

U.S. National Ice Center (NIC)



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Chief Scientist
U.S. National/Naval Ice Center



USCG



USN



NOAA



U.S. National Ice Center History



- 1976: Common requirements between Navy and NOAA resulted in the formation of the Navy/NOAA Joint Ice Center (JIC).
- 1995: USCG joined, JIC became the U.S. National Ice Center (NIC).
- NIC responsibilities established via Annex IV under the MOA between DOC and DON.
 - Participation authorities
 - NOAA: 15 U.S.C. § 313, 15 U.S.C. § 2921 et seq., and 15 U.S.C. §1525.
 - Navy: 10 U.S.C. § 5013
 - USCG: 14 U.S.C. § 141

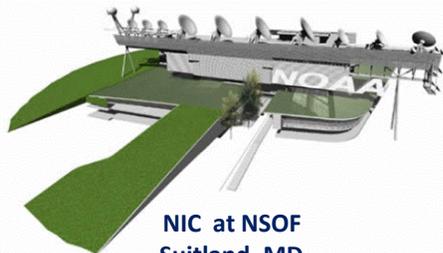




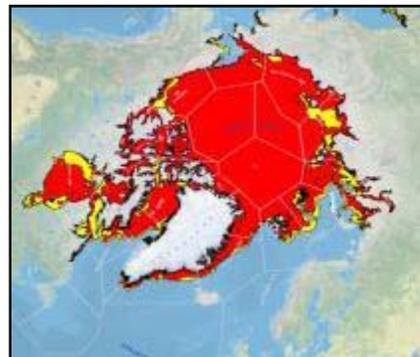
NIC Mission



- A multi-agency operational center operated by the United States Navy, National Oceanic and Atmospheric Administration, and United States Coast Guard.
- Located in Suitland, Maryland and employs ~40 military and civilian personnel.
- Over 140 National and International Customers, including SUBFOR, ONI, NOAA, NWS, NSF, USCG, MSC, and NASA.
- GLOBAL sea ice analysis and forecasting.



NIC at NSOF
Suitland, MD



Coverage 20.6 Million Square Miles – Arctic, Antarctic, and Great Lakes

Mission: Provide the highest quality, timely, accurate, and relevant snow and ice products and services to meet the strategic, operational, and tactical requirements of U.S. national interests across a global area of responsibility.



International Partnerships



- **North American Ice Service (NAIS)**

- Multi-agency partnership between U. S. National Ice Center, Canadian Ice Service and International Ice Patrol.
- Mission: Transform individual organizational strengths into a unified source of ice information and meet all marine ice information needs and obligations of the United States and Canadian governments.



- **International Arctic Buoy Program (IABP)**

- Global participants working together to maintain a network of drifting buoys in the Arctic Ocean to provide real-time operational requirements and research purposes including support to the World Climate Research Program and World Weather Watch.



- **International Ice Charting Working Group (IICWG)**

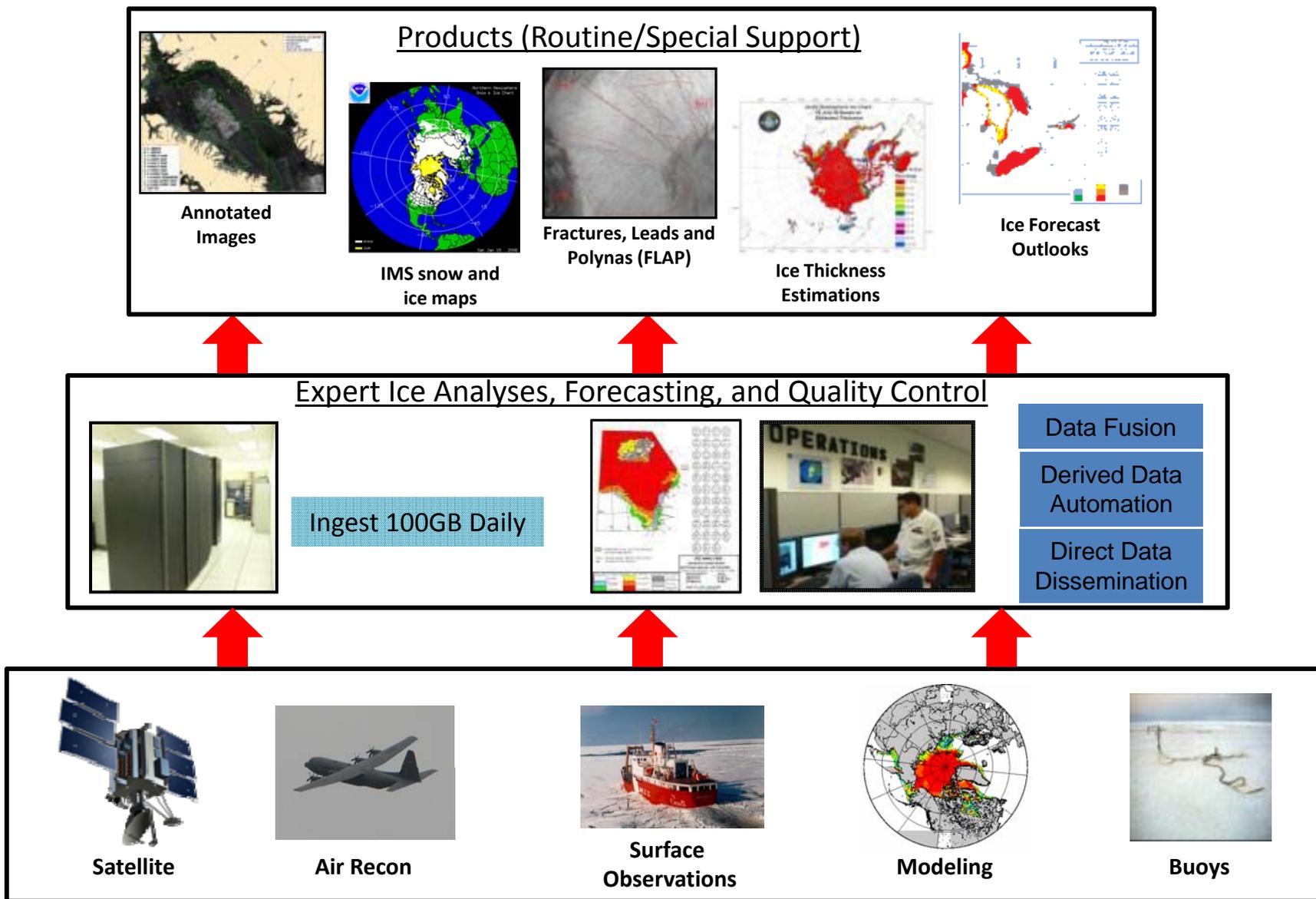
- Formed in October 1999 to promote cooperation between the world's ice centers on all matters concerning sea ice and icebergs.





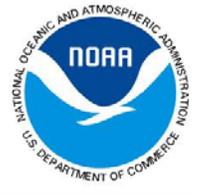
Operations and Product Generation

Human, Derived, Automated, and Reconfigured

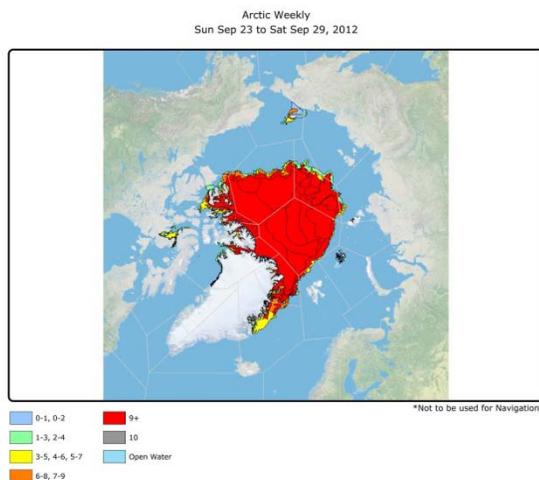




NIC Products and Services

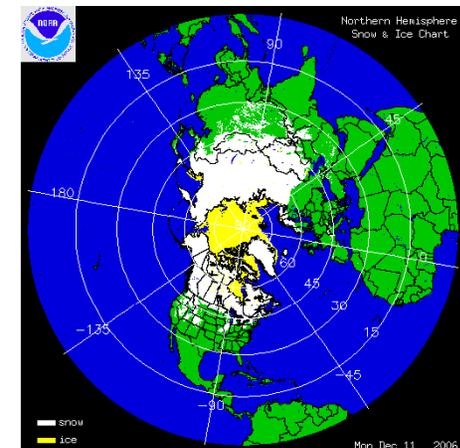


- Daily Arctic and Antarctic-wide sea ice analysis, AK gridded ice edge, and weekly or bi-weekly ice charting
- Near real-time access to high-resolution satellite radar imagery
- Tactical support for sea ice navigation
- 2x monthly 30-day ice outlooks for North American Arctic Waters, Hudson Bay (June – November), and the Ross Sea/McMurdo Sound
- Daily Snow and Ice Interactive Mapping System (IMS) Product
- Arctic Region Ice Forecast System (ARIFS) Seasonal Forecast
- Access to Navy's Arctic Cap Nowcast and Forecast System (ACNFS)



