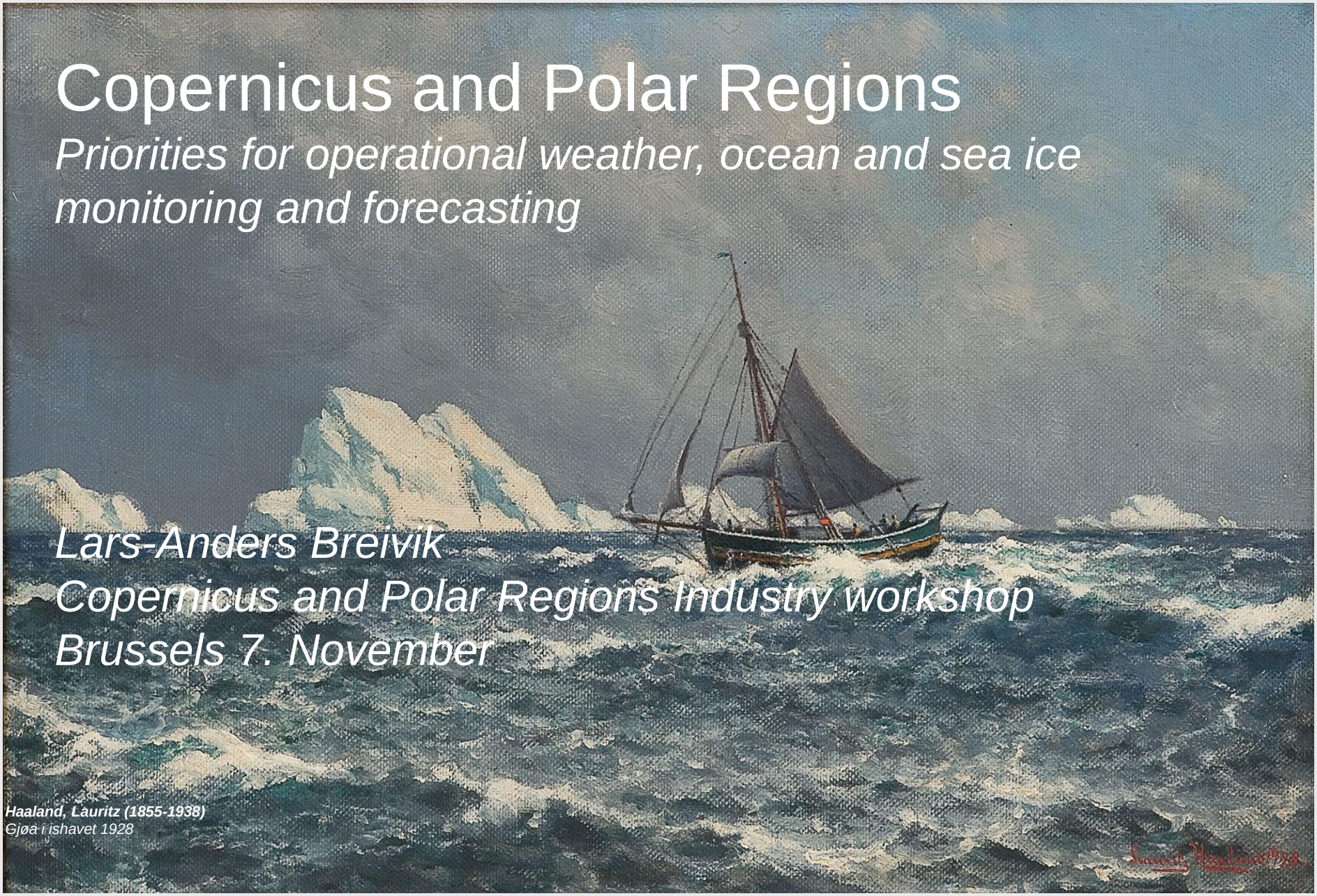
Copernicus and Polar Regions

Priorities for operational weather, ocean and sea ice monitoring and forecasting



Lars-Anders Breivik
Copernicus and Polar Regions Industry workshop
Brussels 7. November

