EFFICIENSEA 2.0 GETTING CONNECTED

The Digital Coastal State

Initiatives from EfficienSea2

25 January 2018, E-Navigation Underway

Christopher Saarnak, Danish Maritime Authority

This project has received funding from The European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement no. 636329

Facts

32 partners, joining

- Academia
- Authorities
- Industry
- International interest organisations

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THE DIGITAL COASTAL STATE

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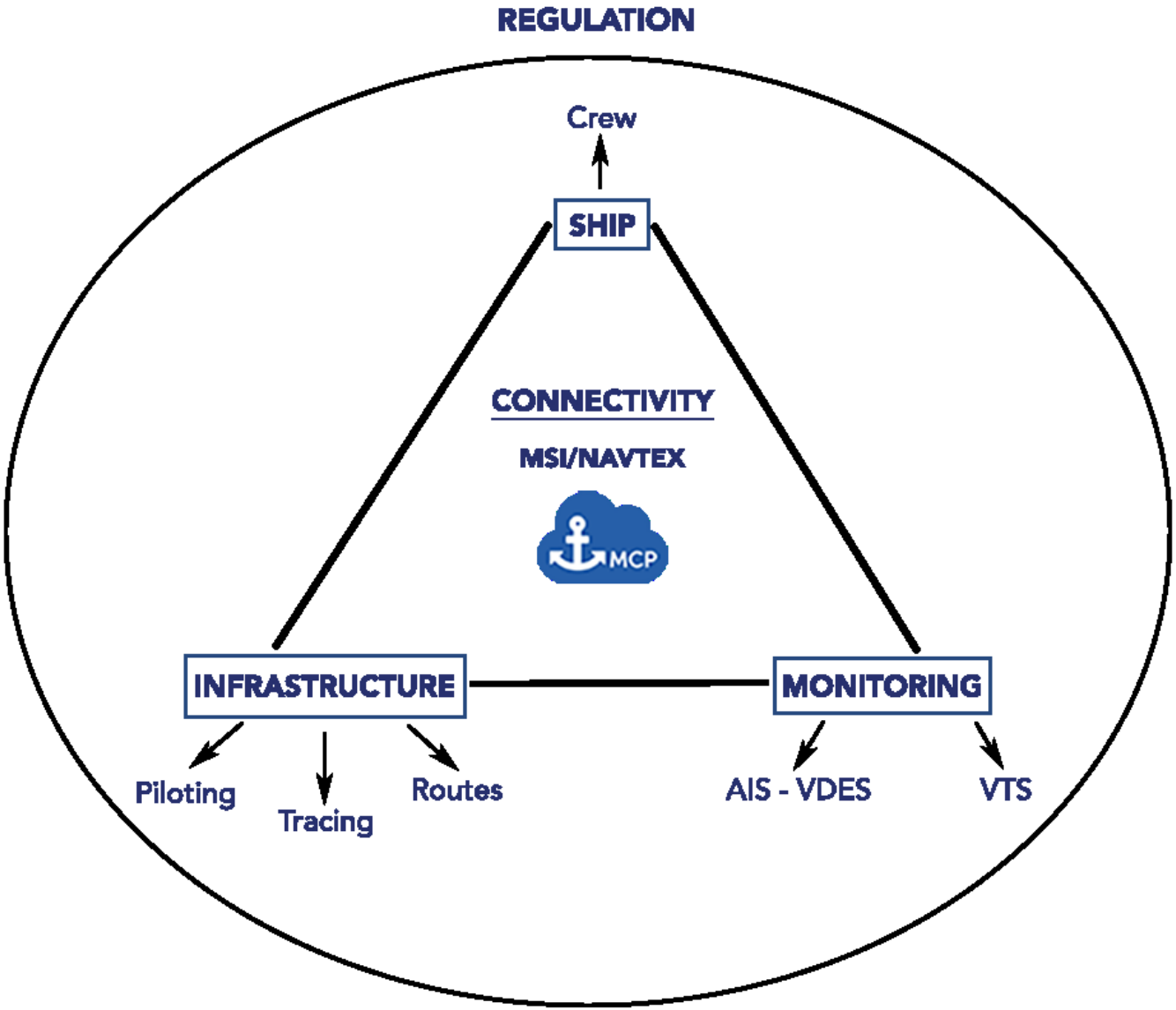

Roles and Obligations of a Coastal State

- Offering safety and security to ships passing through local waters
- Providing laws and regulations to be followed when sailing
- Offering information on regulations
- Offering aids for operating safely
- In short: Providing both rules and tools

The coastal state: Providing innocent, safe and secure passage

Rypen
Blaew landt
Tonderen
Lutke Tondere
Volzee Quijde mae
Guertmans huys
Langheleg
Fanu
Suijder hooft
wadt
Manu
wadt
Rim
flack
flack
De Foecht huys
Clif
Silt
Schellincker oogh
tgraeuwe diep
Knutf diep
Ryper diep
tdiep van Silt
De Ruck
De Ruft
Oost
Noordt
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Offering aids for operating safely

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Providing laws and regulations to be followed when sailing

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Offering information on regulations and aids

REGISTRATION | RECREATIONAL & SCHOOL SAILING | SEAFARERS AND MANNING | GROWTH AND FRAMEWORK CONDITIONS

New rules and regulations

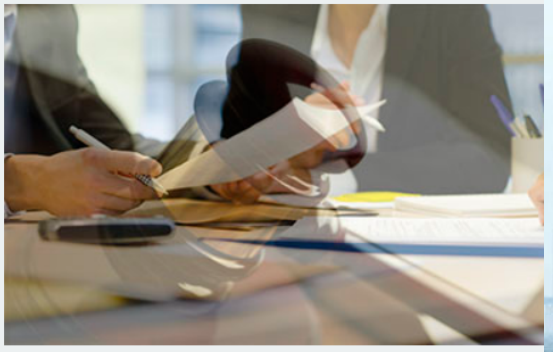
Danish Maritime Authority > Safety at sea > Regulations > New rules and regulations

The Danish Maritime Authority is responsible for issuing acts and executive orders on maritime safety, maritime employment and social law as well as ship registration.

On Legislation you will find English versions of the acts, executive orders, technical regulations and guidances issued by the Danish Maritime Authority that are currently in force. Please note that only the Danish versions have legal validity.

Read about relevant legal preparatory measures in the technical area, inter alia about the sessions of the IMO Committees and Sub-Committees

You can read more about the most recent rules and regulations (in Danish) issued within the area of responsibility of the Danish Maritime Authority on our Danish website.



