

Sea Ice and Ocean Observing As part of its mission to develop an integrated ocean observing system for Alaska and the Arctic, the Alaska Ocean Observing System (AOOS) considers sea ice observations to be a key component of an Alaska observing system for the Arctic (Beaufort and Chukchi Seas), the Bering Sea, and Cook Inlet in order to meet stakeholder and resource management needs. In addition, the US Arctic Research Commission (USARC) needs enhanced coastal sea ice observations for Alaska as part of the US contribution to the Arctic Marine Shipping Assessment.

In 2006, AOOS and the USARC established a Sea Ice Working Group (SIWG) to develop strategies for furthering our knowledge of coastal sea ice in Alaska. The SIWG will assess the status of past and current sea ice data for Alaska (Arctic and Cook Inlet), identify gaps in the current observations and research, and provide recommendations to AOOS and to the USARC.

This brochure highlights several **existing, mainly operational** sea ice products for Alaska and will be used to help identify future product needs.

Polar bear photo courtesy National Ice Center



SEA ICE

Tools for Measuring and Observing
Sea Ice Along Alaska's Coasts

AOOS
Alaska Ocean Observing System

www.aos.org

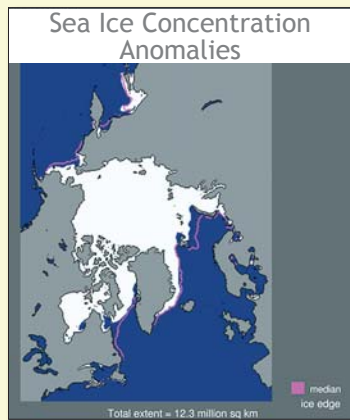
NATIONAL SNOW AND ICE DATA CENTER

www.nsidc.org

Established by NOAA to support polar and cryospheric research, NSIDC archives and distributes snow and ice data as well as information about snow cover, avalanches, glaciers, ice sheets, freshwater ice, sea ice, ground ice, permafrost, atmospheric ice, paleoglaciology, and ice cores.

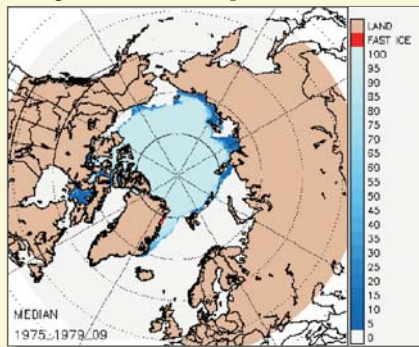


A daily browse image of a Sea Ice Concentration derived from passive microwave data. (Updated several times yearly)

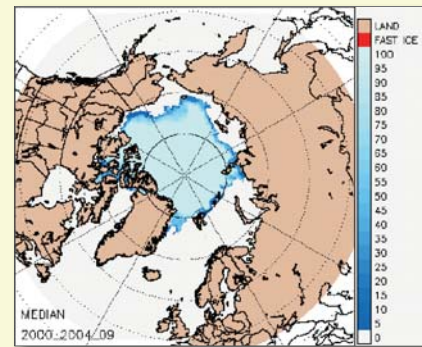


Anomalies in sea ice extent show the difference between where the ice edge is on average, and where it is in a particular month. (Updated monthly)

Passive microwave products have coarse resolutions of 25 km or greater, but are consistent over the entire time series and can therefore be used to derive trends in ice concentration. Arctic Sea Ice Charts and Climatologies are based on operational data that are not consistent over the entire series.



Median sea ice concentration climatology for September for 1975-1979.



Median sea ice concentration climatology for September for 2000-2004.

Sea Ice Concentrations from Passive Microwave Data

NSIDC provides passive microwave data that show sea ice concentrations (percentage of ocean area covered by sea ice), including daily and monthly averages for polar regions. Images and data set documentation are available at <http://nsidc.org/data/nsidc-0051.html>.

Sea Ice Index

Images in the Sea Ice Index data set depict average ice conditions, which are estimated using passive microwave data for the most recent month are available, as well as "snapshots" that compare recent conditions with monthly means. Images, animations and documentation are available at http://nsidc.org/data/seaice_index/.

