climate-change/services/weather-manuals-documentation/manice-manual-of-ice.html>.





## NAVTEX

Western Lake Superior.

Open water except 2 tenths new lake ice along parts of the shore and 8 tenths thin lake ice in Black Bay. 6 tenths new lake ice including 1 tenth thin lake ice in western Nipigon Bay.

Eastern Lake Superior

Whitefish Bay

Northern Lake Huron

Georgian Bay.

Open water except 2 tenths new lake ice along parts of the shore.

Southern Lake Huron.

Open water.

North Channel.

Open water except 2 tenths new lake ice along parts of the shore and 6 tenths new lake ice including 1 tenth thin lake ice in parts of the St. Marys River.

Lake St. Clair

Lake Erie

Western Lake Ontario.

Ice free.

Eastern Lake Ontario.

Open water except 2 tenths new lake ice along parts of the shore and 8 tenths new lake ice including 2 tenths thin lake ice in the Bay Of Quinte.

Northern Lake Michigan.

Open water except 1 tenth new lake ice along northwestern coast.

Southern Lake Michigan.

Ice free.

Green Bay.

Open water except 1 tenth new lake ice in Bays de Noc and 5 tenths new lake ice south of Marinette.



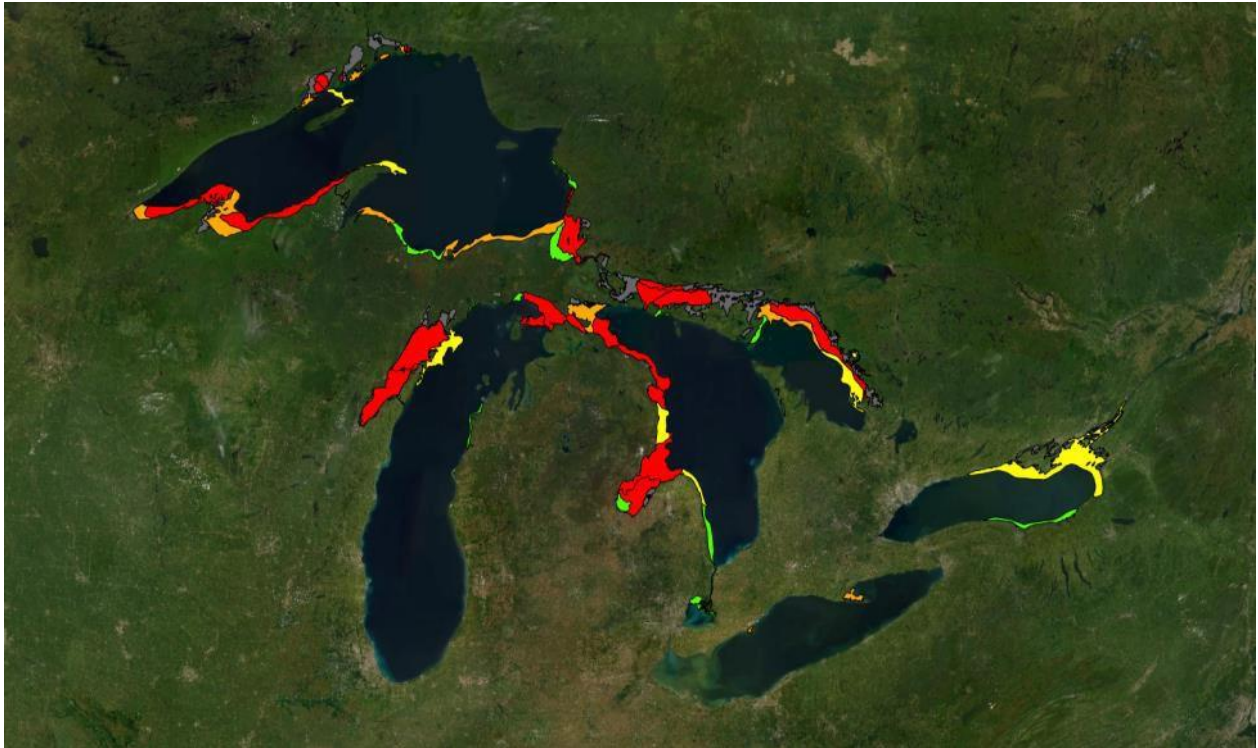
**ASCII List File**

Great Lakes Ice Concentration  
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US National Ice Center  
file generated: Feb 26, 2020  
coordinates: NAD 1983  
vals: LONG, LAT, iceCT, iceSA, LAKEid

