IHO International Hydrographic Organization

TWCWG 5 Meeting, 16 - 18 March 2021

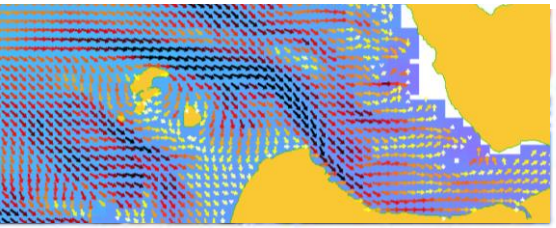
BSH BUNDESAMT FÜR SEESCHIFFFAHRT UND HYDROGRAPHIE

ImoNav

German S-104/S-111 activities in project ImoNav

Oceanographic data for electronic navigation systems

Stephan Dick & Luis Becker, BSH





Federal Maritime and Hydrographic Agency (BSH), Germany

Bundesministerium für Verkehr und digitale Infrastruktur

mFUND Das Startkapital für die Mobilität 4.0

ImoNav - Integration of high resolution marine geodata into electronic navigation systems

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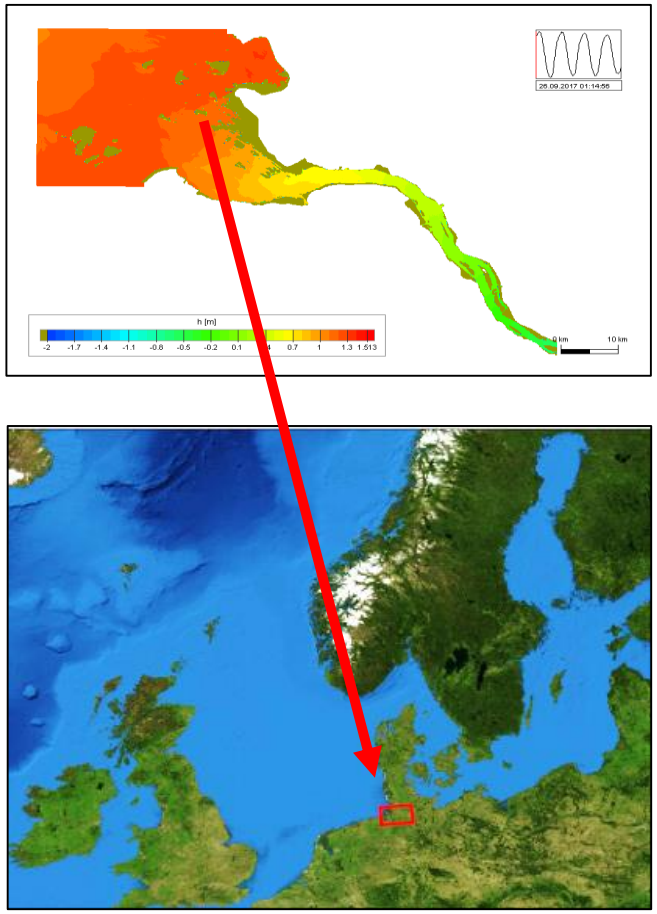
Main goal:

- Develop an innovative high resolution navigation service for marine water ways (e.g. Elbe, German Bight)
  - Produce high-resolution and high-quality water level, current and bathymetry data
  - Combine bathymetric data and (optimized) water level forecast
  - Deliver data according to IHO S-100 standards
  - Automate all processes and data fluxes
  - Portray the data in ENCs and ECDIS
  - Carry out pre-operational production



Provision of high-quality dynamic water level forecasts

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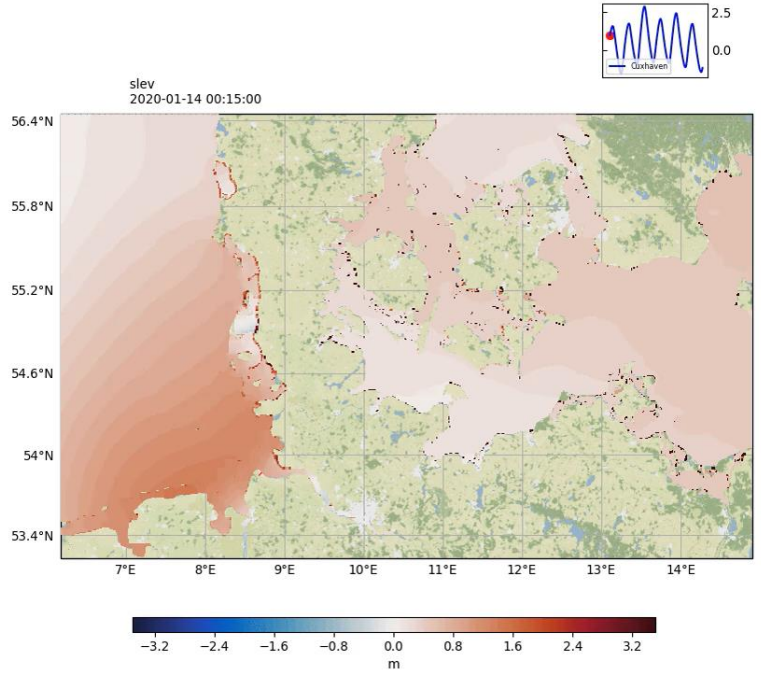
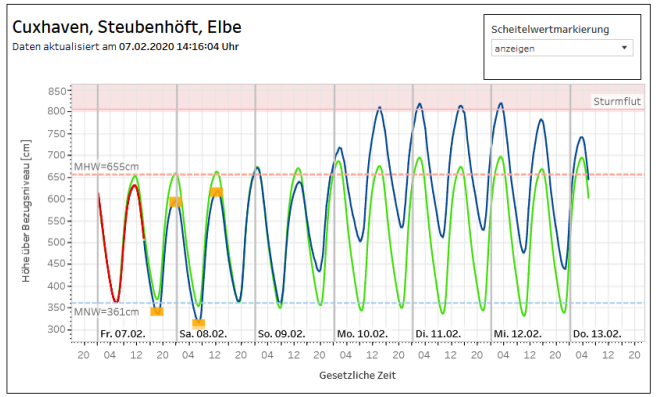
Combination of two automated products for BSH water level forecast service

