



Polar View



EOX



DRIFT+NOISE
Polar Services



DestinE Sea Ice Decision Enhancement (DESIDE)

Photo: Andreas Cziferszky



Norwegian
Meteorological
Institute



The Danish
Meteorological
Institute



ILMATIETEEN LAITOS
METEOROLOGISKA INSTITUTET
FINNISH METEOROLOGICAL INSTITUTE



Funded by the
European Union



Theme

- The DESIDE project is an opportunity to provide various user groups with **access*** to ice products for decision support.



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Background

ESA's Destination Earth (DestinE) Use Cases demonstrate the capability of the DestinE infrastructure to provide actionable information and decision support to its end users.



The graphic features a central globe with a glowing blue and green network overlay. Three callout boxes point to specific applications: "EVIDENCE-BASED POLICY DEVELOPMENT" (with a solar panel icon), "ACTIONABLE PREDICTIONS" (with a factory icon), and "APPLICATION DEVELOPMENT" (with a field of crops icon). The word "destinE" is written vertically next to the globe. The top left corner contains the text "DESTINATION EARTH" and "SHAPING EUROPE'S GREEN AND DIGITAL FUTURE". The bottom left corner includes logos for the European Union, ECMWF, esa, and EUMETSAT. The esa logo is also present in the top right corner.

DESTINATION EARTH

SHAPING EUROPE'S GREEN AND DIGITAL FUTURE

Destination Earth (**DestinE**) will support the European Union's Green Deal and Digital Strategy and will enable policymakers and users to reach the next step in informed decision-making.

EVIDENCE-BASED POLICY DEVELOPMENT

ACTIONABLE PREDICTIONS

APPLICATION DEVELOPMENT

European Union ECMWF esa EUMETSAT



Context

- **Objectives**

- **Aggregating** diverse information sources to provide common products across jurisdictional boundaries.
- Providing **new forecast products** to improve decision-making by users.
- **Customizing delivery** of products to different user communities based on their needs.

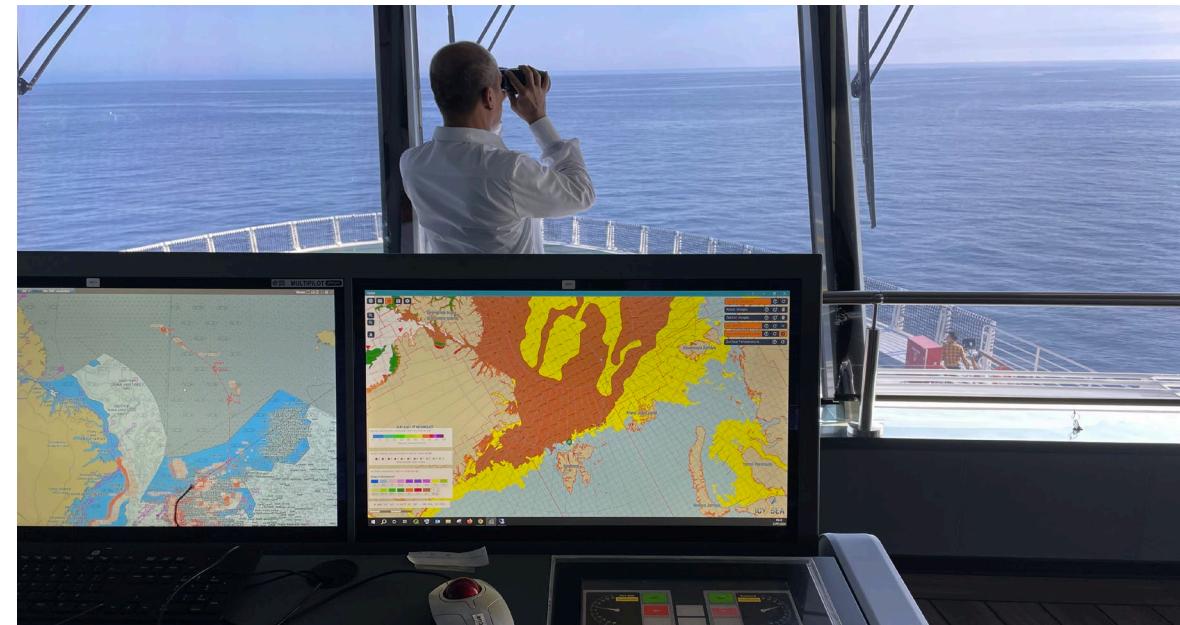
- **Drivers**

- **Regulatory Compliance:** Deliver short and medium-term forecasts of ice, meteorological, and ocean conditions, meeting the requirements of the IMO Polar Code.
- **Climate Change Effects:** Provide long-term forecasts on changing ice and other conditions, enabling planning and policy development for the fishing, tourism, research, and oil and gas industries.