Bi-weekly Sea Ice Chart

Daily Snow&Ice Cover



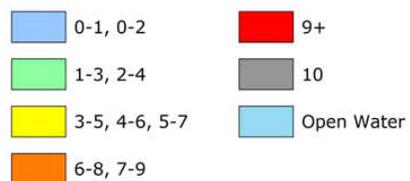
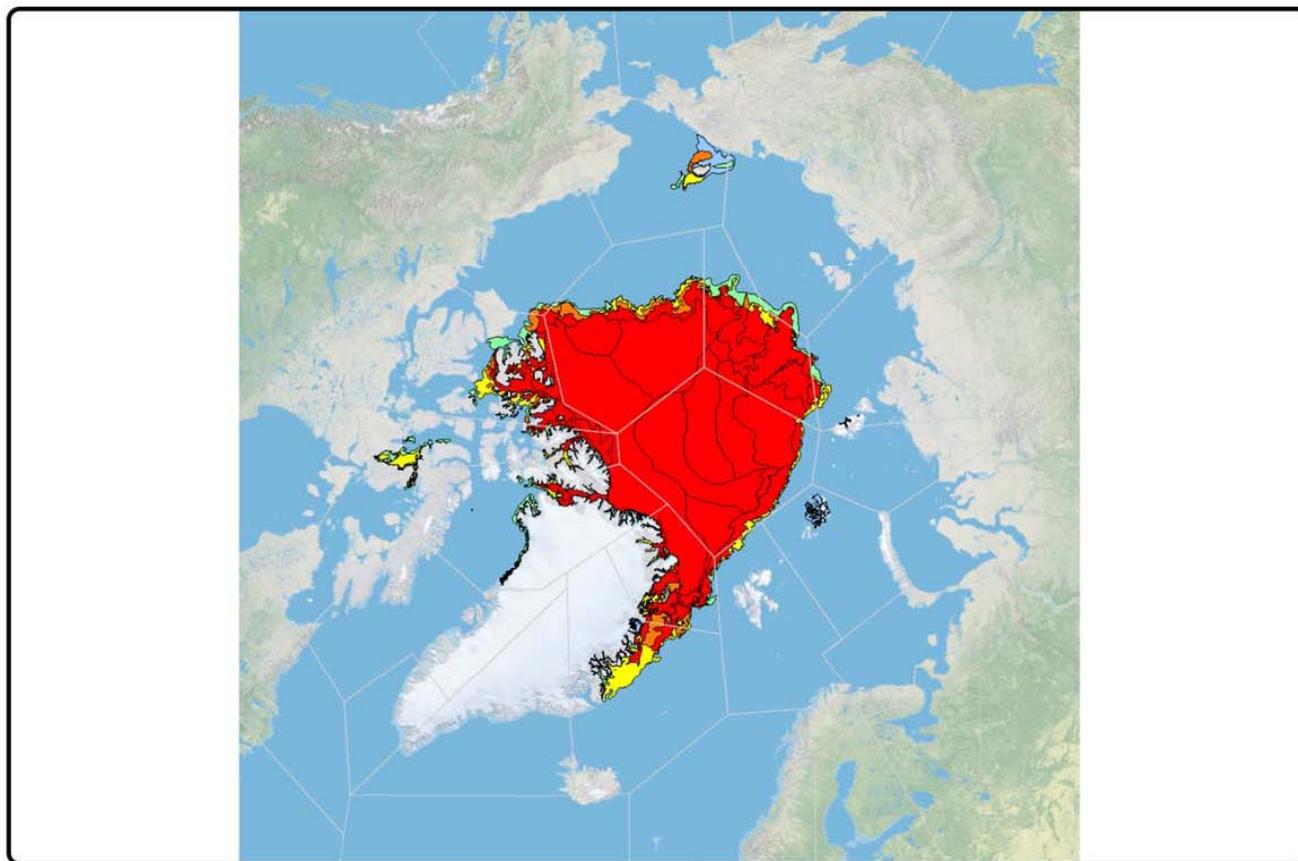
http://www.natice.noaa.gov/products/products_on_demand.html



NIC Weekly Sea Ice Chart after 2012 Minimum Record



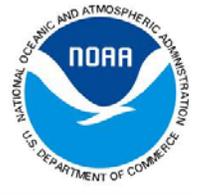
Arctic Weekly
Sun Sep 23 to Sat Sep 29, 2012



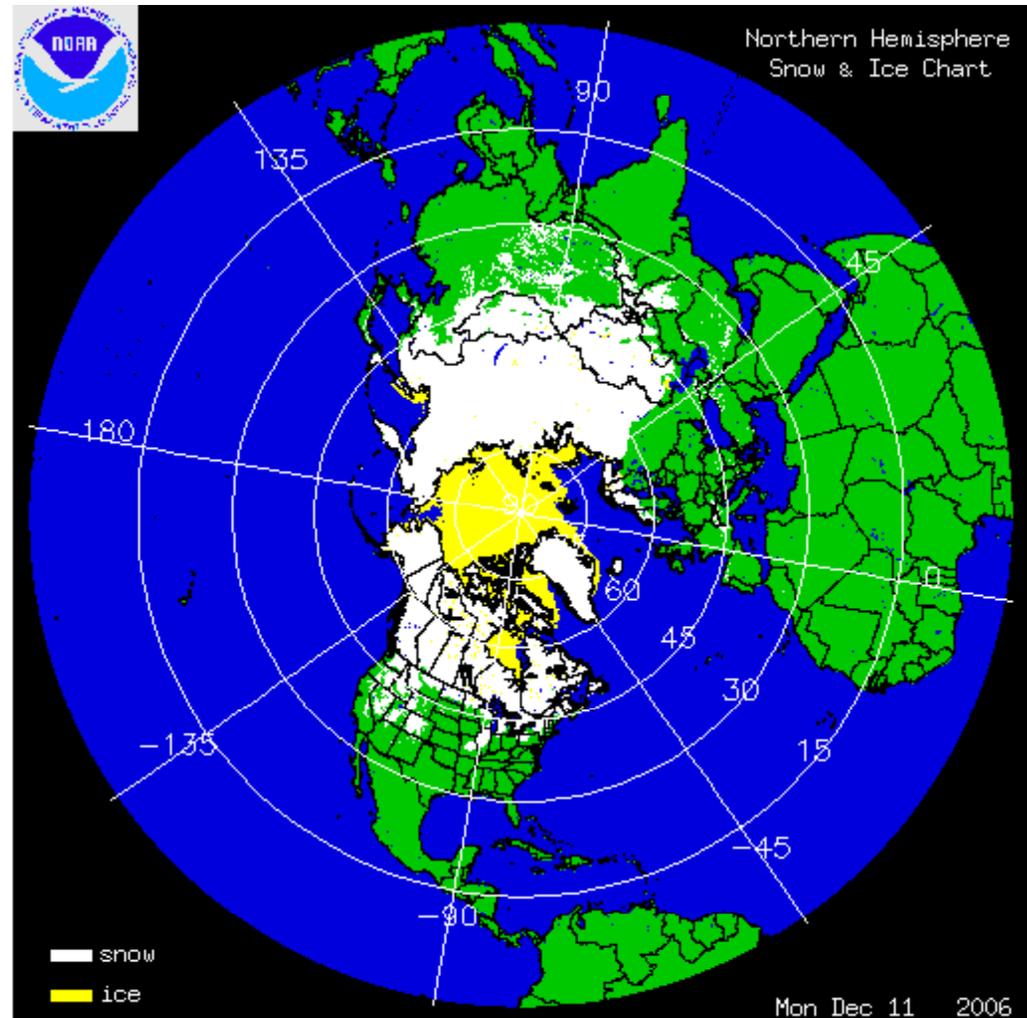
Not to be used for Navigation



NIC Snow and Ice Product



- Interactive Multi-sensor Snow and Ice Mapping System (IMS)
- Transitioned from Satellite Analysis Branch (SAB) of NESDIS in 2008
- Daily Northern Hemisphere snow and ice chart
- Used as input into several NWS computer weather prediction models, and by many other agencies worldwide

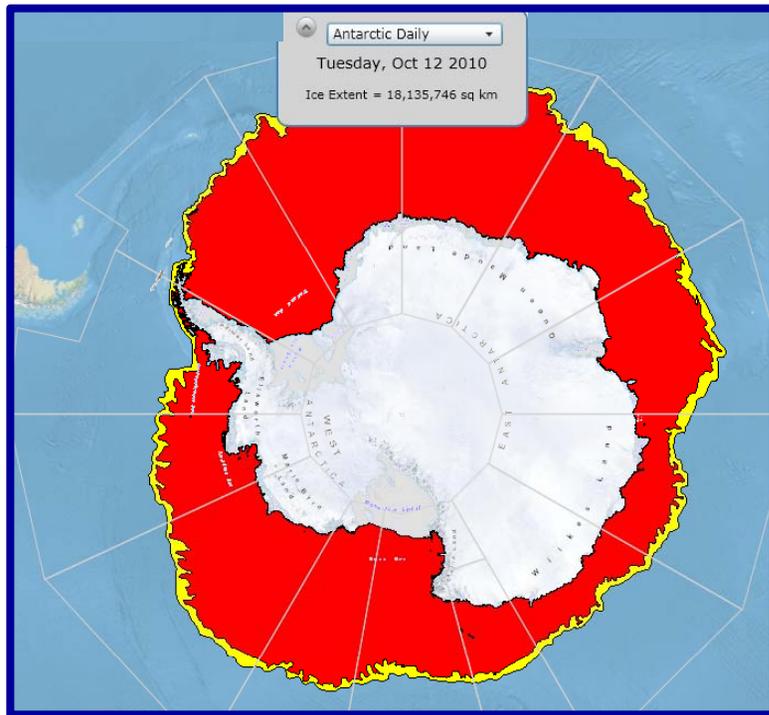




Antarctic Sea Ice Products

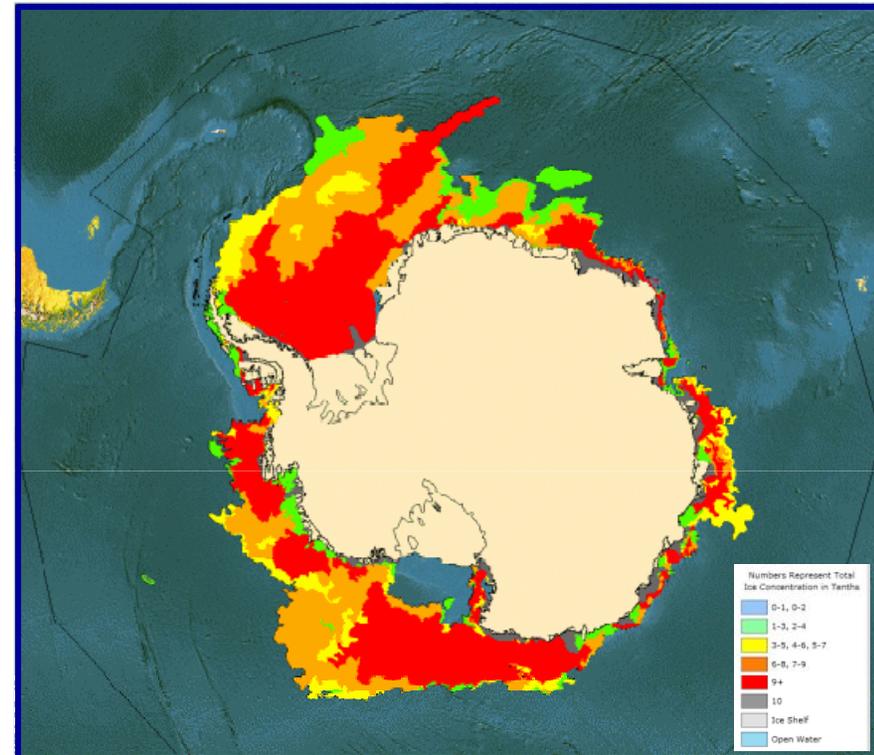


Daily Sea Ice Analysis



Ice Extent (Ice edge) - ice/no ice
Marginal Ice Zone (MIZ) - 1-8/10th ice concentration
Pack Ice - 8-10/10th ice concentration