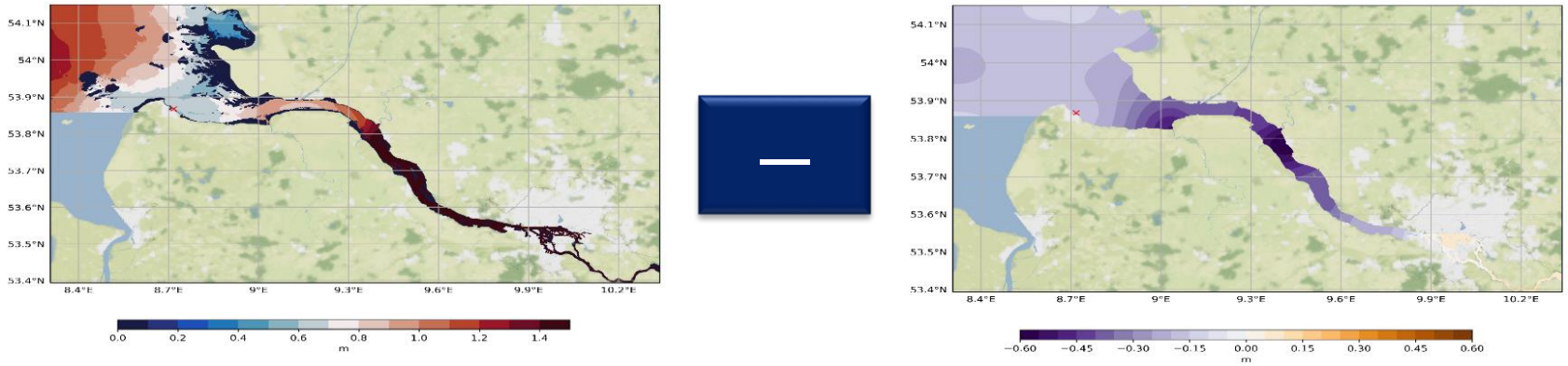
1. Forecast of numerical model (HBM):
Continuous water level surface



2. MOS (Model Output Statistics):
Discrete results for some locations
(statistically postprocessed model output)

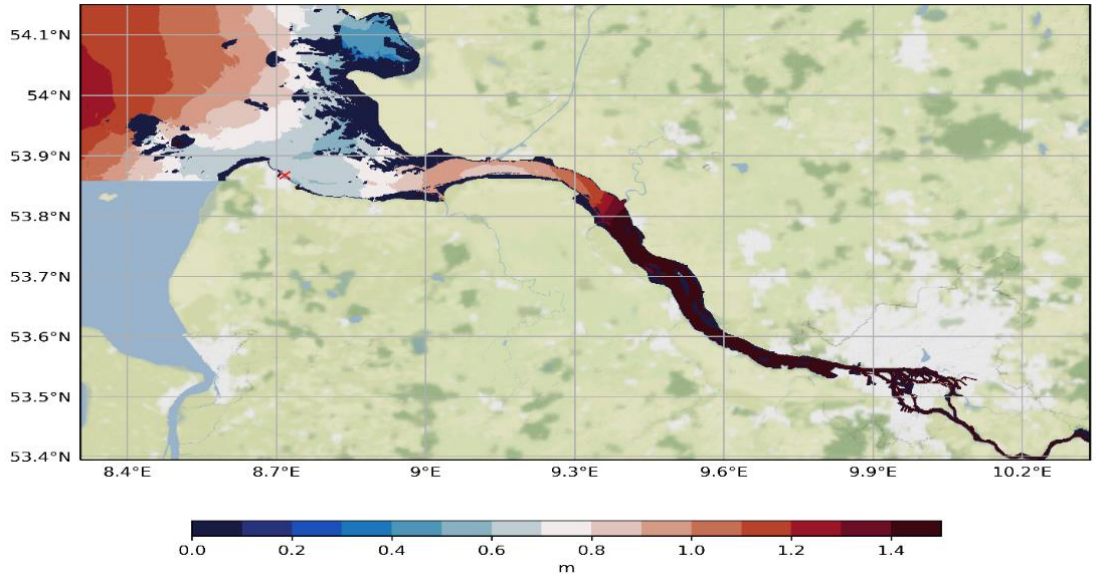


Optimized 2D water level forecasts



Method:

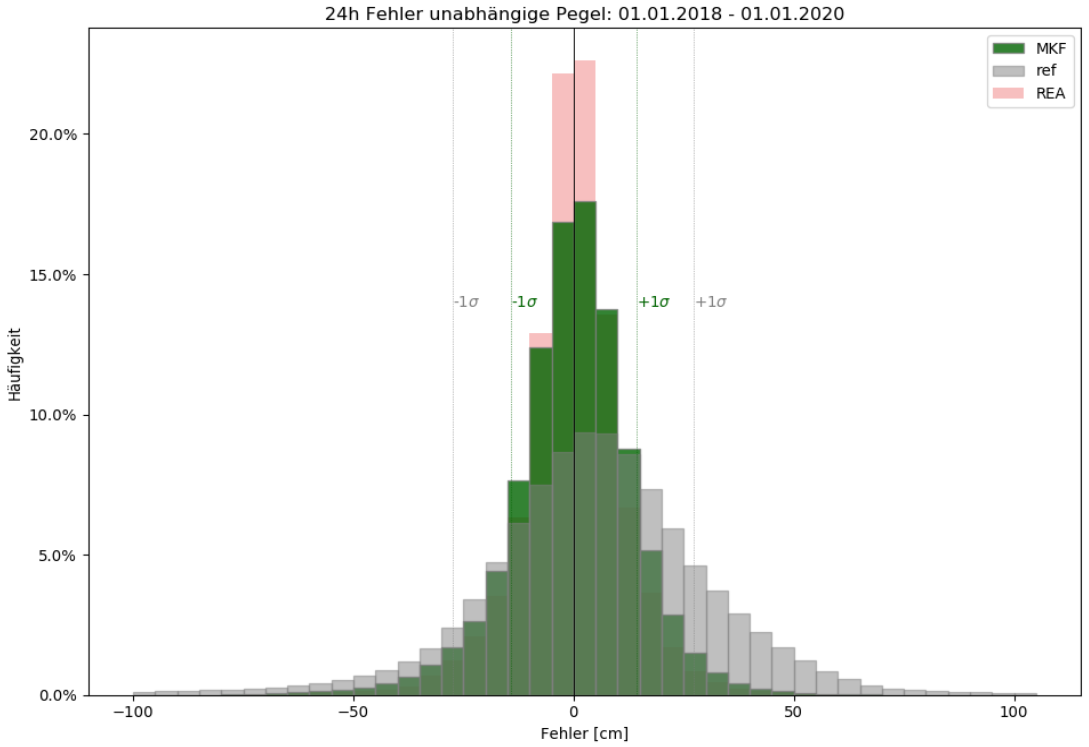
- Calculate 2D correction values
- Substract these from numerical water level surface



'corrected' new water level surface

Optimized 2D water level forecasts

The correction method shows a clear improvement of water level forecasts for the first 24 hours compared to the original numerical forecast (validation period: 2 years)