Benefits to Polar Operations and Society

- **Increased Safety:** Accurate information supports strategic and tactical decision-making, enhancing safety of life and property.
- **Pollution Reduction:** Efficient route optimization minimizes fuel consumption and emissions.
- **Protection of Sensitive Environmental Areas:** Better forecasts can help policymakers protect environmentally sensitive areas affected by changing polar conditions.





Decision Support Levels

The Use Case will demonstrate the added value of the DestinE system in supporting policy and decision making at three levels within the context of polar operations:

- **Execution support:** supporting ships needing to avoid or navigate through sea ice.
- **Planning support:** supporting ship operators in planning for polar voyages, guided by the information requirements of the IMO Polar Code.
- **Strategy and policy support:** supporting organizations and policy analysts wanting to assess the impact of climate change on future decisions regarding polar operations.



Use Case Workflow

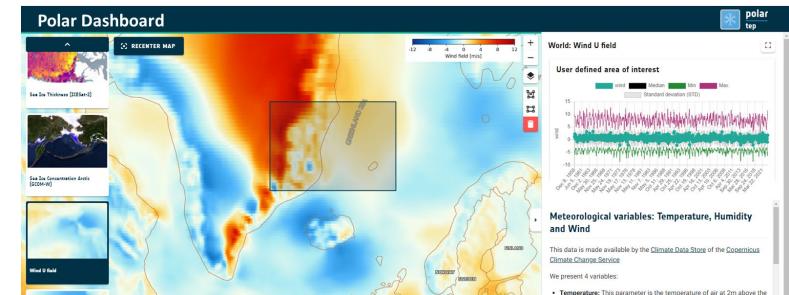
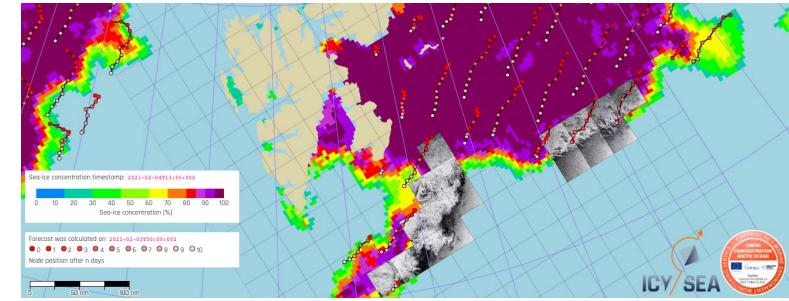
- 1. Data Ingestion:** Collect past, current, and forecasted information on sea ice, snow thickness, icebergs, ocean currents and waves, wind, temperature, visibility, and Sentinel 1 / RCM imagery.
- 2. Data Processing, Modeling, and Analysis:** Use models, machine learning, and algorithms to process data for different user communities.
- 3. Information Product Generation:** Create short, medium, and long-term sea ice charts, risk profiles, and route optimization suggestions for better decision-making.
- 4. Dissemination:** through decision support platforms.



Decision Support Platforms

Decision support will be provided in three ways to meet the different needs and levels of sophistication of user groups:

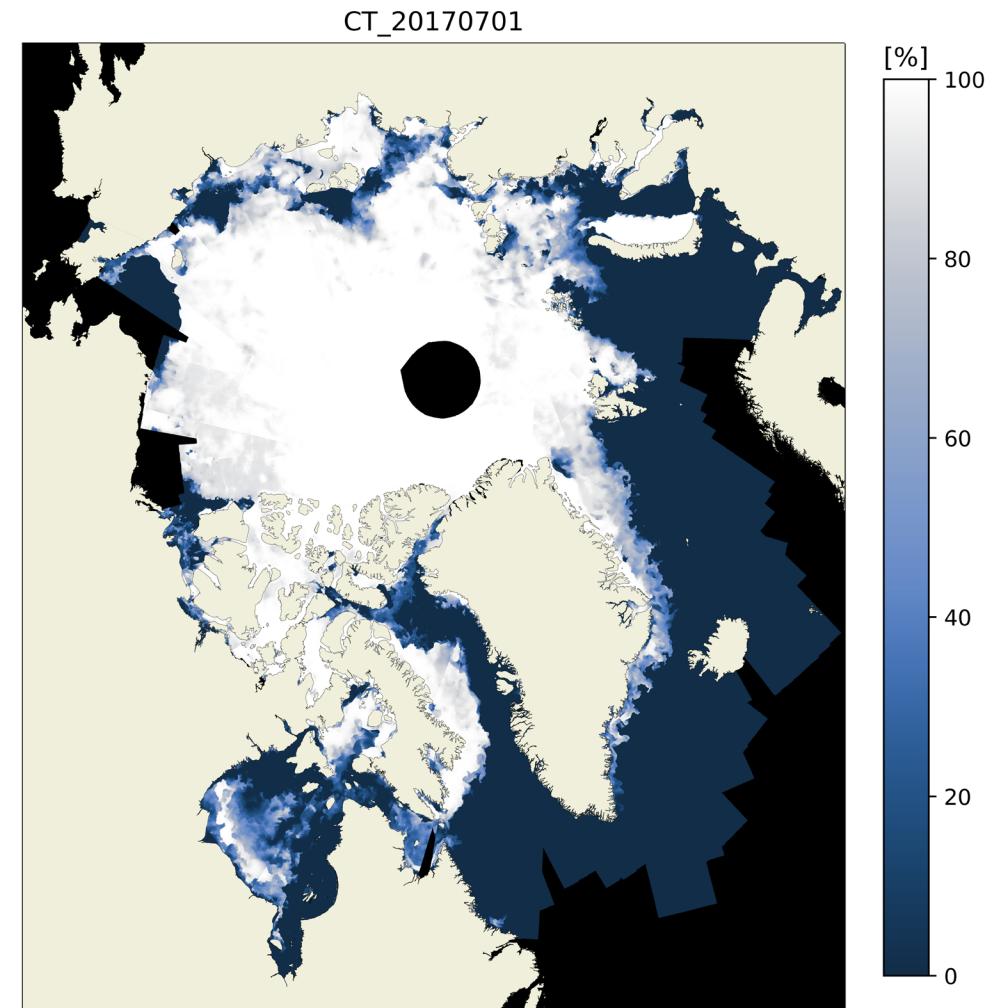
- **IcySea:** Tactical decision support for ships operating in polar regions.
- **Polar Dashboard:** Strategic decision support for policy analysts and residents.
- **Polar TEP:** Research collaboration platform for private, academic, and public sectors.