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In short: Providing both rules and tools

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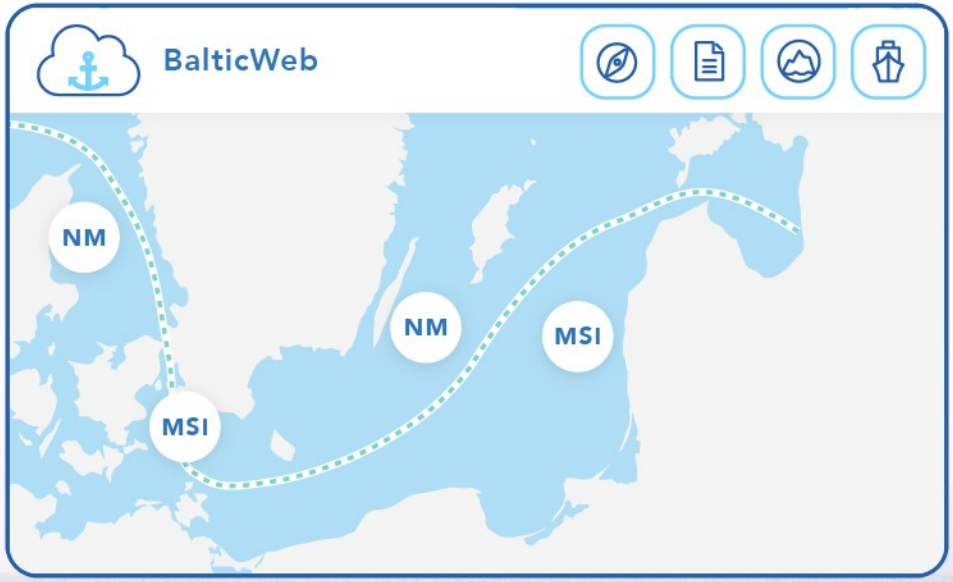
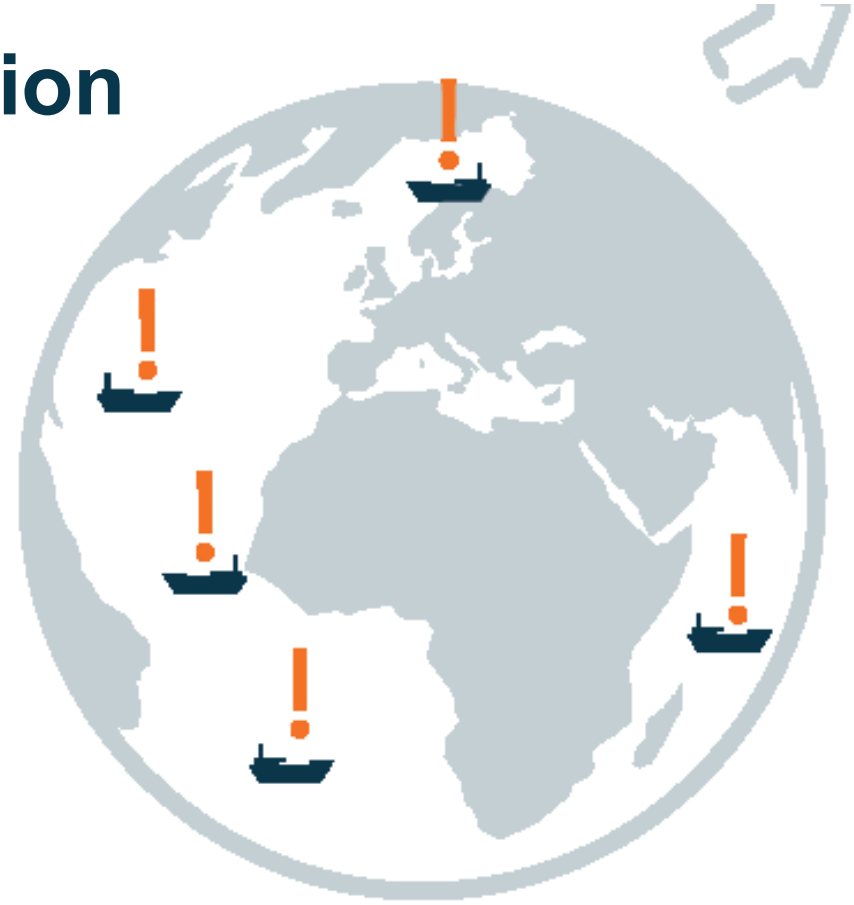
Digital developments



Fragmentation



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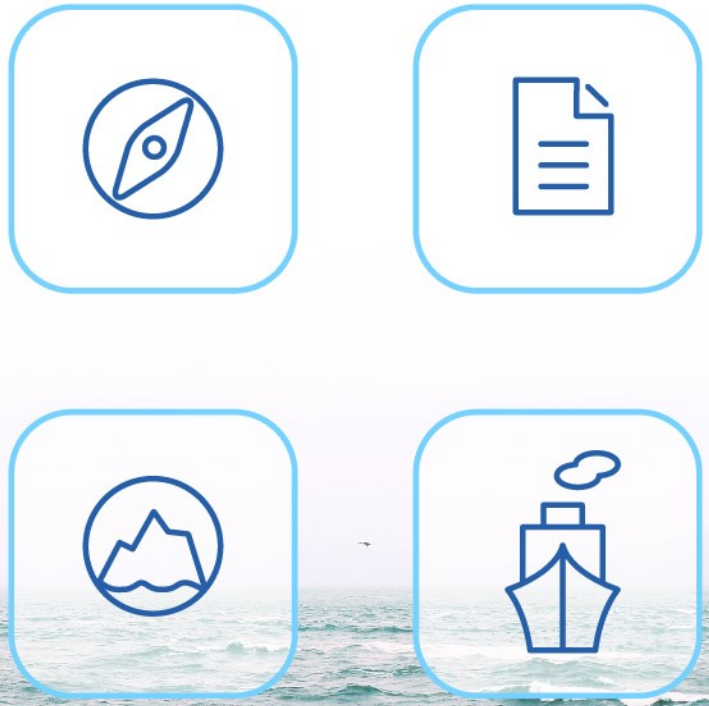
The Coastal State and EfficienSea2

- Bouys
- Navigational Warnings
- Nautical Charts
- Psysichal Infrastructure



- VTS
- SOx
- Weather Reports
- Ice Charts

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Bouys

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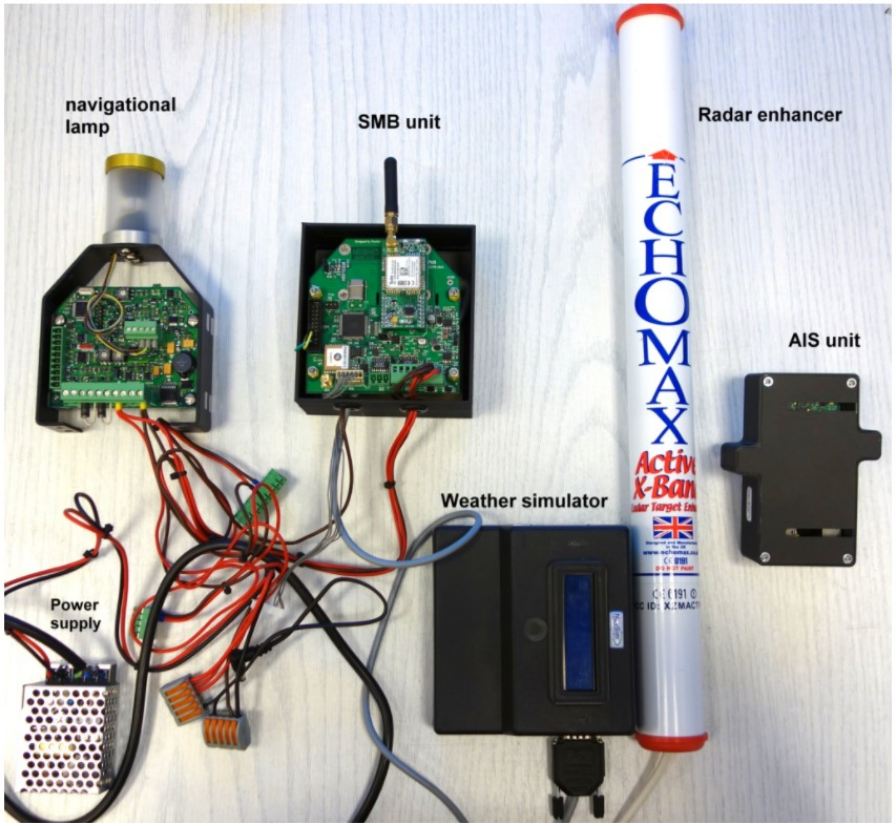
Smart bouys



