Norwegian Meteorological Institute

DMI

# Perspectives on Polar Tourism and Improved Collaborations with Citizen Science


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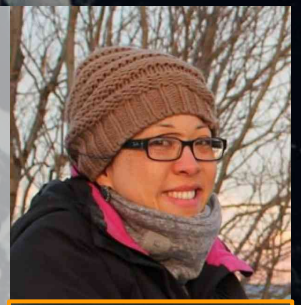

**Trond Robertson**
Senior Ice Analyst, Norwegian Ice Service
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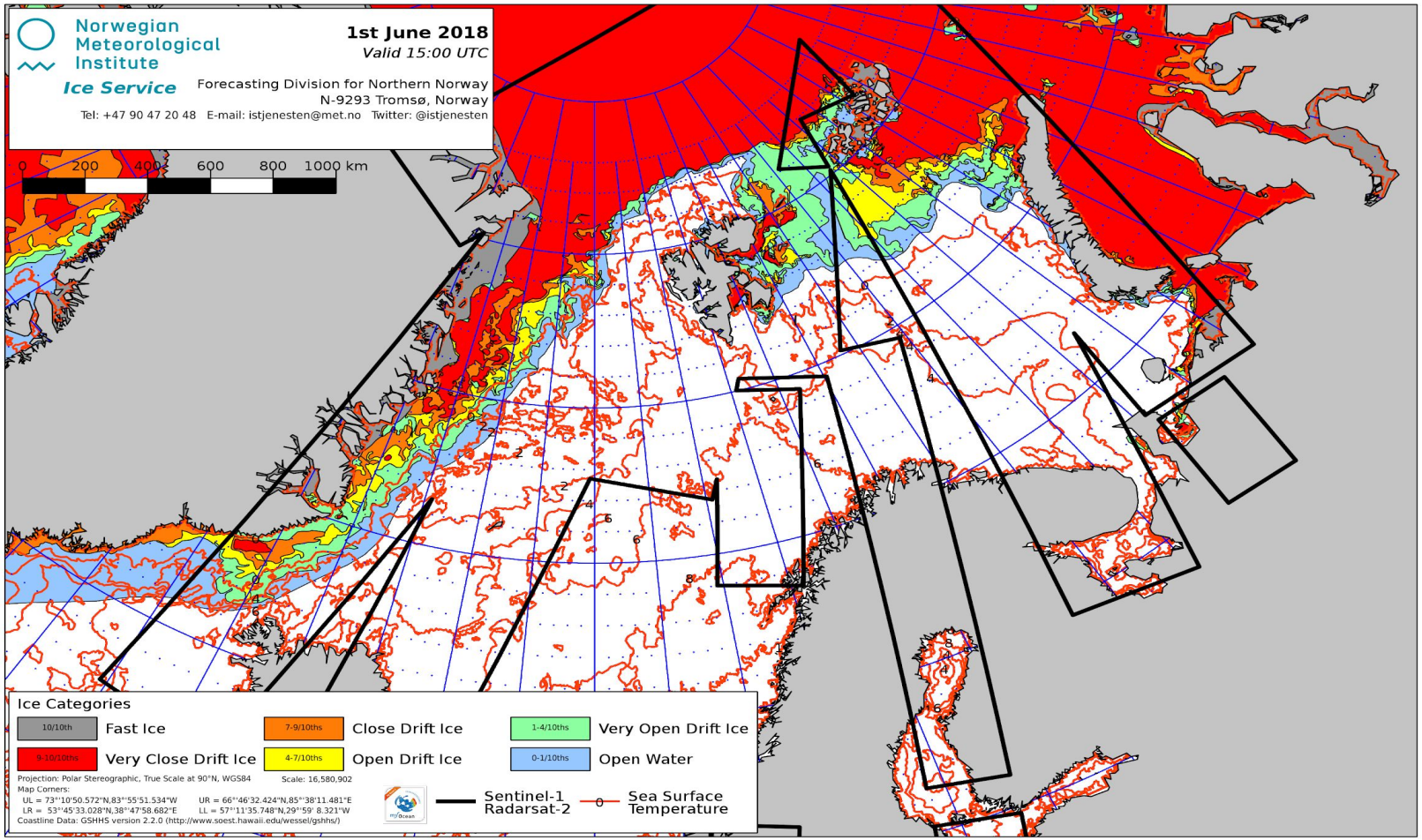
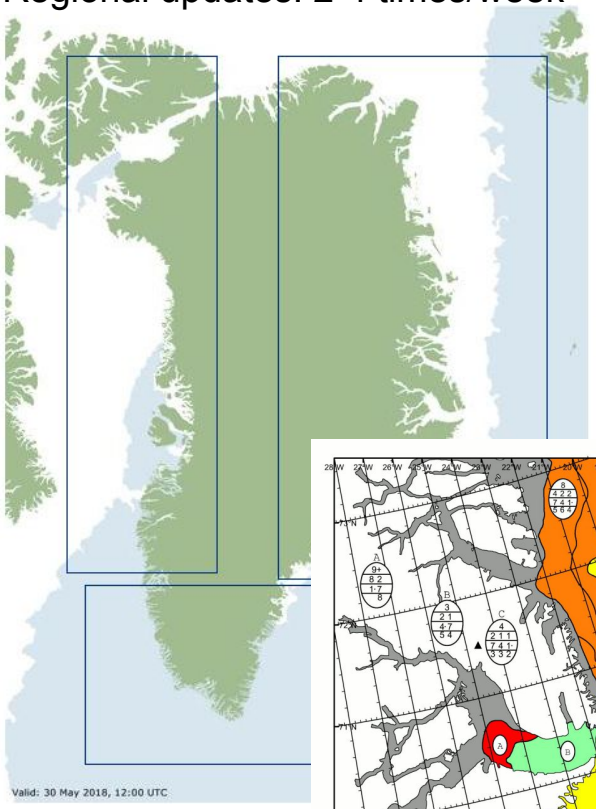
MODIS Terra image of the Antarctic Peninsula, 6 January 2016 [Data NASA 2016]

