

Recent developments in the European coastal observing and forecasting systems. Selected examples

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Motivations

- ***Describe the expected enhancements in the process of shortening the distance between Global Monitoring for Environment and Security (GMES) and coastal downstream services,***
- ***Describe the recent advancements in some European coastal observing and forecasting systems.***
- ***Describe the author's vision on the further evolution (further development of the European coastal capacity)***

Outline

- ***Coastal specificities***
- ***FIELD-AC (lessons learned)***
- ***COSYNA***
 - observations***
 - modelling***
 - products***
- ***Future steps needed***

Scientific Challenges and Motivation in the Field of Coastal Operational Oceanography

Coastal Processes

- **characteristic scales, natural versus forced variability (signals are not generated within the domain),**
- **biogeochemistry and sources of matter,**
- **tidal versus non-tidal dynamics.**

Observations

- **Observations at a high temporal resolution, from coast, data stations, data transmission, long term experience, ...**

Numerical Modelling

- **Fine (coastal resolution), observations constitute a challenge for sequential data assimilation, in coastal models it is not sufficient to update the model state via data assimilation without updating the boundary conditions.**

Applications

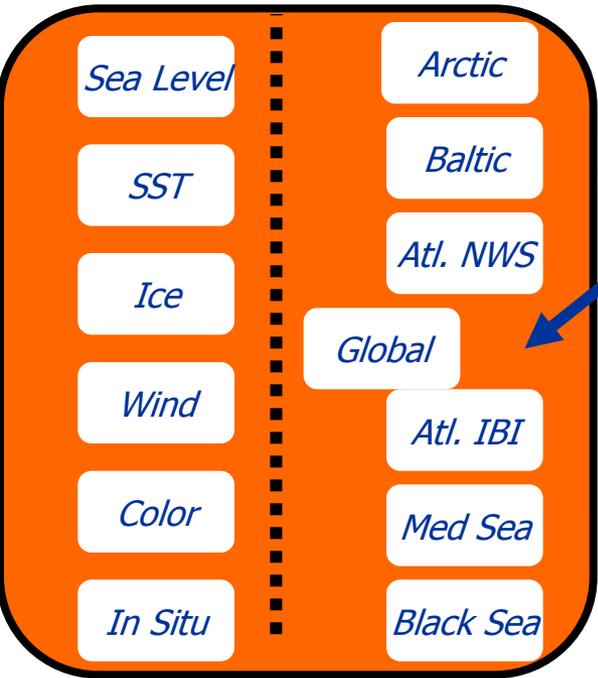
- **Contribution to the Marine Services**

The Marine Service: From Generic Products to Intermediate and End Users

13 PRODUCTION UNITS

TAC

MFC



GMES input information

Core information (ocean state)

User customized information

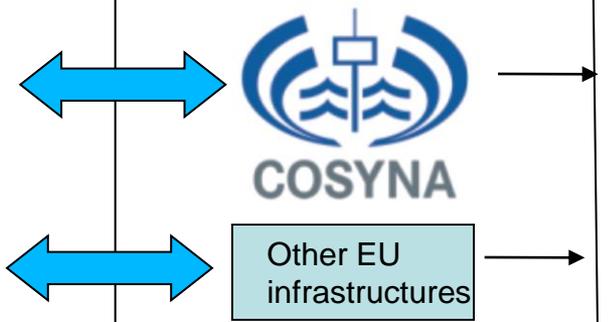
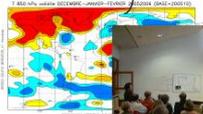
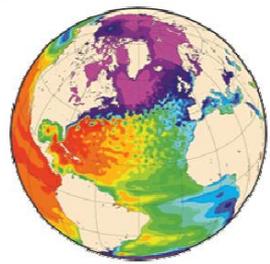
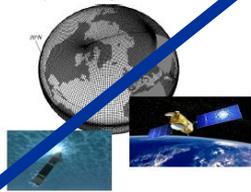
GMES Satellite and in situ networks

GMES Service outputs (others)