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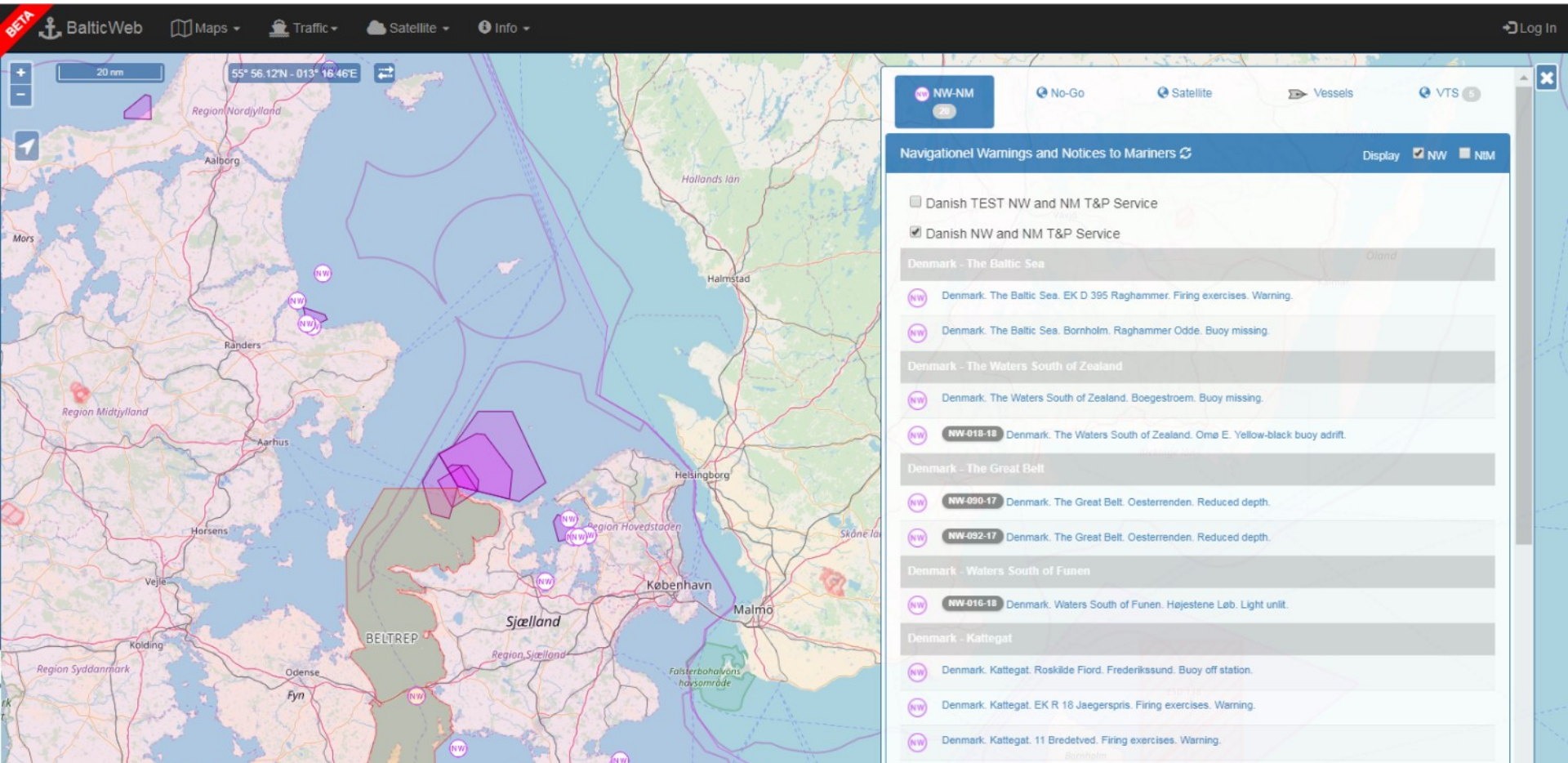
NAVTEX

Digital Navigational Warnings



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From S-57 to S-101

From VTS Radio to standards and integration

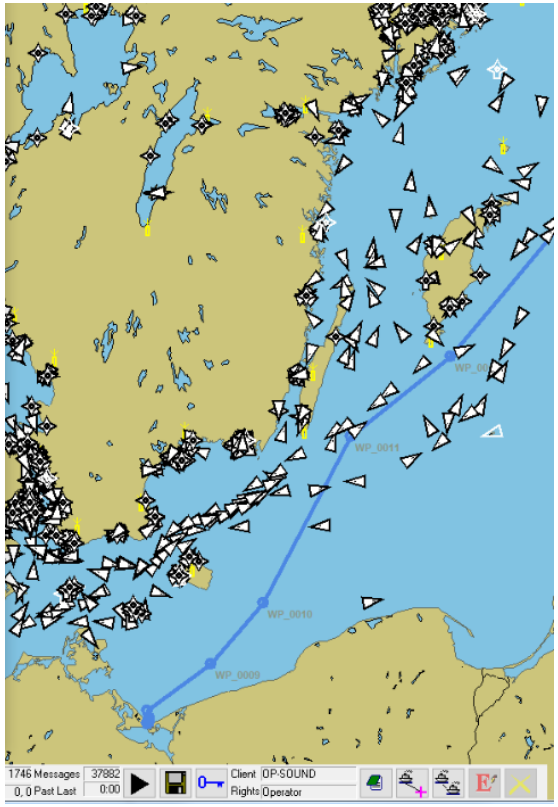
Online reporting

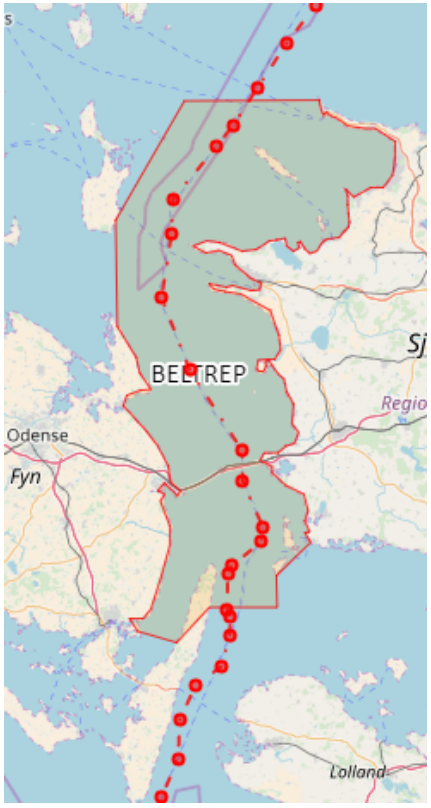
Submit online report. For other means of reporting see reporting procedures.