Hemispheric Chart

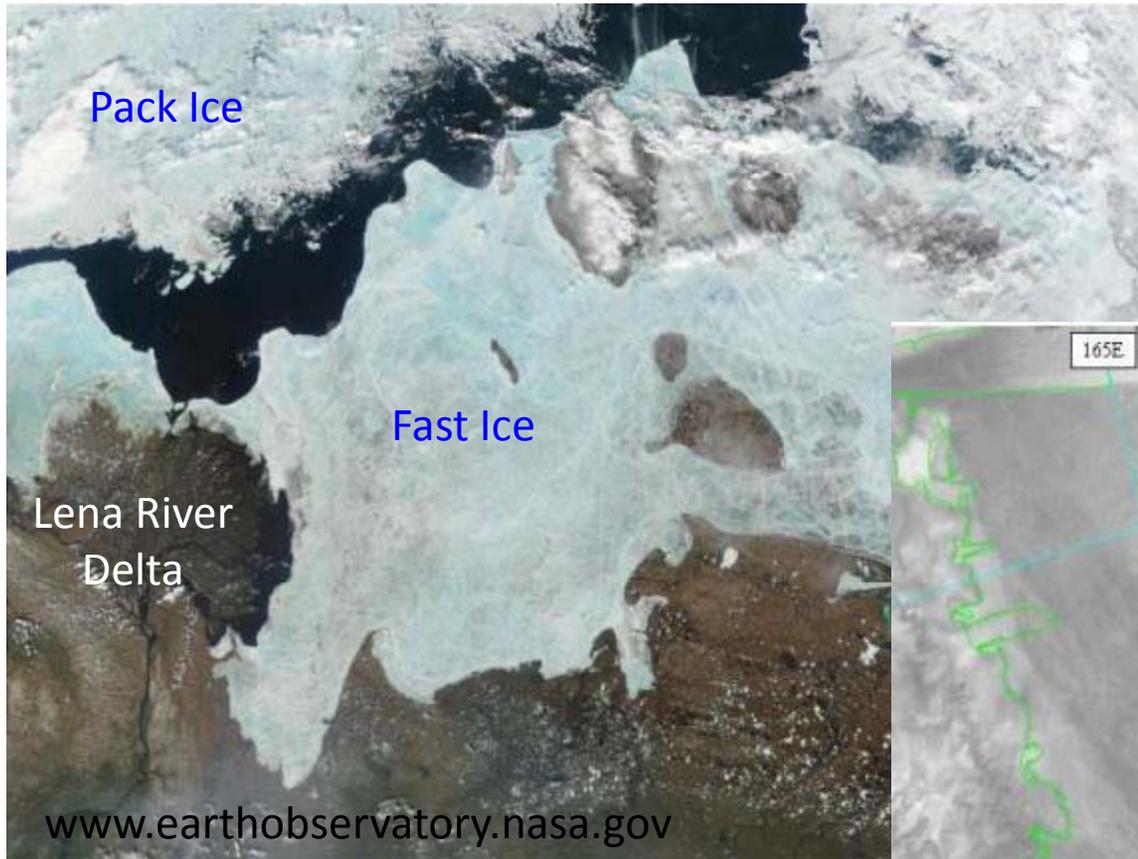


Bi-Weekly ice type and areal Concentration

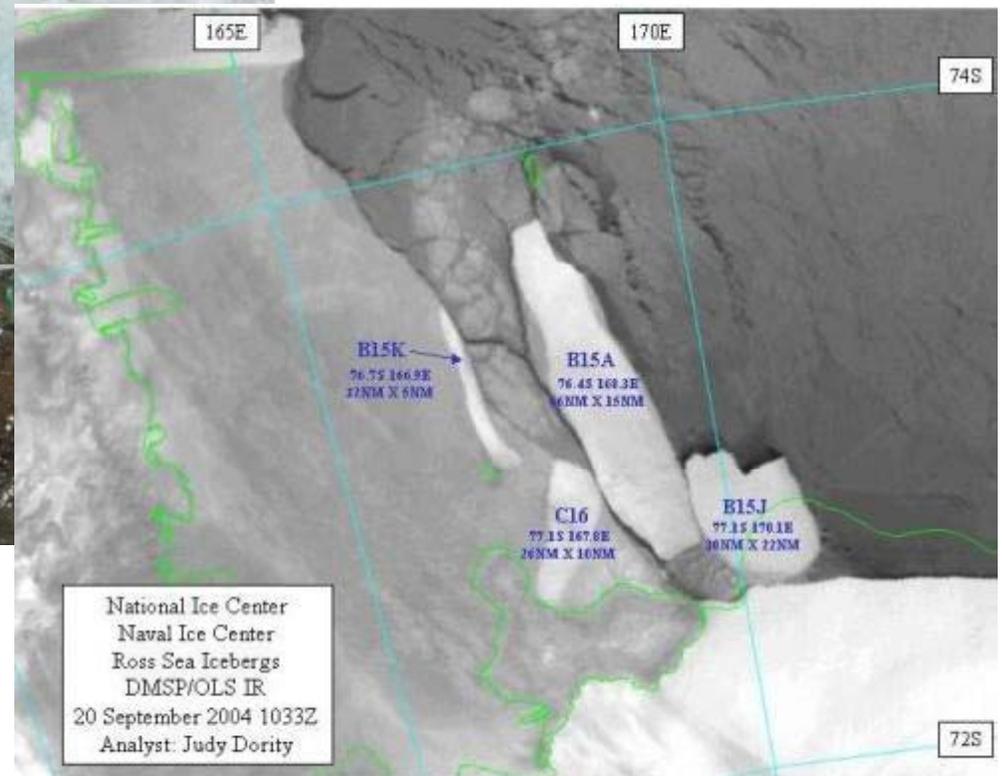
http://www.natice.noaa.gov/products/products_on_demand.html