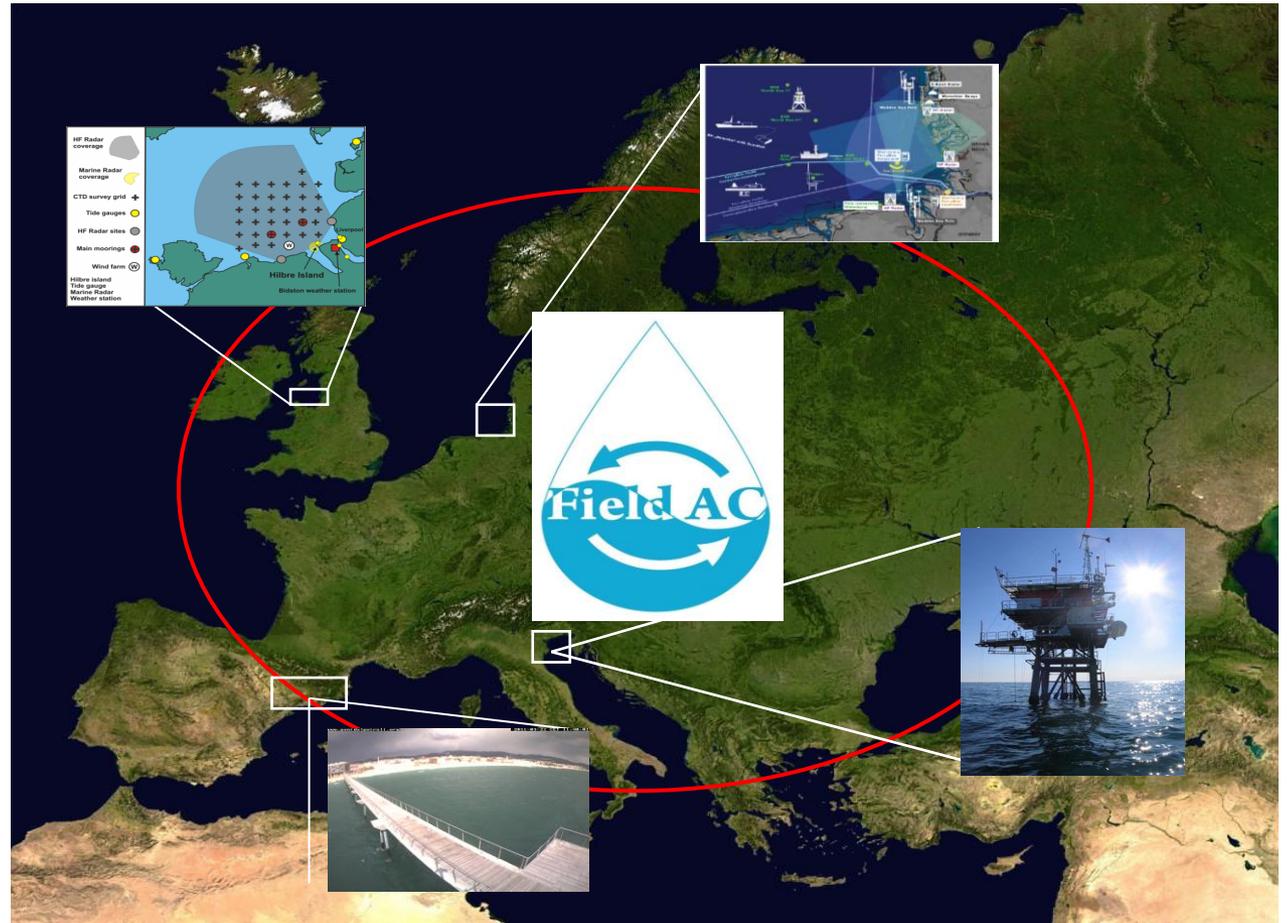
Marine Core Service

Downstream Services

National users

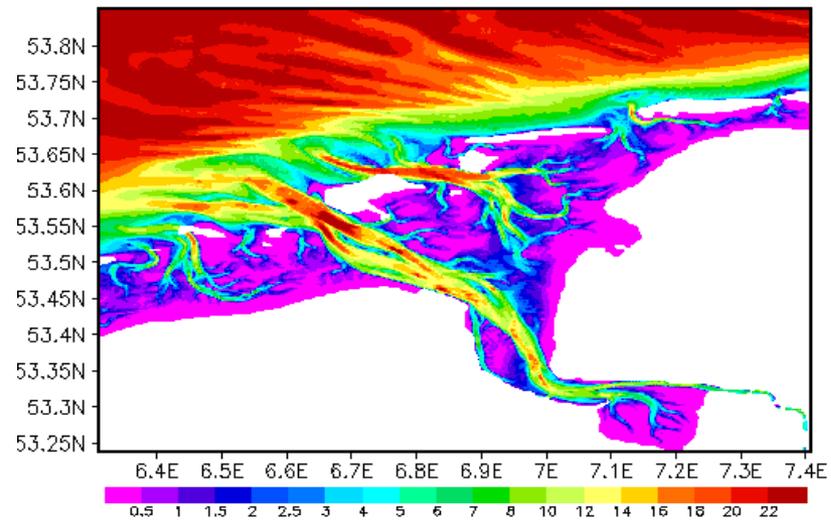
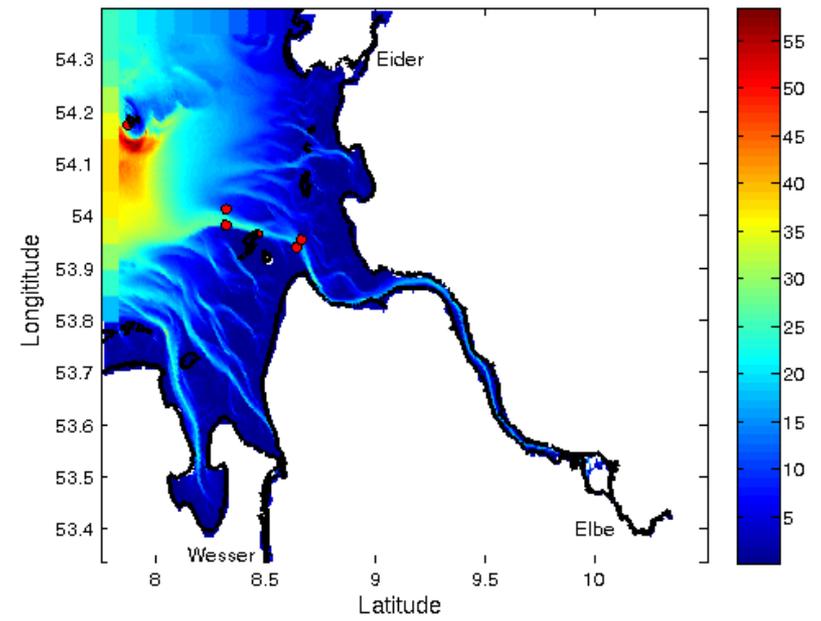
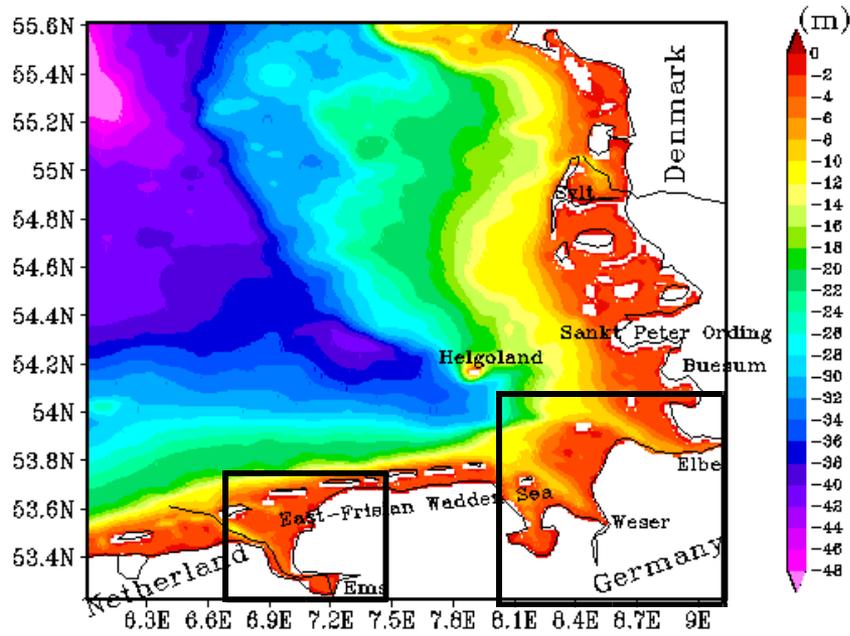


Fluxes Interactions and Environment at Land-Ocean Boundary. Downscaling, Assimilation and Coupling

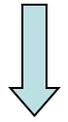


EGU General Assembly 2012, OS2.3 Oceanography at coastal scales. Modelling, coupling and observations

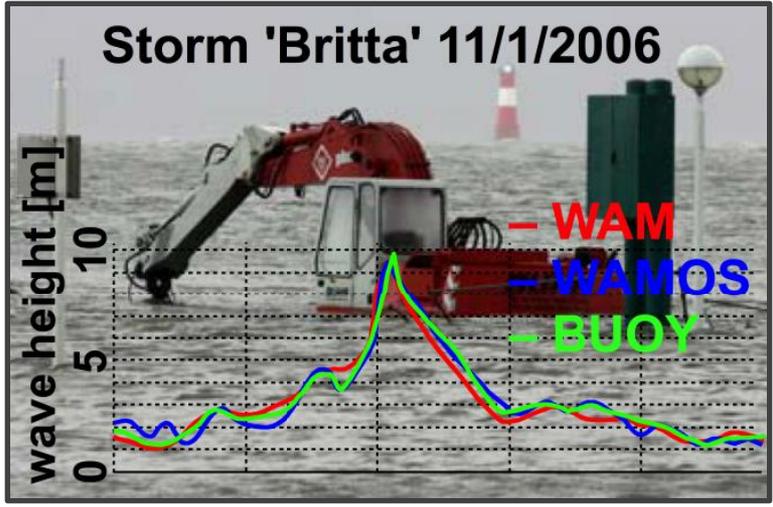
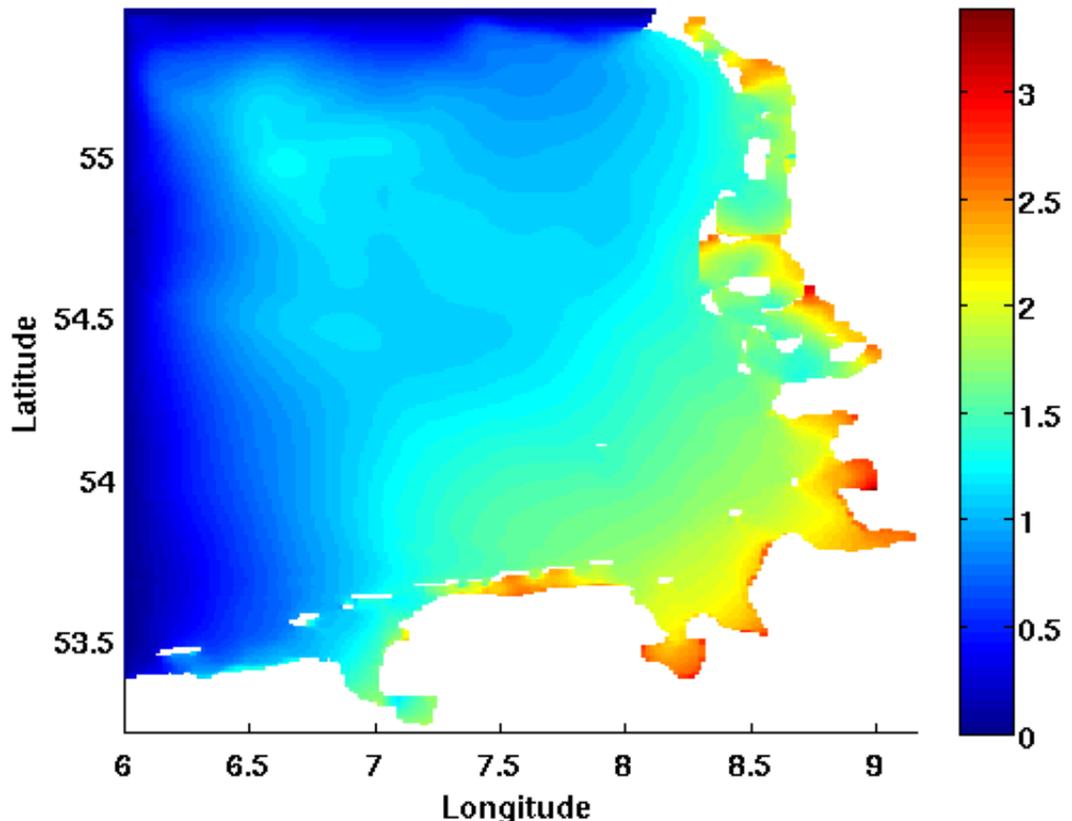
Downscaling