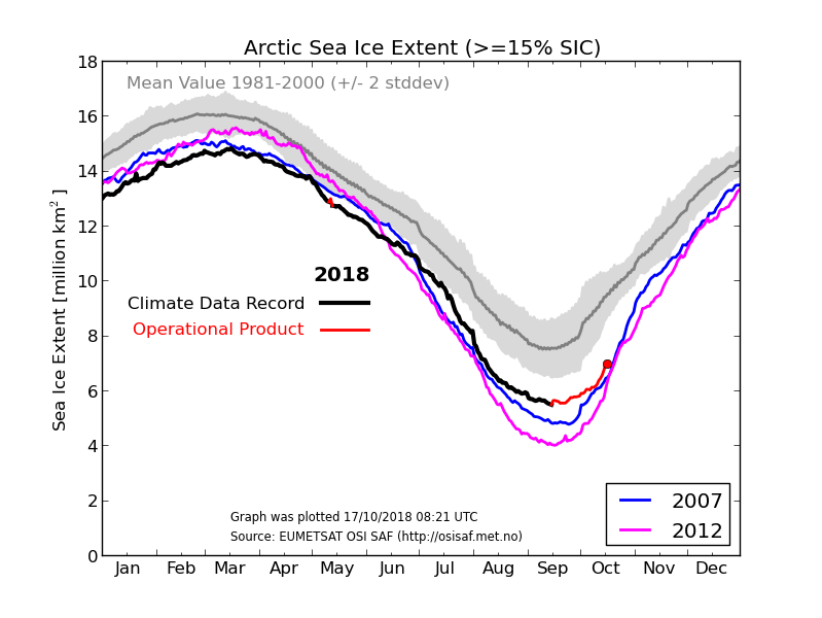
Haaland, Lauritz (1855-1938)
Gjøa i ishavet 1928

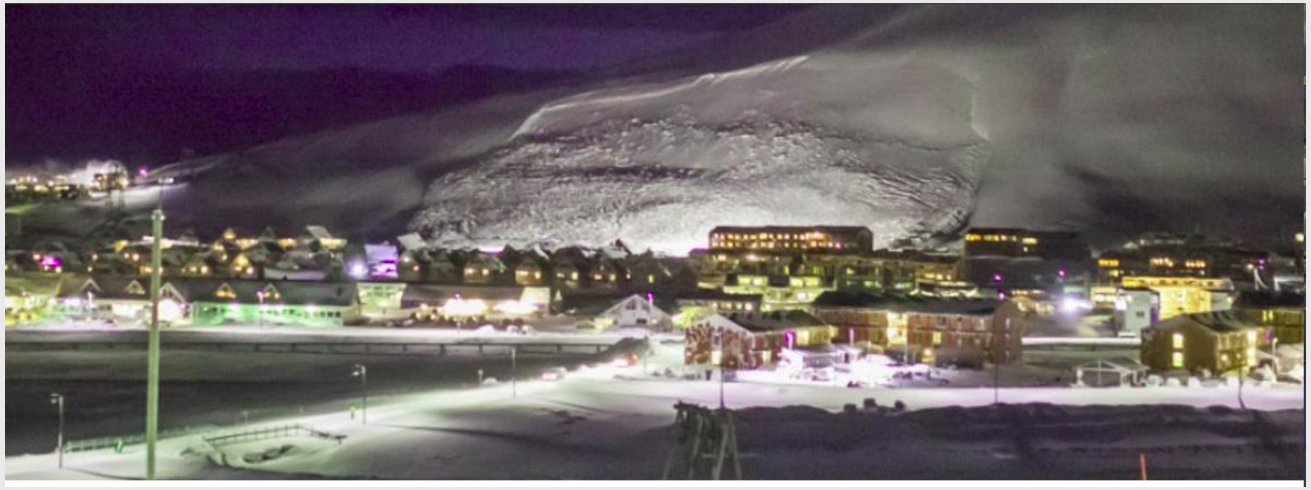
Norwegian Meteorological Institute

Climate change impact weather, ocean and cryosphere

Increased attention in Polar areas !

