BOOS Annual Meeting 2014

Member report

Country	Denmark
Institution(s)	Danish Meteorological Institute (DMI)
Observations **Status and new** **initiatives**	**Current meter observations** *The Sound* - Current meter, temperature (ADCP) at Drogden Light house (real time) *Great Belt, East* - Current meter, temperature (point measurements in real time). *Great Belt, South* - Current meter (point measurements) and temperature at Vengence Ground Pro Ocean buoy (real time). Temperature and current every 30 min. **Water level observations** DMI is in a process of updating all tide gauges to a system consisting of a radar as the primary instrument and a pressure sensor as back up. DMI operates 33 tide gauges in the Danish waters, and get additional real time tide gauge data from other Danish govermental and local harbour authorities. These are for example presented on dmi.dk. Figure. updated DMI tide gauge station in Rødby Havn (radar as primary sensor and pressure sensor as backup or if sea ice, ocean temperature)

| Modelling
Status and new initiatives | **Wave modelling**

WAM cycle 4.5.4 (Helmholtz Zentrum Geesthacht, HZG) is installed and runs in a pre-operational setup include Global (0.5 deg), North Atlantic, Greenland, North Sea/Baltic Sea + Inner Danish waters.
This new code and set up is planned to take over as the operational WAM system at DMI during 2014**.**

In WAM we have implemented routine to calculate wave induced coastal erosion.

As part of the Baltadapt-project, DMI has completed:
   1) 40-year hindcast run of wave climate in the North Sea and Baltic Sea
   2) Climate scenario runs (RCP 4.5 and 8.5) till 2100.

Circulation modelling

At DMI major activities concerning 3D ocean modelling are linked to major EU research projects and governmental funds to maintain a national storm surge warning capacity. DMI use the same model code but at different configuration and set up for storm surge warning and for our involvement in major projects like, eg, MyOcean, OPEC, JERICO, eSurge. Also model grids are different.

DKSS, National storm surge model:
DKSS is DMI's storm surge model. It is based on HBM, but with a different setup as operationalised in MyOcean. Developments in DKSS has been focused on:
   1) Inclusion of internally generated tides by implementation of the Moons and Suns tidal potential.
   2) Revision and extension of the Wadden Sea bathymetry and update of the high resolution bathymetry in the Danish straits. The Wadden Sea domain now covers a larger part of the North Sea with a horizontal resolution of 1 nm and has a higher vertical resolution (4m,2m,…) near the surface.

MyOcean (EU FP7):
DMI has continued to manage the Baltic modelling component within MyOcean. DMI is leading the code development in the group and serve as nominal operational product provider; MSI and BSH are cal/val units; BSH provide the back up operational product; SMHI act as dissemination unit and local service desk; FMI leads BAL part in the R&D WP19 related to DA; HZG leads R&D in BAL and other regions.

Focus have been on:
   1) V4 operational, apr. 2014
   2) V4 updates to improve thread scaling and SIMD (Single Instruction Multiple Data) vectorization to ensure effective use of present day hardware and to prepare for next generation computer systems.
   3) V4 option for flux surface boundary conditions and new exchange coefficients for latent and sensible heat.
   4) V4 Updates related to ERGOM (biogeochemical model) include modelling of sediment resuspension; now two zooplankton groups
   5) V4 sea ice model development with BSH. Update of thermodynamic routine: Implementation of heat flux through the ice and surface boundary parameterisations. Fast ice model planned for next release, V5; full sea ice dynamic model planned for after V5. |

6) V5 planned implementation of frequent update of river inflow data, once per hour and not just once per run (daily river input files).