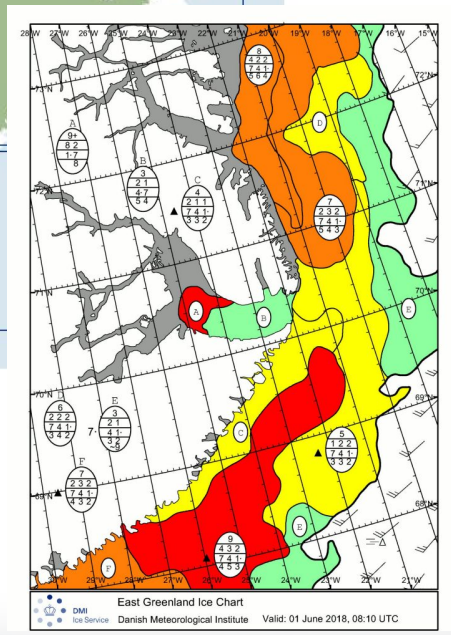
# Area of Operations



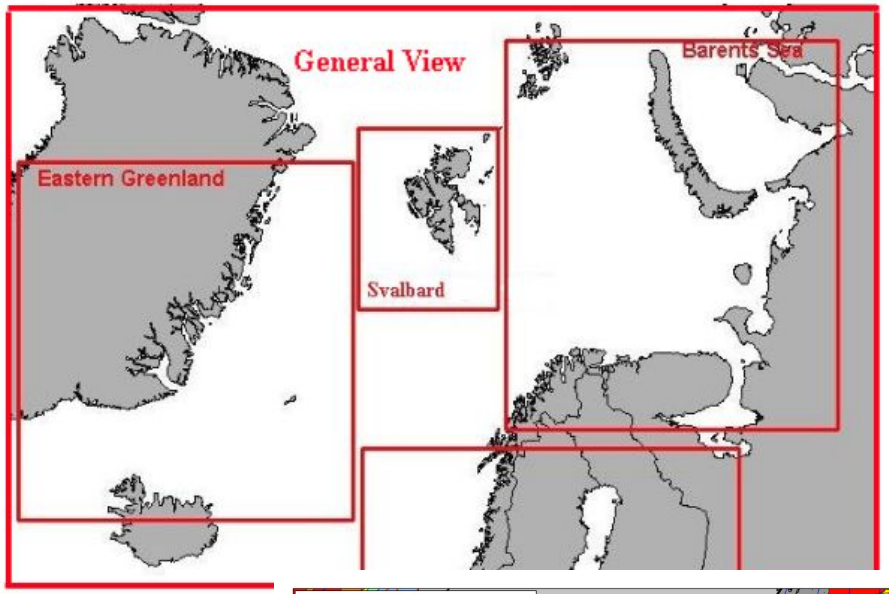
# Area of Operations

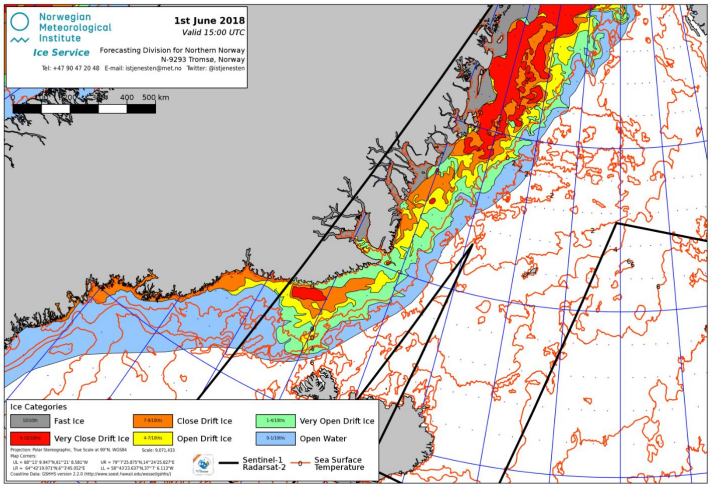
Office staffed 7 days/week
Regional updates: 2-4 times/week