Example Capability: Image Interpretation

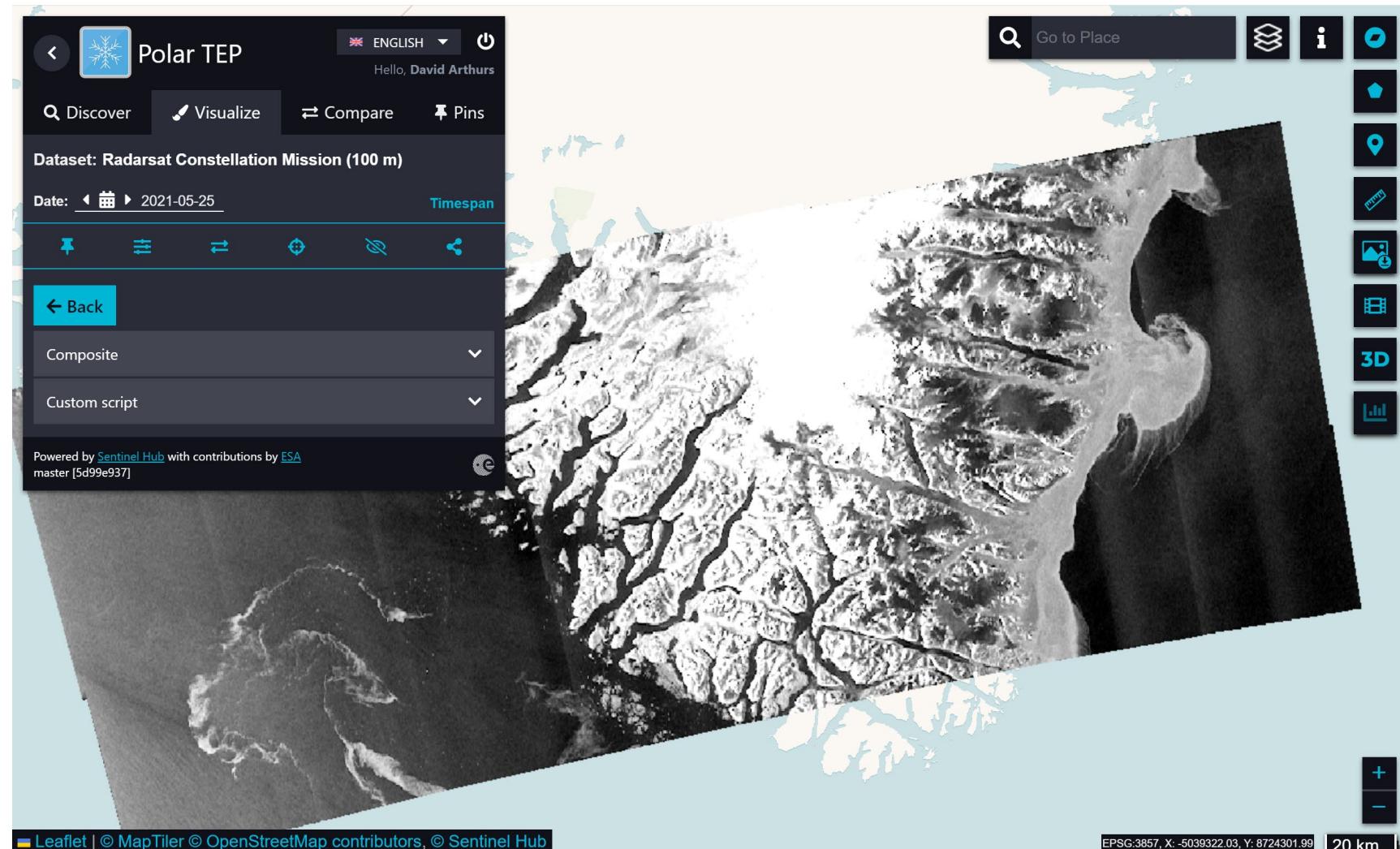
- Automated SAR image interpretation using the DMI ASIP ML algorithm:
 - Concentration
 - Stage of Development
 - Floe Size
- Includes uncertainties
- Can use S1 and RCM data
- (See Tore Wulf's poster)





Example Capability: RCM Data

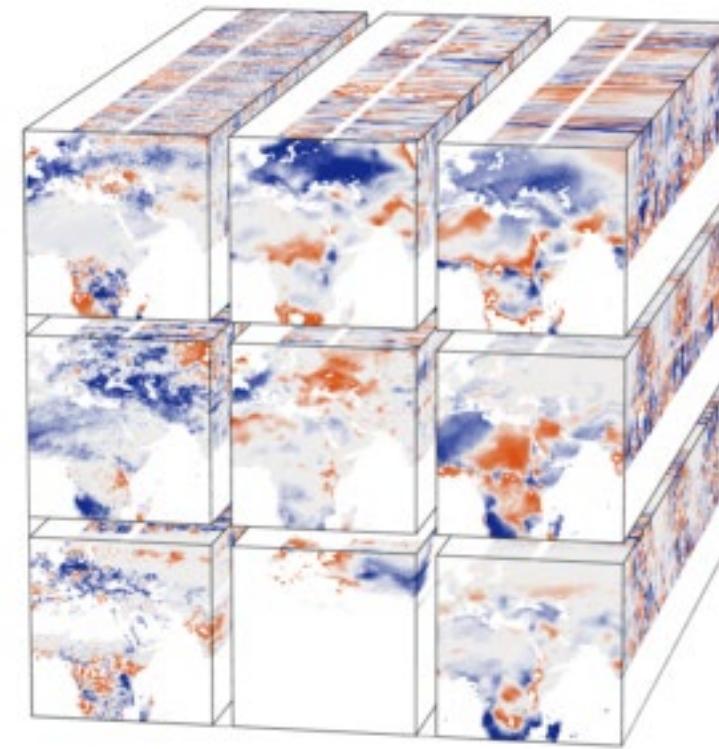
- Access to RCM ARD data (σ^0).
- Provides more convenient and efficient access than EODMS.
- Brings RCM together with Sentinel and other polar data.