OPEC project (EU FP7), efforts are put on:
1) Producing seasonal forecast

CRES project (nationally funded project), efforts are put on:
1) Downscaled, coupled (atmosphere-ocean) simulations for the Baltic Sea/North Sea area. Scenarios are based on RCP 4.5 and 8.5.

eSurge project (ESA), efforts are put on:
1) Assimilation of SSH (obtained from satellite and tidegauges) into the circulation model to explore its applicability in relation of storm surge modelling. 5 storm surges have been modelled and validated with and without data-assimilation

JERICO project (EU FP7), efforts are put on:
1) Observing System Experiment and Observing System Simulation Experiment. Explore the added value of given observations (S-, T- profiles and SST) wrt. DA compared to simulations without these stations.
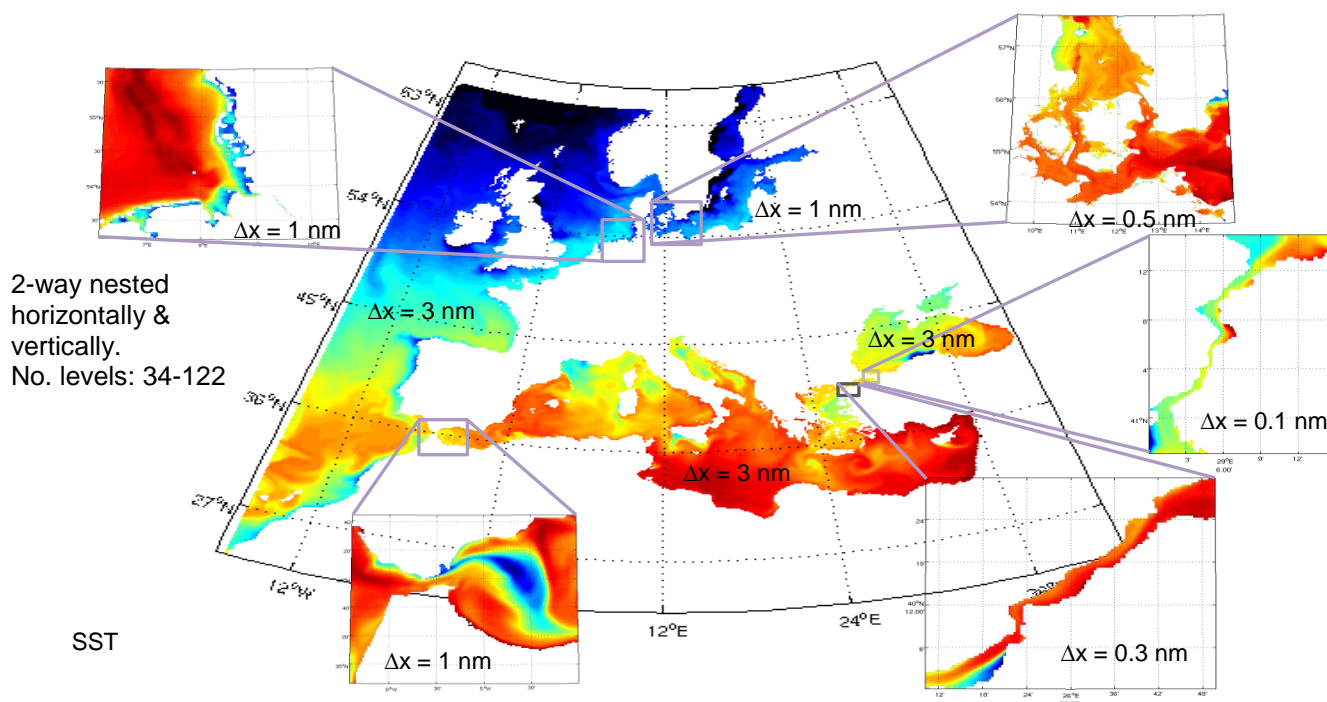
MONA LISA 2 project (EU Ten-T), efforts are put on:
1) Provision on high quality forecasts to increas navigational safety in European and arctic waters. A Pan European setup for seemless forecasting of ocean conditions is implement

2) About the Pan European setup:

   Purpose: To provide seamless, high-resolution, two-way nested, high-quality forecasts for the European waters.