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KMZ



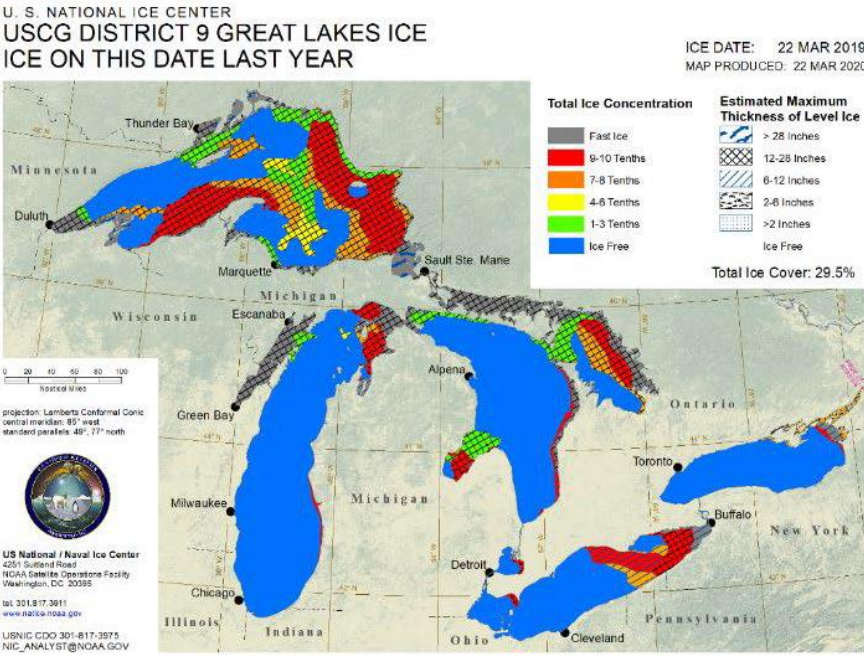
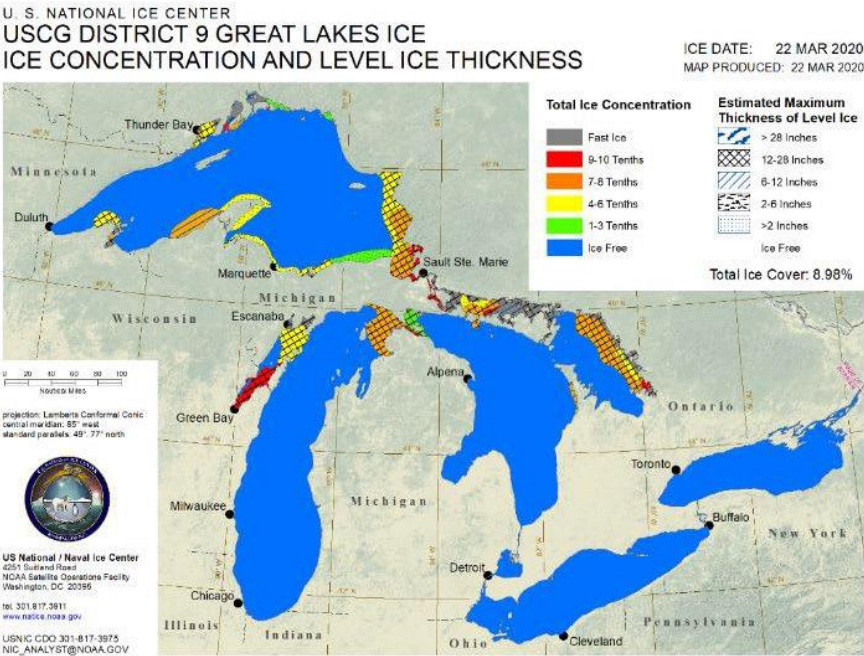
Display of ice concentration and containing additional ice information in Sea Ice Grid (SIGRID)

