RAIA PROJECT. OPERATIONAL IBERIAN MARGIN HYDRODYNAMICAL MODEL

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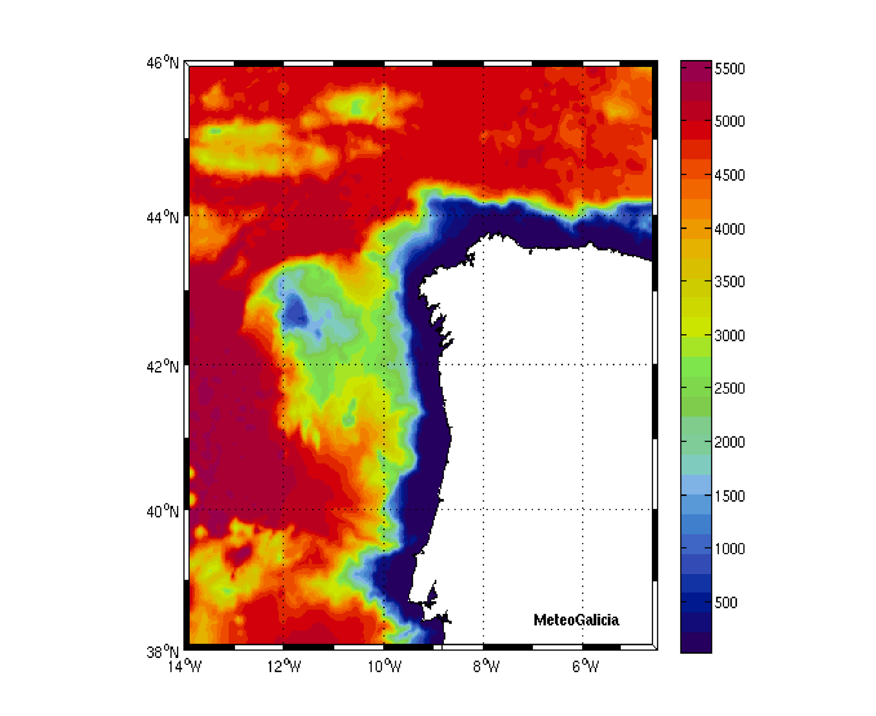
INTRODUCTION

The principal objective of the project is the development of an ocean observatory consisting of a cross frontier infrastructure of ocean observation buoys and oceanographical forecasting models.

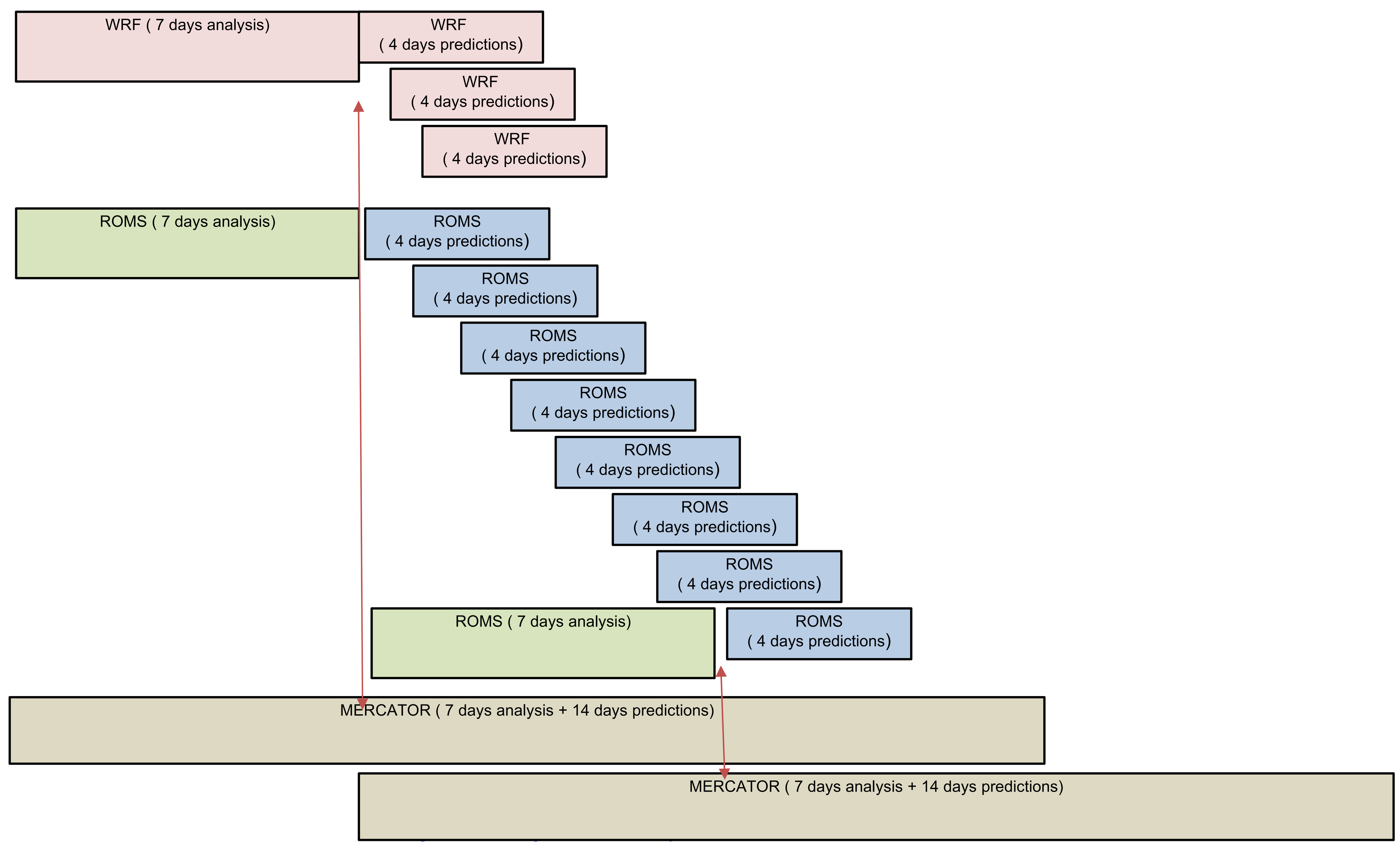
In the framework of the project, the Regional Ocean Modeling System (ROMS) is being adapted to the Iberian margin to become operational in the near future. It is a free surface, hydrostatic, primitive equation ocean model (with Boussinesq and hydrostatic approximations) that uses stretched terrain-following coordinates in the vertical and orthogonal curvilinear in the horizontal.