Daily charts: Monday - Friday



# Polar Expedition Cruise Participation and Assistance

**MET Norway -**

2017 - *Midnatsol* Hurtigruten, Chilean Fjords and Antarctic Peninsula

2017 - *50 Years of Victory*, Murmansk to the North Pole

2017 - National Geographic, Svalbard and Greenland

2018 - Seabourn, Antarctic Peninsula and Antarctic Sound

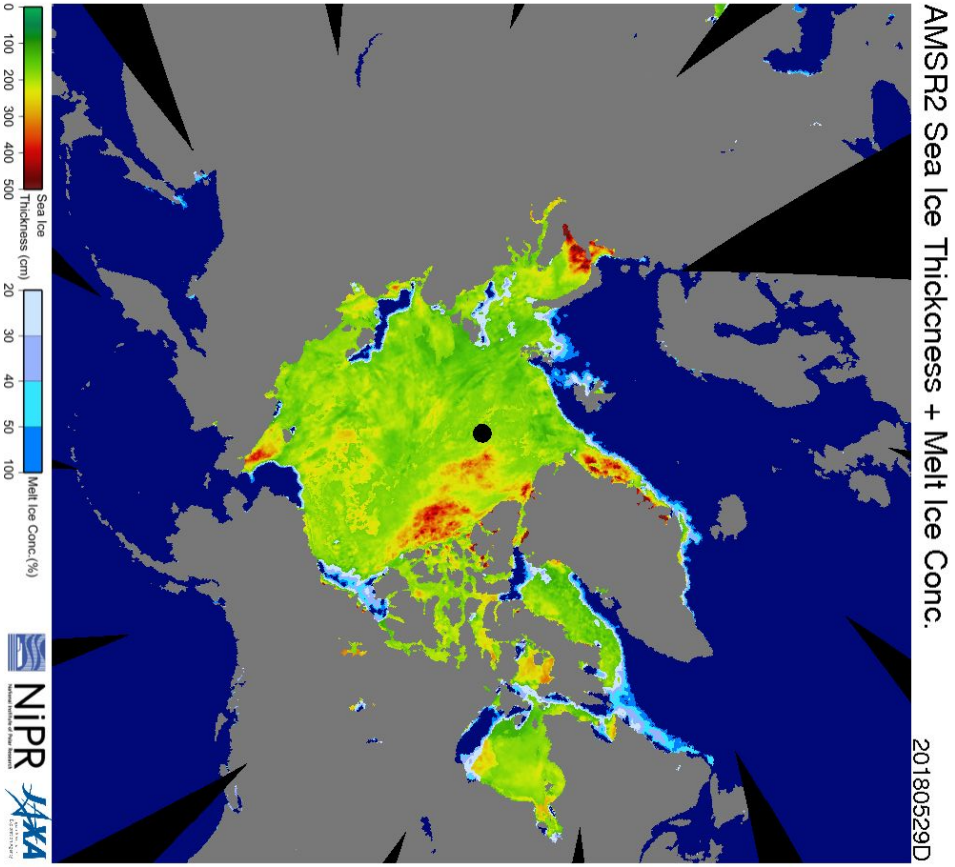
**DMI -**

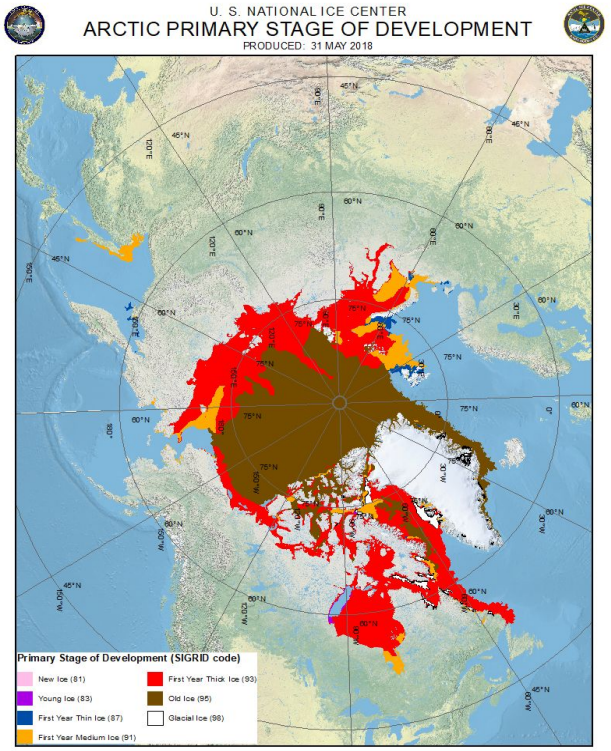
2017 - Contract on services to Greenland Pilot Service