Read less

Ship information

Ship Name *





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From VHF Radio to VDES

Obligations and potential

- Cyber Security

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Danish Meteorological Institute initiatives for the digital coastal state

25 January 2018, E-Navigation Underway

Jens Murawski, Danish Meteorological Institute

This project has received funding from The European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement no. 636329

DMI's data products for the digital coastal state

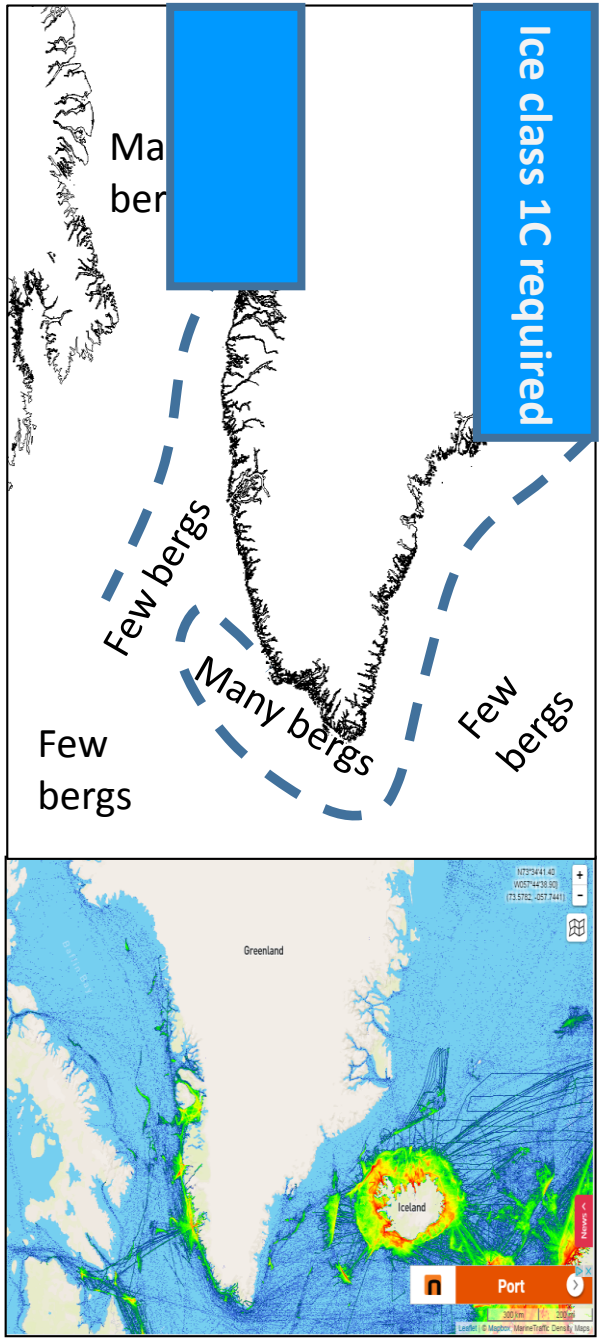
1) Ice-Met.-Ocean data for maritime service
2) Maritime Conectivity Plattform: Service design: ice charts, ice bergs and METOC (Met.Ocean) model data
3) Sattellite derived sea ice products
4) METOC data: introduction into the weather-on-route information system

IceMetOcean data for Maritime service

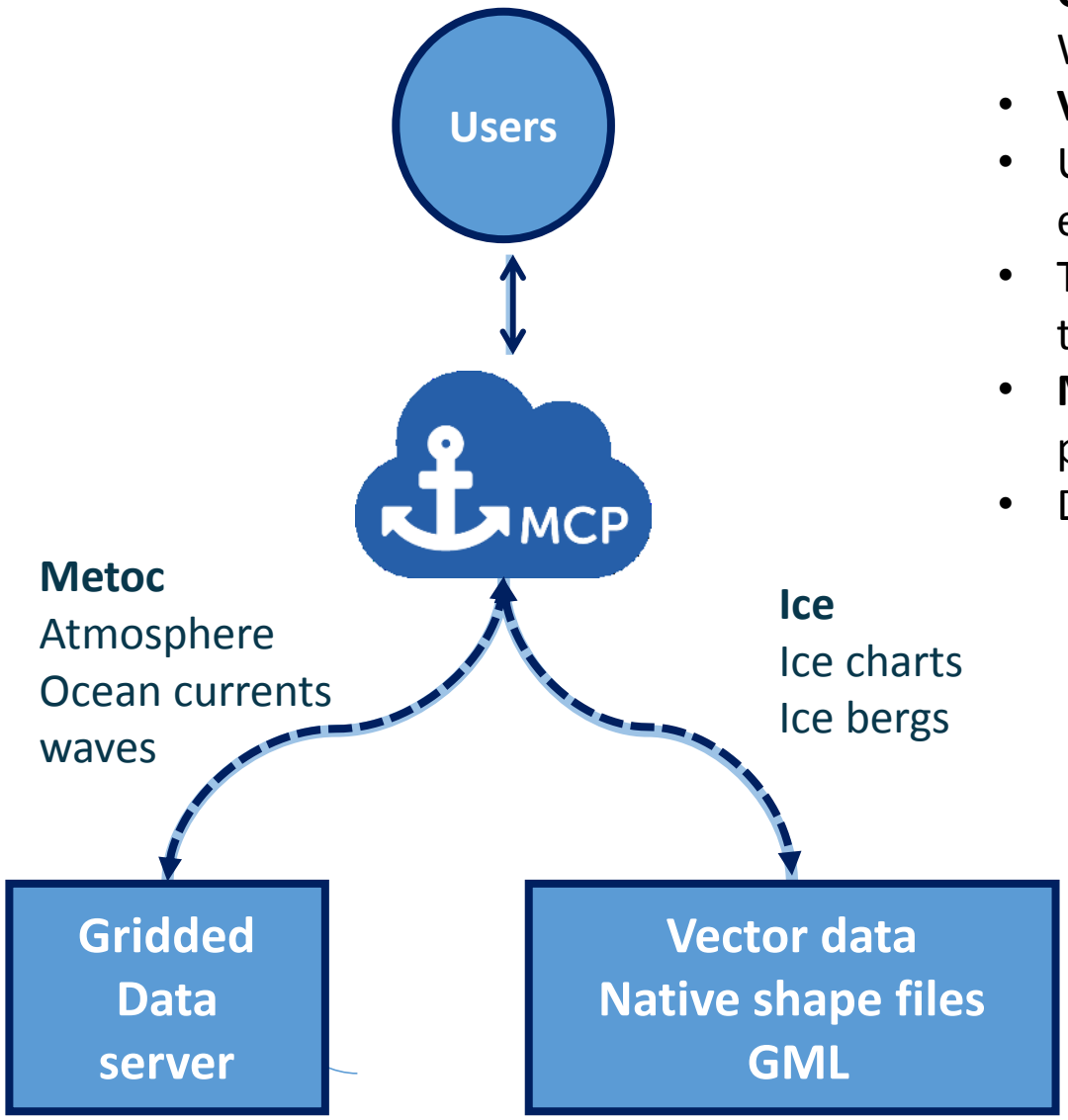
- **Weather routing for maritime savety**: Identification of Go/No go zones (Low water level, Ice infested waters, Extreme weather, Ice bergs) and zones of restricted operations.
- **Route optimisation, planning and guidance**.
- **Forecast of time windows for maritime operations.**
- **Polar code** sets requirement for weather information

Data Service:

- Ability to provide relevant **historical** icemetocean information (marine climatology, planning)
- Ability to provide relevant **current** icemetocean information (situational awareness)
- Ability to provide necessary **icemetocean forecasts** (along route safety and decision making)



Service design



- **Gridded data** server available through WeatherOnroute service
- **Vector data** will download files directly
- Updated when new forecast, ice charts etc is available
- The contact will be established through the **maritime connectivity plattform**.
- **Modell data** is based on **Grib 1 files** projection equidistant lat/lon
- Data based on models
  - Metocean:
    - Atlantic and Arctic
  - Metocean_shelf and waves:
    - Northsea
    - Inner Danish Waters
    - Baltic
    - To be expanded with Arctic and Atlantic areas

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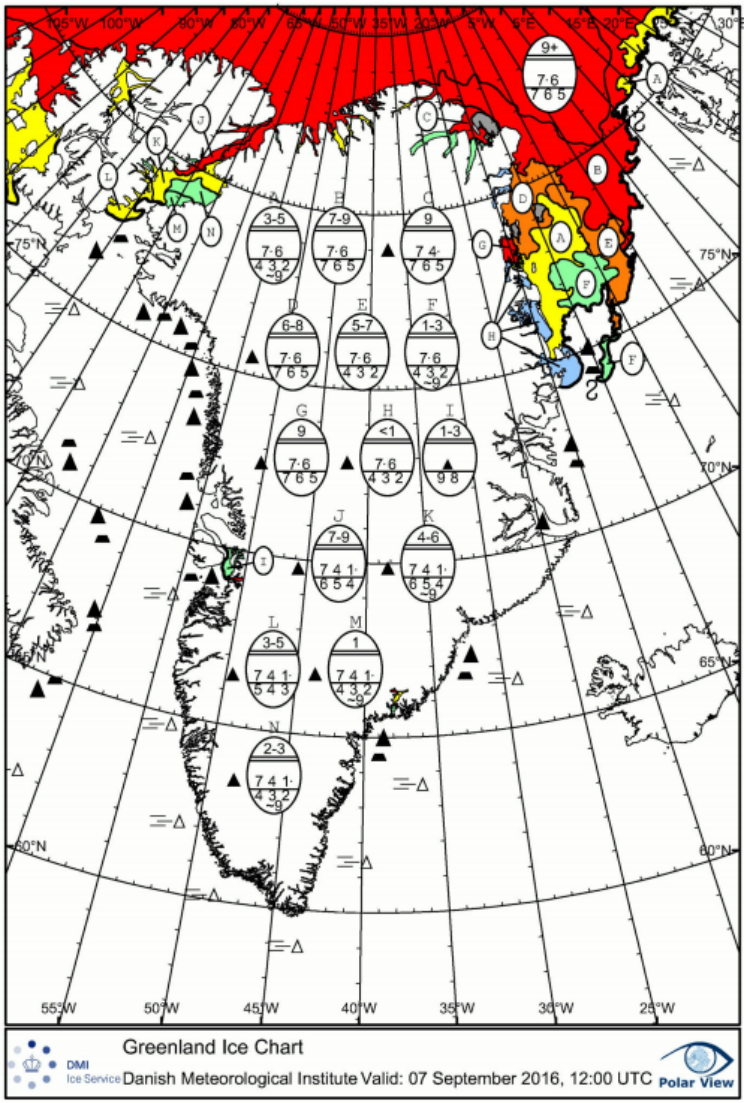
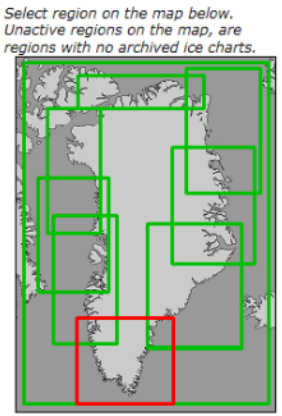
DMI

- Ice charts now available in **S-411 standard**, following the standardization principle of Efficiensea.
- Provides geo-coded vector files: **GML** (Geographical Markup Language)
- Compatible to the **ECDIS** system
- **Baltic Sea** and **Greenland**.
- Ice charts: human interpreted SAR data (**Sentinel-1**, Cosmoskynet, Terra SAR-X) and radar data (ice concentration).

Bi-weekly overview in S-411 format
Mondays and Thursdays



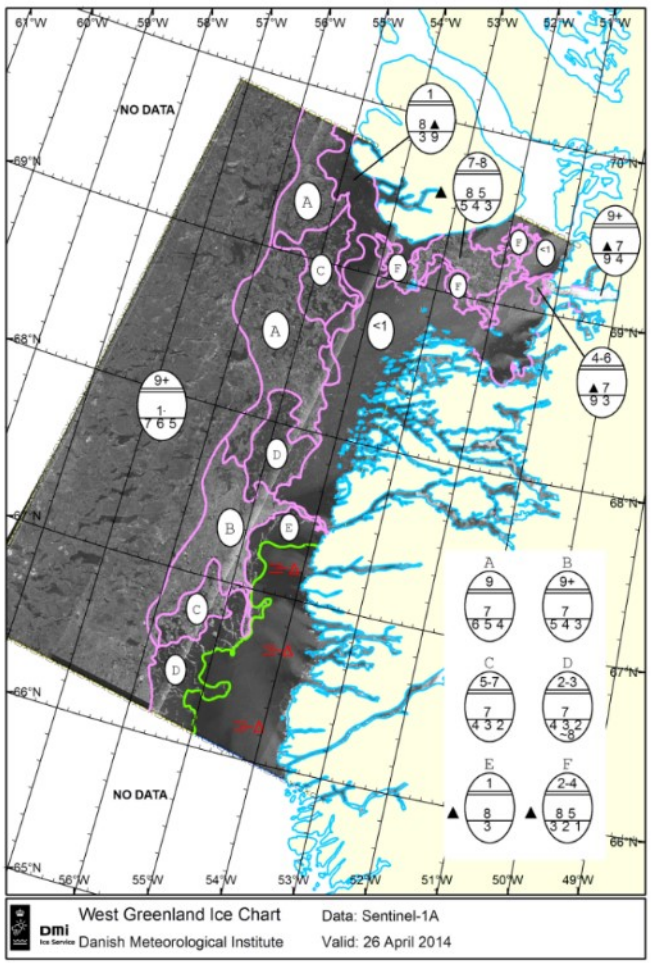


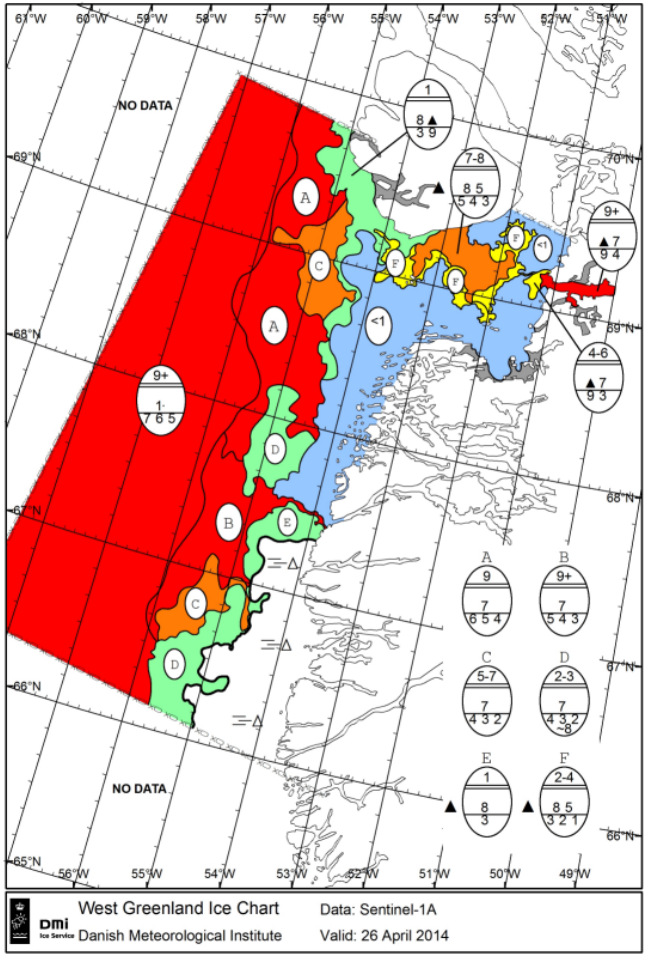
E-Navigation Underway Conference January 24th-26th 2018