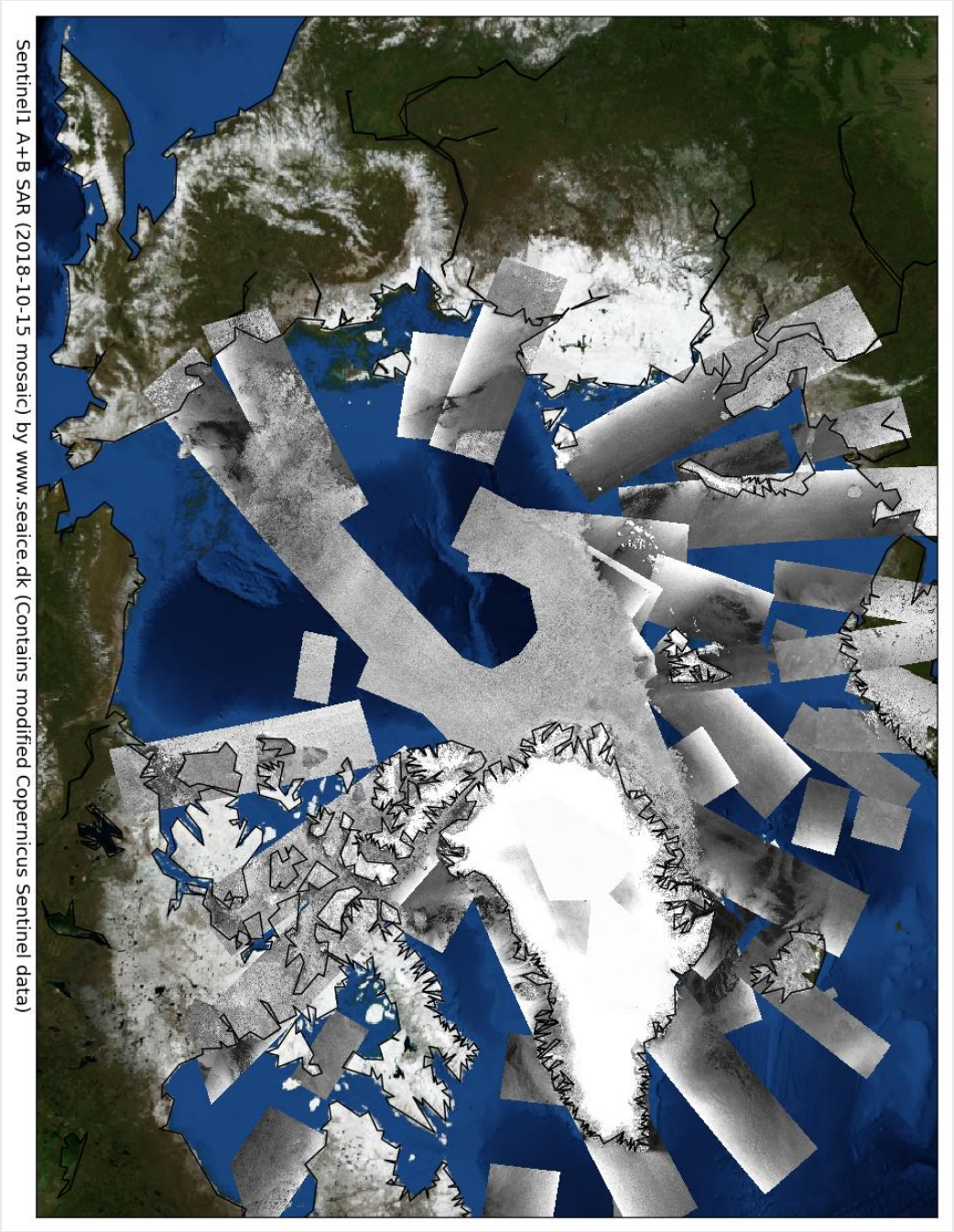
Increased operational demands and needs for knowledge over time and spatial scales, from hours and days to seasons and climate