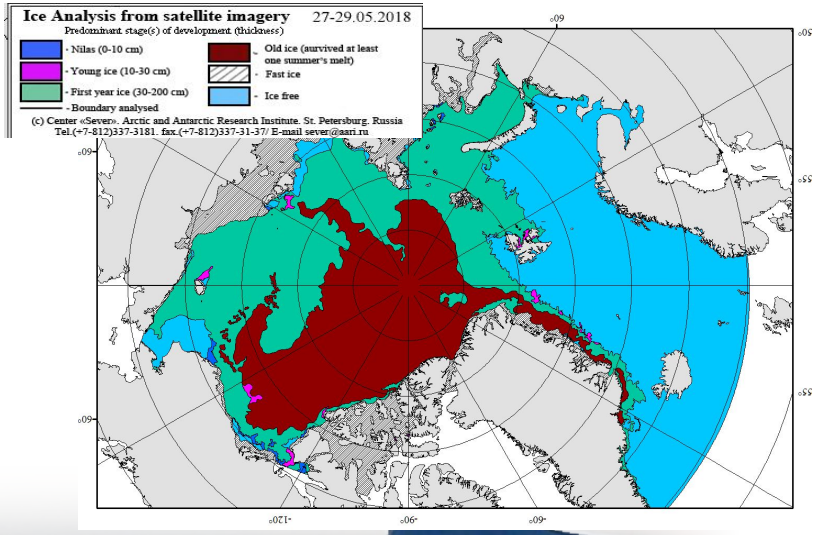
2018 - AECO / IAATO Collaboration

2018 - Mary Arctica, Antarctica

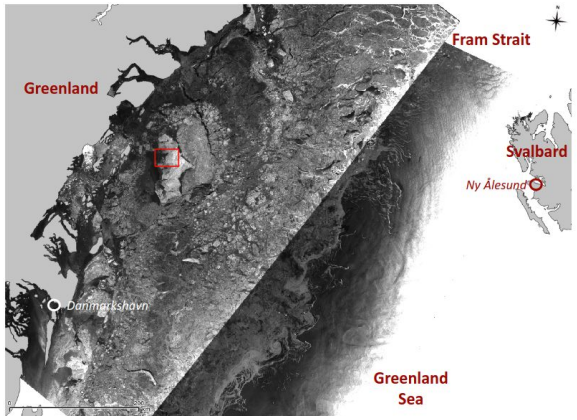
# Importance of accurate sea ice info

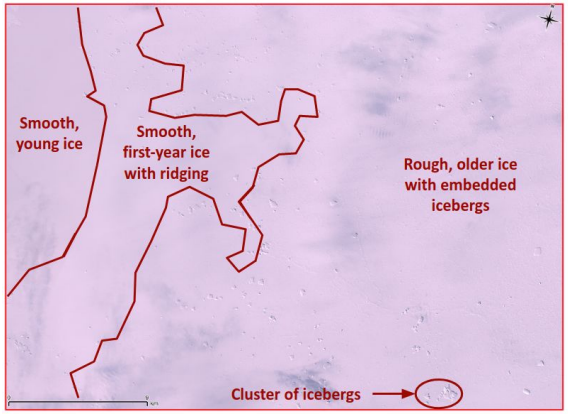


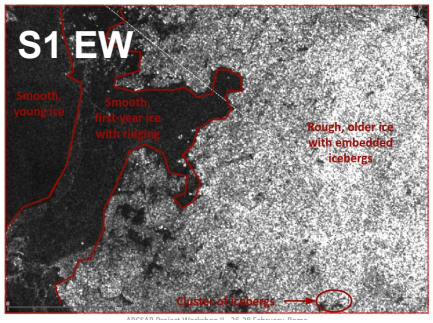
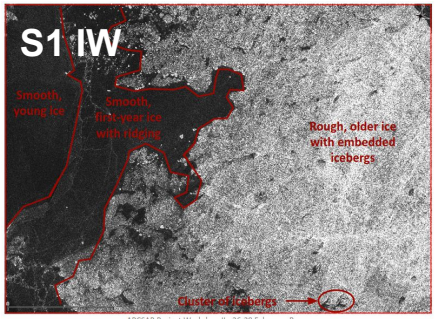
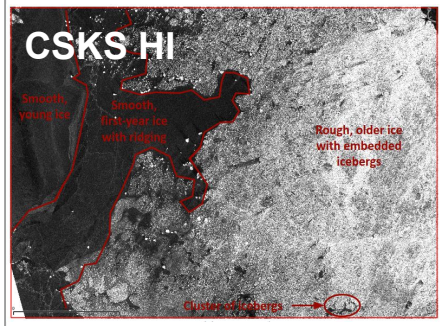
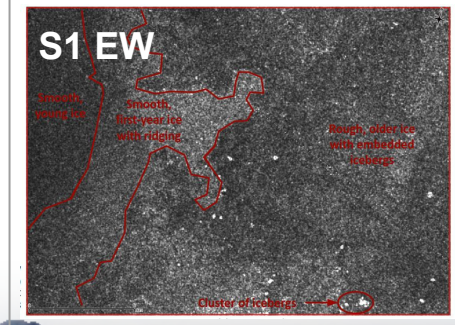
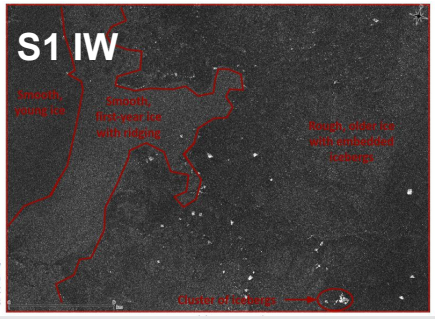
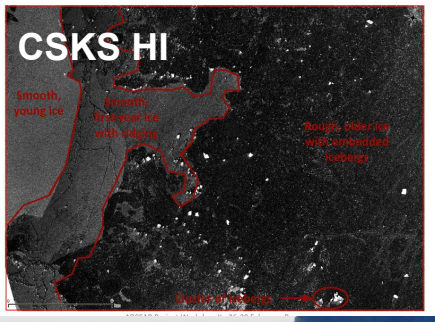