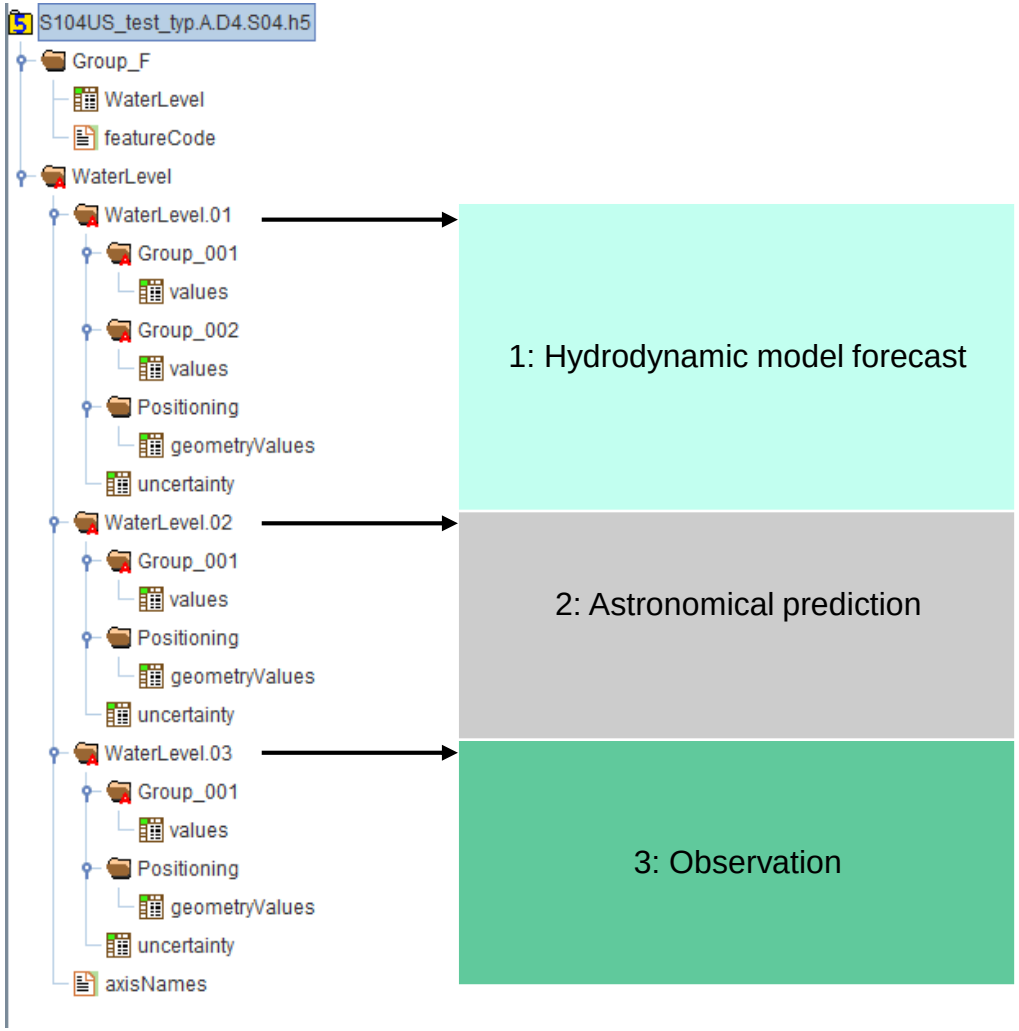
Statistics for independent tide gauges
(forecast lead time < 24 hours)
MKF = New forecast method
REF = Pure numerical forecast [reference run]

	Bias	cRMSE	5% Perzentil	95% Perzentil
REF	5.7 cm	24.4 cm	-36.5 cm	42.8 cm
MKF	2.8 cm	13.2 cm	-22.5 cm	19 cm

Provision of S-104 test data sets

S-104 Encoding:

- German S-104 test data (HDF5)
  - time series data
    - Observation
    - Astronomical prediction
    - Model Forecast
  - based on PS Ed. 0.0.6 (Feb. 2020)



S-104 use cases and test data

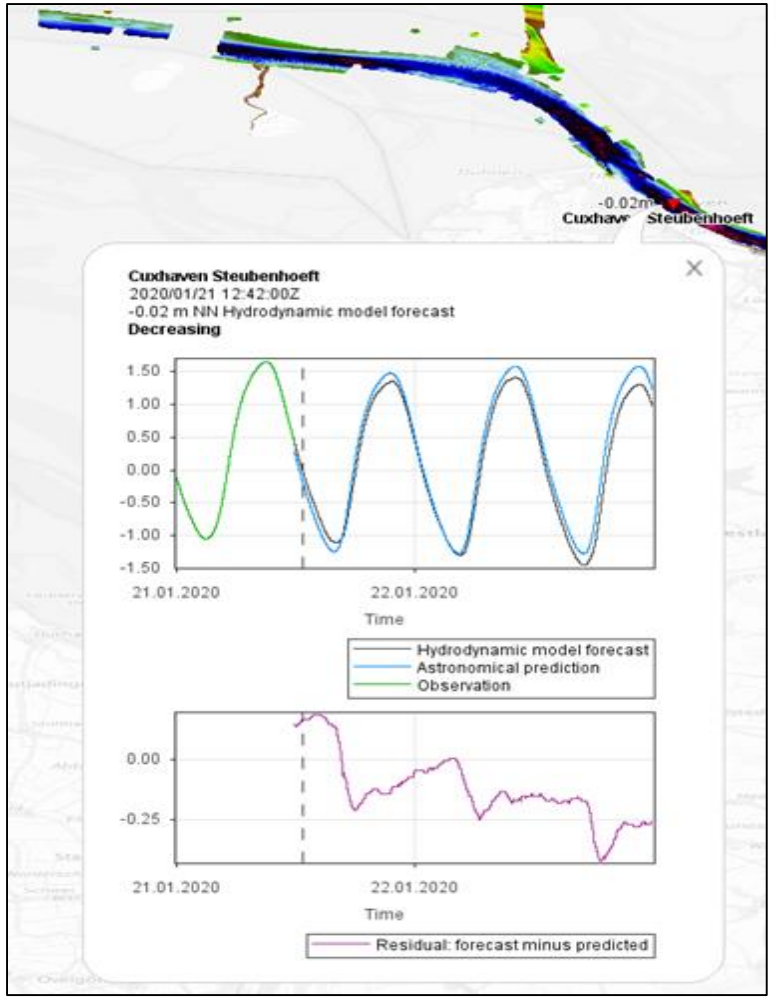
Use Case for German Bight and Elbe estuary