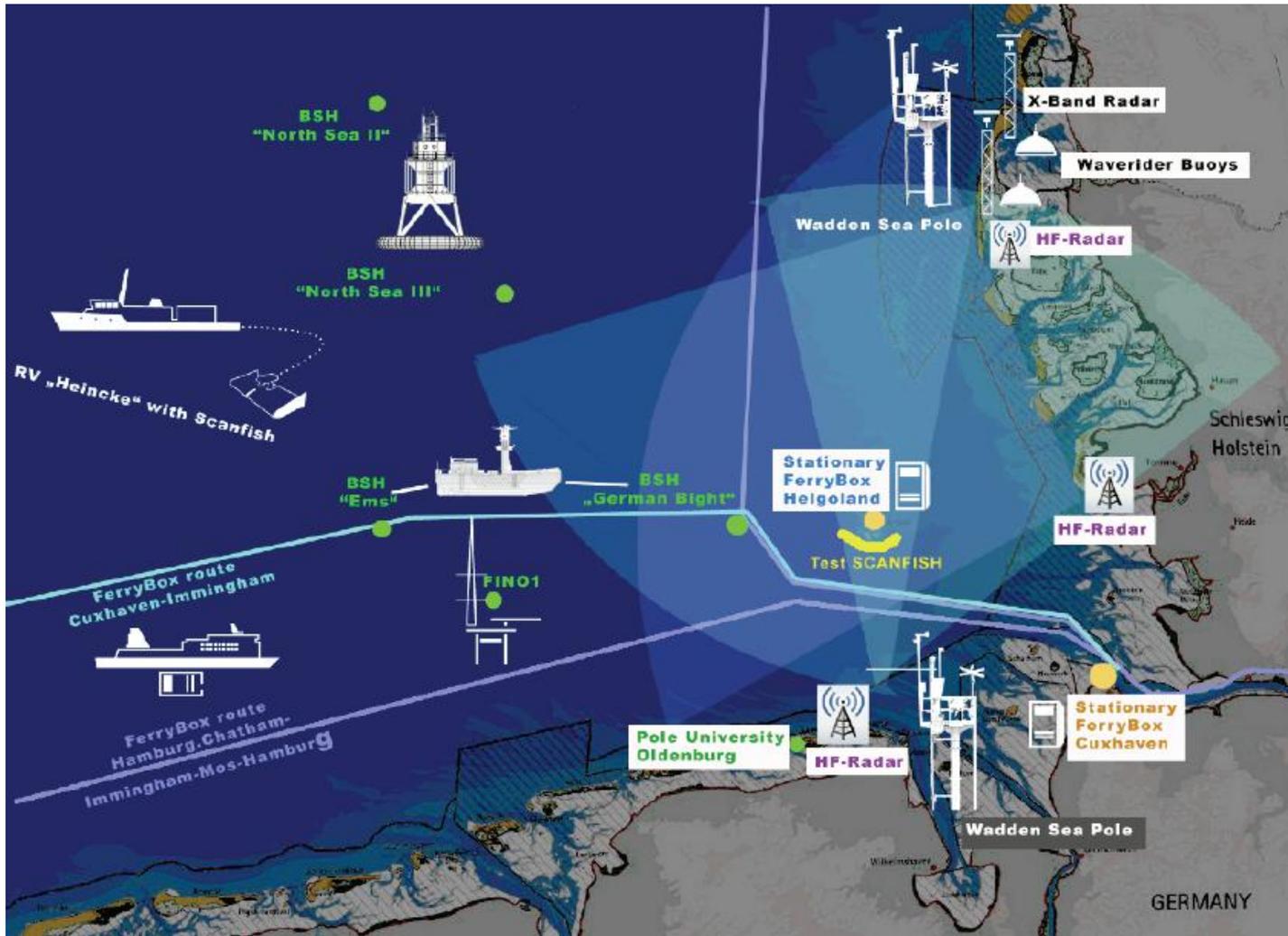
Wind waves in the coastal zone: Their effect on sea level.



standard deviation: elev. [%]



Storm surge predictions



*Coastal
Observing
SYstem
for
Northern
and
Arctic Seas*

COSYNA-Partners



BUNDESAMT FÜR
SEESCHIFFFAHRT
UND
HYDROGRAPHIE



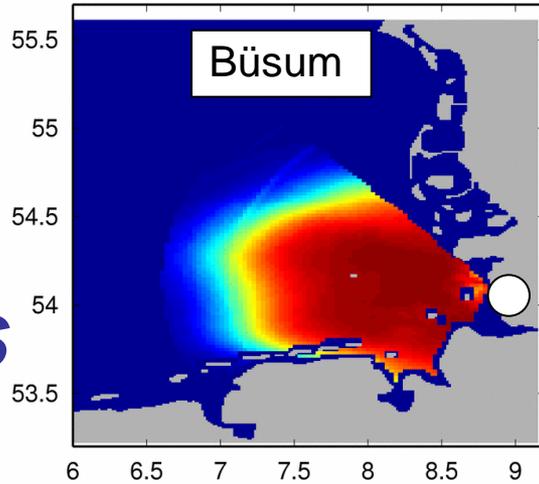
imare
Institute for Marine Resources GmbH



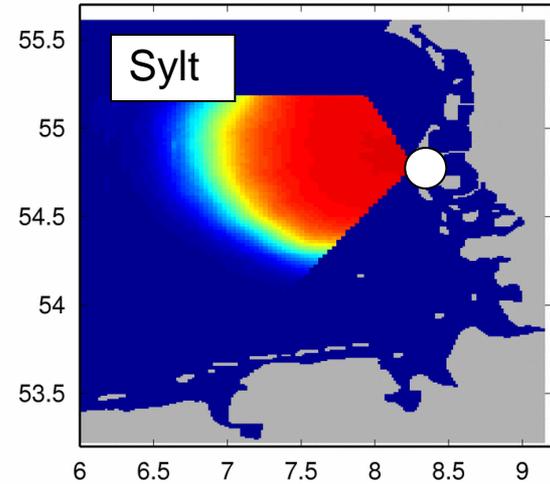
CARL
VON
OSSIEZKY
universität | OLDENBURG

WERA HF Radars

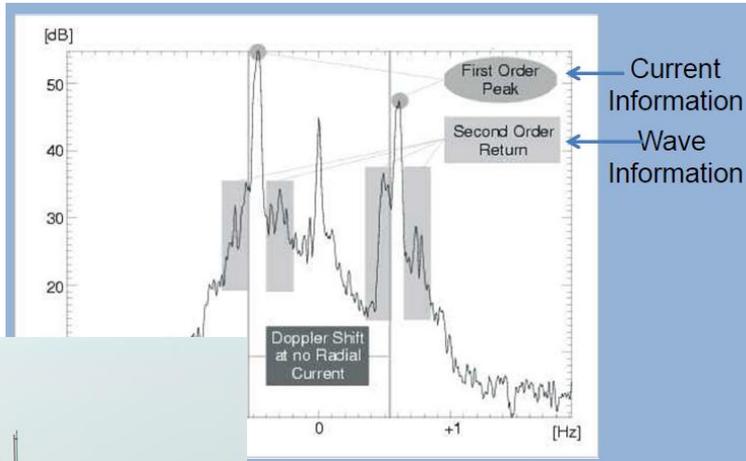
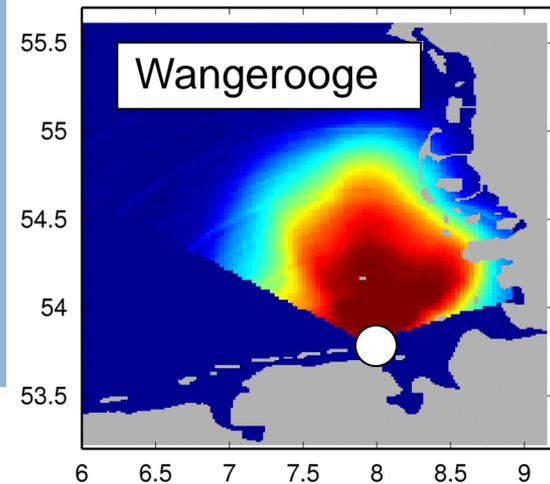
Buesum availability Nov 2010 [%]



Sylt availability Nov 2010 [%]