Example Capability: Sea Ice Chart Data Cube

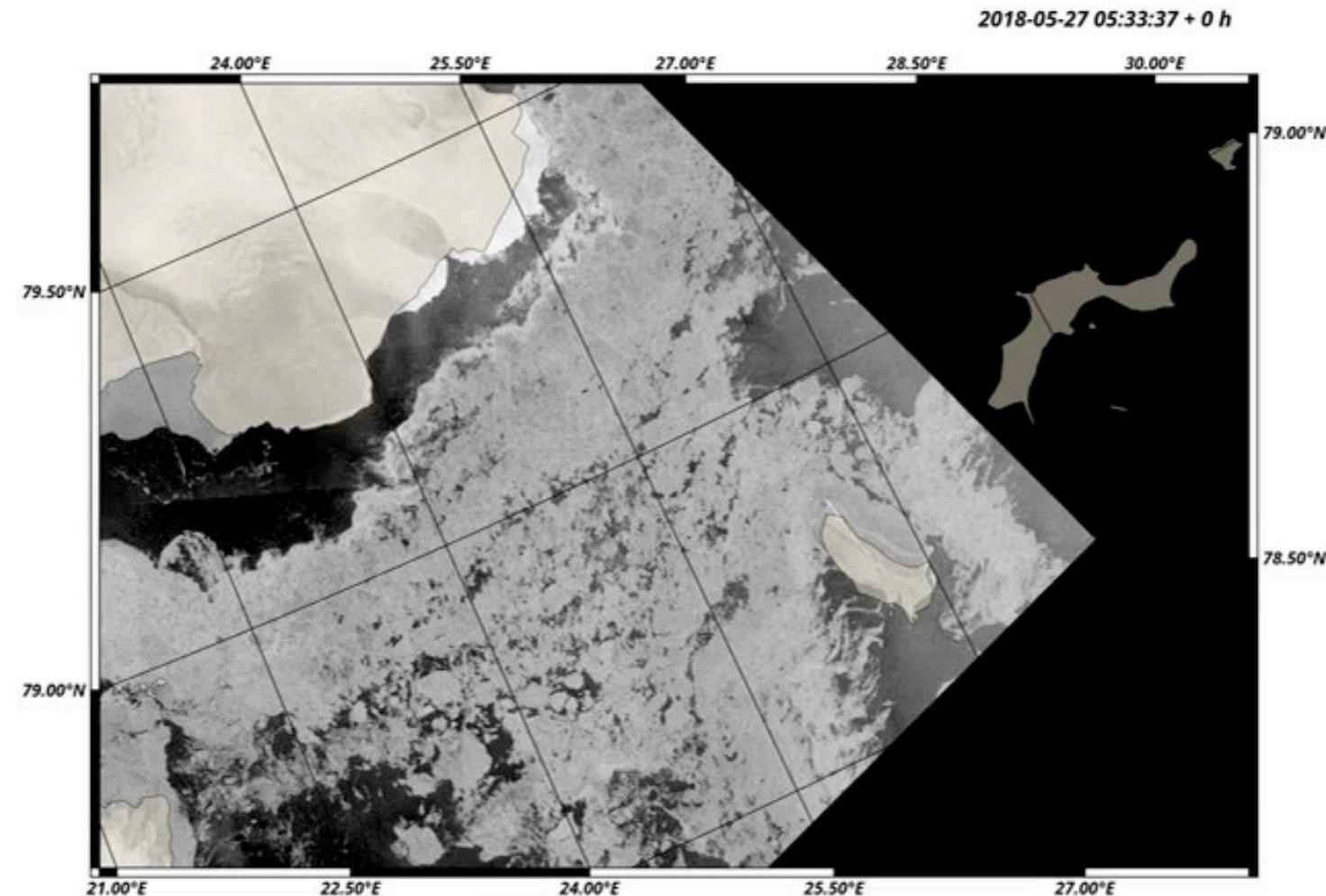
- Sea ice charts are perhaps the most under-utilized source of information on historical polar conditions. Combined with **other data** and with the proper **tools**, they could be a valuable resource for:
 - Operational Planning
 - Climatology
 - Machine Learning Training Data
- Example Data Layers
 - Ice Charts
 - SAR, RCM and other EO Data
 - Met/Ocean Data
 - Model Data
 - Derived Products





Example Capability: SAR Image Morphing

- **Objective:**
Improve situational awareness for ships in and around sea ice.
- **Issue:**
Sea ice can move a considerable distance between Sentinel 1 image acquisitions.
- **Solution:**
Using sea ice drift models, Sentinel 1 images are morphed to show how the sea ice will move until the next acquisition.