Example of ice charts from Sentinel-1A

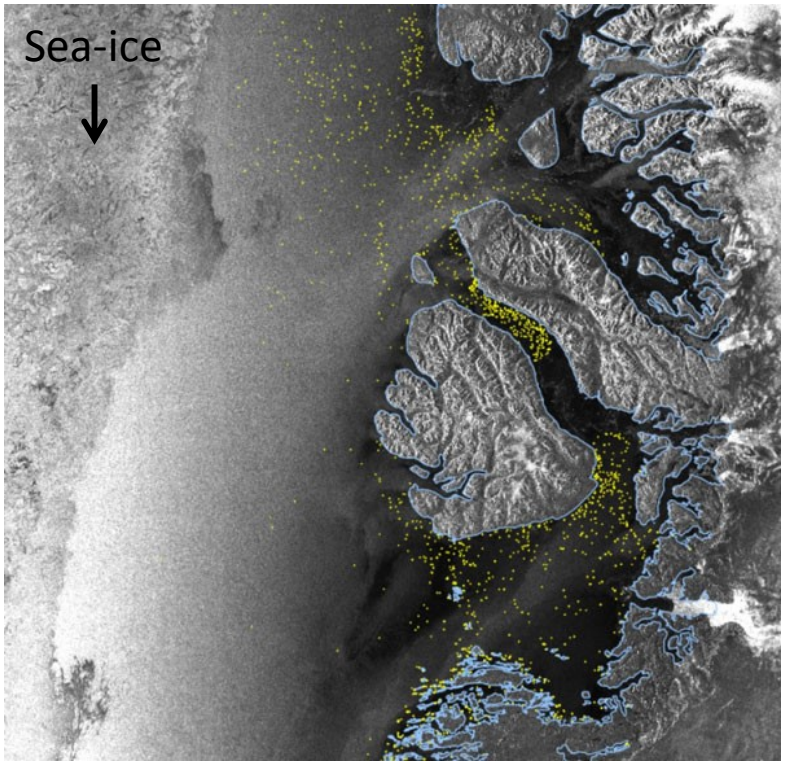
DMI

- Today we derive ice information from **SAR data** by **manual interpretation**
- With the **large number** of SAR scenes we get from Sentinel-1 we need **further automatic methods**
- Not easy - SAR data are very noisy
- However, potential for much higher resolution, and faster delivery
- *S1A image20140426*





Iceberg detection based on Sentinel-1 Synthetic Aperture Radar



Sentinel-1A SAR image featuring Disko Bay West Greenland, on 4 December 2016

- **Automatized product**
- Uses **brightness distribution** of the reflected signal to identify ice bergs
- Product in different formats:
  - **Density** (gridded netcdf)
  - **Number and size** of icebergs (as shape/GML)
- Users are interested in **where and when** icebergs occur and if there are **few or many**. The excact number is most probably less important.

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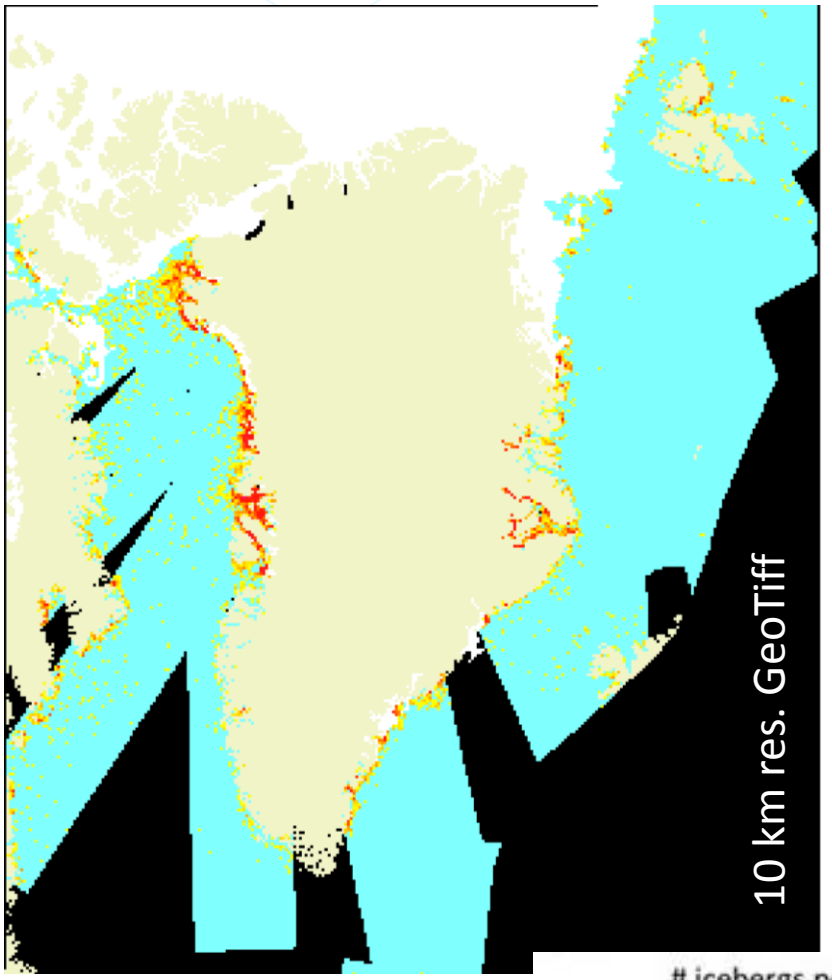
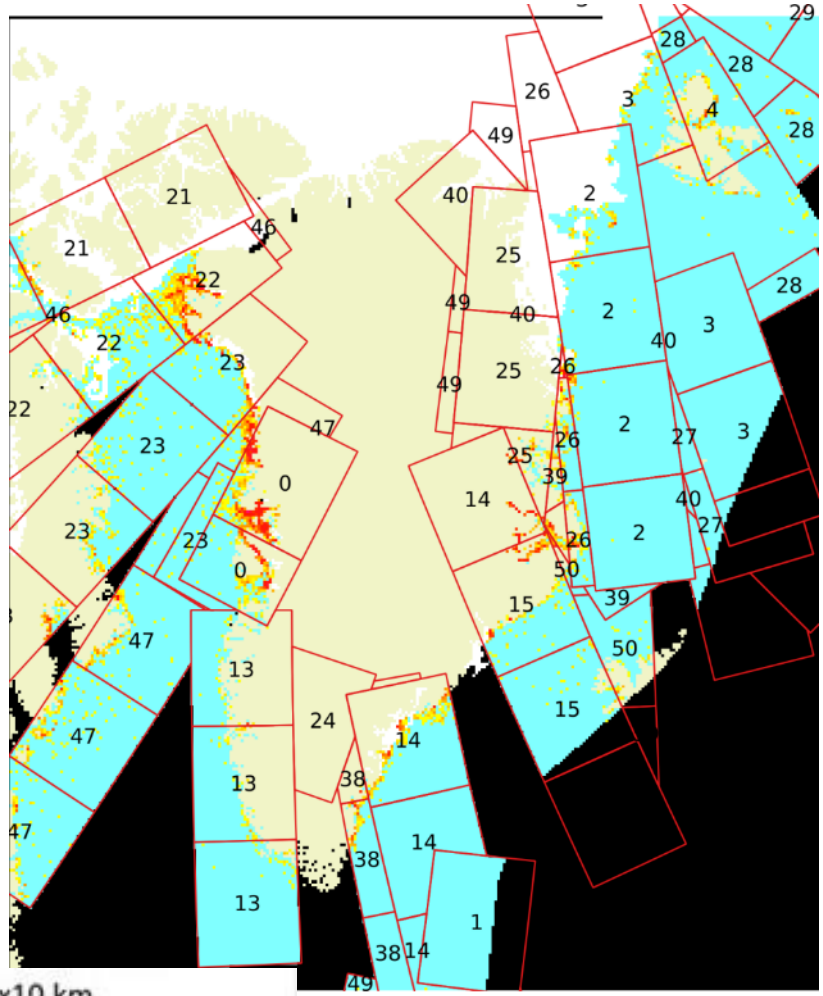
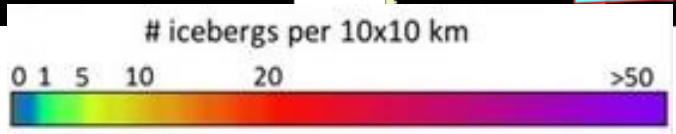
Concentration of icebergs around Greenland inferred form Synthetic Aperture Radar (SAR):
Latest scene acquired: 2017-10-07 10:15