Optimized product for 2-dimensional water level forecasts:

- time series (S-104) and gridded model data (NetCDF)
- Forecast length: 48h
- Update: Every 15 minutes

Pre-operational test data sets available

Beta-Portrayal of continuously updated data via a Web-Map-Service in ImoNav viewer: http://imonavviewer.smileconsult.de/



Pick report for water level data

Provision of surface currents (S-111)

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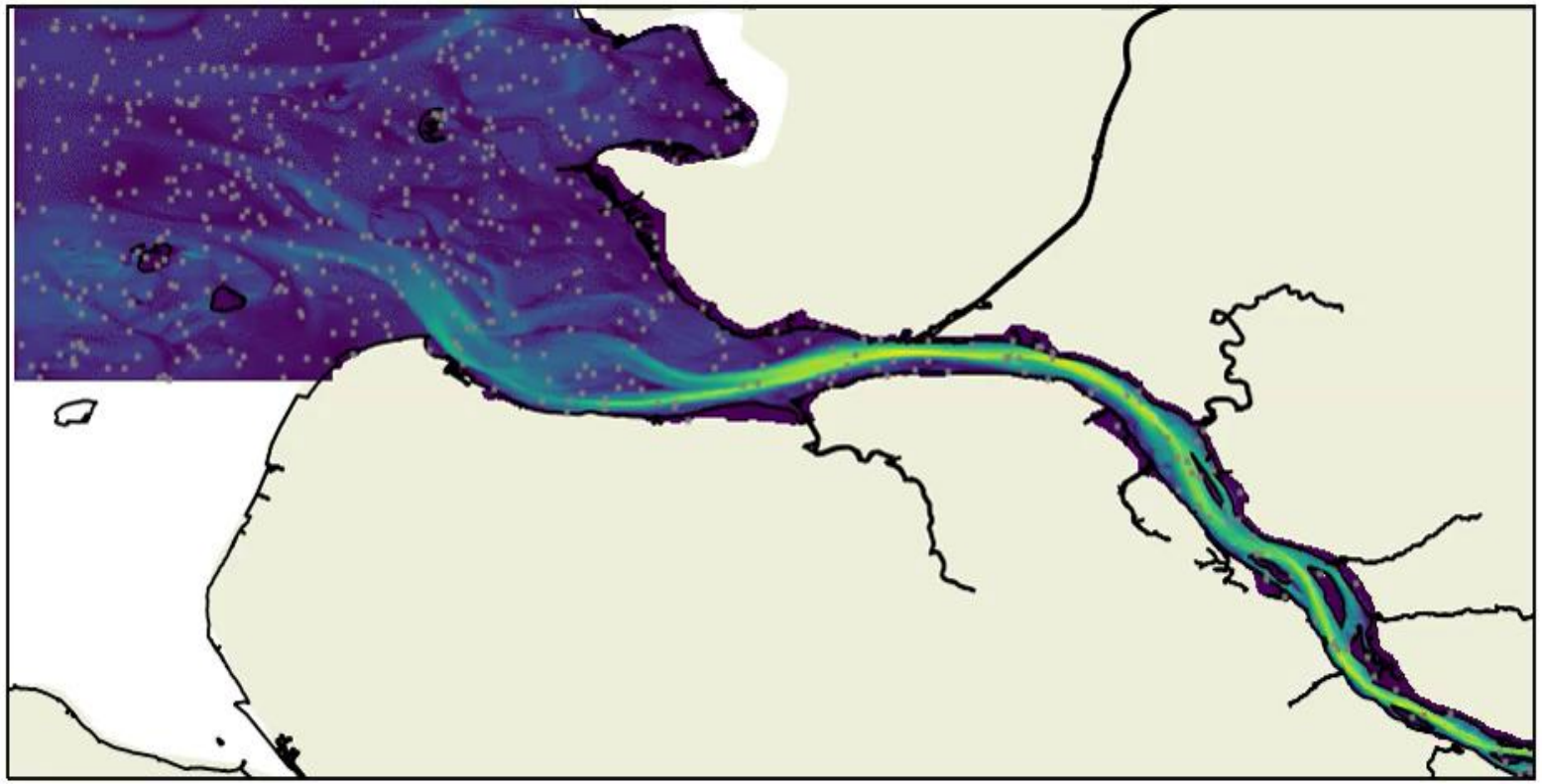
Forecasts of operational circulation models on three grids