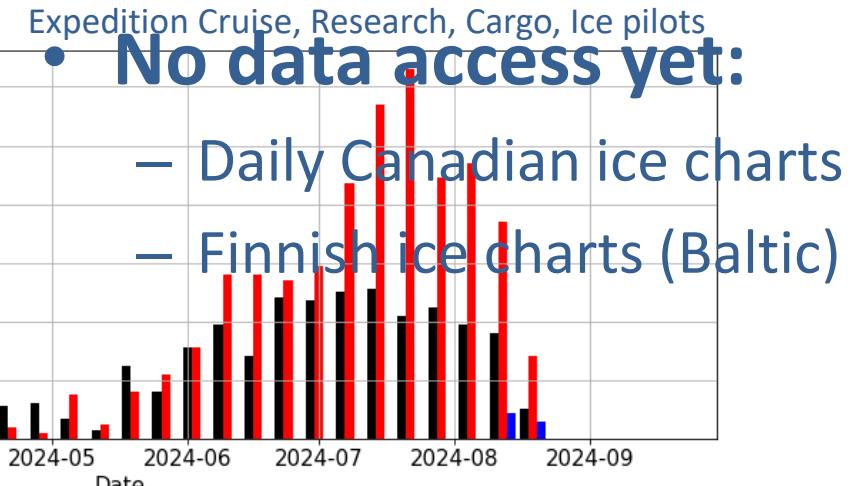
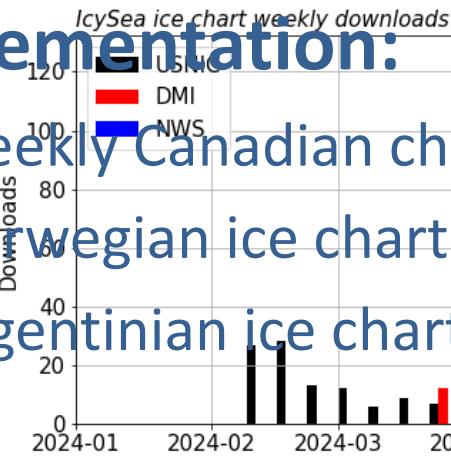




IcySea Platform (Tactical)

- Available in IcySea:
 - US NIC weekly ice charts
 - DMI Greenland ice charts
 - NWS Alaska ice charts