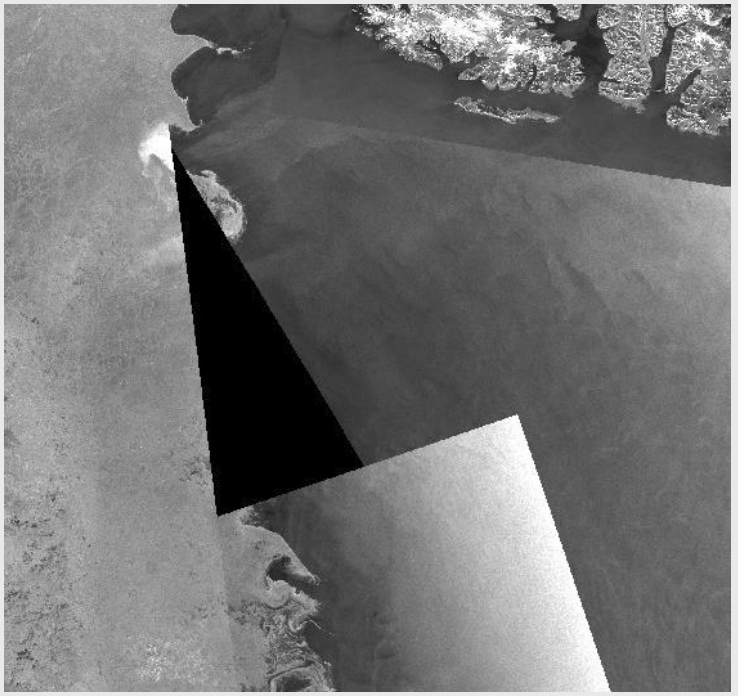




Norwegian Meteorological Institute

Dramatic increase in availability of SAR data over Arctic





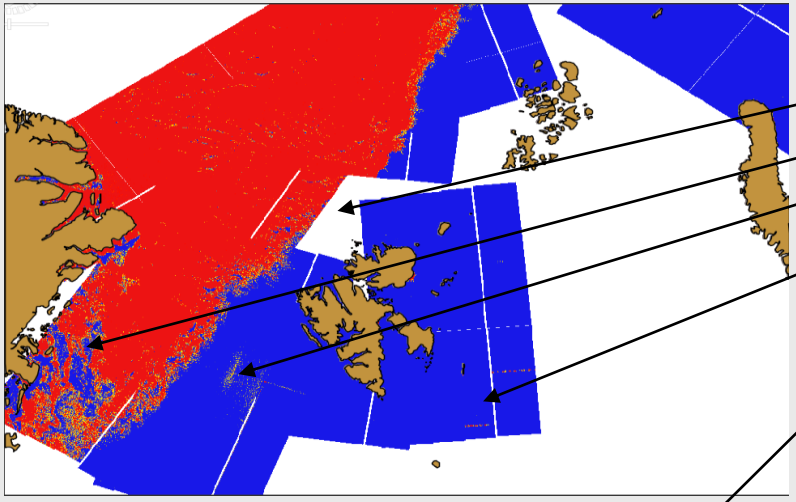
One day of Sentinel-1 data over Arctic (16. October 2018)

Copernicus and the Sentinels has been extremely important for our increase in capability to monitor polar environments, and in particular for operational Sea Ice services !

Norwegian Meteorological Institute

Toward automatic sea ice analysis based on SAR data complemented by Passive MicroWave

