



NOTES

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Arctic Sea Ice Reaches Maximum Extent

Arctic sea ice reached its maximum extent for the year on 31 March at 15.25 million square kilometers (5.89 million square miles). This was the latest date for the maximum Arctic sea ice extent since the start of the satellite record in 1979. The average extent for the month of March was 15.10 million square kilometers (5.83 million square miles). Researchers look at monthly extent numbers in the context of long-term changes in ice extent.

Early in March, Arctic sea ice appeared to reach a maximum extent. However, after a short decline, the ice continued to grow. By the end of March, total extent approached 1979 to 2000 average levels for this time of year.

The late-season growth was driven mainly by cold weather and winds from the north over the Bering and Barents Seas. Meanwhile, temperatures over the central Arctic Ocean remained above normal and the winter ice cover remained young and thin compared to earlier years.

Typically, the maximum Arctic sea ice extent may occur as early as mid-February to as late as the last week of March. As sea ice extent approaches the seasonal maximum, extent can vary quite a bit from day to day because the thin, new ice at the edge of the pack is sensitive to local wind and temperature patterns.

This March, low atmospheric pressure systems persisted over the Gulf of Alaska and north of Scandinavia. These pressure patterns led to unusually cold conditions and persistent northerly winds in the Bering and Barents Seas, which pushed the ice edge southward in these two regions. The late date of the maximum extent, though of special interest this year, is unlikely to have an impact on summer ice extent. The ice that formed late in the season is thin, and will melt when temperatures rise during summer.

Data on the age of sea ice, a proxy for ice thickness, shows that the Arctic has much less thick, multiyear ice than it did during the 1980s and 1990s. However, this winter has seen some replenishment: the Arctic lost less ice the past two summers compared to 2007, and the strong negative Arctic Oscillation this winter prevented as much ice from moving out of the Arctic. The larger amount of multiyear ice could help more ice to survive the summer melt season. However, this replenishment consists primarily of younger, two- to three-year-old multiyear ice; the oldest, and thickest multiyear ice has continued to decline. Although thickness plays an important role in ice melt, summer ice conditions will also depend strongly on weather patterns through the melt season.



Average arctic sea ice extent for the month of March 2010 was 15.10 million square kilometers (5.83 million square miles). The magenta line shows the 1979 to 2000 median extent for that month. The black cross indicates the geographic North Pole. Credit: National Snow and Ice Data Center

At the moment there are no Arctic-wide satellite measurements of ice thickness, because the NASA Ice, Cloud, and land Elevation Satellite (ICESat) mission ended last October. NASA has begun an airborne sensor campaign called IceBridge to fill this observational gap.

For more information and current updates on Arctic sea ice conditions, see the NSIDC Arctic Sea Ice News & Analysis Web site (<http://nsidc.org/arcticseaicenews/>).



Inuit forecasters equipped with generations of environmental knowledge are helping scientists understand changes in Arctic weather. Credit: Shari Gearheard

Inuit Knowledge Helps Scientists Learn Something New About Arctic Weather

Inuit forecasters equipped with generations of environmental knowledge are helping scientists learn something new about Arctic weather. A study published this month in the journal *Global Environmental Change* brings together two worlds, combining indigenous environmental knowledge with the practice of statistical weather analysis.

The study, a collaboration between researchers at NSIDC and the University of Colorado at Boulder's Cooperative Institute for Research in Environmental Sciences (CIRES), shows that including the observations and stories of the Inuit into climate research can not only provide valuable insights into asking the right scientific questions, but also help researchers find new ways of answering them.

NSIDC researcher Shari Gearheard lives in Clyde River, Nunavut, Canada, an Inuit community on eastern Baffin Island, and for the past ten years has been working with Inuit hunters and elders to document their knowledge of the environment and environmental change. She worked with lead author and CIRES environmental statistician Elizabeth Weatherhead to examine changes in weather patterns that Inuit have noticed in recent years.

More and more, Inuit noticed changes during the spring, a time of transition for many environmental processes. "In fact in a lot of places, the name of the season is named after a particular process," said Gearheard. "Inuit are not seeing that process anymore, which was an indicator to them that something had changed."

What the researchers found was a scientific story more in line with what people were witnessing on the ground. Weather along the Arctic latitudes was behaving more unpredictably than in other parts of the world. "That's an incredibly important parameter to care about, incredibly important," said Weatherhead. "The way I try to describe it to some people, if we get an inch of rain out at my house [spread through]

the month of July, I don't need to turn on the sprinklers. But if we get an inch of rain on July 1, and no rain after that, my lawn is dead."