# Case Study- NE Greenland Belgica Bank

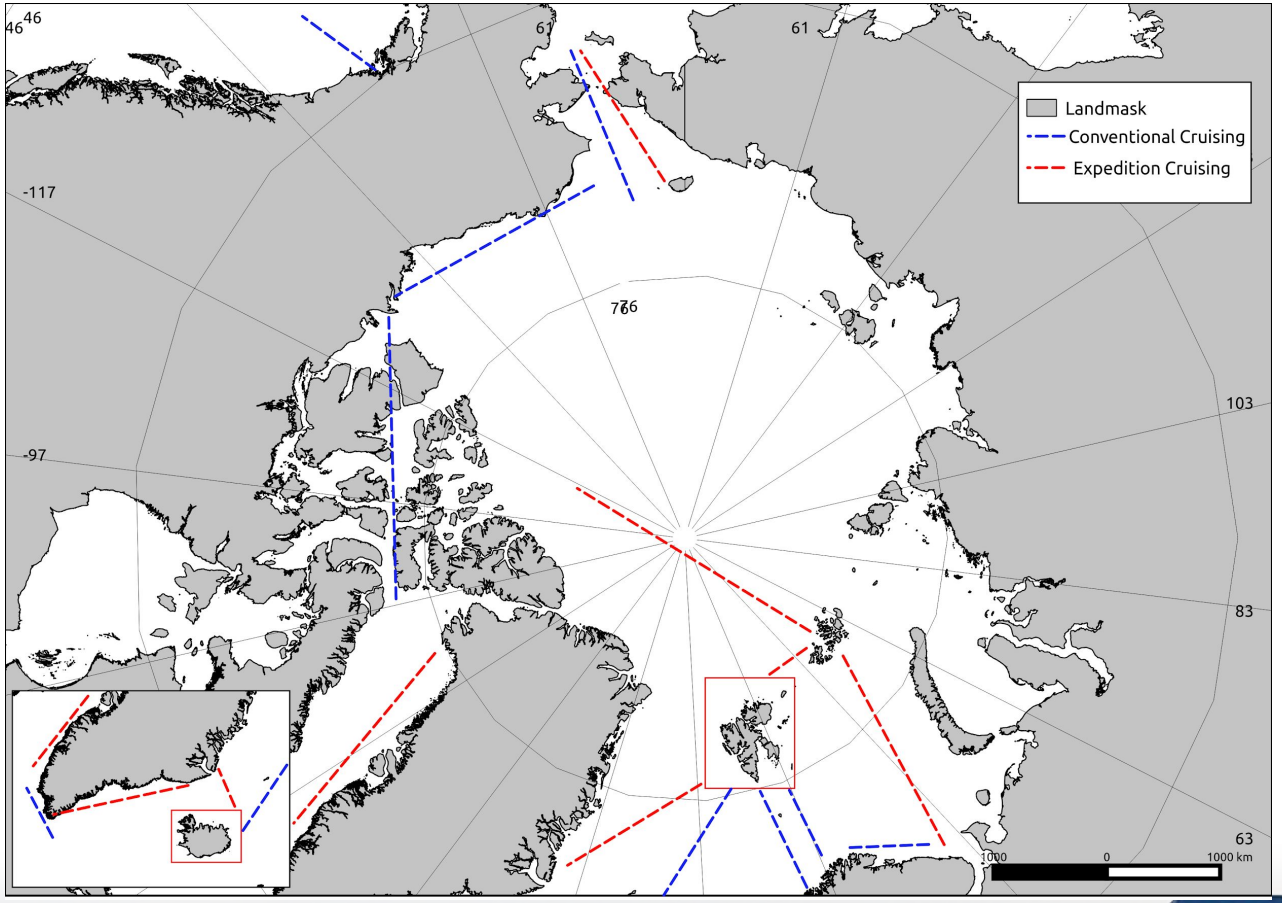



| | | | |
|---|---|---|---|
| | April 18, 2018 | April 17, 2018 | April 18, 2018 |
| Winter |   |   |   |
| | June 17, 2018 | June 16, 2018 | June 17, 2018 |
| Summer |   |   |   |

# Research Opportunities and Citizen Science

- **Polar tourism are one of the best sources for in situ ice observations for operations because:**
  - Travel on routine transects to our areas of interest
  - Passengers who go on these ships are interested in these extreme environments and want to understand how we connect science observations with the big picture



# Improved Configuration

*User Feedback*
*In Situ*
*Observations*

Input Data

*Satellite*
*Images*
*In Situ*
*Observation*

*Model Forecasts*


EXTREME EARTH

CIRFA

*Preprocessed*
*Automatic*
*Products*

KEPLER

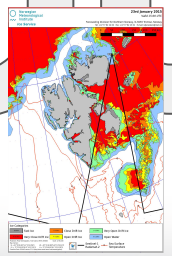
End Users

GIS Analysis (Ice Analyst)