Arctic Sea Ice Charts and Climatologies

Sea ice concentration climatologies (aggregations of historic climate trends) are derived from the National Ice Center's ice charts. Monthly climatologies include median, maximum, and minimum concentrations, as well as frequency of occurrence of ice for 33-year, 10-year, and 5-year periods. This data set is an important alternative to passive microwave-derived ice concentration, which underestimates summertime ice presence. Data files and documentation are available at <http://nsidc.org/data/g02172.html>.

Most Frequent Users

Sea ice and climate scientists are the major users of these products. NSIDC distributes other research sea ice data, including many from relatively high-resolution sensors (e.g., NASA Earth Observing System satellites). However, the Data Center expects more non-research users since climatologies are now available in GIS and gridded formats. Summaries of all of NSIDC's sea ice products are available at <http://nsidc.org/data/seaice/>.

Benefits and Limitations

Products from passive microwave data and data sets based on operational charts have complementary strengths and weaknesses.

NATIONAL WEATHER SERVICE

<http://pafc.arh.noaa.gov/ice.php>

The Anchorage Weather Forecast Office (WFO) assists the NWS mission to protect life and property and enhance the nation's economy with 24-hour sea ice support. This includes advisories, analysis and short-term forecasts available in text and .gif image formats. Future dissemination includes GIS data (beginning March 2007) and inclusion in the National Digital Forecast Database.

Graphics and descriptions for each of these products are available at <http://pafc.arh.noaa.gov/ice.php>.

Sea Ice Advisories

Sea Ice Advisories (text only) describe ice conditions in Alaska waters out to five days, and are issued every Monday, Wednesday, and Friday with updates as needed. Advisories also include monthly seasonal outlooks and climatological ice year comparisons. WFO Anchorage issues Marine Weather Statements to warn coastal and at-sea users of dangerous conditions including flash freezes and Ivus/ice shoves (multi-year sea ice run-ups on beaches).

Sea Ice Analysis Charts

These charts are 1km-resolution graphics for Cook Inlet and the Bering/Beaufort/Chukchi Seas with emphasis on the ice edge and shorefast conditions; they are issued in conjunction with Sea Ice Advisories.

Sea Ice Forecast Charts

Five-Day Sea Ice Forecasts display "snapshots" of ice conditions expected five days from the issuance date. Interim ice conditions are described in Sea Ice Advisories.

Sea Surface Temperature (SST) Charts

SST charts are produced every Tuesday and Thursday for the north Pacific and Arctic Oceans from Russia's Kamchatka Peninsula to British Columbia.

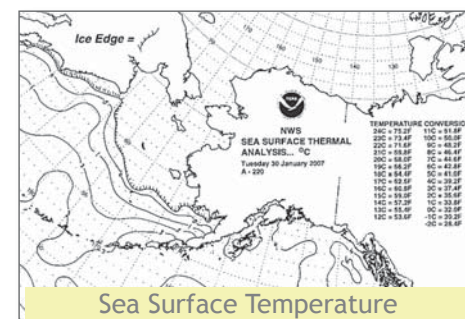
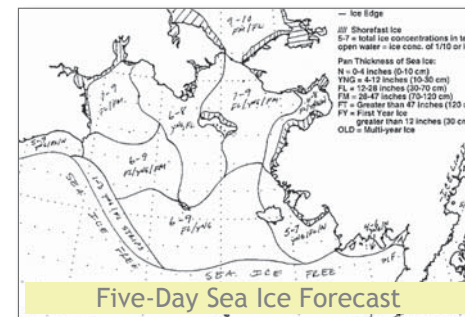
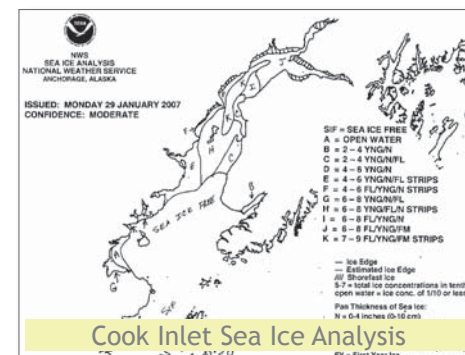
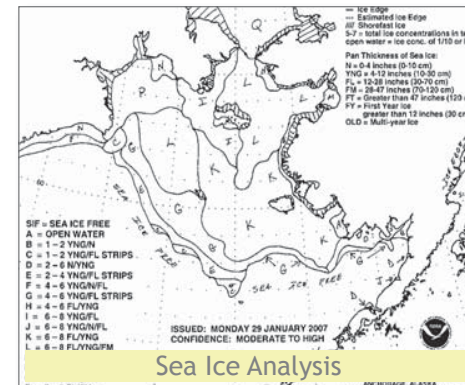
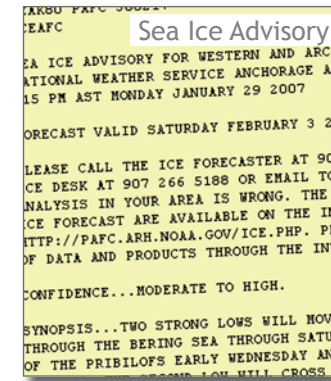
Most Frequent Users