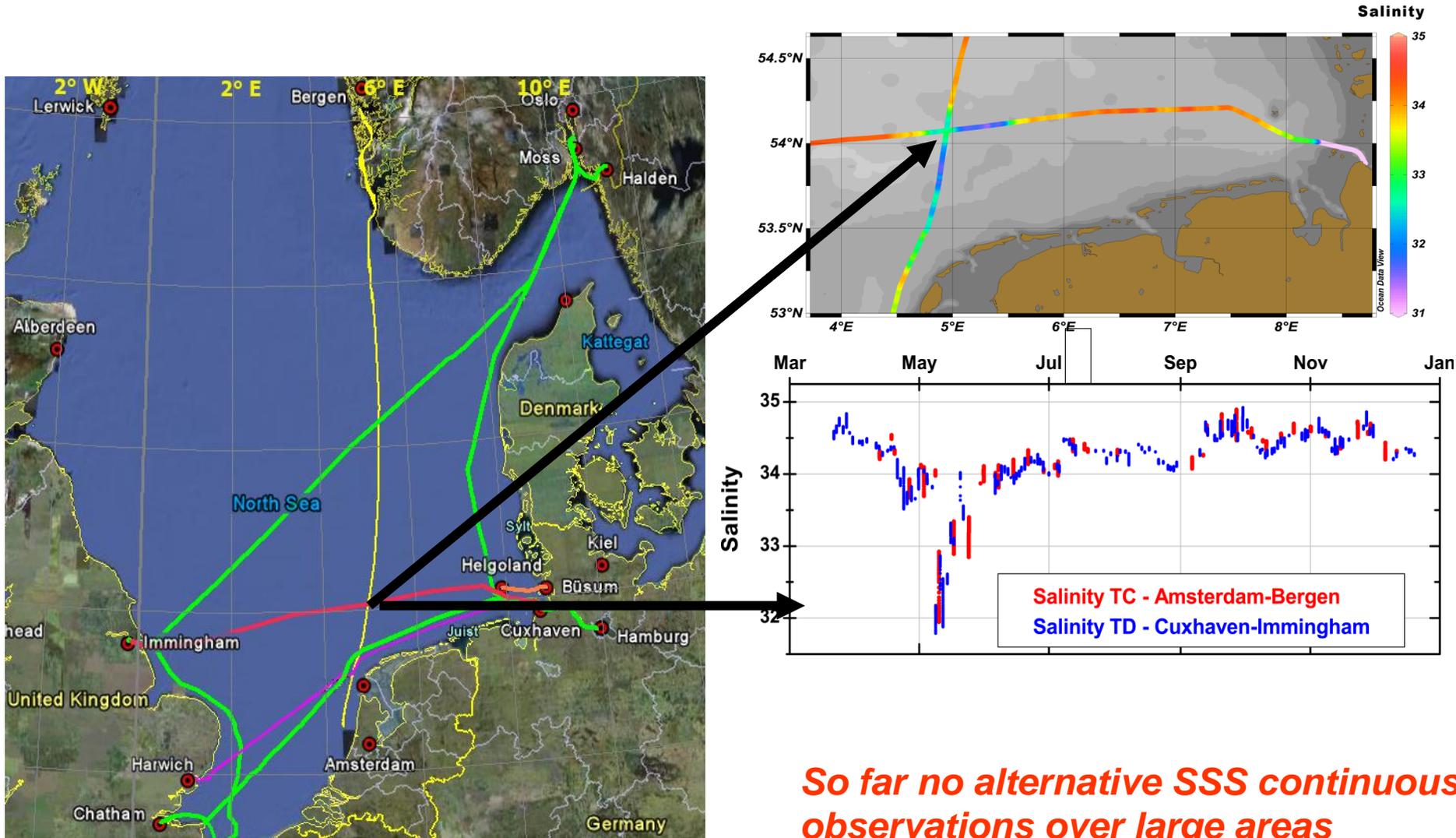


Wangerooge availability Nov 2010 [%]



Radars measure radial component of surface currents
12.5 MHz WERA HF Radar
Measurement every 20 min
Observation grid with 2 km resolution

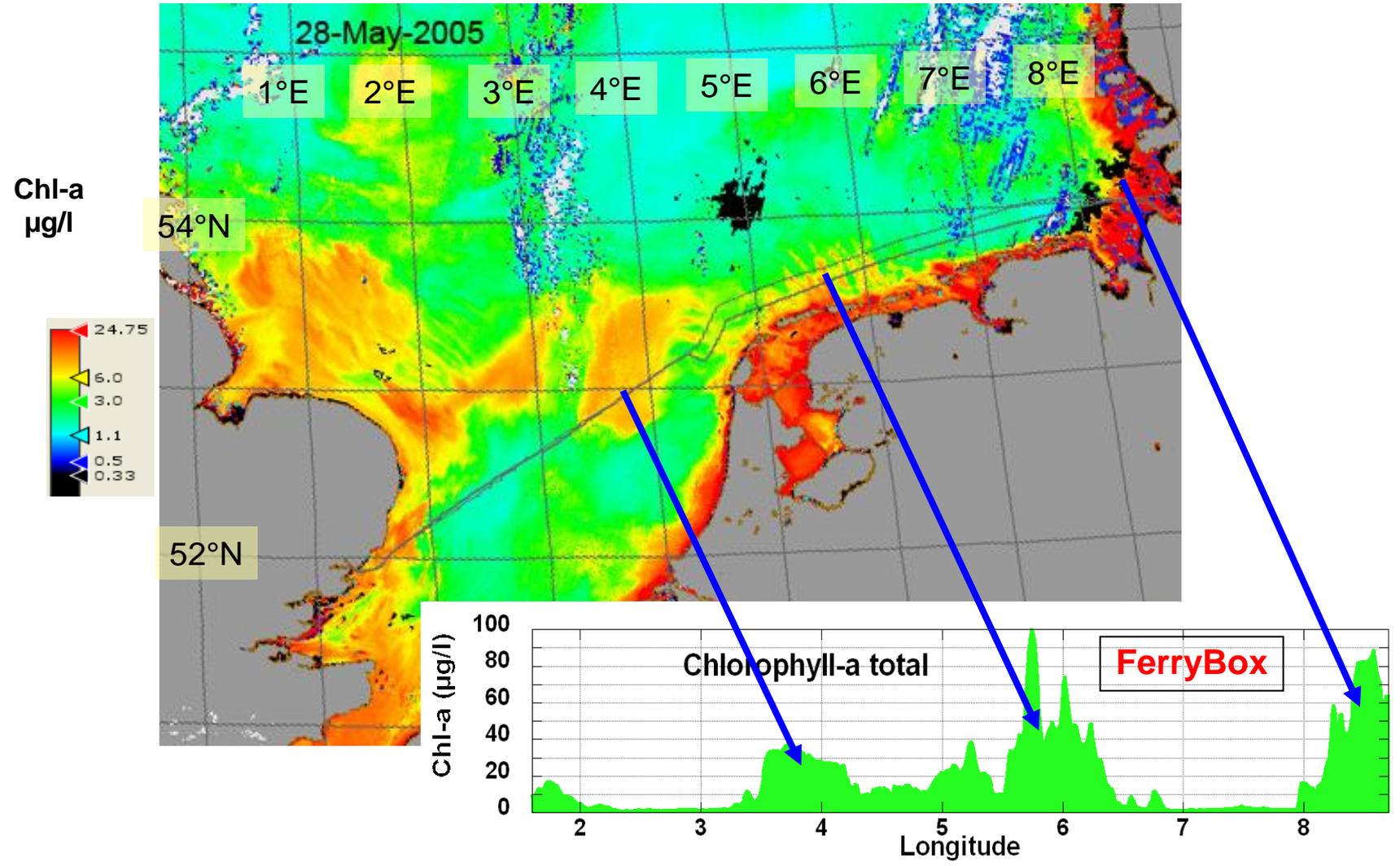
Freshwater intrusions seen by two independent FB Lines in 2008



So far no alternative SSS continuous observations over large areas

SPM: comparison between FerryBox and Satellite remote sensing

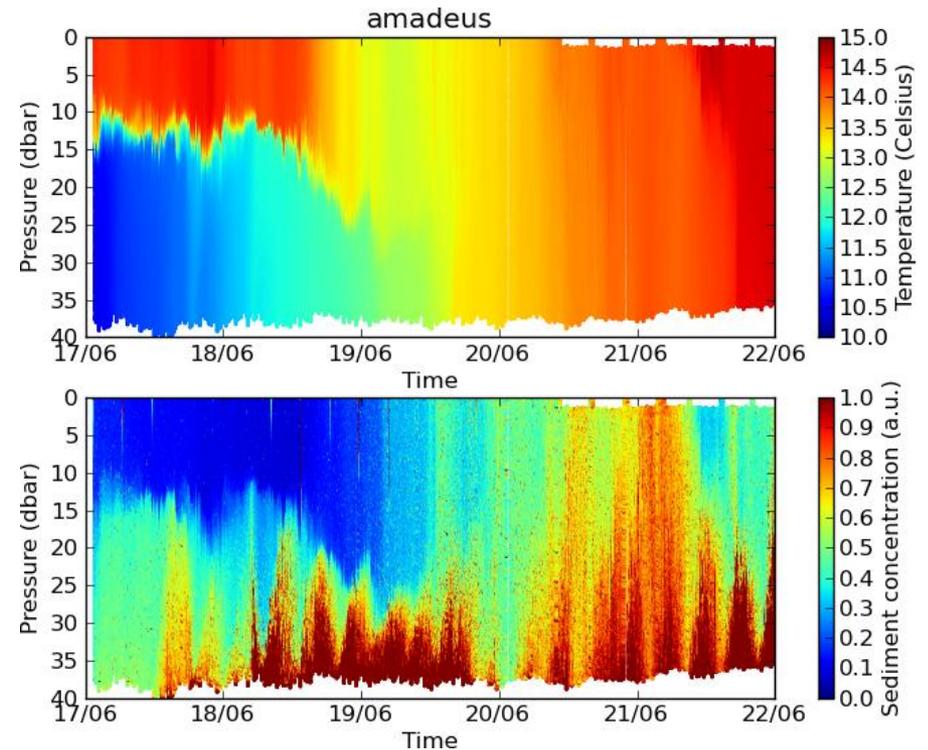
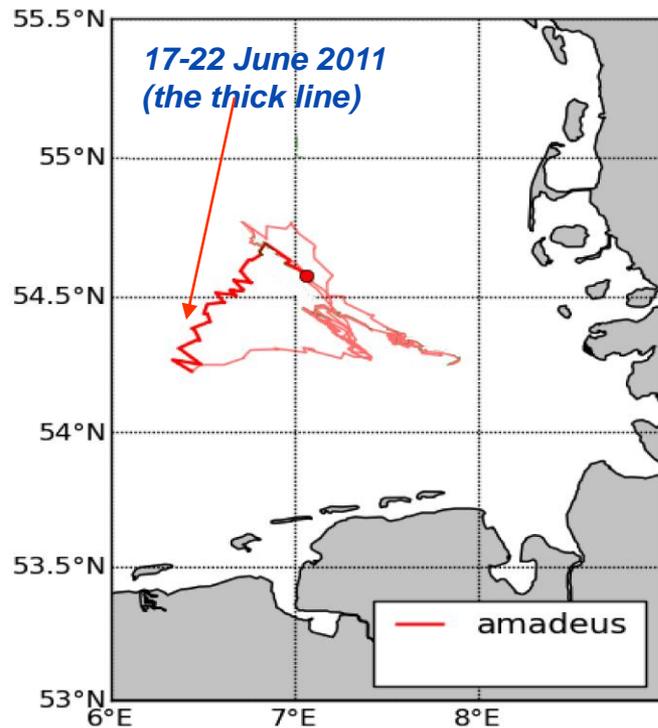
Remote Sensing & FerryBox Data