Visible and IR Sea ice Detection



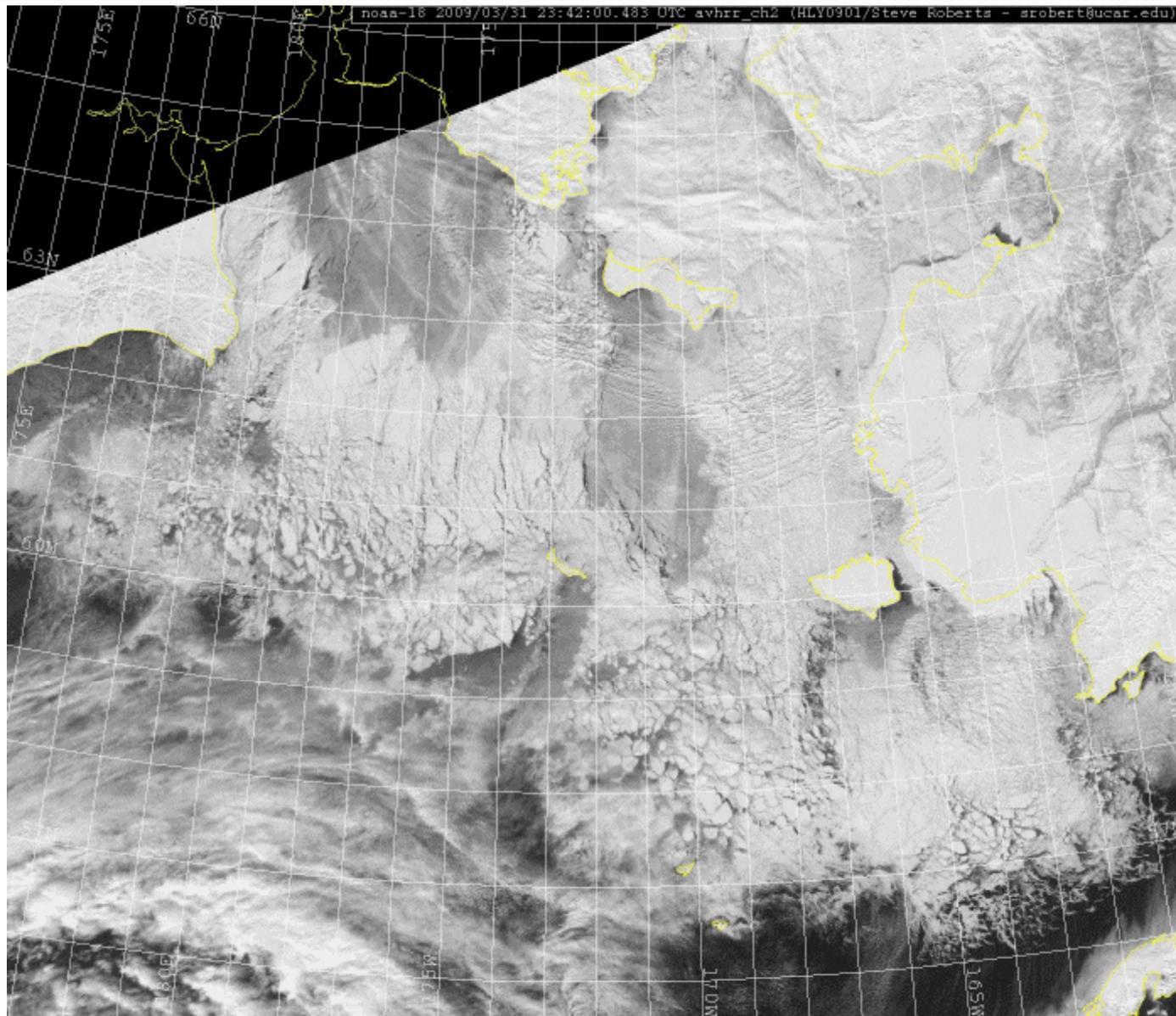
MODIS true color image



AVHRR infrared image



Cloud Impact on Visible (and IR) Sea ice Detection and Analysis

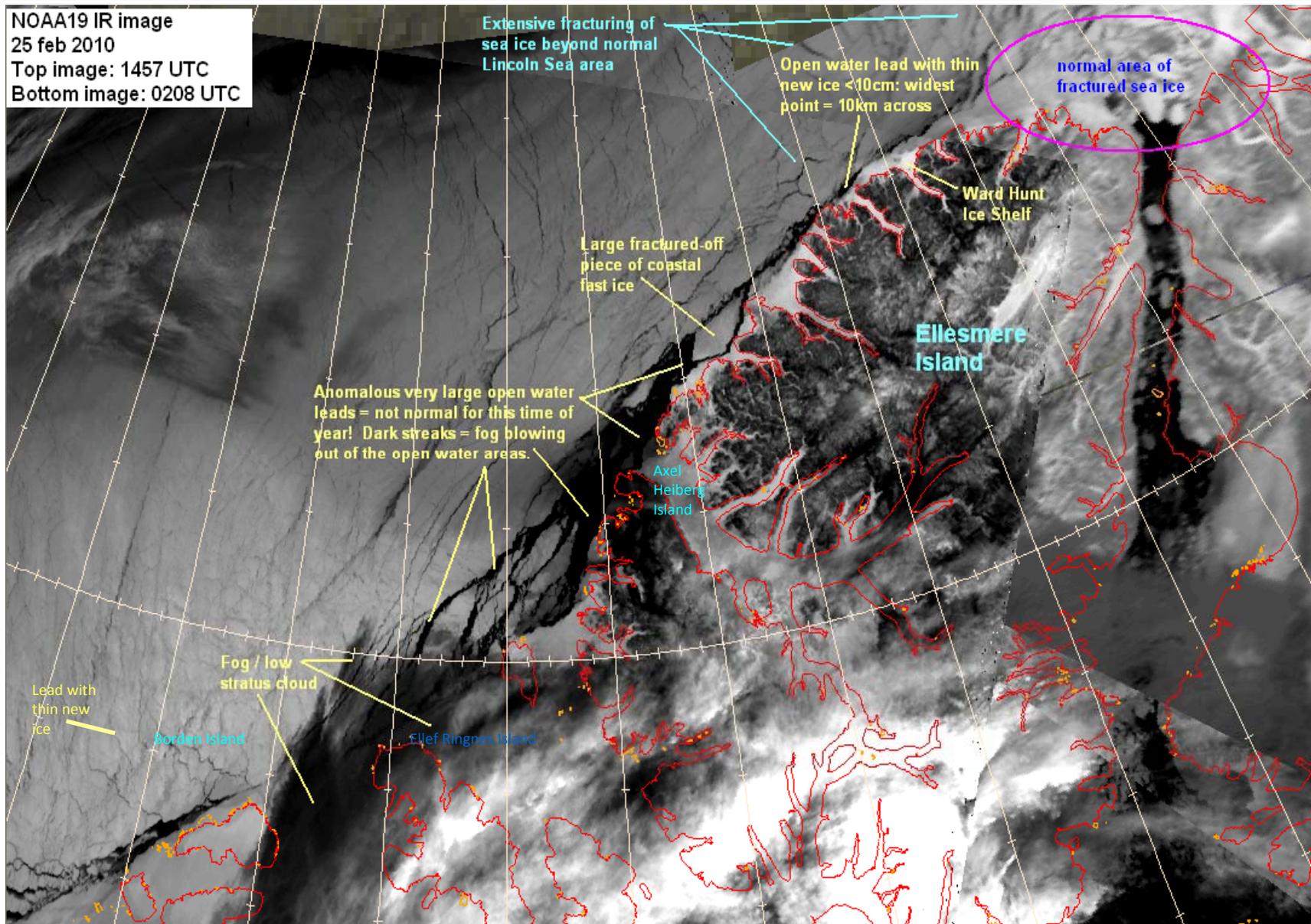




Infrared Sea ice Detection

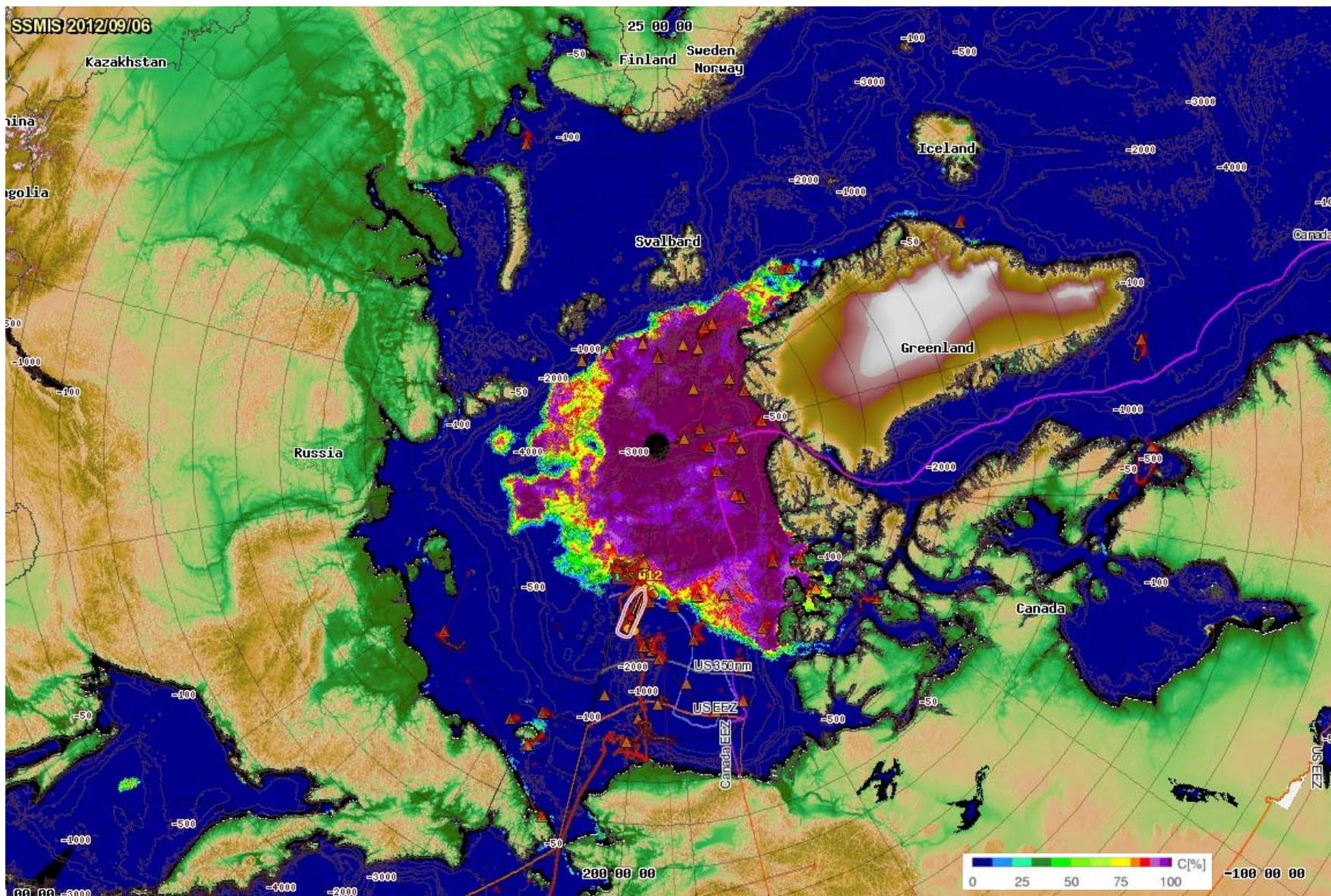


NOAA19 IR image
25 feb 2010
Top image: 1457 UTC
Bottom image: 0208 UTC



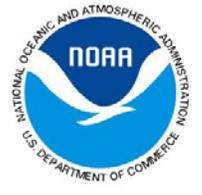