   Setup: Based on HBM, covering Baltic Sea-North, Sea-Western Shelf-Mediterranian Sea-Black Sea (high-resolution: 01 nm - 3 nm).

2-way nested horizontally & vertically.
No. levels: 34-122

SST

Δx = 1 nm
Δx = 1 nm
Δx = 0.5 nm
Δx = 3 nm
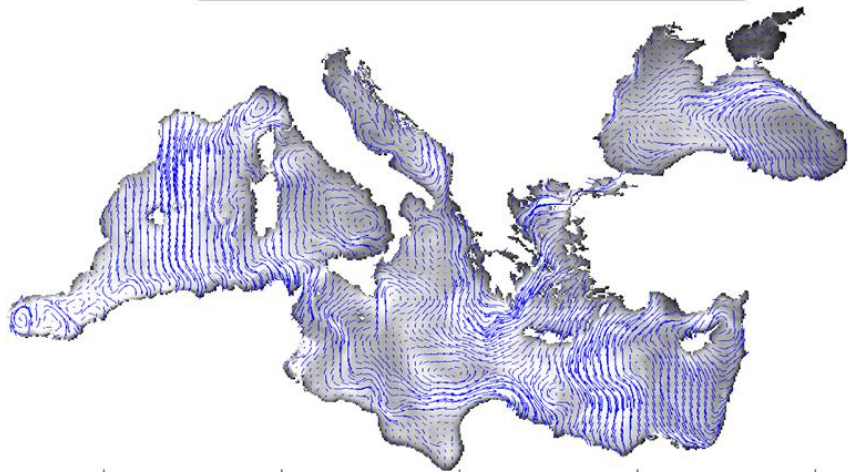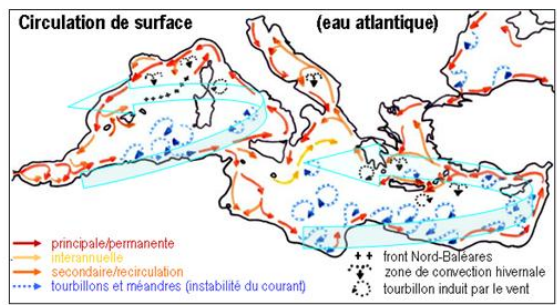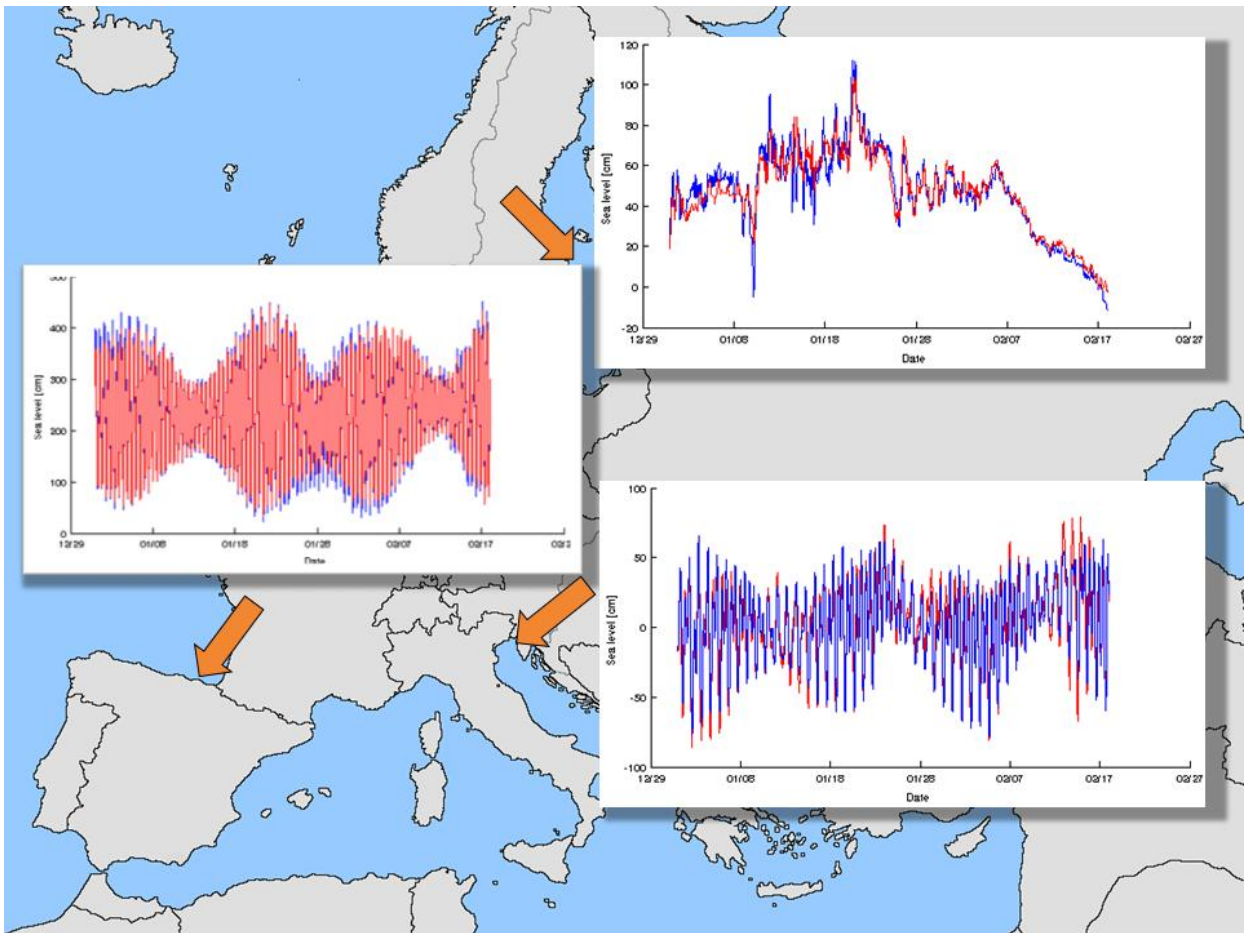Δx = 3 nm
Δx = 0.1 nm
Δx = 3 nm
Δx = 1 nm
Δx = 0.3 nm