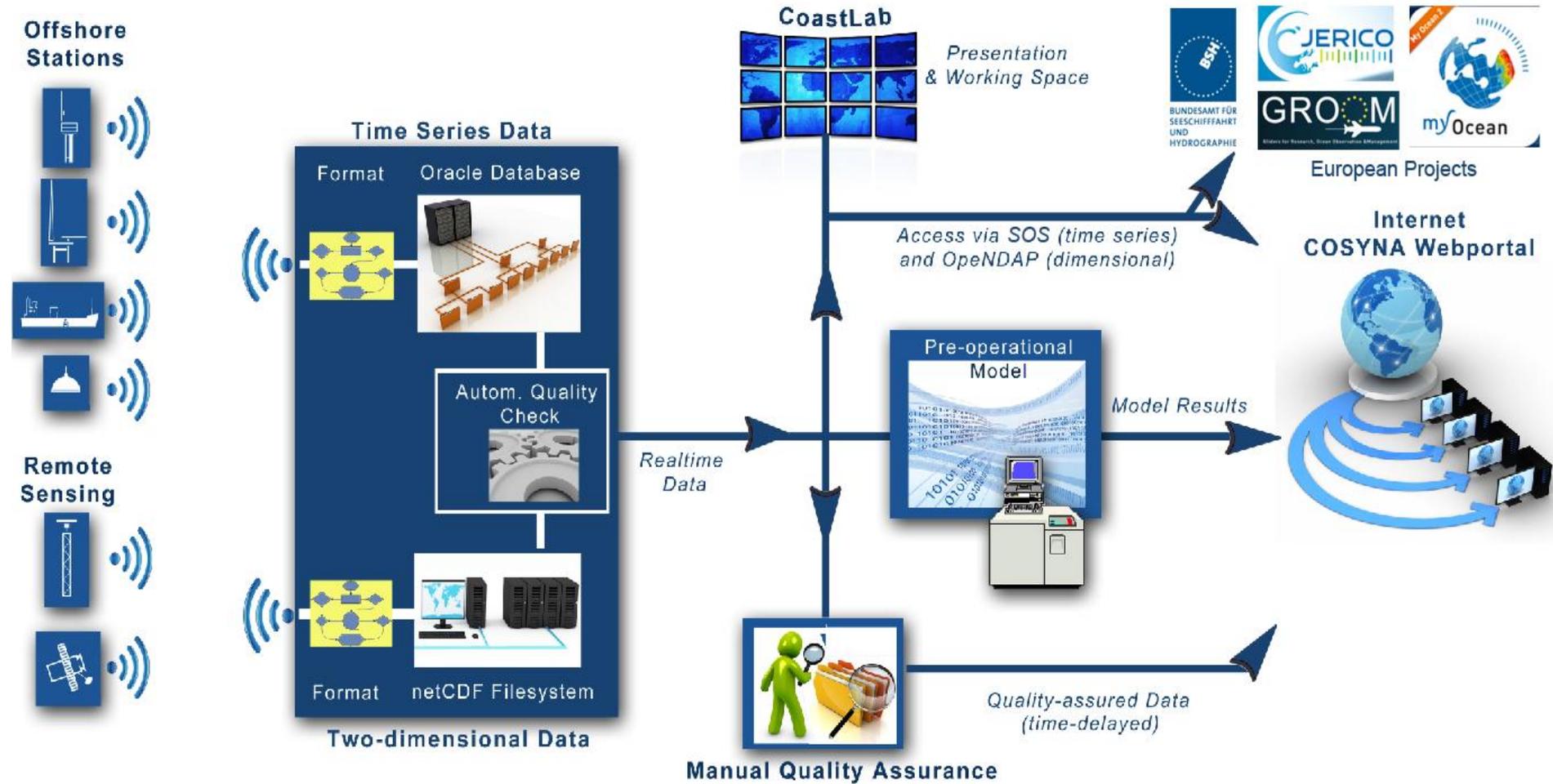
Gliders in the shallow tidal Sea



The vertical stratification is erased after the summer storm.

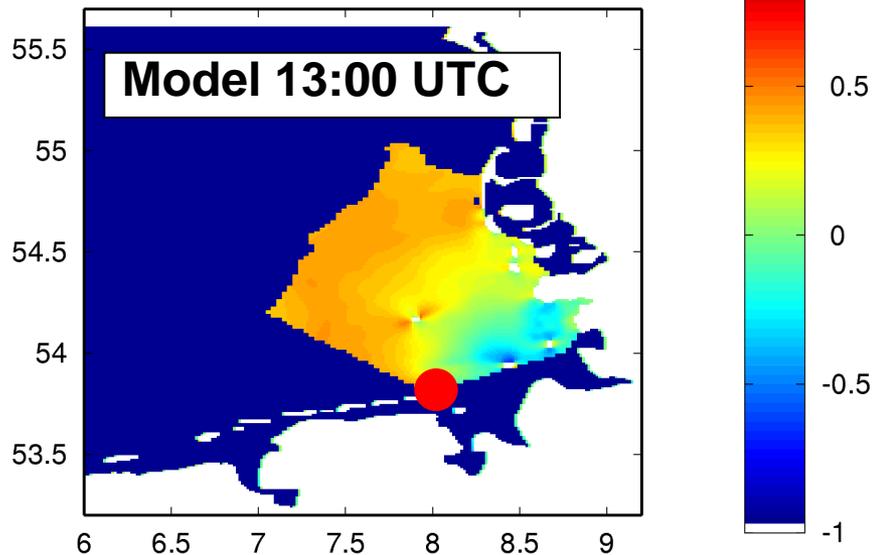


COSYNA data System

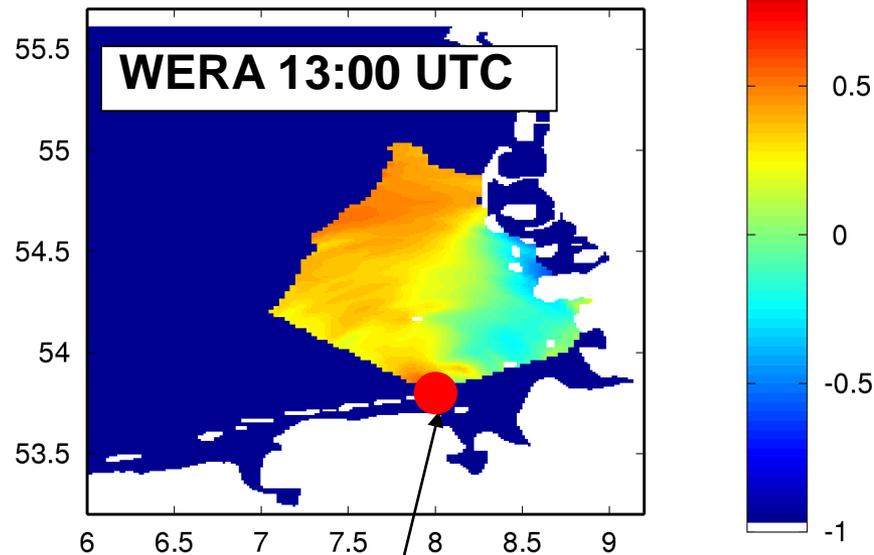


Model vs. WERA (Radialkomponenten Wangerooge station)