Sentinel-1 A+B concentration



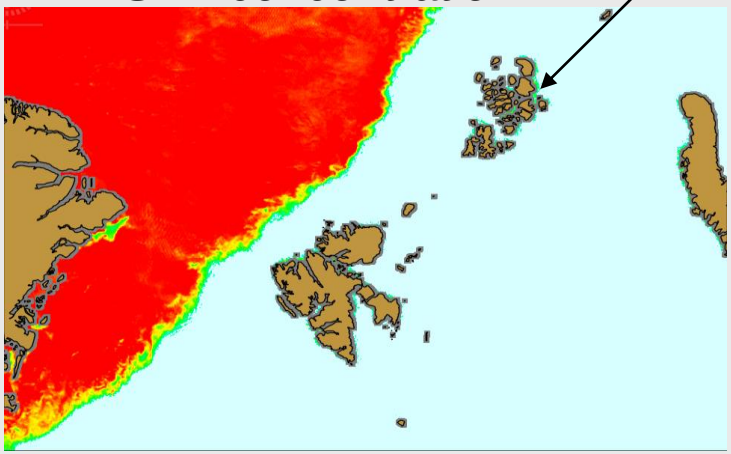
SAR is great, but has limitations

Noise in SAR classification due to

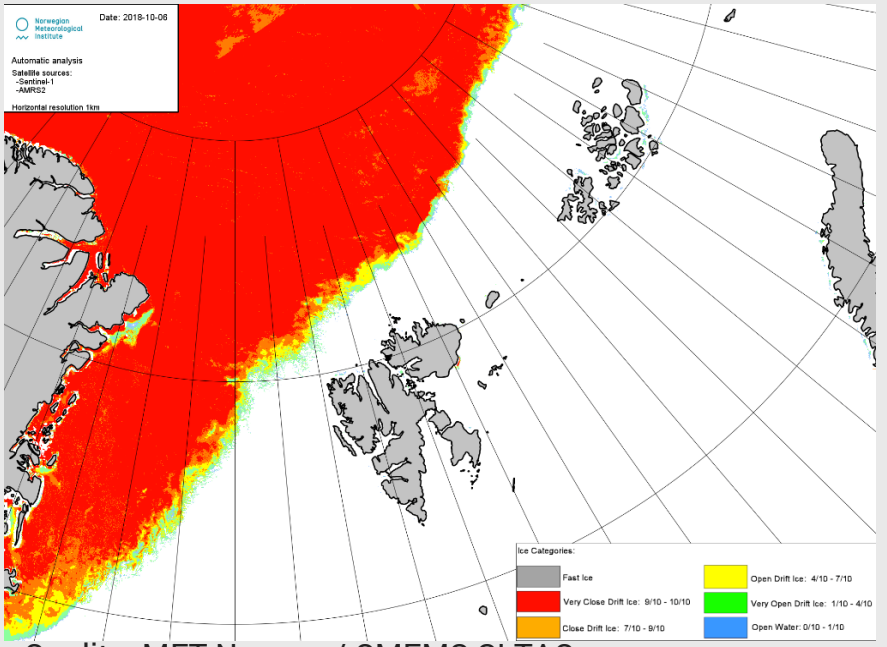
- Missing SAR coverage in some areas
- Level ice misclassified as water
- Wind over open water affecting the backscatter signal
- System noise in SAR image

Coastal false sea-ice in AMSR2

AMSR2 concentration



Multisensor concentration, SAR supported by PMW, example form 6.October 2018



Credits: MET Norway / CMEMS SI TAC

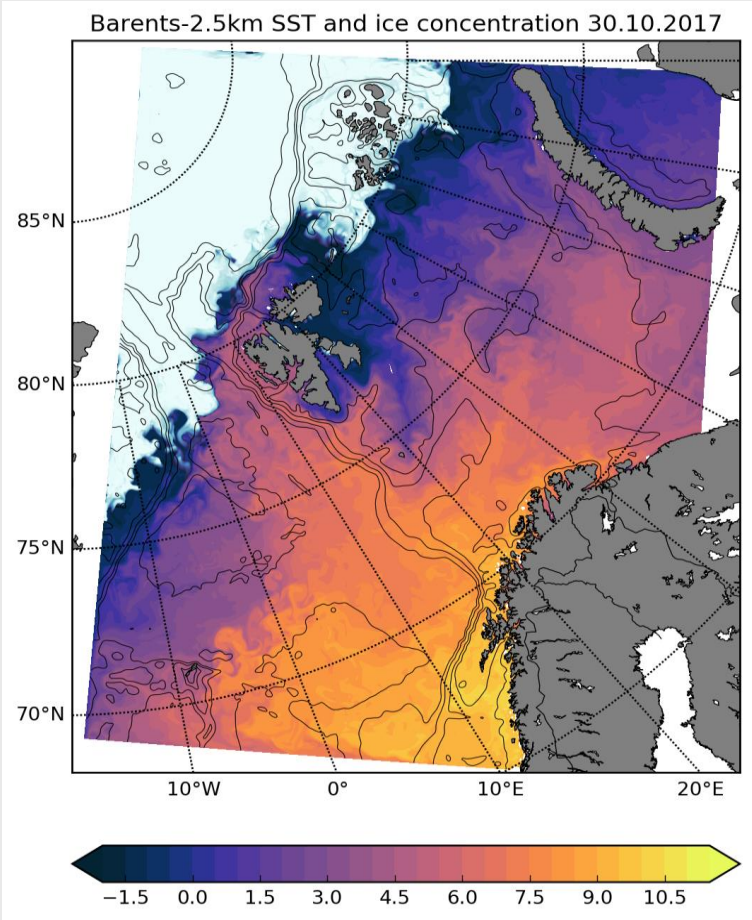
The proposed CIMR will further improve the capability for multisesor sea ice analysis