Sea Ice Concentration Based on Passive Microwave Satellite Data

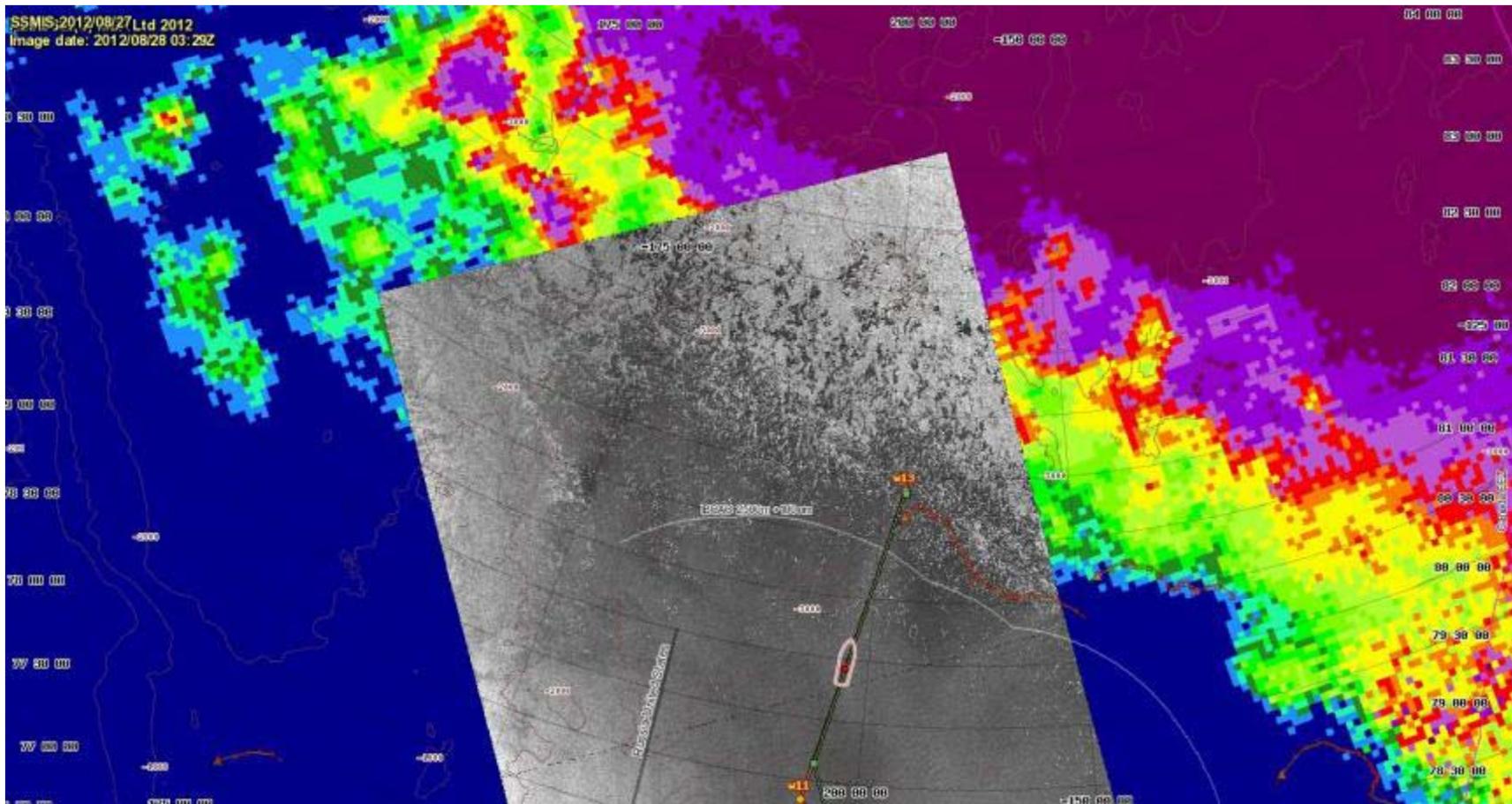




Active and Passive Sea Ice Observations 27-28 August 2012

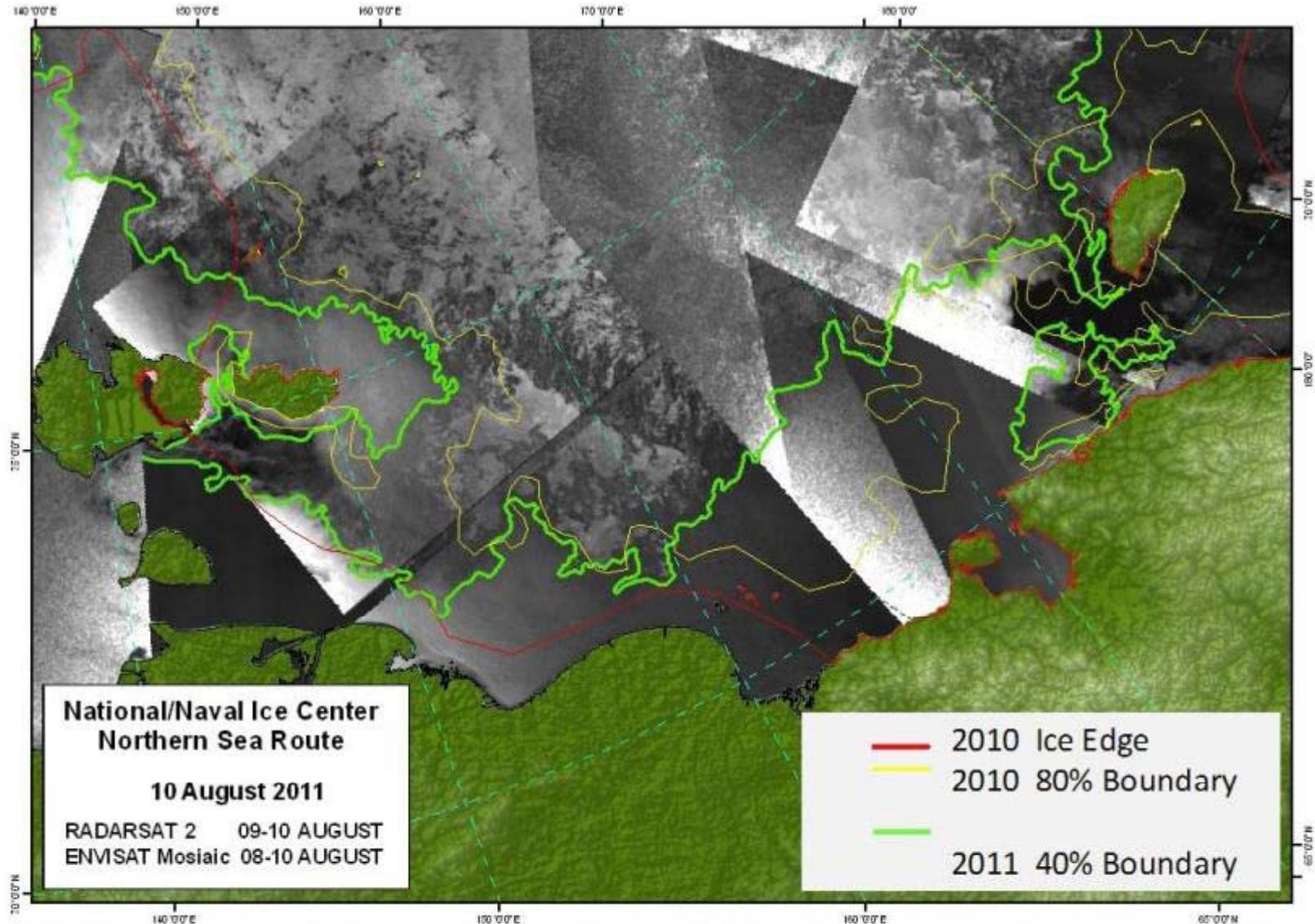


RADARSAT-2 SAR over SSMIS Concentrations





RADAR Imagery Mosaic Showing the Northern Sea Route Open



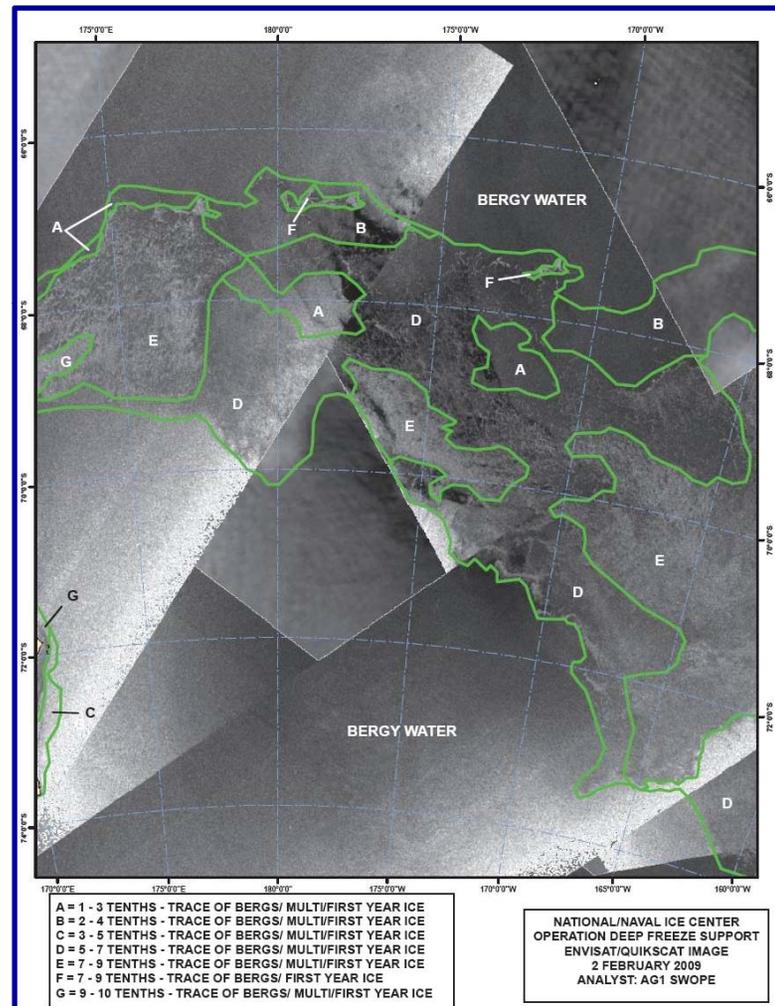
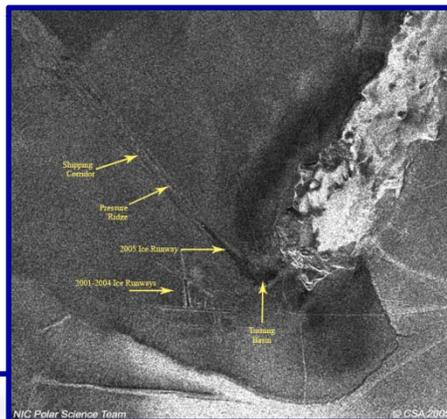