WFO Anchorage provides 24-hour support specifically for Alaska users: emergency managers concerned about ice formation/concentration and coastal erosion impacts, government agencies, subsistence hunters and fishermen, commercial fishing fleets, boat operators, energy and shipping industries, and navigation safety partners.

Benefits and Limitations

Graphical products are rich in detail but designed for low-bandwidth dissemination so users can obtain these products in remote locations via satellite internet and HF Radiofax services. Beginning in March, the Sea Ice Analysis will be available in GIS format with the intention of expanding digital services to all graphical sea ice products. Five-Day Sea Ice Forecasts display end results of ice conditions and movement at day 5, but does not display fluctuations that may occur.

See the back panel for a summary of which products best suit different users.



NATIONAL ICE CENTER (NIC)

www.natice.noaa.gov/

NIC is operated by the US Navy, NOAA and the US Coast Guard. Since 1972, NIC has produced sea ice charts using in situ, remotely sensed, and model data for regions containing sea ice.

Digital products include sea ice-edge products consisting of latitude-longitude pairs; sea ice analysis charts in .gif format; and ArcInfo coverages.

Northern Hemisphere Ice Charts

NIC produces ice analysis charts for regions in the Arctic, the North Atlantic, the Baltic Sea, the Yellow Sea, the Sea of Okhotsk, and the Sea of Japan that contain sea ice. Charts are available at www.natice.noaa.gov/products/arctic/index.htm.

Alaska Ice Charts

NIC produces Alaska regional analysis charts of current ice conditions for regions in the Beaufort Sea, the Chukchi Sea and the Bering Sea that contain sea ice. Charts are available at www.natice.noaa.gov/products/alaska/index.htm.

Arctic Hemispheric Ice Coverage

Northern Hemisphere ice charts are combined and provided as hemispheric analyses in ArcInfo and SIGRID formats. These are available at www.natice.noaa.gov/pub/arcgis/arctic/arctic_hemi/ (current year) and www.natice.noaa.gov/pub/Archive/arctic/ (past years).

Daily Ice Edge and Marginal Ice Zone (MIZ)

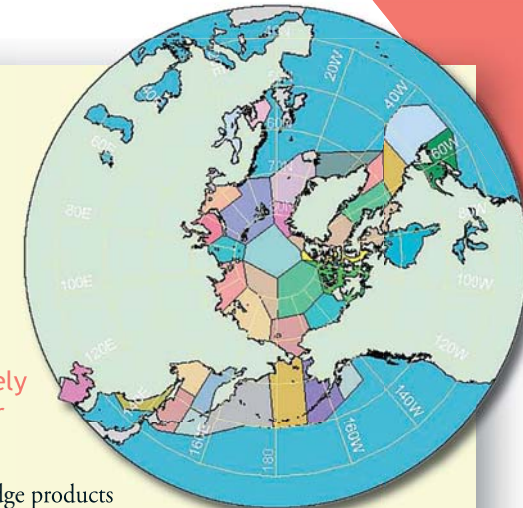
NIC analysts adjust daily ice edge contours using additional higher resolution imagery. The MIZ product is similarly generated, but includes the ice edge (ice/no ice boundary) as well as pack ice contour analyses. These are available at www.natice.noaa.gov/products/edge/index.htm and www.natice.noaa.gov/pub/MIZ/.