# USCG District 9 Charts (four graphics)

<https://usicecenter.gov/Products/GreatLakesCharts>





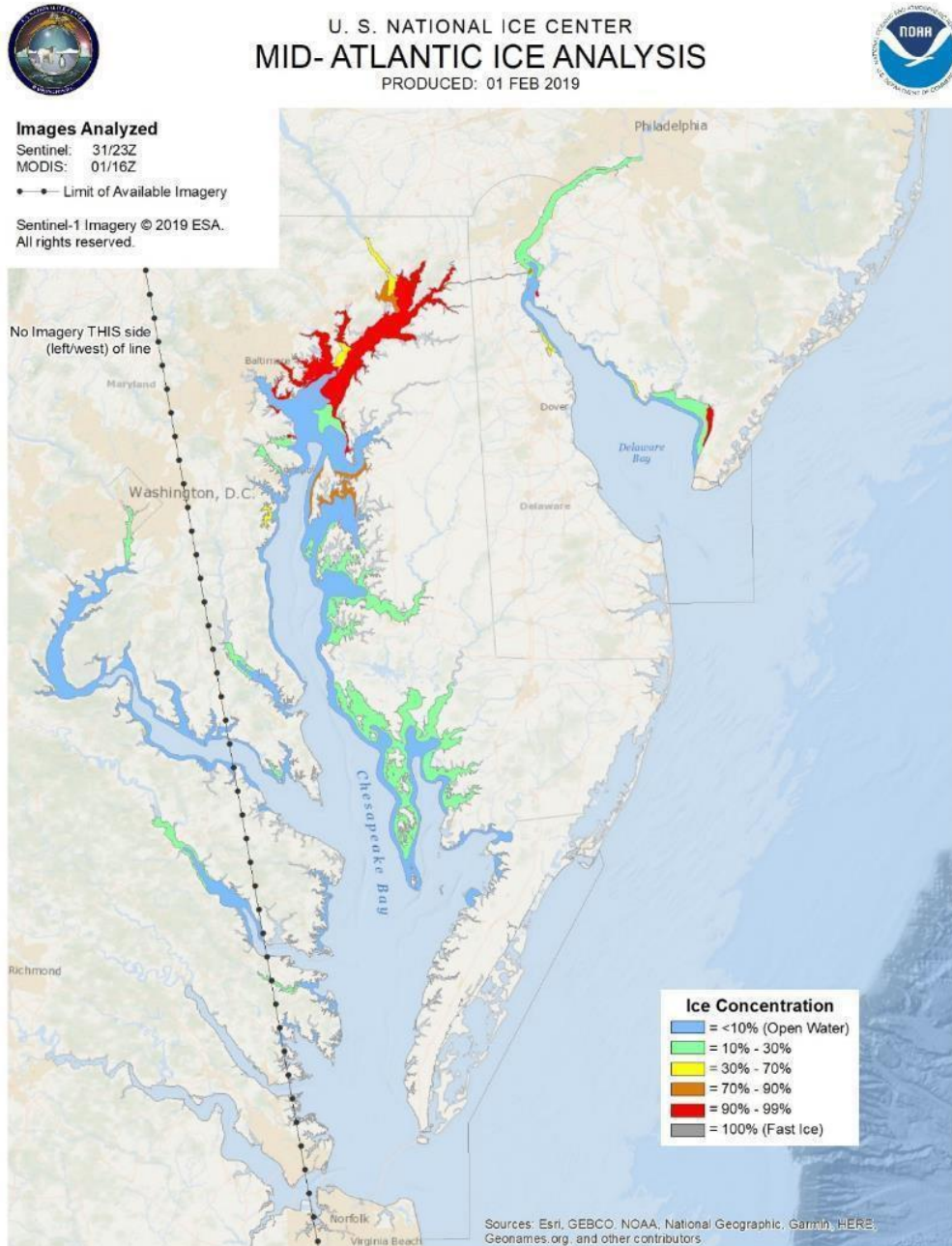




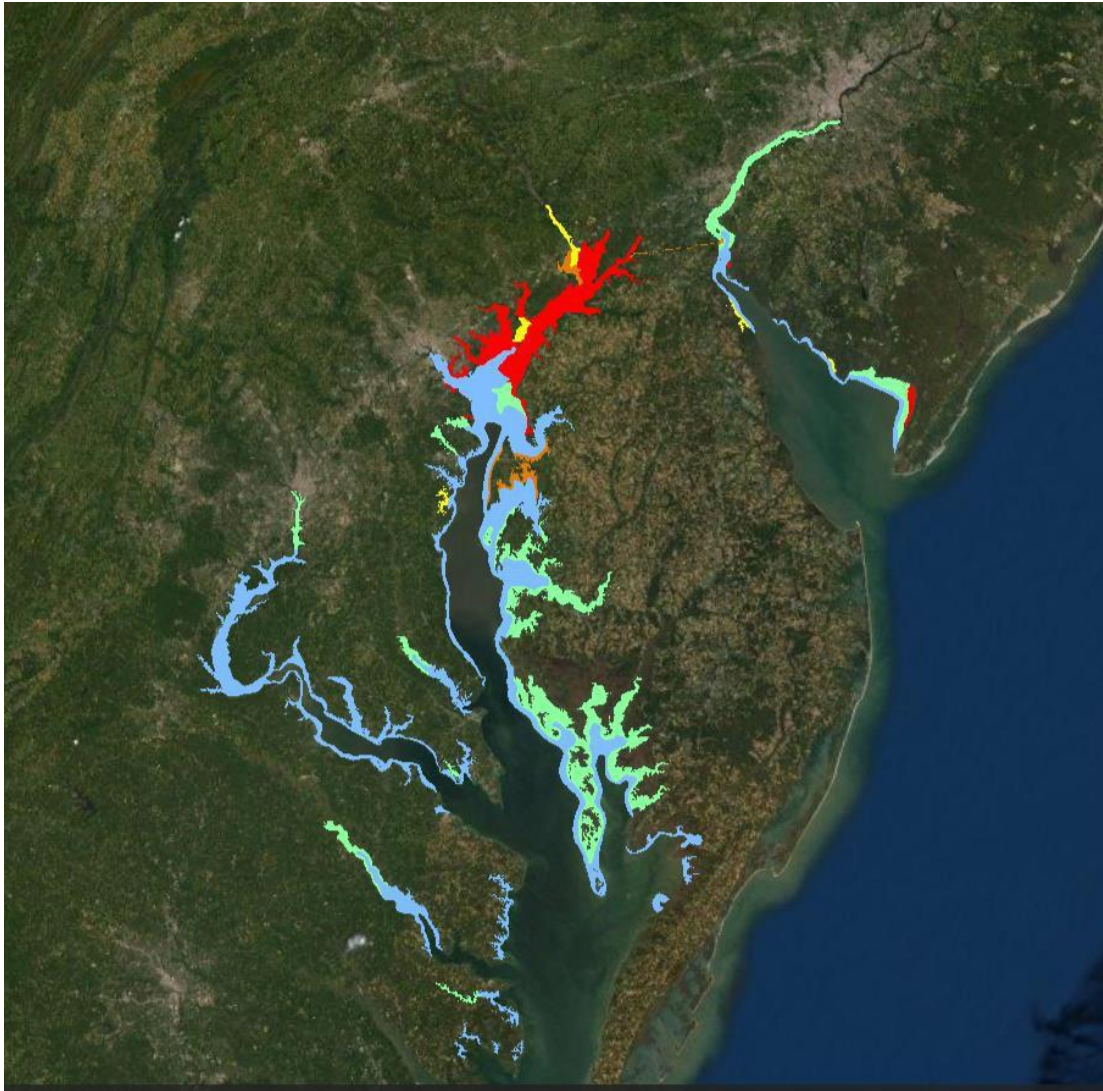
## Mid-Atlantic Region

### Graphic Chart

<https://usicecenter.gov/Products/MidAtlanticHome>



KMZ



Mid Atlantic Ice Analysis - KMZ

## Mid Atlantic Forecast

### Weekly Ice Forecast for Chesapeake and Delaware Bays

Week of: 02/04/2019  
 nic\_analyst@noaa.gov

#### Weather Outlook:

Early morning radar imagery shows ice from the recent cold snap persisting in the Upper Chesapeake... analysis forthcoming. Despite the presence of ice, air temperatures are climbing into the 40's late this morning. Warmth is expected through much of this week, which is expected to preclude the formation of more ice and rot the ice that remains from last week's chilly temperatures.

Tonight, temperatures will remain above freezing. In the short term, through Thursday, overnight temperatures will remain above freezing and afternoon temperatures will reach into the 50's over marine areas and likely be in the 60's inland. Rain chances increase Wednesday to Friday, with a cold front finally passing sometime Friday. The combination of warmth and rain is likely to rot away our current ice cover through the week though it's tricky to predict how much, if any, ice cover will remain at the end of the warm period.

In the longer term, over the weekend, a more seasonable cool period is expected with highs in the upper 30's and lows in the upper 20's. A very modest regime of ice growth is possible late weekend into early next week.

#### Ice Conditions:

Average of 8 tenths of ice north of Rte 50 Bay Bridge with some isolated inlets containing 100% ice. Isolated ice along shores and sheltered inlets south of Rte 50. Isolated shore ice and some scattered ice patches in Delaware Bay.

#### Ice Forecast:

##### **Delaware Bay:**

Continued ice decay will likely lead to ice free conditions by Thursday.

##### **Upper Chesapeake Bay:**

Ice will decay through the week. Some ice likely to survive through the warmth. Possibility of some refreezing over the weekend.

##### **Lower Chesapeake Bay:**

Continued ice decay will likely lead to nearly ice free conditions by Thursday.

**Northern Hemisphere Interactive Multi-Sensor Snow and Ice Mapping System (IMS)**  
<https://usicecenter.gov/Products/ImsHome>