McMurdo Station Resupply



Operation Deep Freeze

Annual Support ~ December
Military Sealift Command

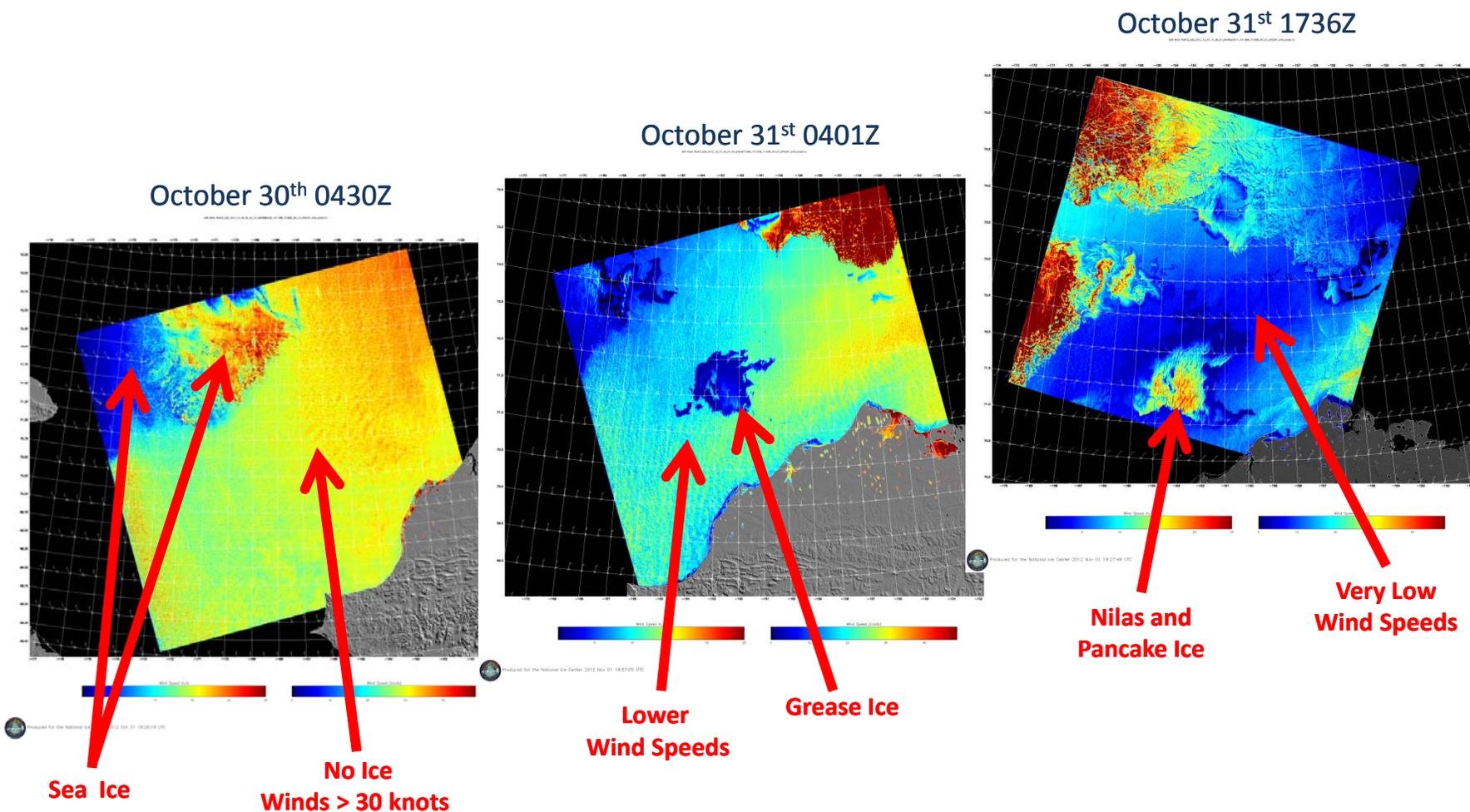




SAR Surface Winds Product Captures Freeze-up at Drilling Site



NIC RADARSAT-2 (R-2) Synthetic Aperture Radar (SAR) Surface Winds Products



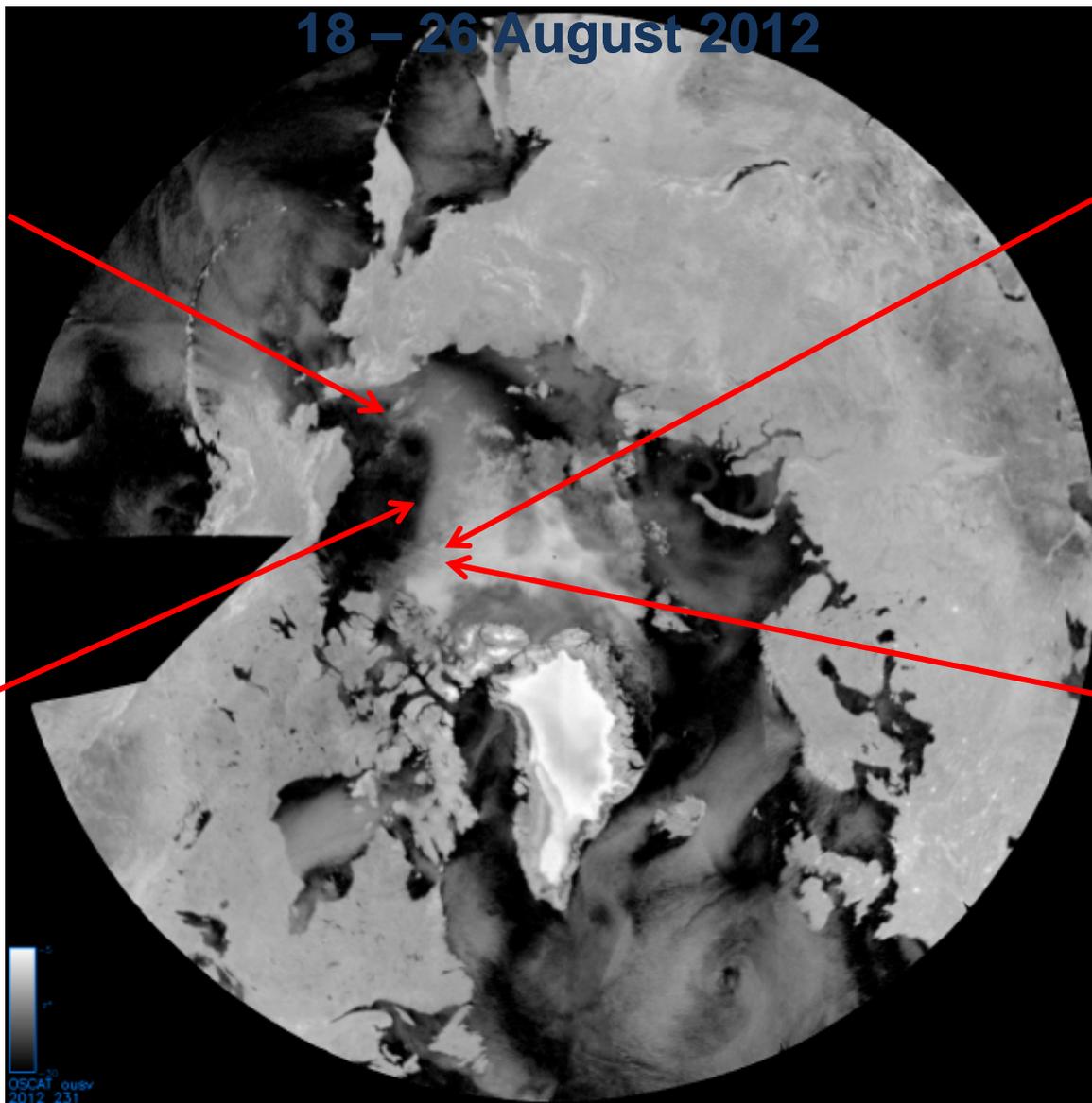


Active Microwave Sea Ice Observations From OSCAT During HLY1202



18 – 26 August 2012

More Persistent Ice
Observed Around
Wrangle Island



Stressed FYI Pack



Belts. Strips or
Filaments of MYI



MYI Traces within
FYI Cover

OSCAT obsv
2012 231



OSCAT Sea Ice Class Distribution



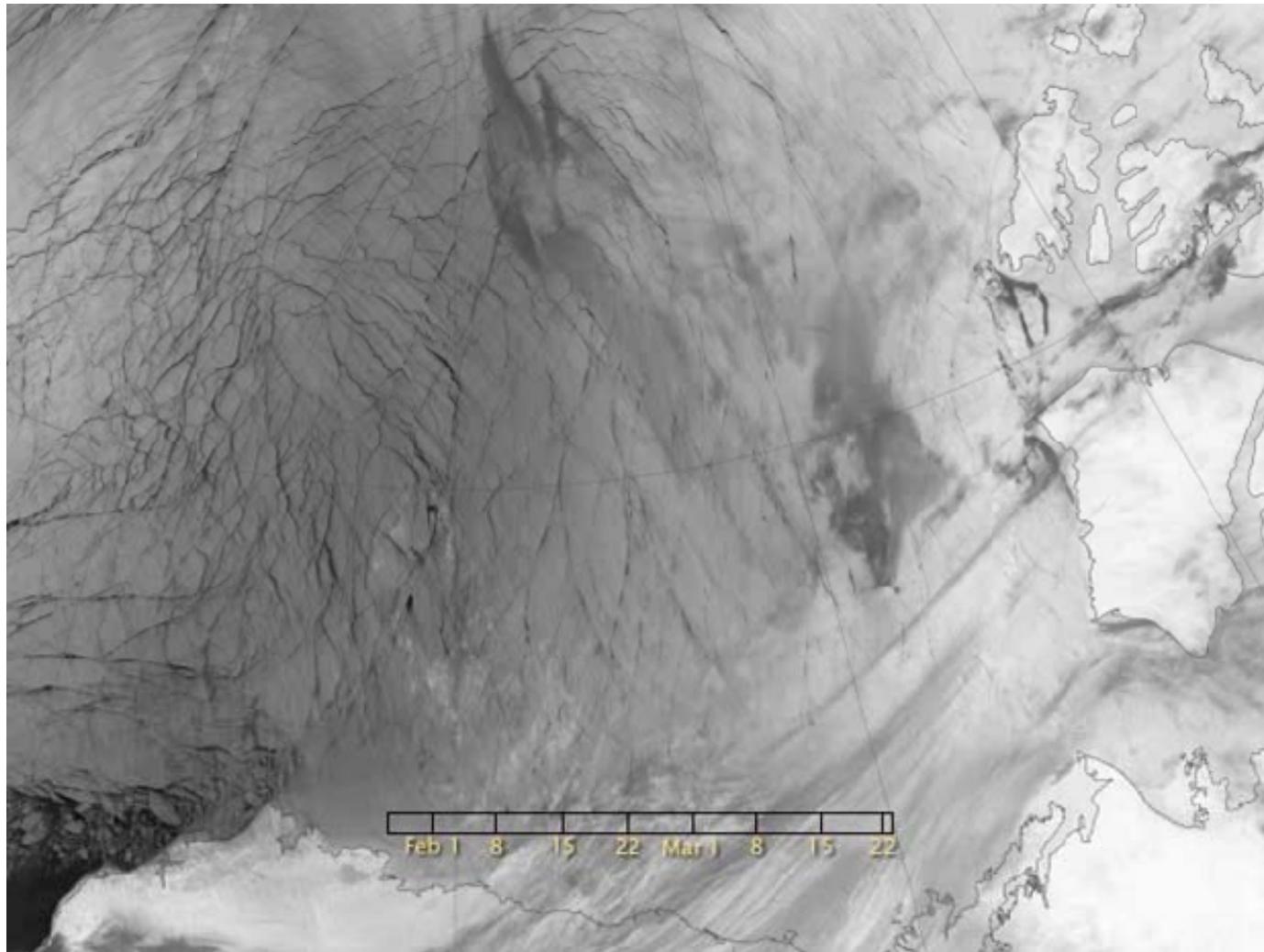
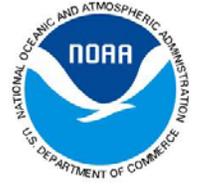
March 1, 2012

March 1, 2013



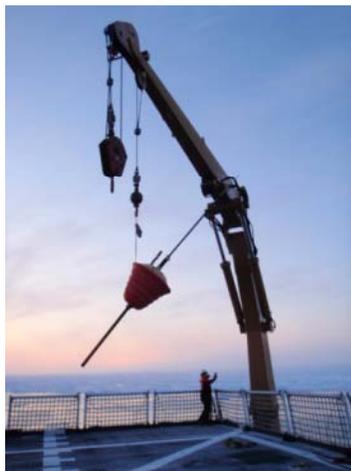


VIIRS Captures First Year Sea Ice Cover Massive Fracturing in the Beaufort Sea



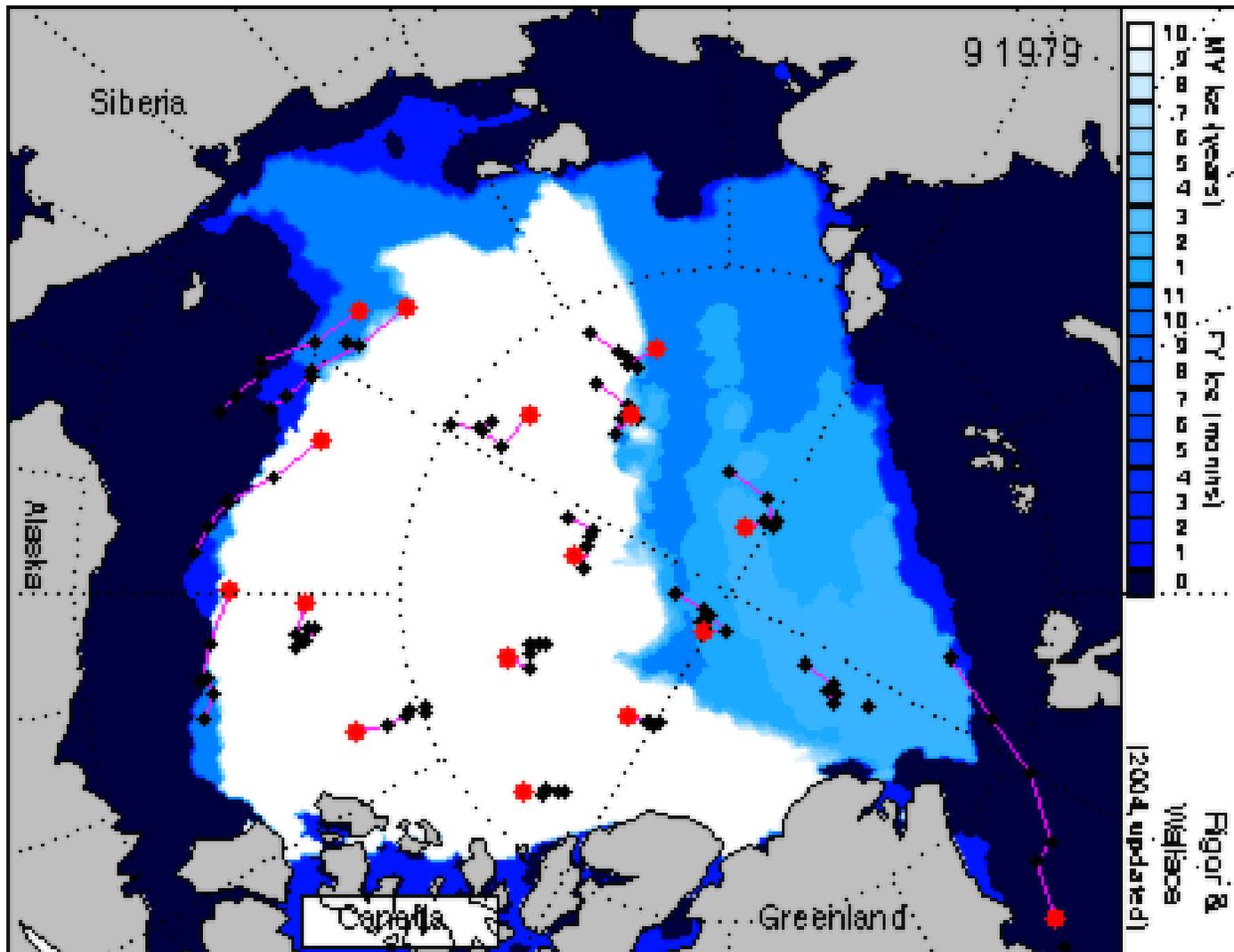
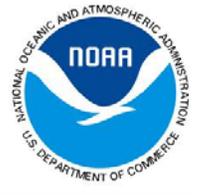