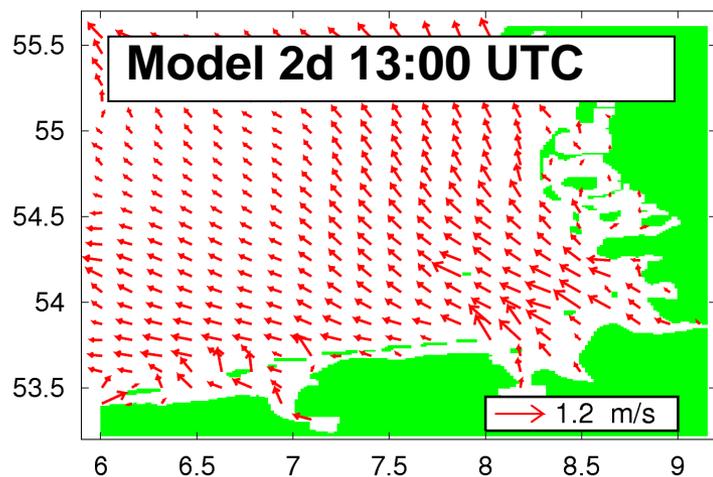
Radial GETM 20091101130000



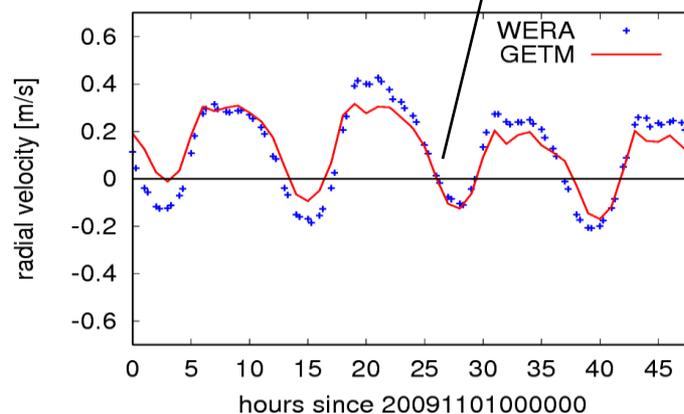
Radial WERA 20091101130000



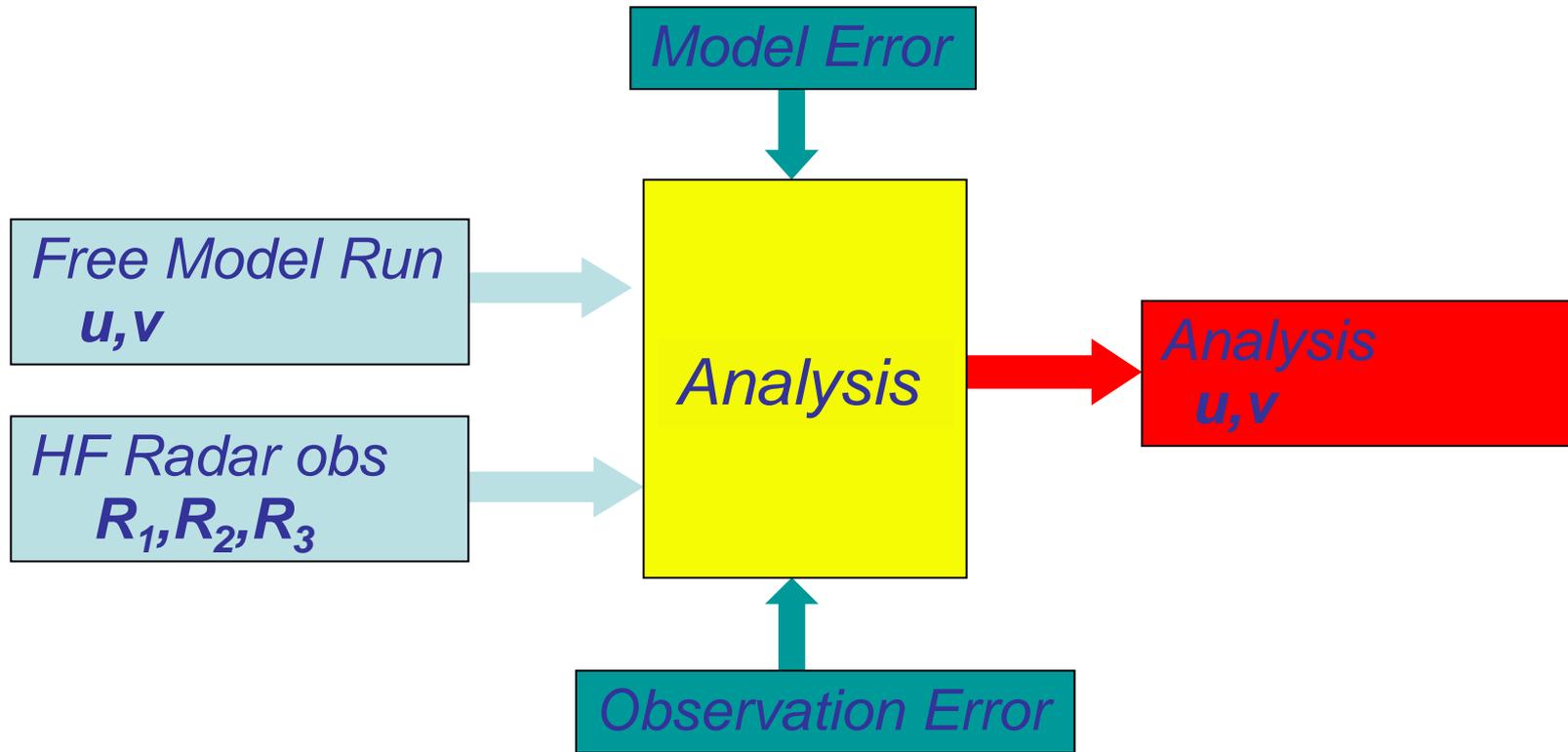
GETM surface current 20091101130000



Position C



Analysis of previous 12 Hours

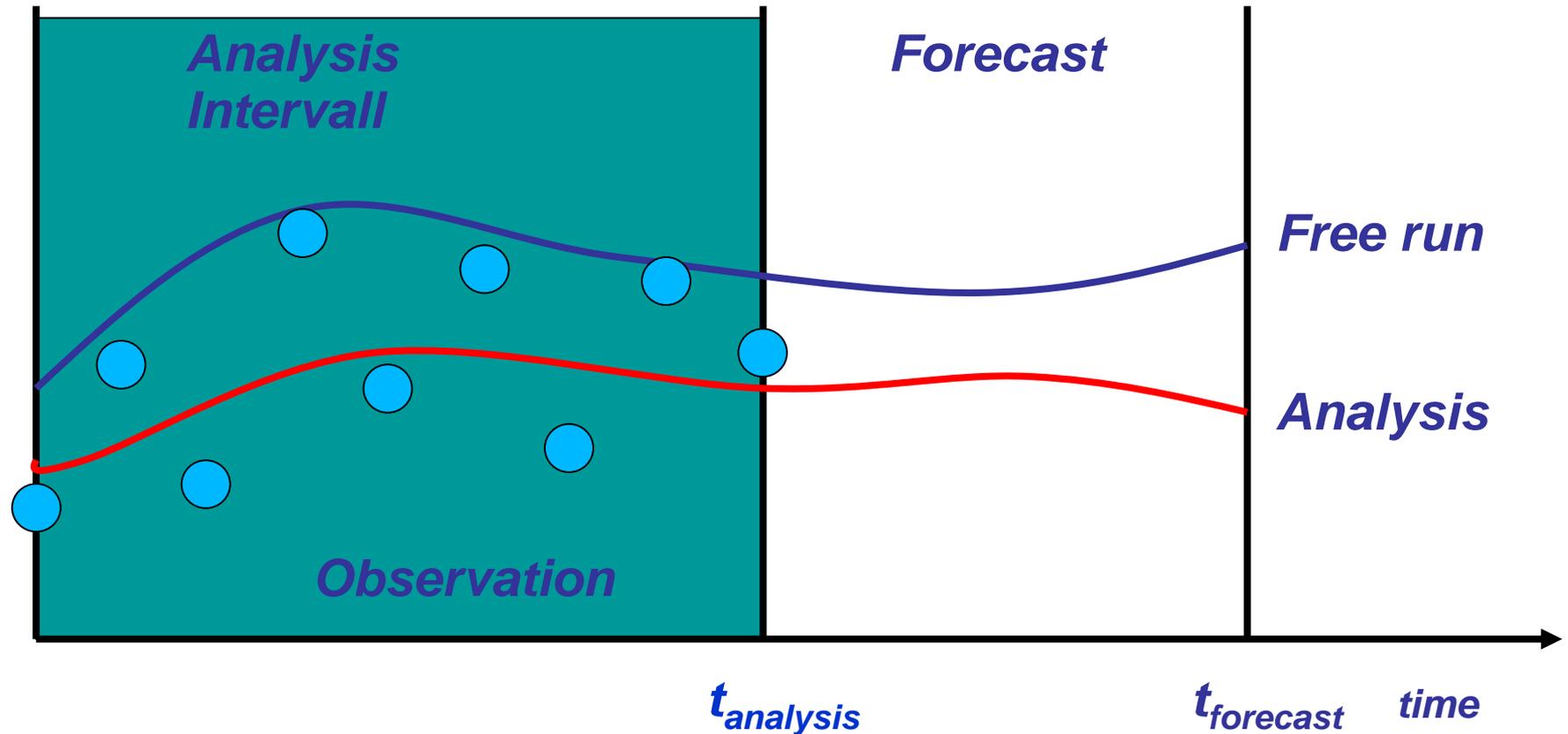


- *Use HF radar observations and free model run of the previous 12 hrs to compute a analysed model trajectory for the same period.*
- *Considered state variables: surface current components u, v*
- *Requires EOF analysis with state dimension of about 800.000*