NSIDC scientist Roger Barry, a CIRES fellow and director of the World Data Center for Glaciology at NSIDC, was also an author on the paper.

Read the full announcement and listen to a podcast with the authors on the CIRES News Web site (<http://cires.colorado.edu/news/press/2010/gearheardInuit.html>).

NSIDC Selected to Manage and Distribute IceBridge Data

NSIDC was selected by NASA to manage and distribute data for the IceBridge project, which runs from 2009 to 2015. Operation IceBridge is a six-year NASA field campaign that will provide three-dimensional information about ice sheets, ice shelves, and sea ice in the Earth's polar regions. IceBridge was designed to collect data during a gap between the first ICESat satellite mission, which concluded in 2009, and the second ICESat mission, which is scheduled to launch in 2015.

The IceBridge mission will also take advantage of its airborne platforms to make additional geophysical measurements, including gravity mapping and radar sounding of ice and snow depth. These measurements will provide important information about the landforms hidden beneath ice sheets and glaciers, and changes in ice volume.

NSIDC will archive and distribute the data collected during the IceBridge mission, as well as provide tools and services that will help facilitate increased and broader use of the data. NSIDC will also coordinate the development of new synthesized products that combine single data sources to enable use by an expanding scientific community.

NSIDC hosted its initial Science Working Group meeting on 4 March 2010. This group of science researchers was convened to advise NSIDC on the priorities for development of value-added products, as well as to offer guidance on NSIDC's plans and progress for the data management tasks.

Visit the IceBridge Data Management project Web page for further information (<http://nsidc.org/data/icebridge/>).

New Friends of ROCS Newsletter

The Roger G. Barry Resource Office for Cryospheric Studies (ROCS) recently published the first issue of the Friends of ROCS Newsletter. Want to learn about special events, activities for the year and upcoming projects at ROCS? Request a subscription to the electronic newsletter mailing list by emailing library@nsidc.org

New Products from AGDC

The Antarctic Glaciological Data Center (AGDC) at NSIDC has released two new data sets.

- *Microstructural Location and Composition of Impurities in Polar Ice Cores* consists of measurements of impurities and ions in three polar ice cores: the Vostok 5G ice core and the Byrd ice core from Antarctica, and the Greenland Ice Sheet Project 2 (GISP2) D core. To view this data set, see the product Web page (<http://nsidc.org/data/nsidc-0436.html>).
- *WAIS Divide Ice Core Images, Antarctica* contains digital images of ice core sections from the WDC06A ice core in Antarctica. To access this data set, visit the product Web page (<http://nsidc.org/data/nsidc-0375.html>).

For more information on Antarctic data from AGDC, see the AGDC Data Catalog Web page (<http://nsidc.org/agdc/data.html>).

Release of Snow Depth Analysis Data

Canadian Meteorological Centre (CMC) Daily Snow Depth Analysis Data is now available from NSIDC. The data set contains a Northern Hemisphere subset of the global, daily snow depth analysis produced by the Canadian Meteorological Centre since 1998. The daily snow depth analyses are based on the optimal interpolation of real-time snow depth information from surface synoptic observations, meteorological aviation reports, and special aviation reports. Also included are monthly mean snow depth and derived monthly mean snow water equivalent estimated using a monthly mean snow density look-up table. The data set covers the period from April 1998

through the end of 2009, and will be updated annually while the operational analysis is maintained. For more information, please see the *Canadian Meteorological Centre (CMC) Daily Snow Depth Analysis Data* product Web page (<http://nsidc.org/data/nsidc-0447.html>).

V12 AMSR-E Level 3 Sea Ice Products Released

NSIDC has released the Validated 12 (V12-Stage 1) Advanced Microwave Scanning Radiometer – Earth Observing System (AMSR-E) Level-3 sea ice products. The V12 algorithm corrects an error in the method for applying the multiyear sea ice mask that caused large areas of the Arctic to be erroneously masked in the “Snow Depth on Sea Ice” parameter. The multiyear sea ice mask and the snow melt mask are now stored within the *AMSR-E/Aqua Daily L3 12.5 km Brightness Temperature, Sea Ice Concentration, & Snow Depth Polar Grids* (AE_SI12) product. The AE_SI12 product is the only sea ice product with the “Snow Depth on Sea Ice” parameter, but all AMSR-E sea ice products use the same production code and will be processed with the V12 algorithm.