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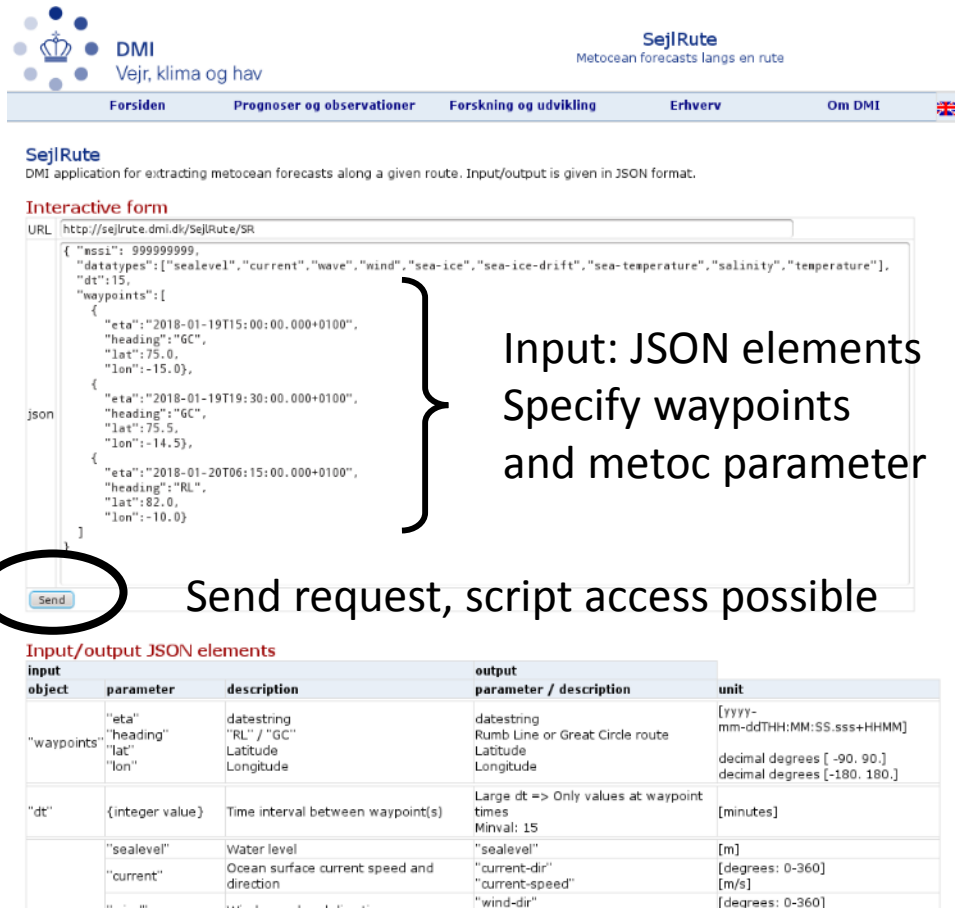
Weather on route service for Baltic Sea & Greenland

- Ocean
  - SST [K]
  - SSS
  - SSH [M]
  - Currents (northward and eastward) [m/s]
  - Density?
- Sea ice
  - Ice concentration (fraction 0..1)
  - Ice drift [m/s]
  - Ice thickness [m]
- Wind
  - Wind (northward and eastward) [m/s]
  - Air temperature
- Waves
  - Significant wave height
  - Significant wave direction
  - Energy period

Ocean.dmi.dk/apps/SejlRoute/SejlRoute.php



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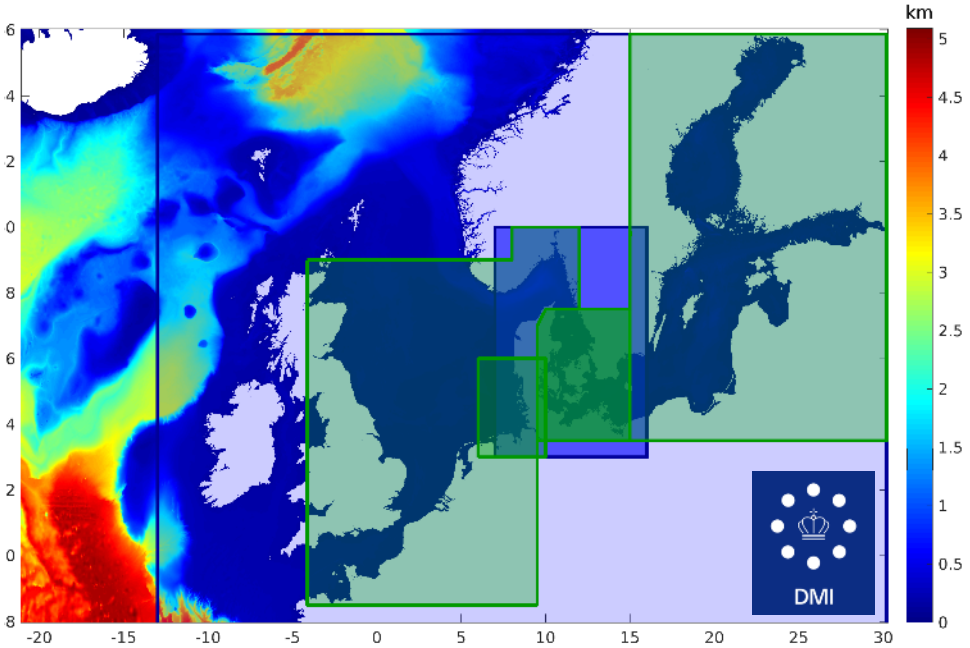
Weather on Route service
provides metoc data of highest possible model quality for a given location and time.