Norwegian Meteorological Institute

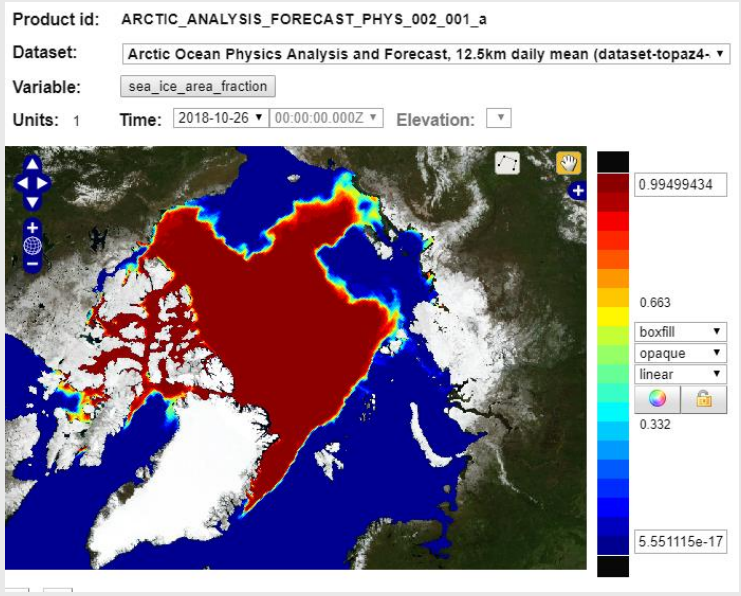
Numerical ocean-ice model systems are key tools for sea ice analysis and forecasting
Assimilation of Copernicus satellite data is essential

- Coupled Ocean-Sea Ice models, from basin to regional/coastal scale
- Assimilation of sea ice data based on satellites
- Assimilation of SST from satellites
- Access to in situ data
- Coupling towards waves and atmosphere

ROMS-Arctic, Barents 2.5
MET Norway ocean forecast system



Copernicus, CMEMS, ARC MFC, Topaz



COPERNICUS
MARINE ENVIRONMENT MONITORING SERVICE
Providing PRODUCTS and SERVICES for all marine applications