Most Frequent Users

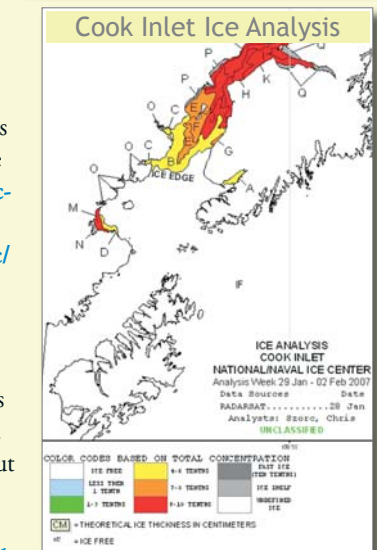
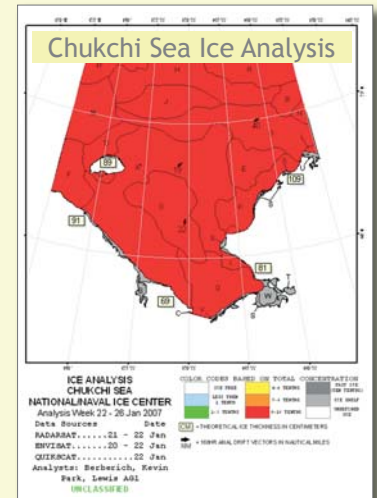
Users of NIC products include both operational users and researchers.

Benefits and Limitations

NIC charts are used for trip planning and navigation safety. In general, they show more ice than do passive microwave-derived ice concentrations, especially in the summer when passive microwave algorithms can underestimate ice concentration.



Northern Hemisphere Ice Charts: Interactive map of sea ice regions





Seagoing vessels often report changing ice conditions to the NWS Ice Forecaster.
Photo: Elizabeth Labunski, USFWS



Seals and other marine mammals, as well as seabirds, depend on the presence of sea ice for rest and protection.
Photo: Kathy Kuletz

WHICH PRODUCTS ARE BEST FOR MY USES?

Operational/Applied Users

These users include field camp workers, shippers, US Coast Guard search and rescue teams, and US Navy personnel, as well as whalers and commercial and subsistence fishermen.

These users seek real-time sea ice condition analyses, most often in the form of a chart or picture. They are often on the water, either approaching or already in sea ice, and make navigation decisions based on the most updated information they receive.

Most Useful Operational Products

- **National Weather Service**
 - » Sea Ice Advisories
 - » Sea Ice Analysis Charts
- **National Ice Center**
 - » Northern Hemisphere Ice Charts
 - » Alaska regional ice charts
 - » Products are available in EASE-Grid (gridded binary) and GIS-compatible (selected products only) formats; browse images are GIF files.

Researchers and Forecasters

These users include climate modelers, sea ice scientists, and climatologists.

Researchers are in a position to take best advantage of many of the products from the National Snow and Ice Data Center, which provides data that must be manipulated using Geographic Information System (GIS) software. Images shown on individual NSIDC web pages are large-scale and not likely to be of immediate use to those at sea. However, more “applied science” users may find these data useful now that National Ice Center chart climatologies are available in GIS as well as gridded formats.

Most Useful Research Products

- **National Ice Center**
 - » Sea Ice Charts
 - » Climatologies
- **National Snow and Ice Data Center**
 - » Sea Ice Concentrations from passive microwave data
 - » Sea Ice Indices
 - » Arctic Sea Ice Charts and Climatologies



Seabird observers and scientists aboard the US Coast Guard cutter *Healy* amid thick sea ice.
Photo: Elizabeth Labunski, USFWS

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