Numerical Forecast Model

*Web*
*E-mail*
*Twitter*
*Radio*

Output Dissemination



*Ice Chart*
*Situation Analysis*

# Ice Watch - Assist

**Total Concentration (tenths)**

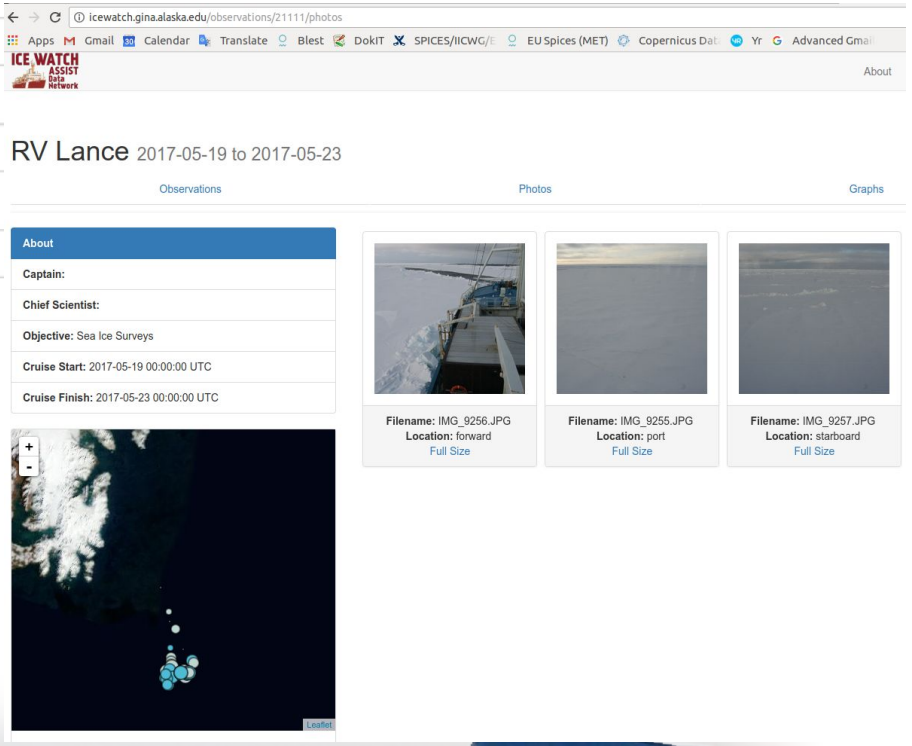
No Observation

**Open Water**

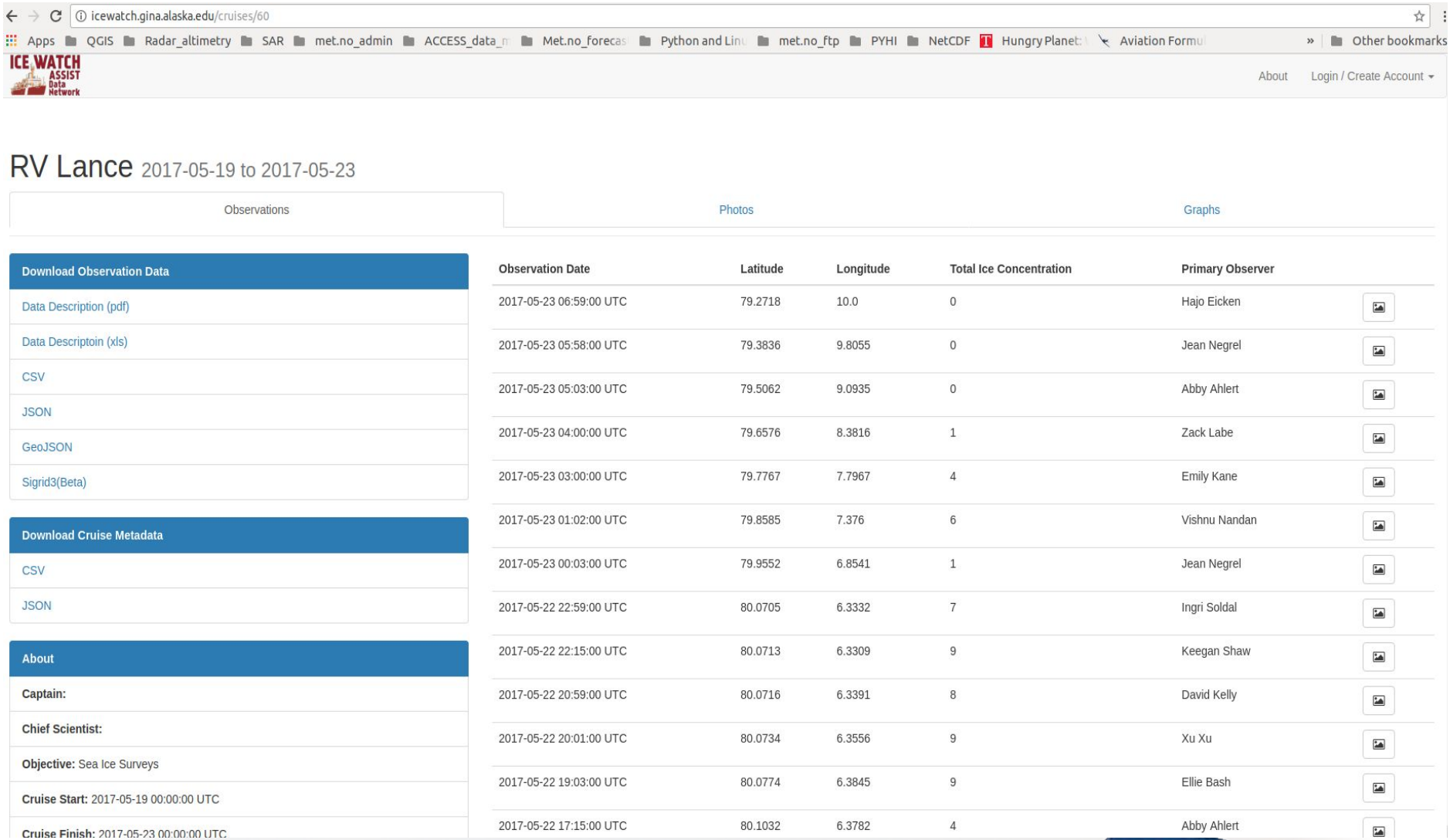
No Observation

Ice | Snow | Topography | Melt | Other

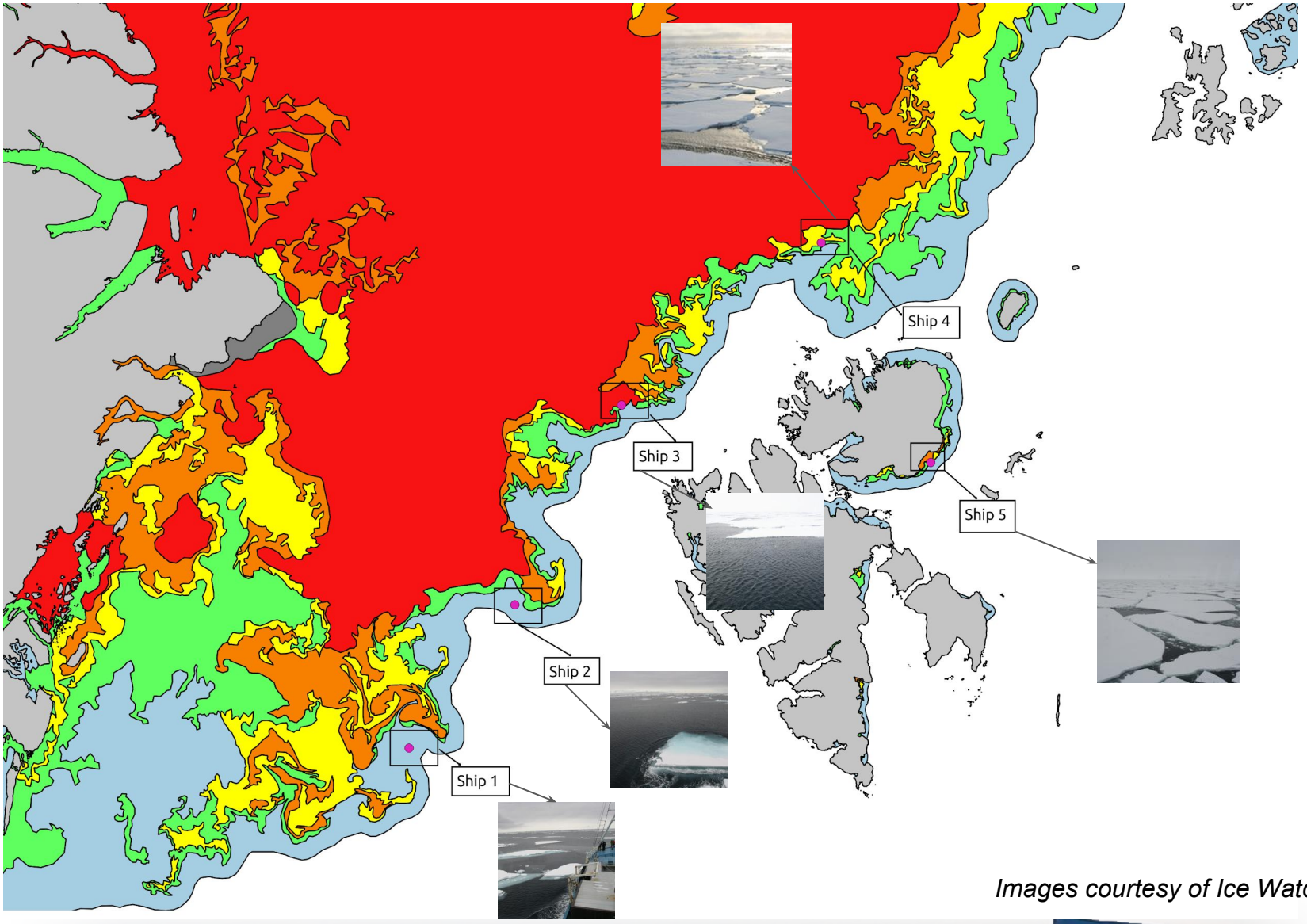
| Primary | Secondary | Tertiary |
|---|---|---|
| **Partial Concentration (tenths)** | **Partial Concentration (tenths)** | **Partial Concentration (tenths)** |
| No Observation | No Observation | No Observation |
| Total Concentration: /10 | Total Concentration: /10 | Total Concentration: /10 |
| **Ice Type** | **Ice Type** | **Ice Type** |
| No Observation | No Observation | No Observation |
| **Thickness (cm)** | **Thickness (cm)** | **Thickness (cm)** |
| | | |
| **Floe Size** | **Floe Size** | **Floe Size** |
| No Observation | No Observation | No Observation |