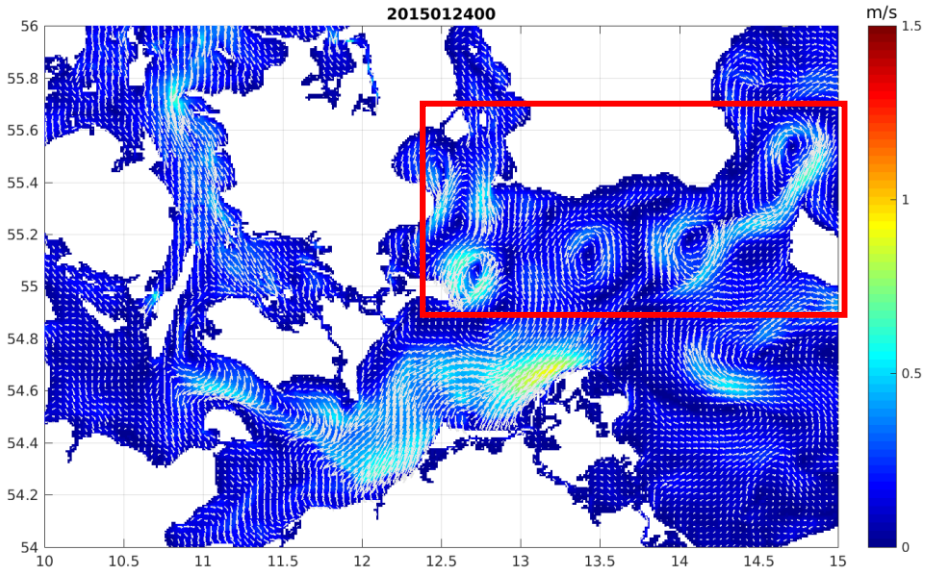
Development of the Baltic Sea service

Improvement of model numerics and physics make it possible to run high resolution applications:

Modelling of mesoscale eddys (<20km size) and even sub-mesoscale eddys (<10km size)



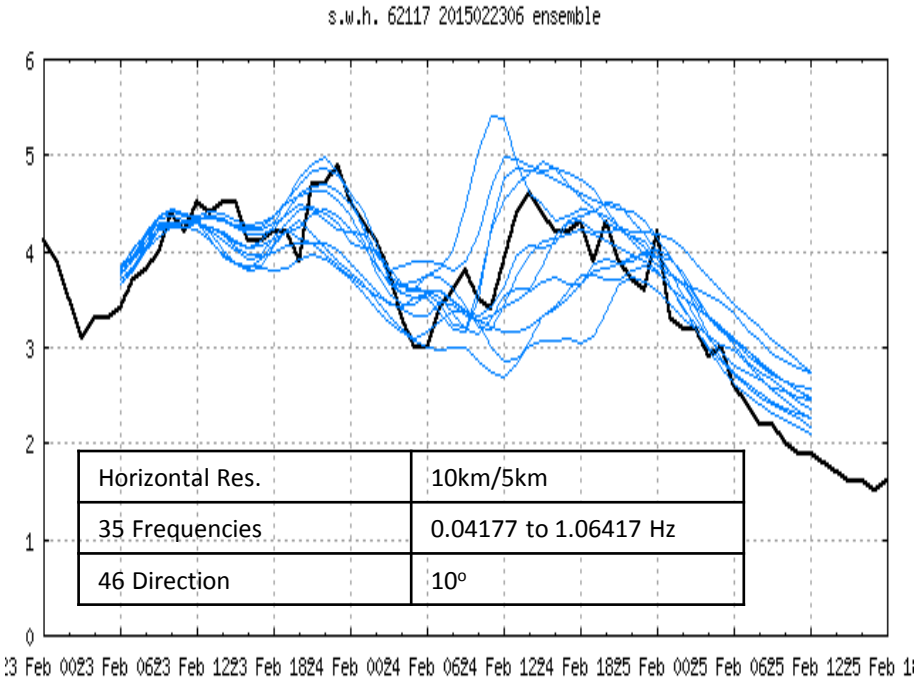
Waves (blue): North-Atlantic/Shelf/Denmark: ≈25km/5km/1km
Currents (green): North-Sea/Waddensea/Baltic-Sea/Denmark:
Wind: Skandinavia: 3km *≈5km/2km/2km/1km*



Example for eddies in the southern Baltic Sea with a life time of 3-4 days.

New developments
Uncertainties – Wave ensembles Baltic region

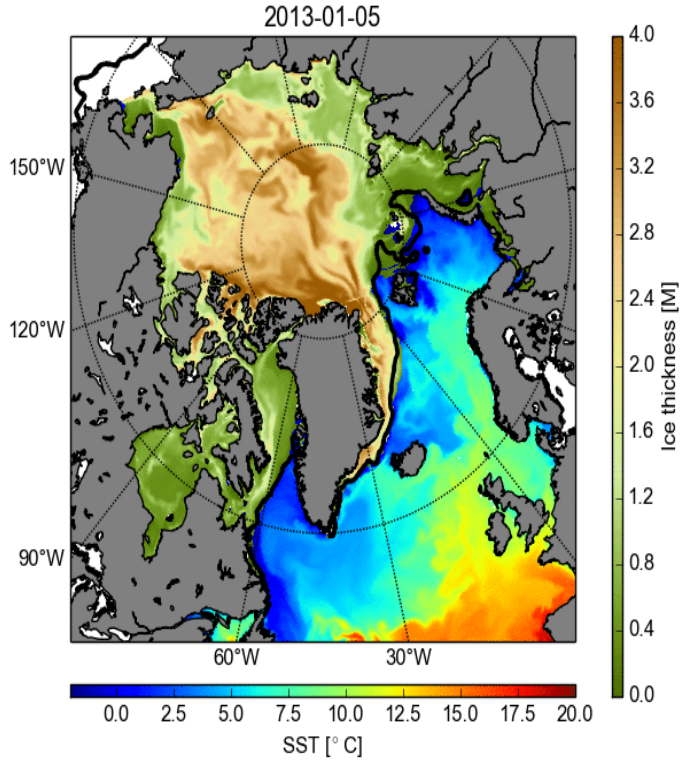
- Assumption: Forecast are not 100% accurate
- Use multiple (12) weather forecast to force wave model in order to estimate the uncertainty of wave heights
- Based on ensemble of weather predictions
- Improved wave growth at high frequencies (up to 1.06Hz) and transport (36 directions).



Significant wave height and spread of ensembles (blue) and observation (black)

Arctic service

DMI



Observed sea ice extent

- Ocean & Sea Ice forecasts based on a physical model
  - Ocean currents, surge and tides, temperature, salinity
  - ice thickness, concentration, drift
- Weather
  - Winds included in all model based fields

Developments:

- Improvement of the numerical efficiency of the sea ice model (CICE, Los Alamos)
- Assimilation of ocean temperature and sea ice products at the ocean surface

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Summary and Conclusions