AMSR-E Level-3 sea ice products include the following:

- AMSR-E/Aqua Daily L3 6.25 km 89 GHz Brightness Temperature Polar Grids (AE_SI6)
- AMSR-E/Aqua Daily L3 12.5 km Brightness Temperature, Sea Ice Concentration, & Snow Depth Polar Grids (AE_SI12)
- AMSR-E/Aqua Daily L3 25 km Brightness Temperature & Sea Ice Concentration Polar Grids (AE_SI25)



Sanikiluaq residents Peter Kattuk (left) and Johnassie Ippak (right) are two of the hunters whose interviews and maps form part of the product *Sea Ice Observations in the Belcher Islands, Nunavut, Canada*. Credit: Chris McNeave

ELOKA Releases Data Set on Sea Ice Observations

The Exchange for Local Observations and Knowledge of the Arctic (ELOKA) collaborates with communities across the Arctic to help preserve local and traditional knowledge. ELOKA currently manages data for several community efforts, and is pleased to release its first data product: *Sea Ice Observations in the Belcher Islands, Nunavut, Canada*. Inuit residents of the Belcher Islands draw on traditional knowledge of sea ice to find animals and navigate around the islands, but ice conditions have recently become unstable and less predictable. To help document the changes, three hunters of the hamlet of Sanikiluaq were interviewed by members of the Sanikiluaq Sea Ice Project. This new ELOKA data product presents the resulting videos and maps describing each hunter’s observations.

For more information about the Sanikiluaq Sea Ice Project and to access the data, please visit the Sanikiluaq Sea Ice Project Web page (<http://eloka-arctic.org/communities/sanikiluaq/>).

NSIDC encourages users to always work with the latest data (highest version number) available for a given date. The AMSR-E Science Investigator-led Processing System (SIPS) has begun reprocessing data, and forward processing will begin once reprocessing is complete. For more information about AMSR-E data sets at NSIDC, please see the AMSR-E products Web page (<http://nsidc.org/data/amsre>).

New Data Set Features AMSR-E Brightness Temperatures

NSIDC has released a new data set, *Co-Registered AMSR-E, QuikSCAT, and WMO Data*. The data set contains the following spatially and temporally co-registered data:

- AMSR-E brightness temperatures for all channels
- Quick Scatterometer (QuikSCAT) backscattering coefficients
- World Meteorological Organization (WMO) ground observations acquired from more than two thousand stations

QuikSCAT and WMO data are available from 01 January 2002 through 19 March 2009, and AMSR-E data are included from 19 June 2002 through 19 March 2009. For more information and data access, please refer to the *Co-Registered AMSR-E, QuikSCAT, and WMO Data* product Web page (<http://nsidc.org/data/nsidc-0450.html>).

New AMSR-E Land Surface Data Available

The *Daily Global Land Surface Parameters Derived from AMSR-E* data set is now available. This data set contains geophysical parameters generated from the AMSR-E instrument on the NASA Aqua satellite, including:

- Air temperature minima and maxima at approximately 2 meters in height
- Fractional cover of open water on land
- Vegetation canopy microwave transmittance
- Surface soil moisture at less than or equal to 2 centimeters soil depth
- Integrated water vapor content of the intervening atmosphere for the total column

Data extend from 19 June 2002 through 31 December 2008 and were derived over land for non-precipitating, non-snow, and non-ice land surface conditions. The primary input data were daily AMSR-E dual polarized multi-frequency, ascending and descending overpass brightness temperature data. For more information and data access, please refer to the product Web page (<http://nsidc.org/data/nsidc-0451.html>).

New AMSR-E Validation Data Sets Published

The AMSR-E Validation data portal at NSIDC has been updated with additional data sets for the Soil Moisture Experiment 2005 Po-

larimetry Land Experiment (SMEX05-POLEX), AMSRice03, and AMSRice06 campaigns. NASA's AMSR-E Validation field experiments were conducted to assess and improve the quality of data products derived from AMSR-E. The SMEX05-POLEX campaign was conducted in Iowa, USA during June and July 2005. The AMSRice03 and AMSRice06 campaigns were conducted during March 2003 and March 2006, respectively. Joint ground and aircraft measurements were taken as part of the AMSRice03 campaign over the Chukchi and Beaufort Seas in the Arctic Ocean, and in Elson Lagoon, off the northern coast of Alaska. The AMSRice06 campaign was conducted over the Chukchi and Beaufort Seas of the Arctic.

For more information, please see the AMSR-E Validation Data page (http://nsidc.org/data/amsr_validation/).

DMSP SSM/I Brightness Temperature Data Update

The *DMSP SSM/I Daily Polar Gridded Brightness Temperatures* data set has been updated through 29 April 2009. However, processing updates for this product beyond 29 April 2009 have been temporarily suspended due to the failure of the Defense Meteorological Satellite Program (DMSP) F13 satellite. NSIDC is working with the data source for this product, Remote Sensing Systems (RSS), to acquire Special Sensor Microwave Imager/Sounder (SSMIS) data from the DMSP F17 satellite. SSMIS is the next generation Special Sensor Microwave/Imager (SSM/I) instrument.