Assimilation Approach

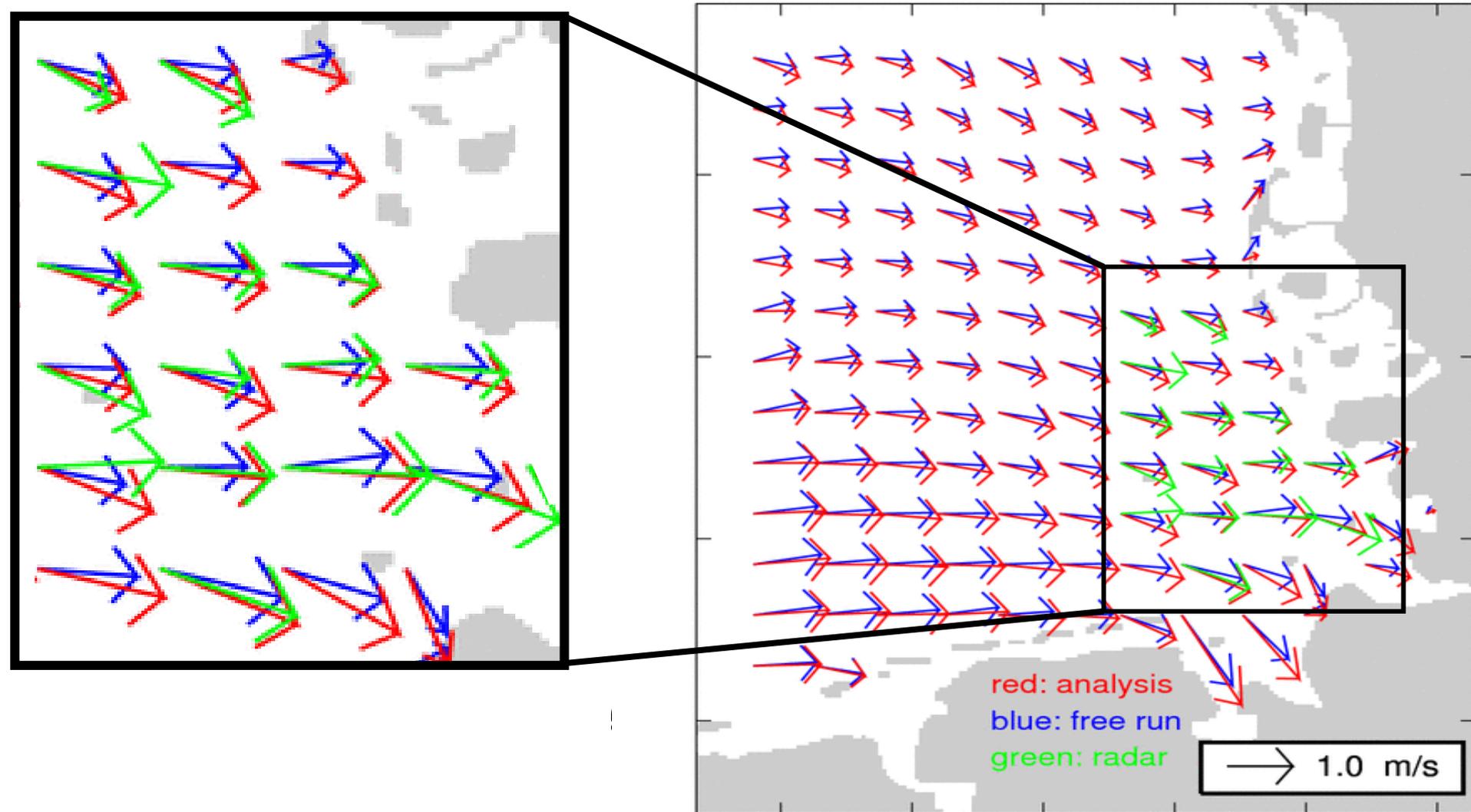
Use analysis intervall in order to

- avoid frequent shocks in the model
- better use information on phase of tidal constituents