Norwegian Meteorological Institute

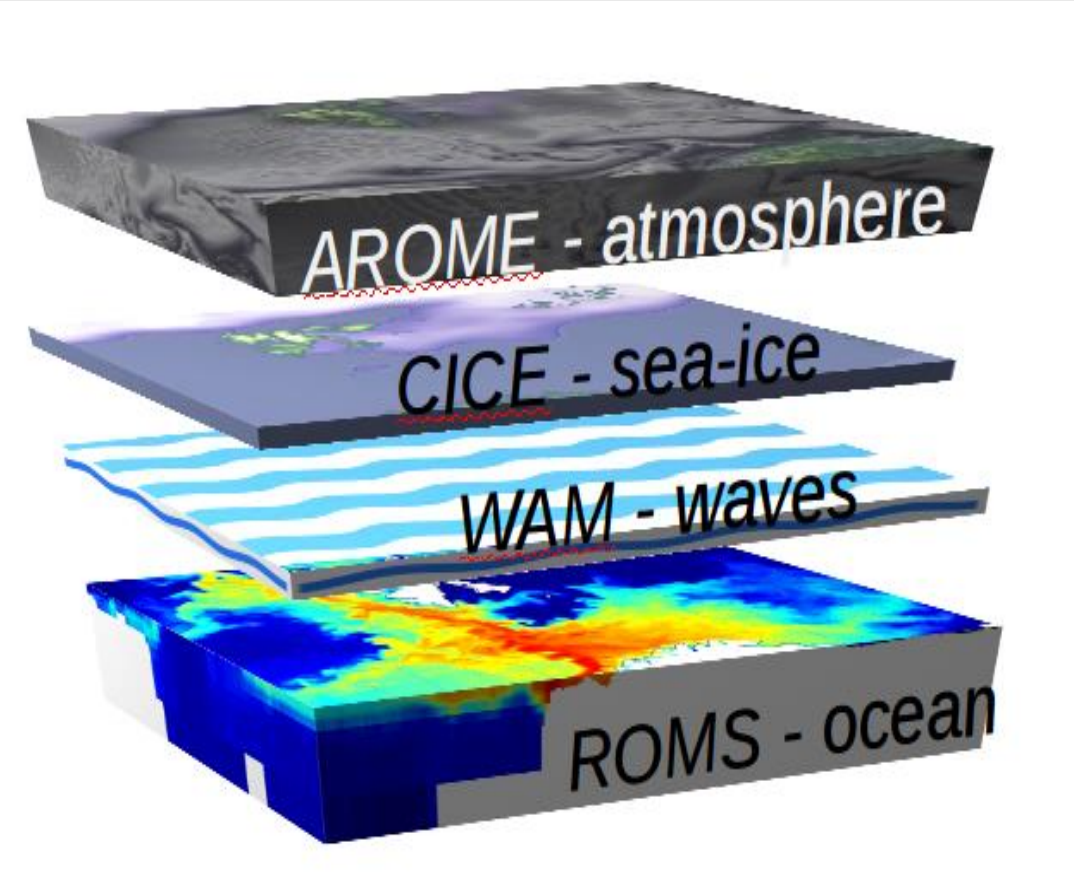
Toward a coupled Arctic forecasting system

Earth system model perspective

➔ Coupled Atmosphere, wave, ocean, sea-ice forecasting system for the European Arctic

Models:

➔ MET Norway, Nansen Legacy: AROME Arctic, ROMS-CICE, and Wave models
➔ Copernicus CMEMS: similar plans for coupling in ARC MFC



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Strong demands for observations of the ocean surface in order to get the right fluxes.

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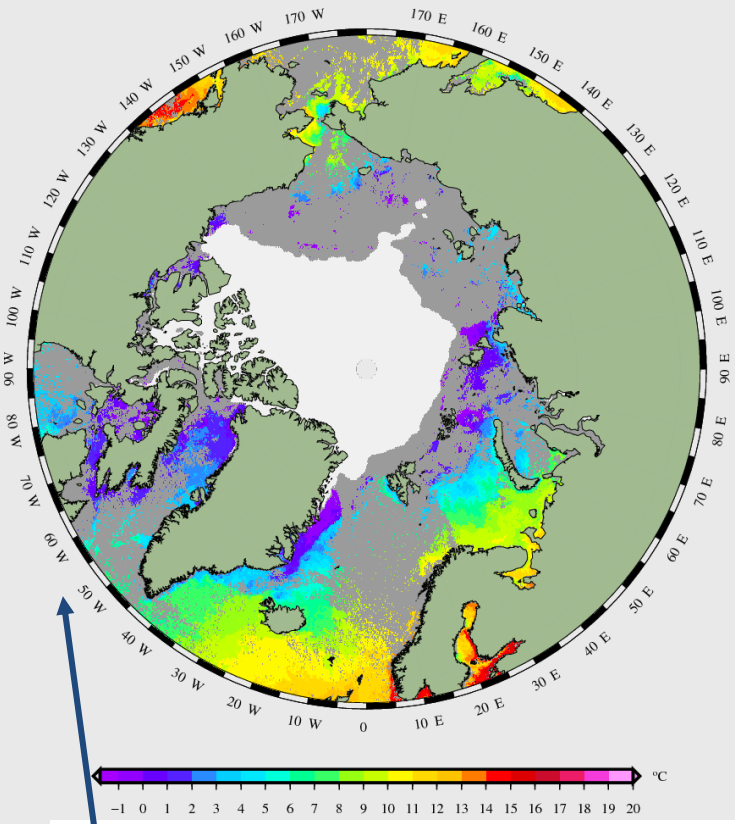