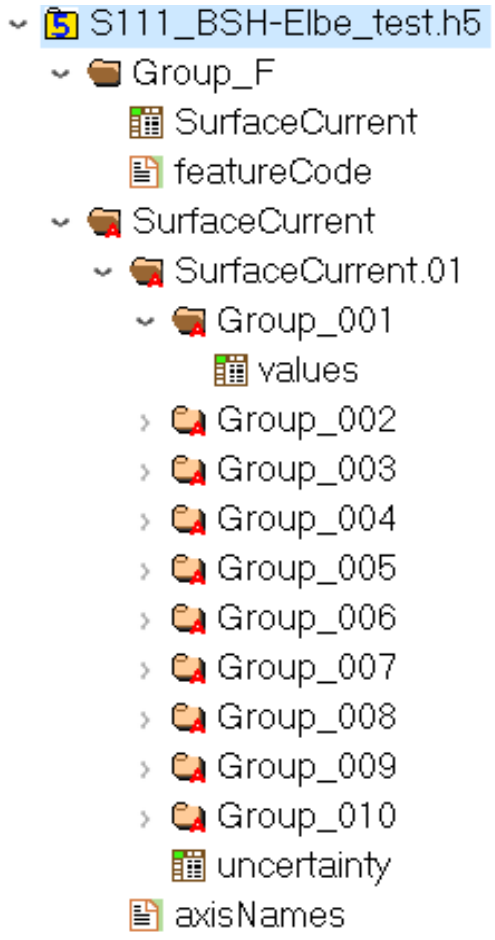
- Elbe estuary [90 m]
- German coastal waters [900 m]
- North Sea and Baltic Sea [5 km]

- Forecast length: 48 h / 72h
- Update: Twice daily
- Automated conversion and provision of S-111 grided data sets



Example for currents in Elbe test bed: [90x90m]

Provision of S-111 test data sets



S-111 Encoding:

- S-111 test data (HDF5):
  - Gridded data
  - based on S-111 PS Vers. 1.0.0

	0		1	
	surfaceCurrentSpeed	surfaceCurrentDirection	surfaceCurrentSpeed	surfaceCurrentDirection
18	-1.0	-1.0	-1.0	-1.0
19	-1.0	-1.0	-1.0	-1.0
20	-1.0	-1.0	-1.0	-1.0
21	0.34	275.9	0.33	273.3
22	0.36	284.9	0.34	279.6
23	0.37	288.6	0.34	283.4
24	0.37	288.4	0.33	283.9
25	0.37	284.7	0.33	280.6
26	0.34	276.2	0.3	274.5
27	-1.0	-1.0	-1.0	-1.0

S-111 use cases and test data

Use Cases for North Sea, Baltic, German Bight, Elbe estuary

Gridded HDF5 data sets according to S-111 Prod. Spec. (Ed. 1.0.0)

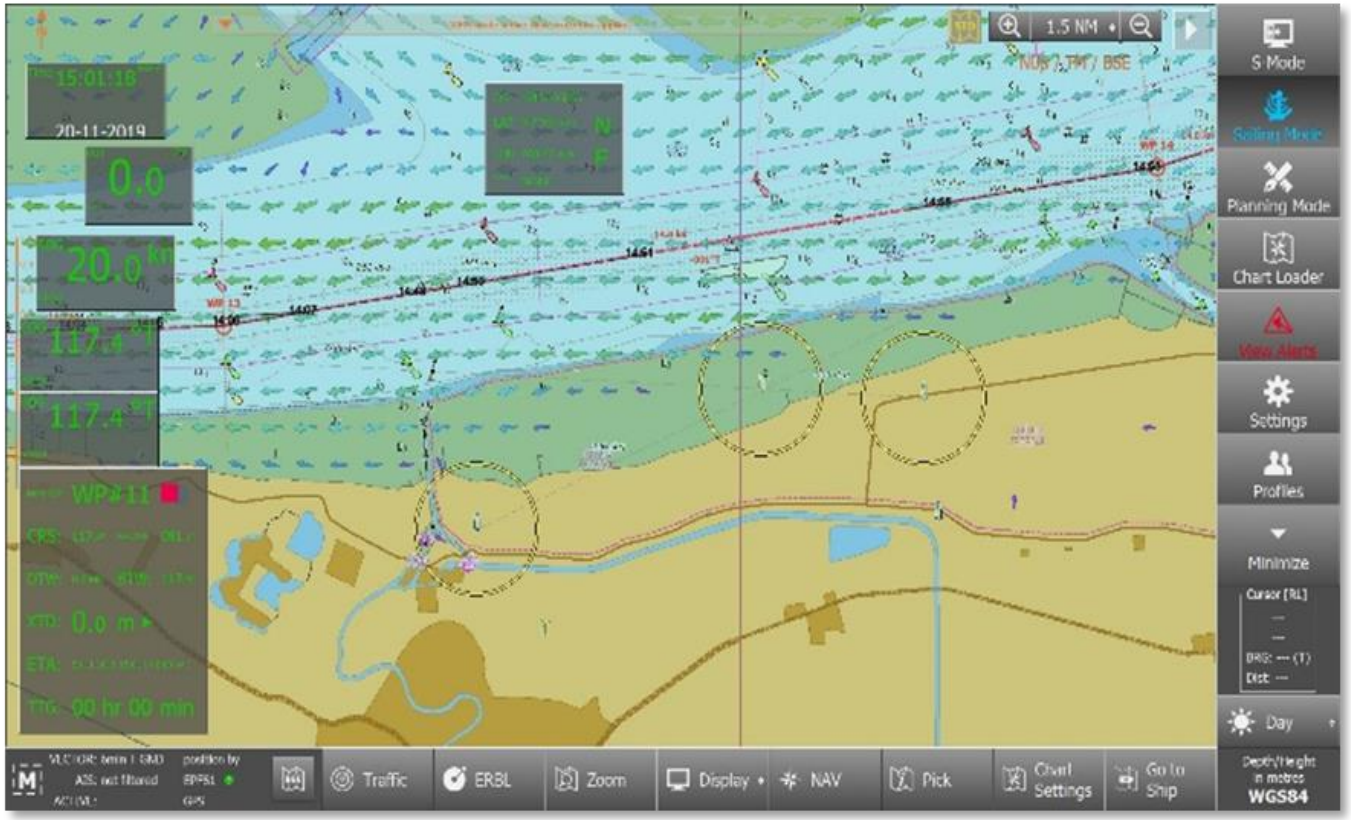
Pre-operational test data sets available