Figure. Top showing modelled sea level at three positions from the Pan European setup. Bottom: Modelled surface circulation in the Mediterranean Sea (For reference surface circulation based on litterature)

Dissemination **Status and new** **initiatives**	A number of peer review articles on ecosystem modelling, DA modelling etc.have been produced (see DMI.dk) Technical HBM model reports (see DMI.dk)
Relevant **national** **projects**	**Horns Rev 3 offshore wind farm** (off Jutland west coast): Met Ocean study (10 yr analysis of wind, waves and current at construction site, including model validation for periods where observations are available). **Coast-near wind farms** (six sites: 2 off Jutland west coast, 3 in inner Danish waters; one by Bornholm). Comprehensive MetOcean study (11 yr analysis of wind, waves and current at construction site, including model validation for periods where observations are available).
Relevant **International** **projects**	MyOcean2, (FP 7) (2012-2014) MyOcean2 Follow On (FP 7) (2014-2015) eSurge (2011-2014) (ESA, satellite data for the storm surge community) JERICO (2011-2014) (FP7, Joint research infrastructure network for coastal observations) CRES (2011-2014) (National funds, HBM-HIRHAM coupling. Provision of downscaled, coupled (atmosphere-ocean) simulations for the Baltic Sea/North Sea area. Scenarios are based on RCP 4.5 and 8.5). OPEC (2011-2014) (FP7, Operational Ecology Ecosystem, develop forecast tools for ecosystem and ecosystem management) SOROS (2012-2013), SOROS 2 (2013-2014) (InterReg A, feasibility study for HF radar system in the Skagerrak).
Additional **information**	