Deployment of Seasonal Buoys





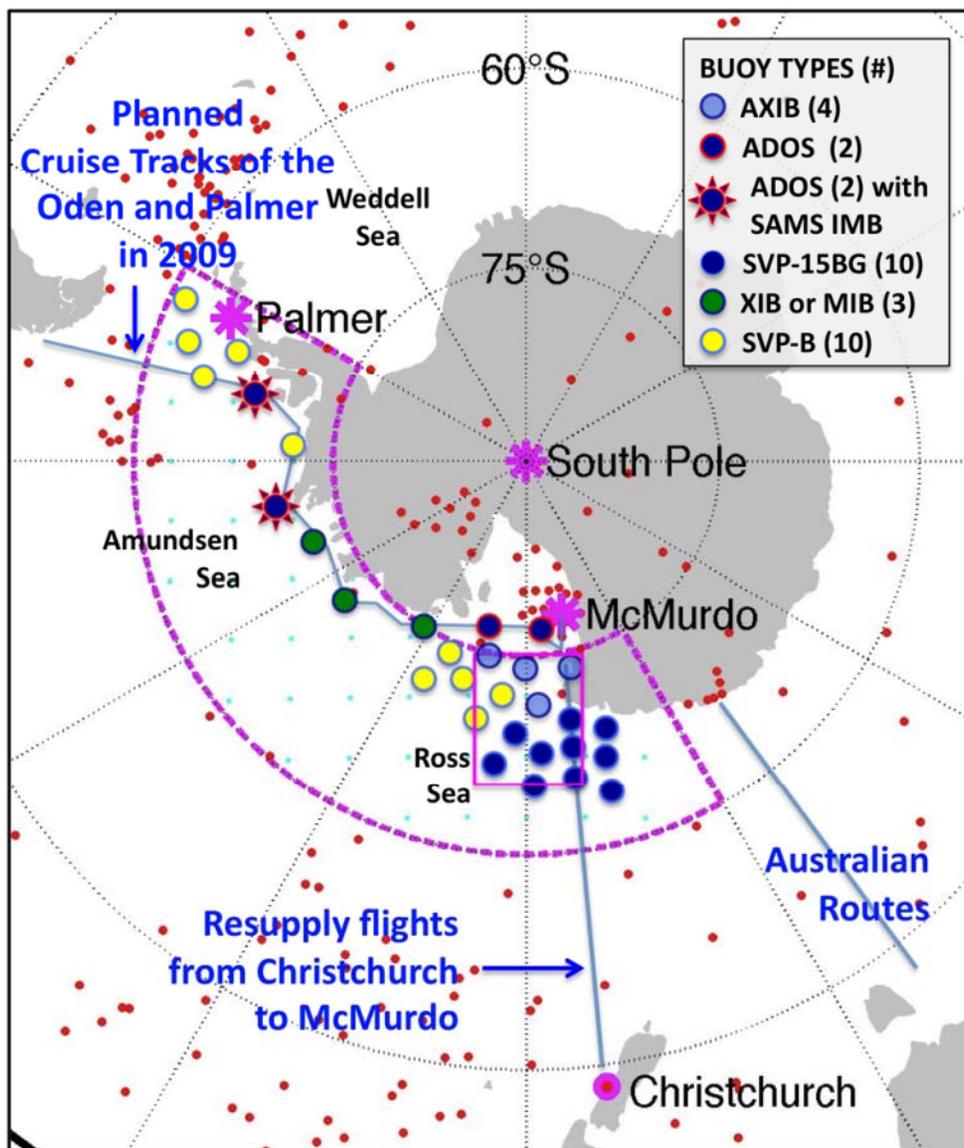
Buoy Ice Drift Sea Ice Age Model



- Sea ice grows thicker with age.
- Prior to 1989, ice over 80% of the Arctic Ocean is at least 10 years old.
- High Arctic Oscillation (AO) conditions from 1989-1991 blew most of the older, thicker sea ice out of the Arctic Ocean.
- Younger (thinner) Ice persist through today despite “normal” AO conditions.



U.S. Interagency Program for Antarctic Buoys (USIPAB)



U.S. Interagency Program for Antarctic Buoys (USIPAB) co-led by the UW/PSC and NIC.

Demonstration Project seed funding has been provided by NSF.

USIPAB deployments to be concentrated over U.S. Antarctic main region of interest, from the Antarctic Peninsula to the Ross Sea.

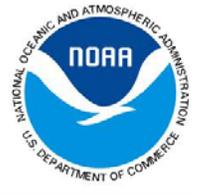
Activities include airborne, shipboard, and on ice deployments.

Initial plan based on seed funding are for 9 AXIB (surface), 3 UpTempO, and 10 to 12 SVP upgrades, or about 22 of 31 buoys proposed.





Some Final Remarks



- Following the loss of QuikSCAT and Envisat ASAR, operational use of the Oceansat-2 OSCAT data for sea ice products is intended thanks to the operational availability of the global data as part of the ISPRO, EUMETSAT, NOAA and NASA agreement.
- Launch of critical sea ice monitoring missions have been delayed.
- There is a need for increased automation of sea ice and snow analysis a degree of which could be provided with the availability of SMAP.
- There still a need for increased collaboration between sea ice services and research centers in the areas of remote sensing observation, data analysis, applications and validation.



FUTURE SATELLITE MISSIONS FOR NIC OPERATIONAL MONITORING



ESA Sentinel-1



Credit: European Space Agency

LAUNCH PLANNED FOR 2013-2015

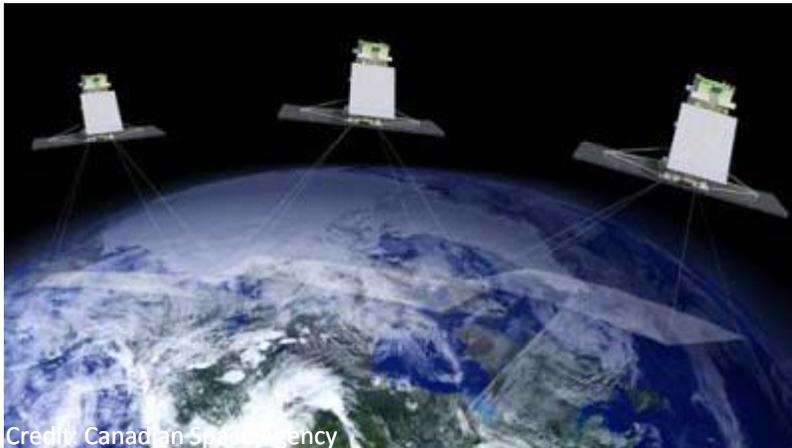
NASA Soil Moisture Active and Passive (SMAP)



Credit: Canadian Space Agency

LAUNCH PLANNED FOR 2014

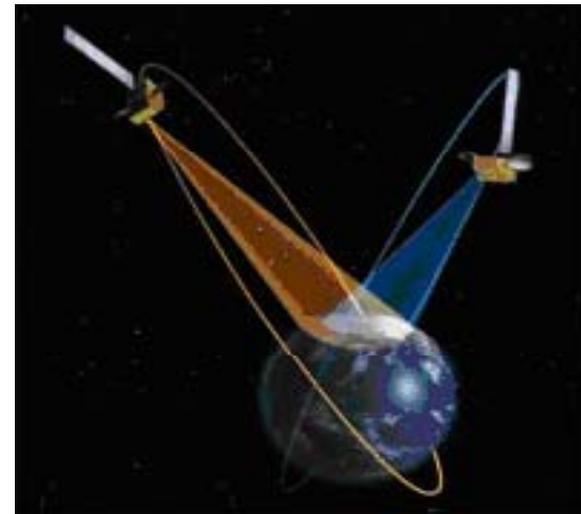
CSA RADARSAT Constellation Mission (RCM)



Credit: Canadian Space Agency

LAUNCH PLANNED FOR 2018

CSA Polar Communication and Weather (PCW)



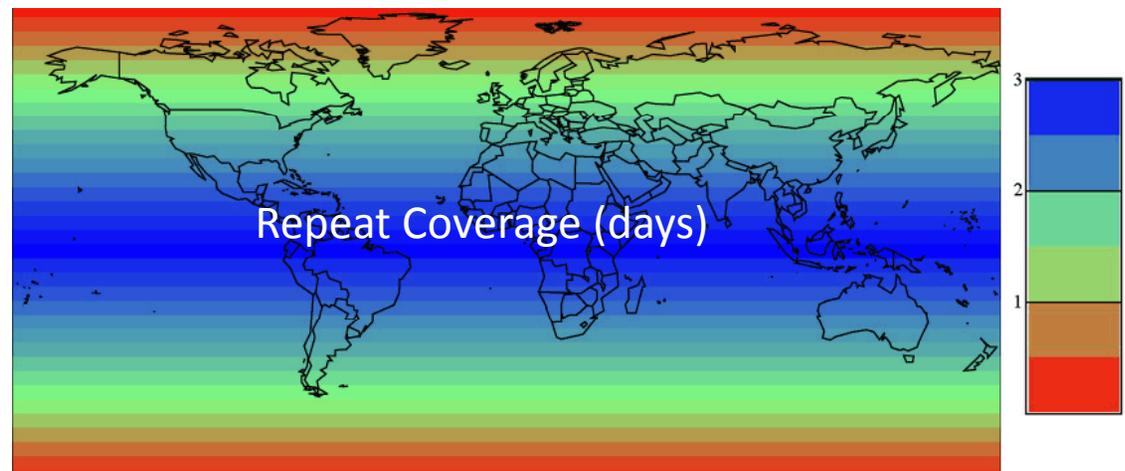
TENTATIVE LAUNCH PLANNED FOR 2017-2018



ESA Sentinel-1 SAR Constellation

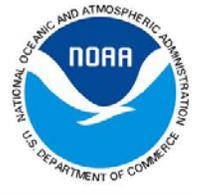


- 2300 Kg spacecraft mass
- 7 years design life time, consumables for 12 years
- Sun synchronous dawn-dusk orbit at 693 Km mean altitude
- 12 days repeat cycle (1 satellite), 6 days for the constellation
- The two satellites are in the same orbit but with a different mean anomaly
- C-Band SAR Payload with centre frequency 5.405 GHz

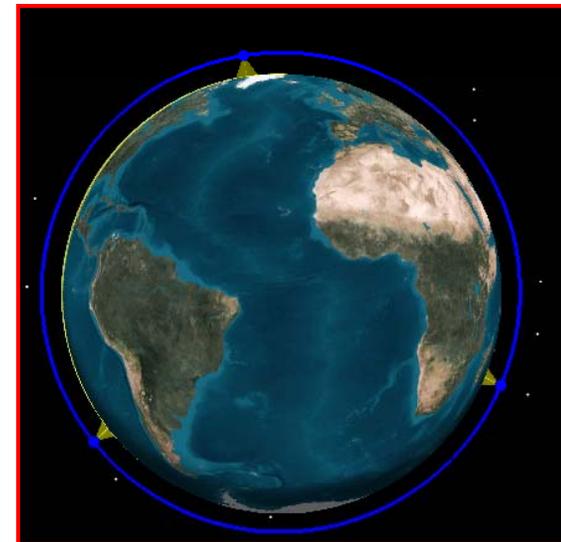
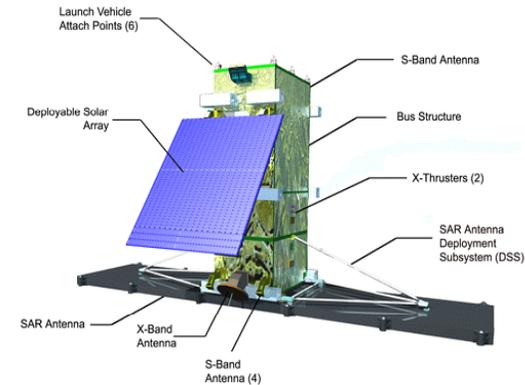




