Arctic Cross-Copernicus forecast products for sea Ice and iceBERGs

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ACCIBERG Project Newsletter

Expanded Satellite Iceberg Detection

Satellite-based iceberg detection capabilities have been improved and expanded, with the goal of supporting pan-Arctic applications. ACCIBERG partner DMI's Iceberg Detection Algorithm (DIDA) has been expanded to achieve more comprehensive coverage of the Barents and Kara Seas.

Daily coverage currently remains limited by reliance on the single satellite, Sentinel-1A, but the addition of Sentinel-1C and RADARSAT Constellation Mission (RCM) data is expected to address these limitations. Sentinel-1C will improve temporal resolution and incorporate automatic identification system (AIS) data, which may further improve DIDAs ship removal procedure. Incorporating RCM imagery (firstly Low Noise imagery) may complement Sentinel-1 by filling many spatial and temporal gaps. The Figure below illustrates the DIDAs extended Area of Interest.

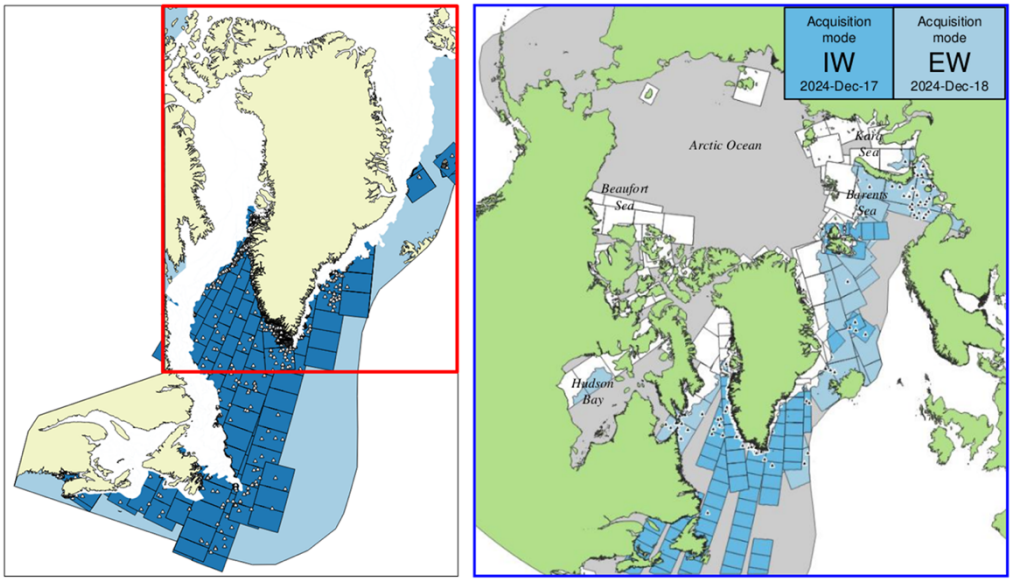


Figure: *Spatial coverage of iceberg information available through Copernicus Marine Services. Left: Coverage pre-November 2024 (light blue). The red rectangle highlights the area covered by gridded iceberg concentration products. Iceberg positions and satellite scene coverage are based on Sentinel-1 IW acquisitions from March 16–20, 2020. Right: Coverage post-November 2024 (grey). Iceberg positions and satellite scene coverage are based on Sentinel-1 EW and IW acquisitions from December 17–18, 2024. Note: the gridded iceberg concentration coverage remains unchanged from the pre-November 2024 period. By early December 2025, both gridded and point-position products will achieve full pan-Arctic coverage.*

Release of ICECAP software

Retrieving and comparing different sea ice forecasts (from operational forecasts and climate models) used to be a cumbersome task, but ECMWF has finally made our life simpler by developing a software package coined ICECAP (sea-Ice Calibration, vErifiCAtion and Products).

ICECAP is specifically designed to provide end-user forecast products based on sea ice forecasts from days to seasons ahead from multiple forecast centres, alongside information on the quality and uncertainty of those forecasts.

ICECAP can be used to retrieve and pre-process sea-ice cover fields from ensemble forecasts from C3S seasonal forecast models, TOPAZ5 forecasts (available through the MetNorway THREDDS server) as well as the corresponding sea-ice cover observations from C3S and CMEMS. More data sources will be added when they become available. ICECAP computes and visualizes a set of validation metrics and can also compute calibration statistics if necessary, i.e. for seasonal forecasts. This functionality allows scientific users to perform research on the forecasts and develop the forecasting systems.

ICECAP can also retrieve and pre-process sea-ice cover fields from a single ("real-time") ensemble forecast, calibrate for known errors using calibration statistics computed in the steps above, and compute and visualize a set of user-relevant information products together with the information on forecast quality. This functionality is targeted at end users who need reliable sea-ice forecast information for planning their activities in potentially ice-infested waters.

The software therefore has two interfaces to cater for these two main user types. The scientific-user interface can run ICECAP on a Linux system using a workflow manager (e.g. ecFlow). This enables the user to use all implemented capabilities, i.e. verification, calibration, products. In addition, the end-user interface can be used via jupyter notebooks, however providing simpler capabilities.

The software can be found at https://github.com/ecmwf/ICECAP

ICECAP can be used to verify sea ice model results against observations. The Python package will be implemented on the WEkEO/EDITO platform to allow users to use ICECAP to easily obtain user-relevant products based on sea ice forecasts from TOPAZ5 and selected C3S models.