# Ice Watch - Assist



# Sea Ice Observations and Ice Charts



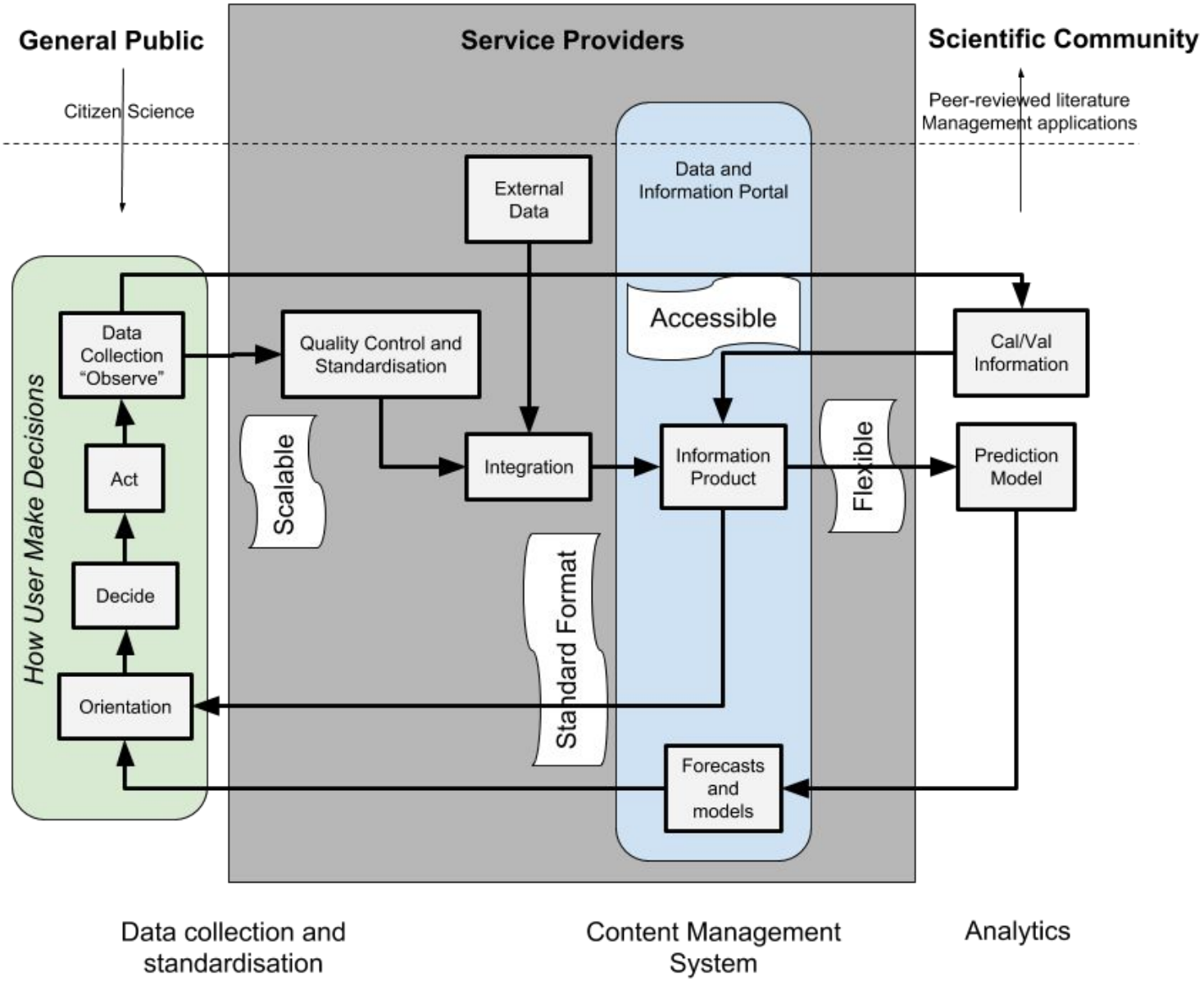

*Images courtesy of Ice Watch*

# Challenges

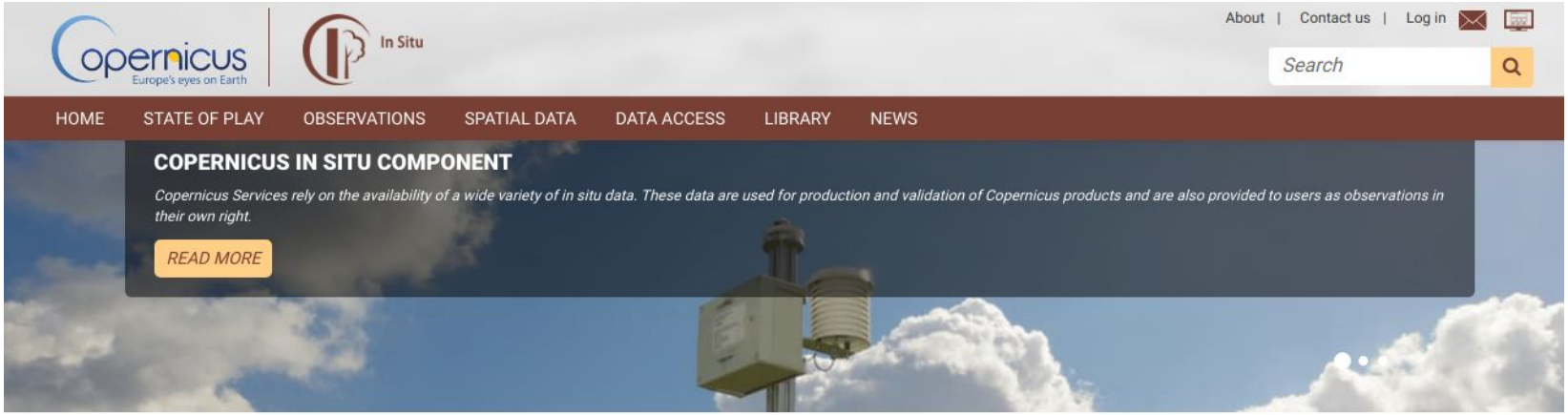
- **Challenges with the use of satellites for sea ice**
  - *Limited SAR coverage (space/time), resolution not sufficient for smaller ice and icebergs (size/shape)*
  - *Useful to have some information going back to Ice Services*
- **Coordination of citizen science activities with ice services**
- **Quality control of ice information from shipboard observations**
  - *Need for standardization in images*
- **Frequency of observations for ice services**
  - *Ice charts need to be available at a specific time of the day*
  - *Ship may not be in or near ice all the time so it's difficult to plan for acquisition*
- **Resources available to support citizen science initiatives**
  - *Little resources from ships during short trips for efficient data exchange*
- **Provision of tailored support**
  - *Problem with timing of ships location, data acquisition and bandwidth issues at high latitudes or in fjords*
- **Lack of time from crew/expedition personnel**

# Example of observations for ice thickness

Figure 5: Painted pole used to aid eye in estimating ice thickness. Thanks Lauren Farmer and Alex Cowen.


General Public
Service Providers
Scientific Community
Citizen Science
Peer-reviewed literature
Management applications
External Data
Data and Information Portal
Data Collection "Observe"
Quality Control and Standardisation
Accessible
Cal/Val Information
How User Make Decisions
Act
Scalable
Integration
Information Product
Flexible
Prediction Model
Decide
Standard Format
Orientation
Forecasts and models
Data collection and standardisation
Content Management System
Analytics

# COPERNICUS Services




## EXPLORE THE COPERNICUS IN SITU COMPONENT

**Copernicus is the European Union's revolutionary Earth Observation and monitoring programme**. Copernicus offers a world of insight about our planet to European and global citizens, public authorities, policy makers, scientists, entrepreneurs and businesses. Copernicus is openly and freely available to everyone at no cost.

Copernicus **transforms information from multiple sources, including satellites, into operational services** for keeping watch over the planet Earth's land, ocean and atmosphere, monitoring climate change, supporting European emergency management and safeguarding civil security.

**The Copernicus Services rely on many environmental measurements** collected by data providers external to Copernicus, from **ground-based, sea-borne or air-borne monitoring systems**, as well as **geospatial reference or ancillary data**, collectively referred to as "in situ" data.

The **Copernicus In Situ Component maps the landscape** of in situ data availability, **identifies data access gaps or bottlenecks**, **supports the provision** of cross-cutting data and **manages partnerships** with data providers to improve access and use conditions.

**Discover the Copernicus Services**

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**Met Norway: High resolution ice charts on weekdays at http://polarview.met.no/**

**Ice Service – istjenesten@met.no or +47 90 47 20 48 or Twitter @istjenesten**

Chinstrap penguins on an iceberg, Deception Island, Antarctica [Photo: Andrew Shiva / Wikipedia / CC BY-SA 4.0]