CSA RADARSAT Constellation Mission (RCM)

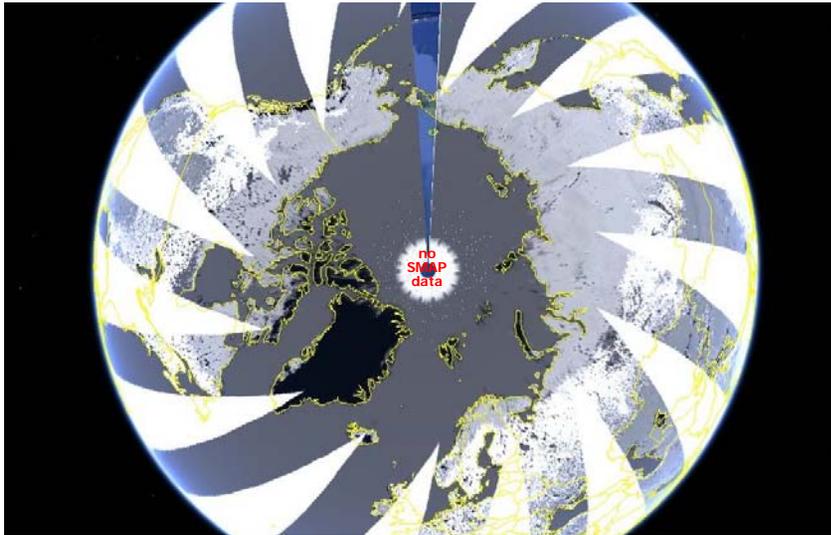
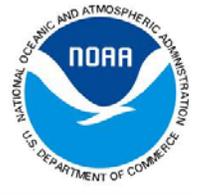


Bus	Canadian Smallsat Bus
Launcher	DNEPR specifications (for design) can use PSLV, Falcon V
Total Mass	< 1300 kg with margin
Antenna	9.45m²
Power	<1600 W peak; <220 W average
Orbit	600 km, 100m radius orbital tube
Polarisation	Single Pol / Dual cross selectable pol & Compact polarimetry available on all modes; One fully polarimetric mode
Imaging Time	12 minutes/orbit (peak 20 minutes every three orbits) 10 minutes continuous imaging
Lifetime	7 years (each satellite)

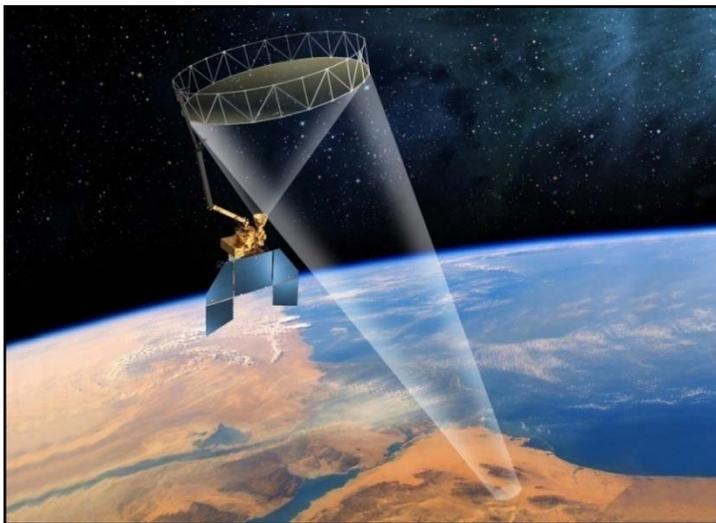




NASA Soil Moisture Active and Passive Mission (SMAP)



Cryospheric Requirements Being Added and recommend as level-1



Hardware Status:

- Currently in System Design
- Prototype Hardware in Test
- Technology Readiness Level: ≥ 6
- Project PDR: October 2011
- Project CDR: May 2012
- Flight Ready: October 2014

Major Instrument or Equipment:

- High resolution measurements
 - Large (6-meter) rotating light-weight deployable mesh antenna
 - 1.26 GHz Radar at 3 km
 - 1.41 GHz Radiometer at 40 km at constant 40° incidence
- Conical scan forming 1000 km wide swath
- Global mapping with 2-3 days revisit time

Launch scheduled for November 2014



Create your own unique workspace

Arctic Collaborative Environment (ACE) Tool Web-Access



Create your ACE User Account

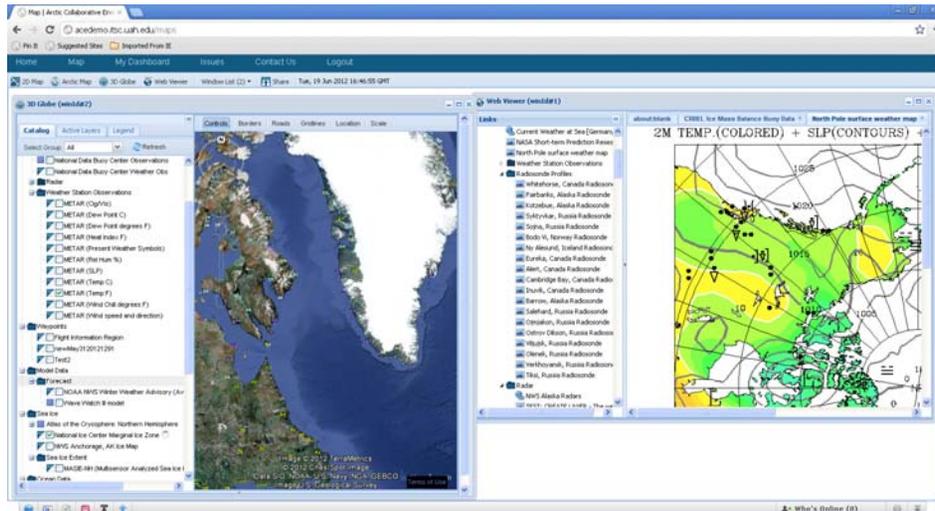
Tutorials and Quickstart guides

The screenshot shows the ACE web application interface. At the top, there is a navigation menu with links for Home, Map, My Dashboard, Issues, Contact Us, and Logout. A search bar is located on the right side of the menu. Below the menu is a large banner image featuring a red icebreaker ship in the Arctic. The text 'ACE Arctic Collaborative Environment' is displayed on the right side of the banner. Below the banner, there are links for 'My Account' and 'Create Content'. The main content area features a news article with a video player showing a person with a red parachute. The article title is 'Canadian military turns to volunteers for Arctic rescues'. To the right of the article is a 'TUTORIALS' section with a list of links to various guides and videos. Below the tutorials is a 'SEARCH CATALOG' section with a search input field and a 'Search' button. At the bottom of the page, there is a 'TAGS IN THEMATIC KEYWORDS' section.

<http://acedemo.itsc.uah.edu/>

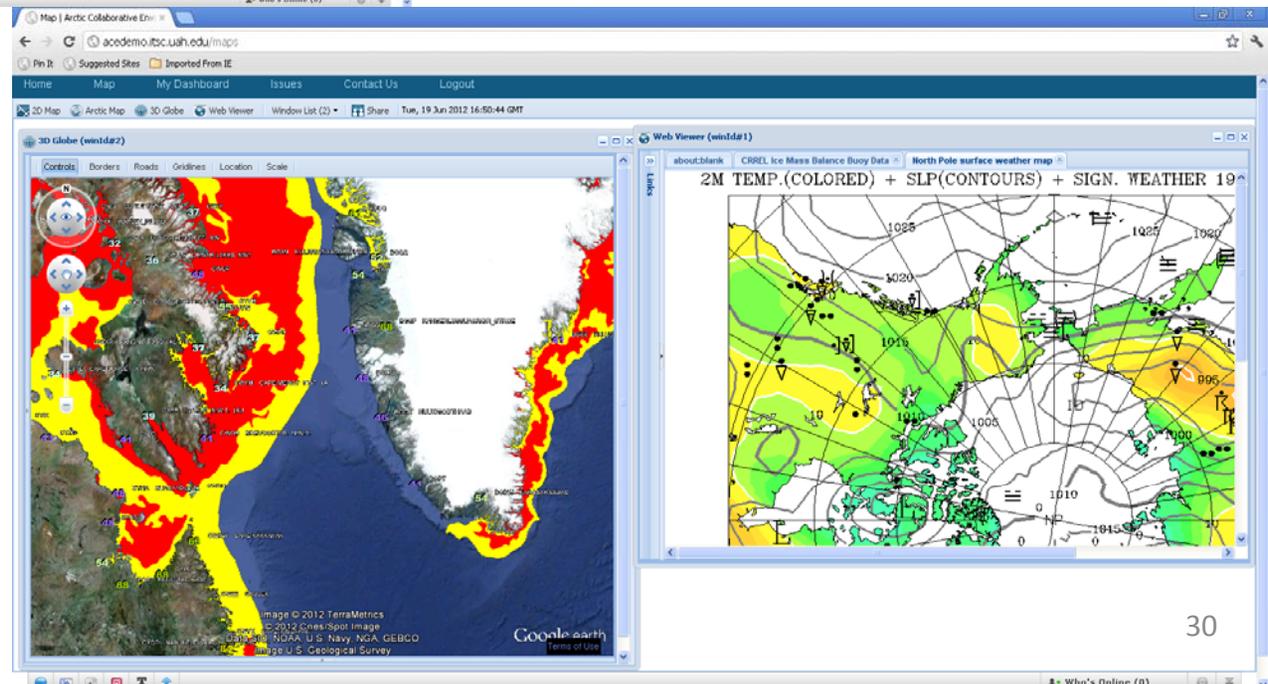


ACE Tool



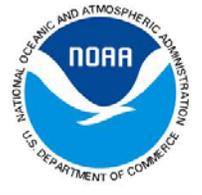
Users select from data catalog, which includes KML/KMZ, WMS, webpages and images. Users can collapse and reopen the data catalog to better view data sets and layer new data sets.

Naval/National Ice Center Marginal Ice Zone [MIZ] product layered with real-time METAR surface temperature (degrees Fahrenheit) [left] and University of Cologne North Pole surface chart [right]





NIC FUTURE REQUIREMENTS



- Strengthen partnerships and collaboration with other Arctic (and Antarctic) countries on safety of navigation, science/research, data collection, and charting.
- Increase data resources
 - Real-time availability of all-weather, day and night, high resolution Synthetic Aperture Radar (SAR) imagery is crucial.
 - Seasonal ice buoys; open ocean drifting buoys; hydrographic sensors; potential exploitation and use of UAV/UUVs?
- Improve modeling and forecasting capabilities for optimum track ship routing (OTSR)
- More trained civilian ice analysts as demand signal for support in the Arctic increases.
- Increased automation capability where it makes sense.

¿Preguntas?