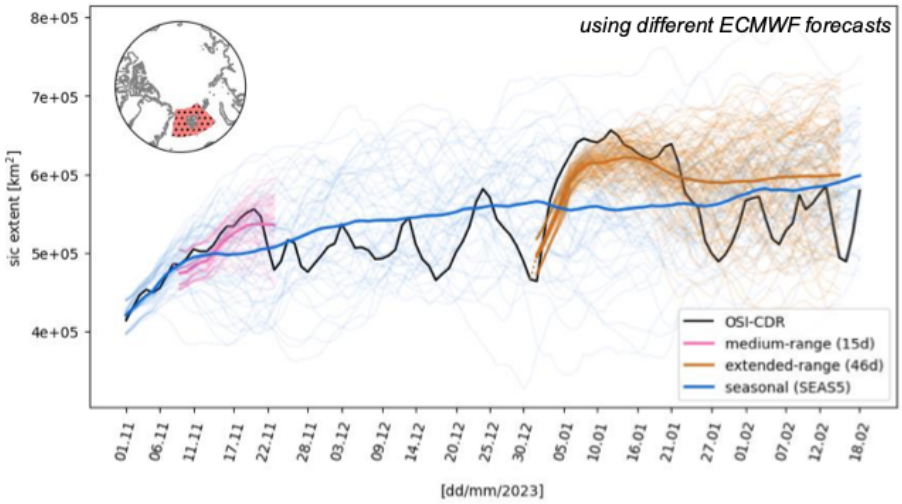


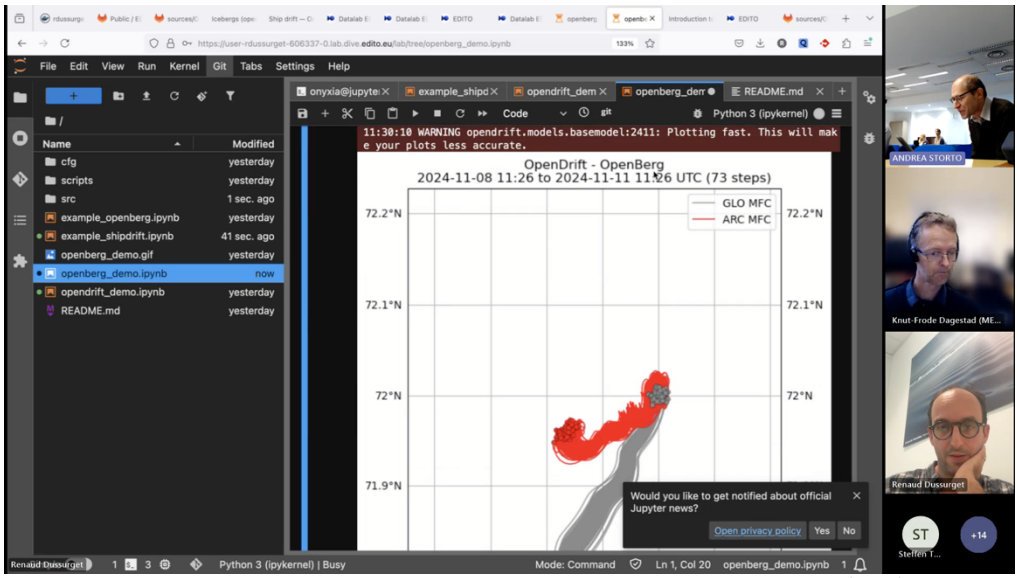
Figure: Successive forecasts of sea ice extending in the Norwegian Sector during Fall 2023 – Winter 2024 from ECMWF forecasting systems at three different ranges. Thin lines indicate different ensemble members. The solid black line indicates in hindsight how the forecasts matched satellite observations.

ACCIBERG Stakeholder Workshop Summary

8th November 2024, CNR ARTOV, Frascati, Italy

ACCIBERG gathered scientists and users to a side-event of the International Ice Charting Working group Data Assimilation workshop in Frascat last autumn. This was a rare occasion to demonstrate our latest results to both European and North American Ice Services active in the Arctic. ECMWF held a demonstration of a pre-release version of the ICECAP software for sea ice forecast validation and NERSC demonstrated the first open version of the OpenBerg module to simulate iceberg drift, including its Graphical User Interface, a default feature of the OpenDrift package. The latter was also demonstrated on the EDITO platform by Mercator Ocean Intl., where anyone can run the OpenDrift package without downloading any data. Collaborative features of EDITO were also highlighted, such as sharing a jupyter notebook with a colleague in a single click.

The European and North American users attending the workshop have appreciated the ease of use of the new tools and suggested a few additions in view of the upcoming summer 2025 demonstrations.



Screenshot from the OpenBerg demonstration on EDITO by R. Dussurget (MOi).

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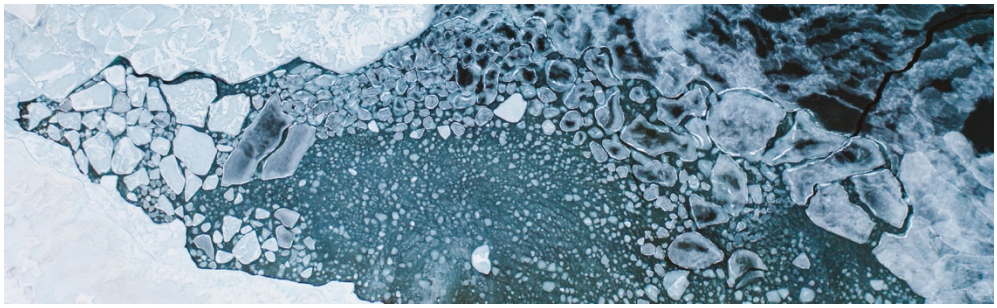

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