Portrayal of surface currents in an ENC (PPU – Portable Pilot Unit)

User feedback:

- need for high-resolution data (< 10m)
- portrayal critical, coverage of other information (interoperability)

WMS overlay for currents in Portable Pilot Unit (PPU)



Provision of other oceanographic data
(NetCDF)

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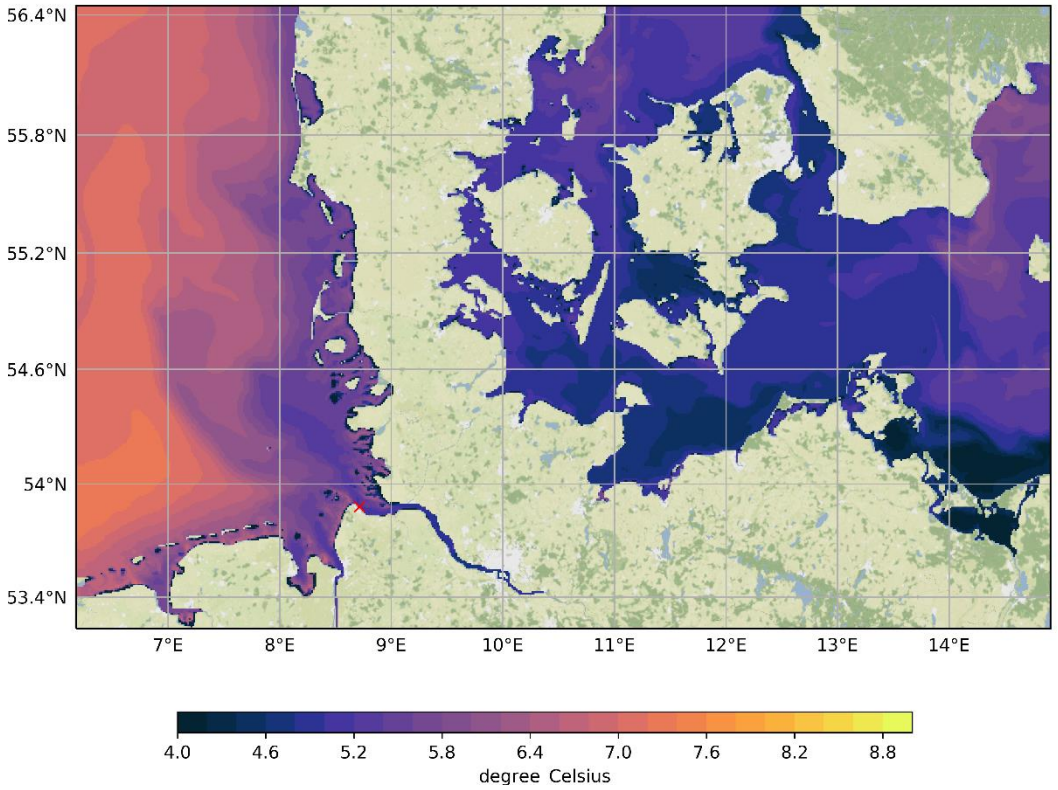
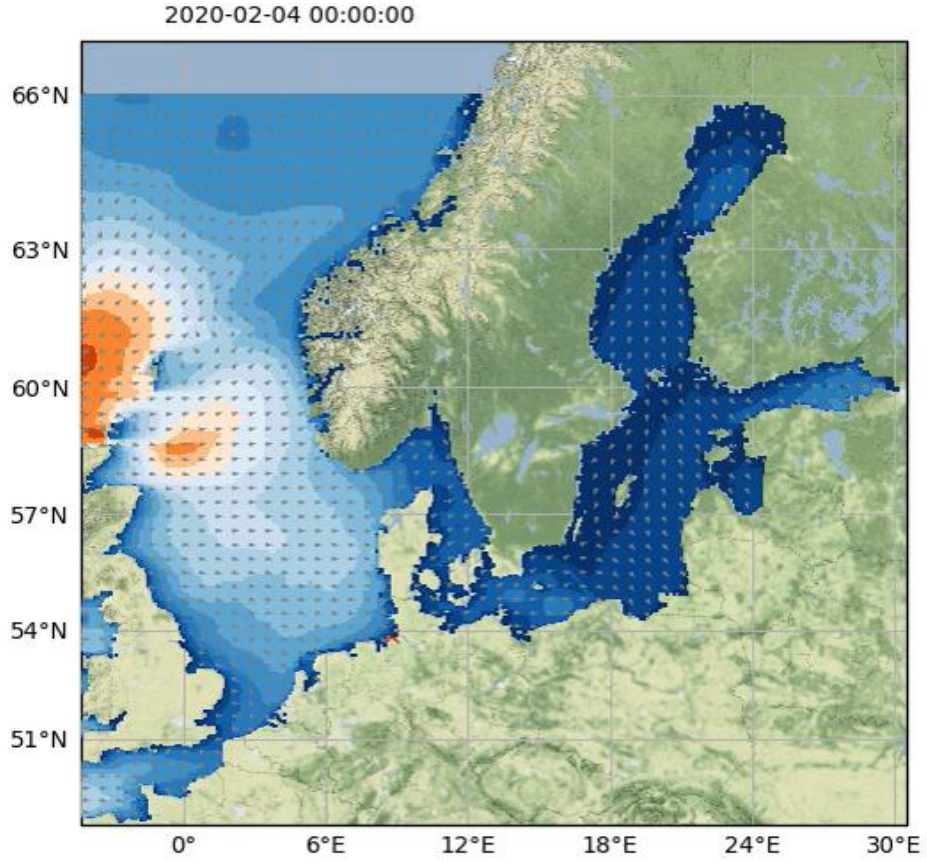
Temperature (left), salinity, wave (right) and wind forecasts are available on 2 grids:

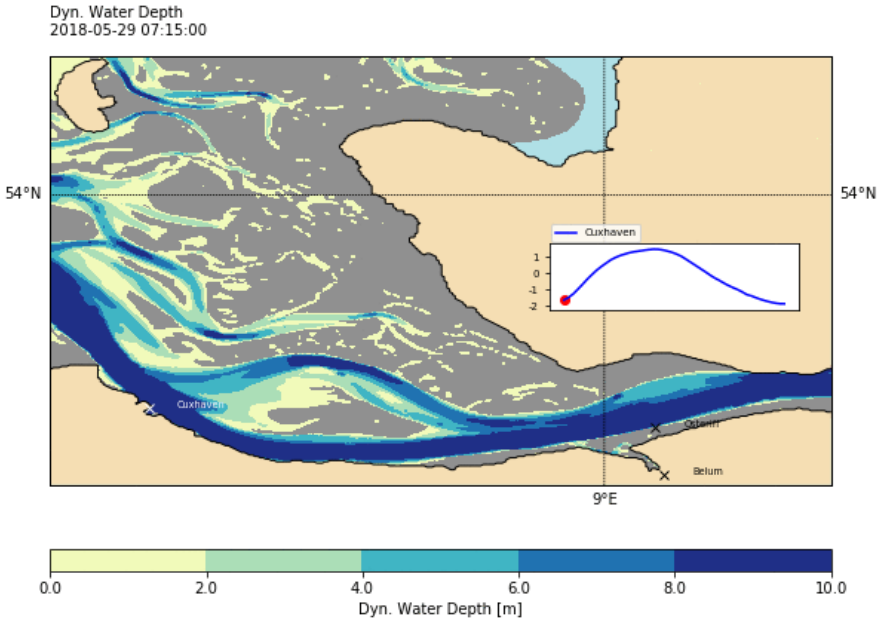
- German coastal waters (900 m x 900 m)
- North Sea and Baltic Sea (5 km x 5 km)





Conclusions

- Project ImoNav succesfully finished
- New method for optimized 2D water level forecasts
- Combination of bathymetry and water level data
- Portrayal in PPU and ImoNav viewer (industry partners)
- User workshop and demonstration phase
- Automated pre-operational daily production
- S-104 / S-111 HDF5 test data still available on ftp box
  - S-104 time series: ftp.bsh.de/outgoing/imonav/AP2/s104_files/
  - S-111 gridded data: ftp.bsh.de/outgoing/imonav/AP2/s111_files/



Thank you for you attention!

ImoNav

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