Sea Surface Temperature (SST)
(example from Arctic Sept 2018).

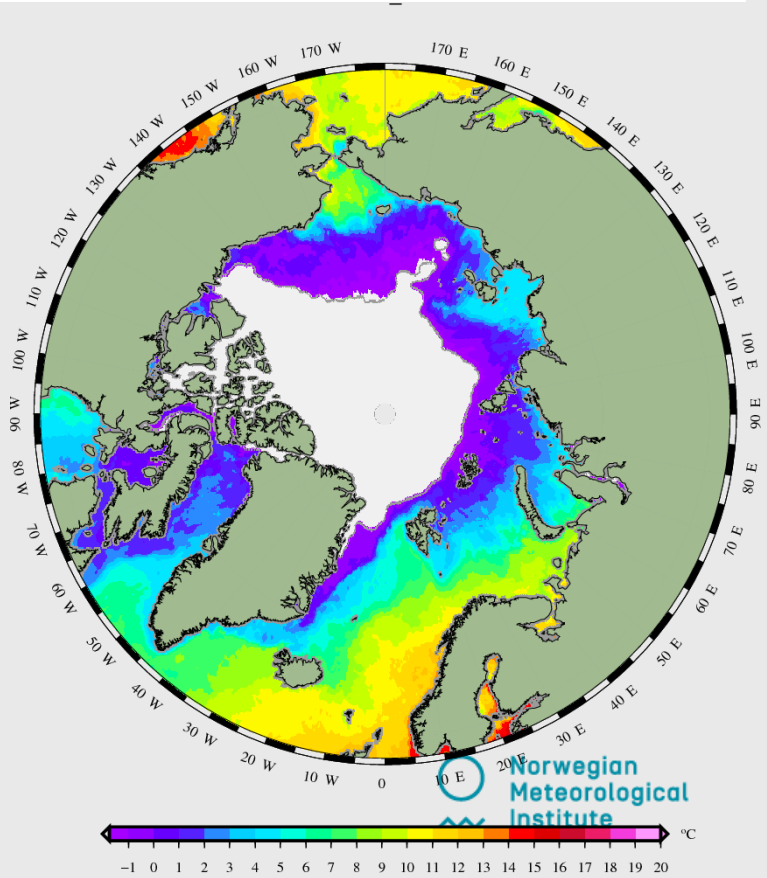
With Arctic sea-ice retreating, SST increasingly important to observe, for initializing coupled met-ocean forecasts.

Traditional “infrared” sensors, such as Sentinel-3 are blocked by clouds.

without CIMR (many satellites fly, including Sentinel-3, but too much cloud cover).

with CIMR (only satellite than can measure SST through clouds at good enough resolution).

Credits: J. Høyer, DMI / CMEMS SST TAC



Summary

Arctic and polar ***met-ocean service*** will rely on a numerical forecast model system coupling information from weather, ocean, sea ice and wave models.

Observations of the sea surface, boundary between ocean and atmosphere, for example SST, will be increasingly important for assimilation in analysis-forecast system.

An advanced passive microwave imager designed for ocean surface, CIMR that provide a full, sub-daily coverage of the Arctic (and Antarctic) at a resolution of a few kilometers, through clouds and polar night will be of great importance for this.

Further, combination of SAR imagery with the proposed passive microwave radiometer **CIMR,** will enable robust pan-Arctic automated mapping of sea ice, as developed in Copernicus Marine Service, CMEMS.