For more information regarding this data set, or to access data via FTP, see the data set product page (<http://nsidc.org/data/nsidc-0001.html>).

ICESat/GLAS Updates

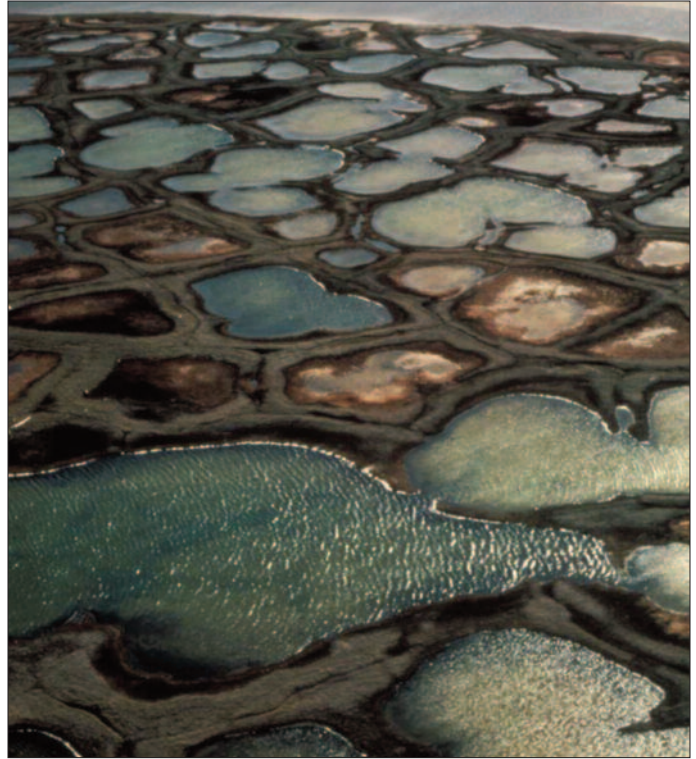
Reprocessing to Release-31 continues for ICESat/GLAS data. ICESat/GLAS Release-31 data for the Laser 3H campaign (12 March 2007 to 14 April 2007) are now available for the following products: GLA01 to GLA07, GLA09 and GLA11 to GLA15. We will continue to receive other laser campaigns for Release-31 until all laser campaigns are reprocessed. Until then, Release-28, Release-29, and Release-31 will be available from NSIDC.

Please note that Release-31 data should not be mixed with any other data release for science analysis, due to changes that were made to the processing code. The DEM and geoid changes manifest themselves in a number of ways including in the troposphere corrections, where they caused some significant (cm level) differences in the computed elevations. For detailed information on all of the Release-31 changes, see the ICESat/GLAS Data Releases Web page (http://nsidc.org/data/icesat/data_releases.html).

For more info about ICESat/GLAS data, including ordering options, see the ICESat/GLAS Data page (<http://nsidc.org/data/icesat/>).

NSIDC TRIVIA

NSIDC's Education Center features information for the general public on cryospheric subjects including sea ice, snow, glaciers, frozen ground, and research field missions. The image on the right is from the All About Frozen Ground Web site, which is part of the Education Center. This landform in the photo can be found in areas containing frozen ground. What is this feature called? For the answer, visit the All About Frozen Ground Web site (<http://nsidc.org/frozenground/>).



Credit: U.S. Fish and Wildlife Service

CITING NSIDC DATA

Please acknowledge NSIDC as the source when you obtain data from us. Refer to the data set documentation for suggested forms of acknowledgement and citation, or contact User Services for more information.

NSIDC also requests one reprint or the exact reference of any publication that was supported by data received from NSIDC. We also greatly appreciate reprints of any publication related to snow and ice research, for inclusion in our Roger G. Barry Resource Office for Cryospheric Studies collection.

If you have published data that you wish to archive and make available to the scientific community, please contact User Services to discuss the content, form, and size of the data set. A list of guidelines for submitting data in electronic format is available.

SUBSCRIPTION, SUBMISSION & CONTACT INFORMATION

For information about any of the products or services offered by NSIDC, or to subscribe to NSIDC Notes, please contact User Services.

NSIDC welcomes the submission of short items from our readers that are of interest to the cryospheric community. Please use the following address to submit news items, publication notes, research notices, or brief articles for publication in NSIDC Notes.

View back issues on the NSIDC Web site (<http://nsidc.org/pubs/notes/>).

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