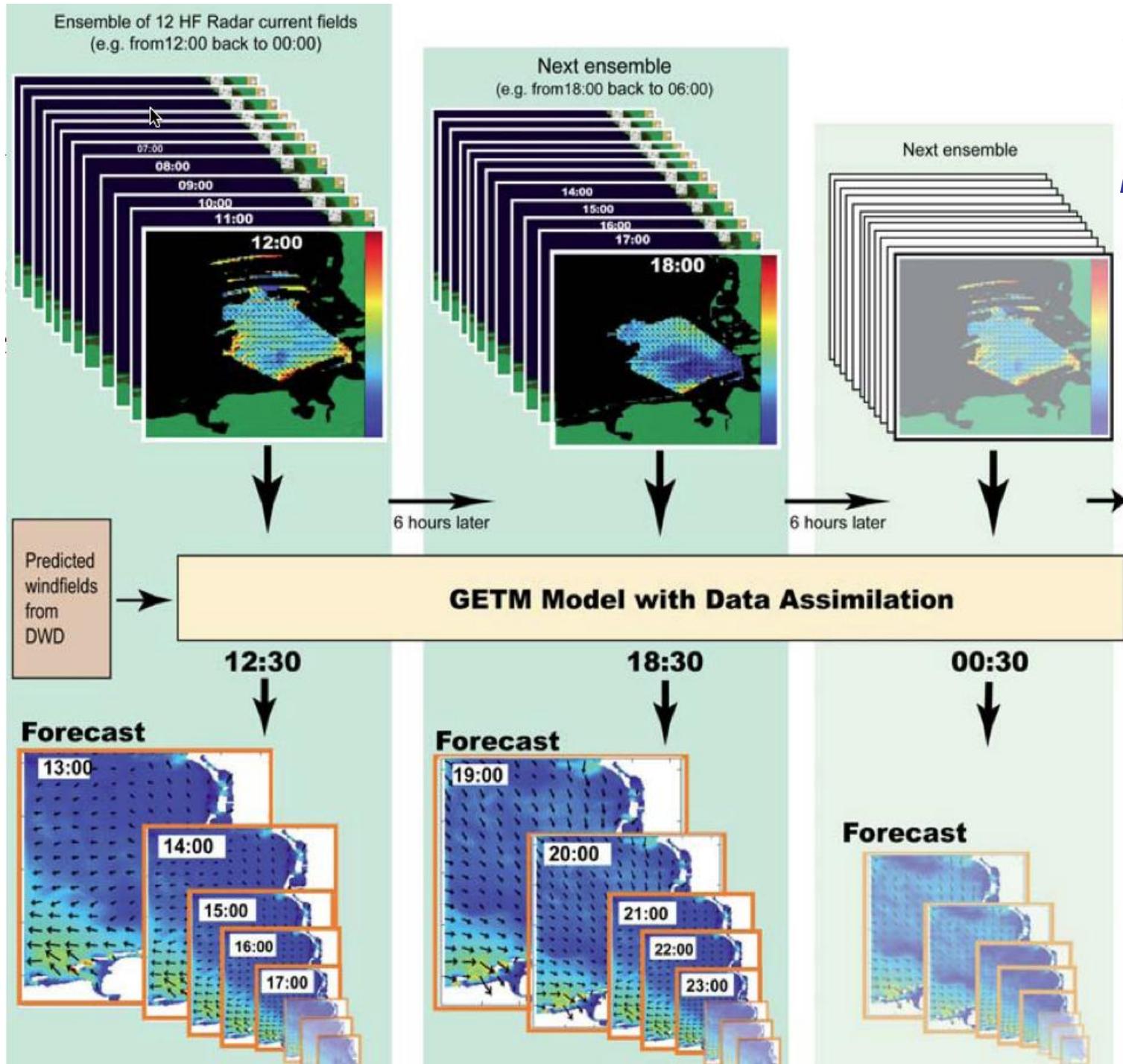


Improved Agreement with Radar data

Current Speed [m/s] Jan 12, 2012 10:00



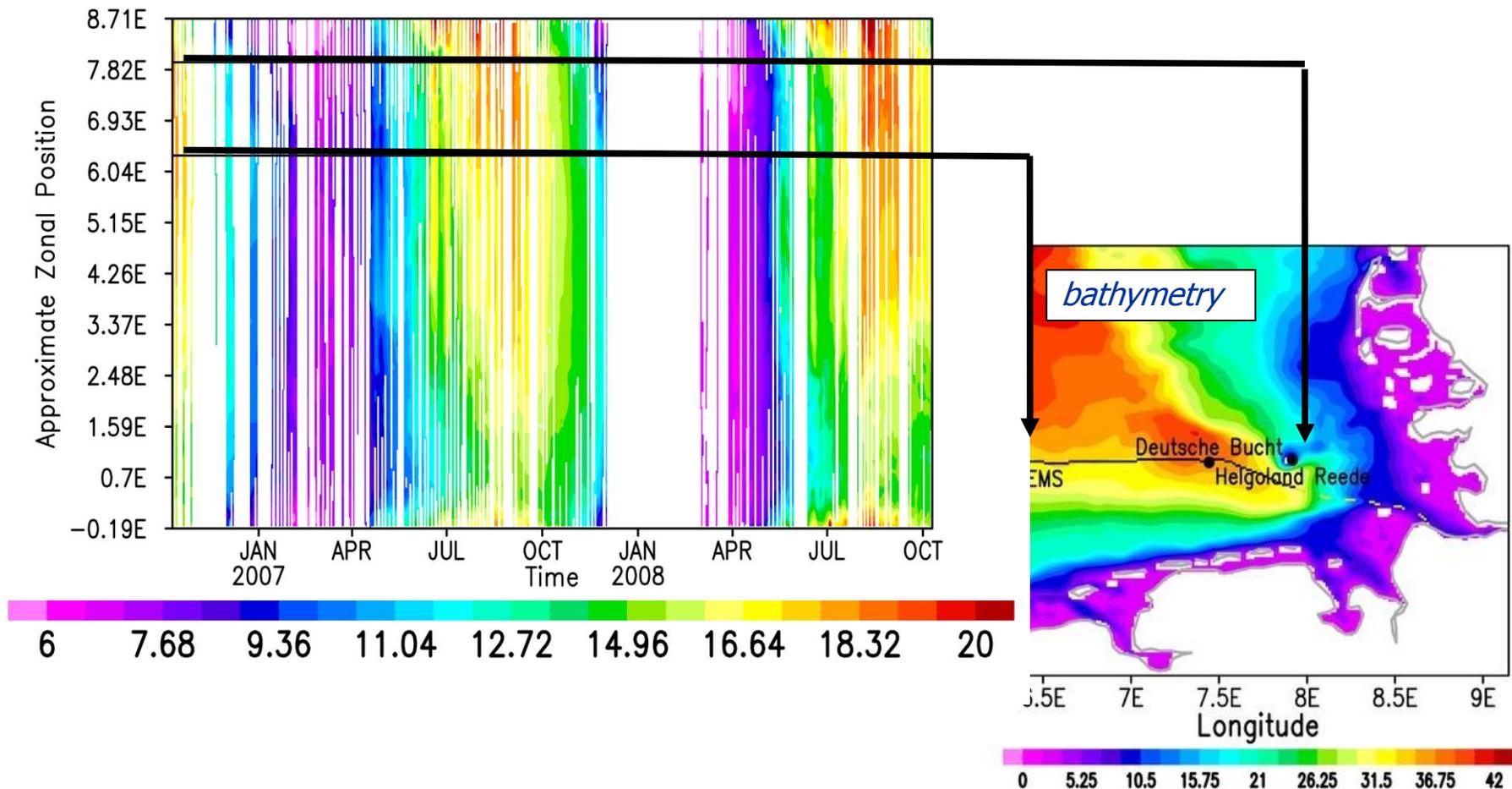
Surface current product



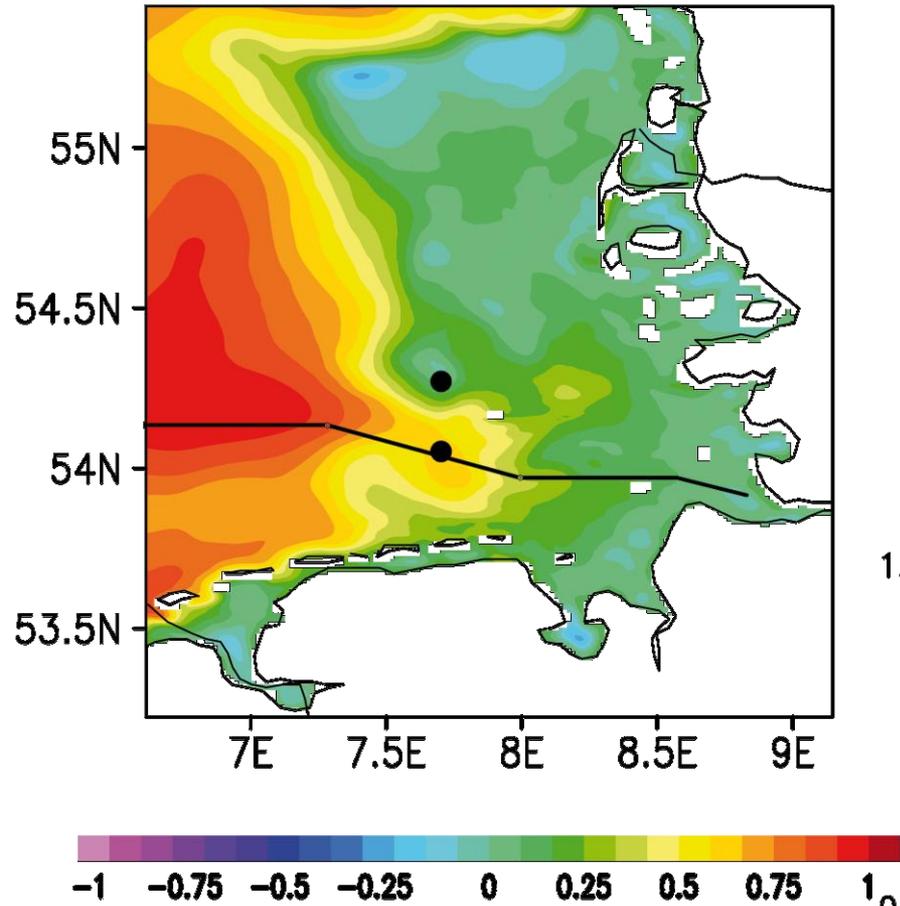
Assimilation of FerryBox Data

Data-Model Based Estimates for the German Bight

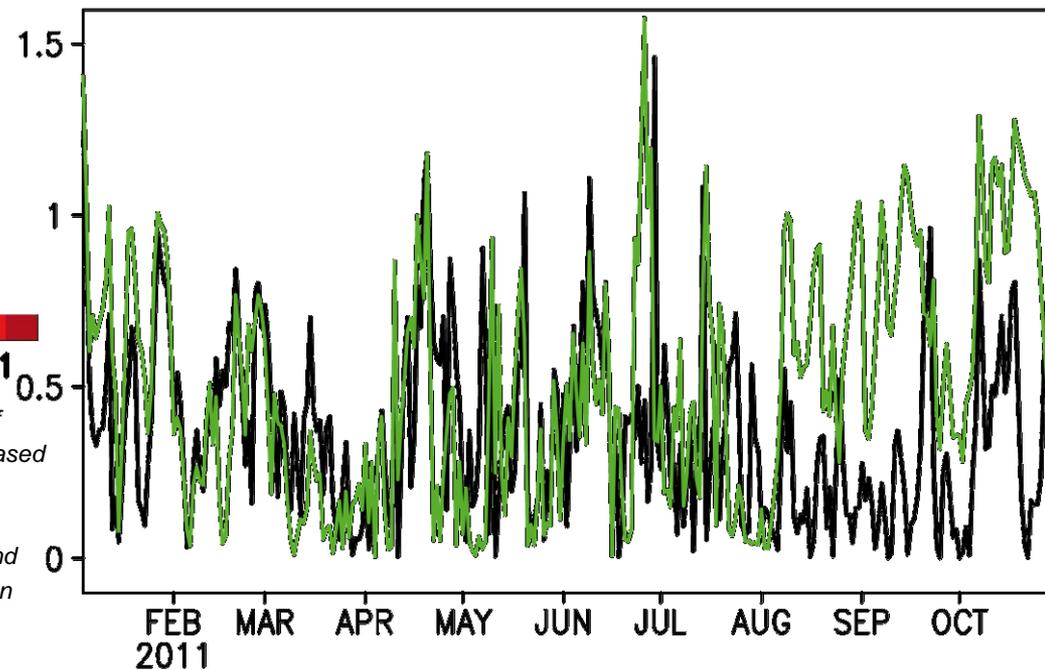
SST from Ferrybox [deg C]



Skill Estimates



$$\text{Skill} = \frac{\text{RMSE}' - \text{RMSE}^{\text{DA}}}{\text{RMSE}'} = 1 - \frac{\text{RMSE}^{\text{DA}}}{\text{RMSE}'}$$



Grayek, S, Staneva, J., Schulz-Stellenfleth, J., and Stanev, E.V. (2010) Use of FerryBox surface temperature and salinity measurements to improve model based state estimates for the German Bight. *Journal of Marine Systems*, 88, 45-59

Stanev, E. V., Schulz-Stellenfleth, J., Staneva, J., Grayek, S., Seemann, J., and Petersen, W. (2011): Coastal observing and forecasting system for the German Bight – estimates of hydrophysical states. *Ocean Sci.*, 7, 569-583

The challenge of the GMES and future steps

Overall future direction:

- **Aggregate data** from fixed platforms, shore-based radars, and satellites and maximise the synergy between data streams from **observations and numerical modelling** in coastal monitoring and forecasting systems.
- Combine resources and **infrastructures** from on-going national and international activities.

Available prerequisites:

- **MyOcean**, which provides information on global and regional scales, has **reached maturity** and challenges the development of up-to date coastal services.
- **Infrastructures such as COSYNA, Previmer, AIFS-SANIFS** have to be optimized to provide structural capacity for a sustainable service on an operational basis.

Needed:

Develop new coastal (downstream) **products** linked to stakeholders and users needs.

Extend GMES-related services **from regional to coastal scales** and demonstrate the added value of enhanced coastal products.

Basic considerations

- Enhance the quality of observation data and forecasting products***
- Ensure sustainability***

To the question “What/How?”

Research methods and technologies have to be further developed. This should include

- (1) continued improvement and evolution of observational platforms and data transmission,***
- (2) data fusion of observations from various platforms,***
- (3) development in numerical modelling, coastal specific data analysis and data assimilation methods,***
- (4) put in place modern sampling strategies, which are enhanced and validated through Observing System Simulation Experiments (OSSE) ensuring optimal and cost efficient exploitation of systems and service sustainability.***
- (5) Strengthen R&D EU Programs in the field.***