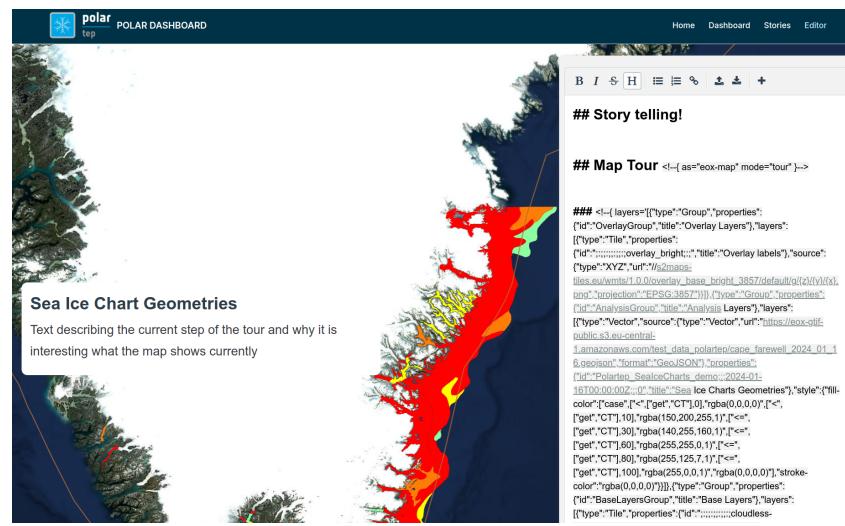
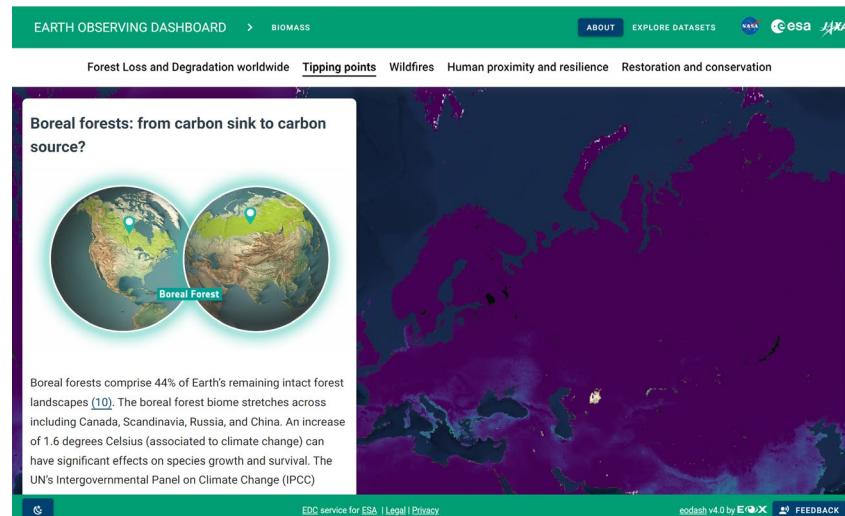
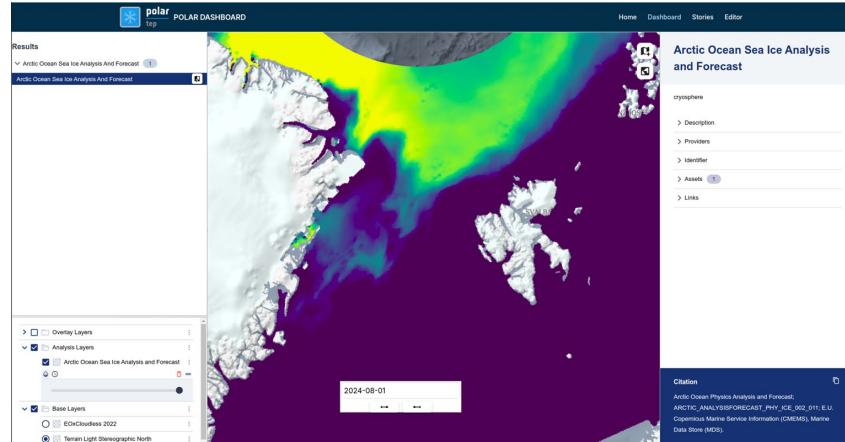
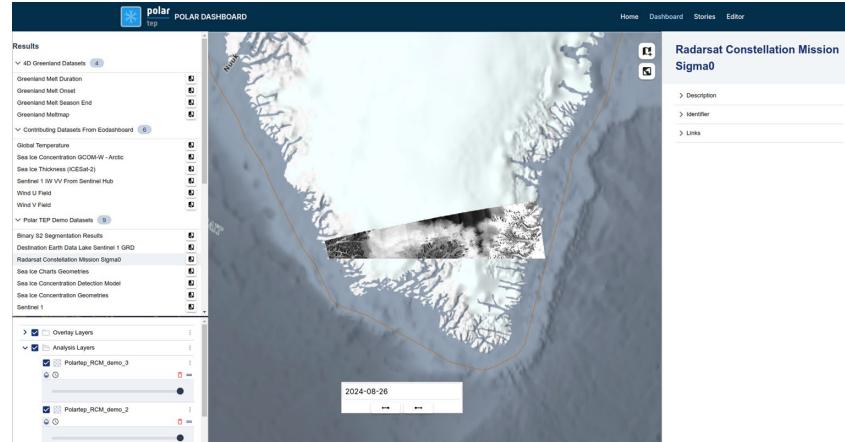
- Implementation:
 - Weekly Canadian charts
 - Norwegian ice charts
 - Argentinian ice charts





Polar Dashboard Platform (Strategy & Policy)

- Curated Data Interaction:
 - CMEMS data
 - WMO data
 - RCM and other EO data
 - Ice Charts
- Statistics
- Story Telling





Polar TEP Platform (Research)

- Data Discovery
- Interactive Development Environment (Jupyter Notebooks)
- Machine Learning (MLflow)
- Execution Environment
- Reproducible Science
- Education and Course Delivery





For More Information

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