STUDY AREA

Model domain approximates the geometry of Northern Iberia, extends approximately south-north along the meridians 14ºW and 4.5ºW, between 38.0ºN to 46.0ºN (approximately 1050 km by 880 km). The grid topography was taken from the General Bathymetric Chart of the Oceans (GEBCO) 30 arc-second, cartography from Oceanographic Spanish Institute and the Portuguese Hydrographic Institute.



OPERATIONAL OCEAN ANALYSIS & FORECAST



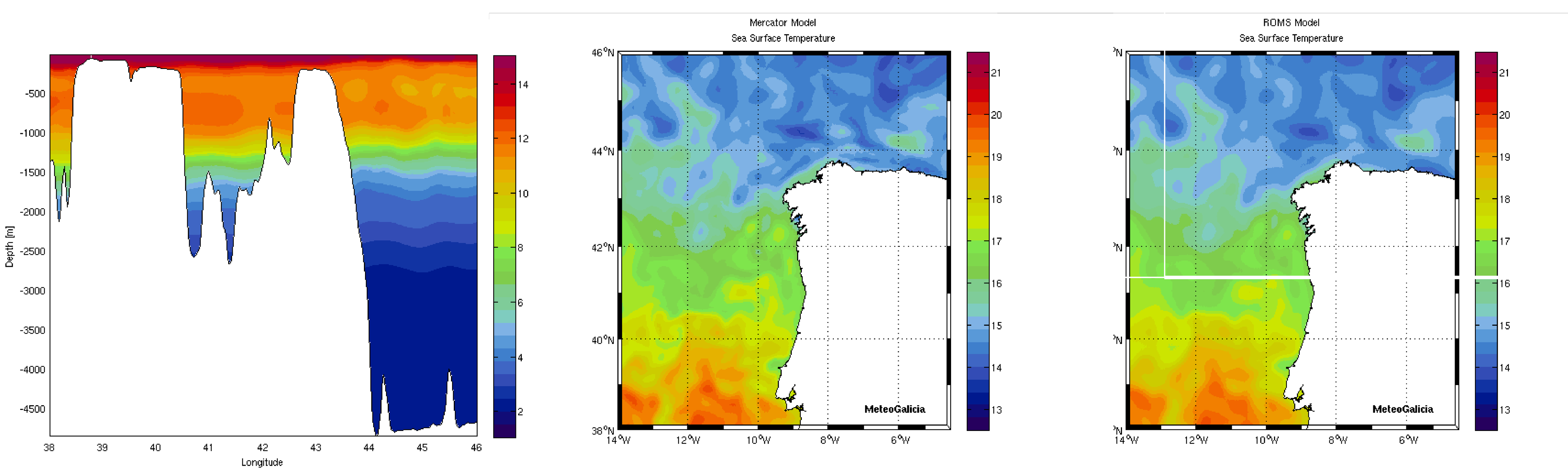


Figure3 - Interpolation product example. Mercator output to roms initial forcing temperature. (Reference time 2009 11 25). Left: Vertical profile time-averaged potentital temperature (9.5W); Centre: Mercator model sea surface temperature;
Right: Roms model sea surface temperature.

INTERPOLATION METHOD

The model boundary and initial conditions has been obtained from Mercator Model with 0.05º of resolution, to achieve that, five steps sould be performed:

(1) Shapiro smoothing is used to accommodate the temperature and salinity gradient
(2) Extrapolation using a spring metaphor, assuming springs connect each node with every neighbor
(3) Interpolation of the mercator output to the Northern Galicia grid is achieved by applying 3D field optimal interpolation
(4) Temperature and salinity were interpolated to sigma vertical grid using roms initial package interpolation routines
(5) Finally, when the velocity fields were interpolated from a grid to another it is almost inevitable that due to interpolation errors and differences in bathymetry the integrated 2D velocity field will change, so it is of extremely importance to perform a consistency implementation between the sea surface height and 2D/3D velocities.

velocity_3D = velocity_3D [interp_mercator_to_roms] - velocity_barotropic_roms + velocity_barotropic_mercator

OPERATIONAL OCEAN ANALYSIS

An operational ocean analysis with 0.02º resolution is running since 27th of January 2010, meaning that every Wednesday is perfomed an analysis of the past seven days. At the present time the model is forced with tide, wind, heat fluxes, air pressure, temperature and relative humidity from the Weather Research and Forecasting Model with 12km resolution.

Temperature and outflows for Minho, Tambre and Ulla rivers from the Model Soil Water Assessment Tool are also included.

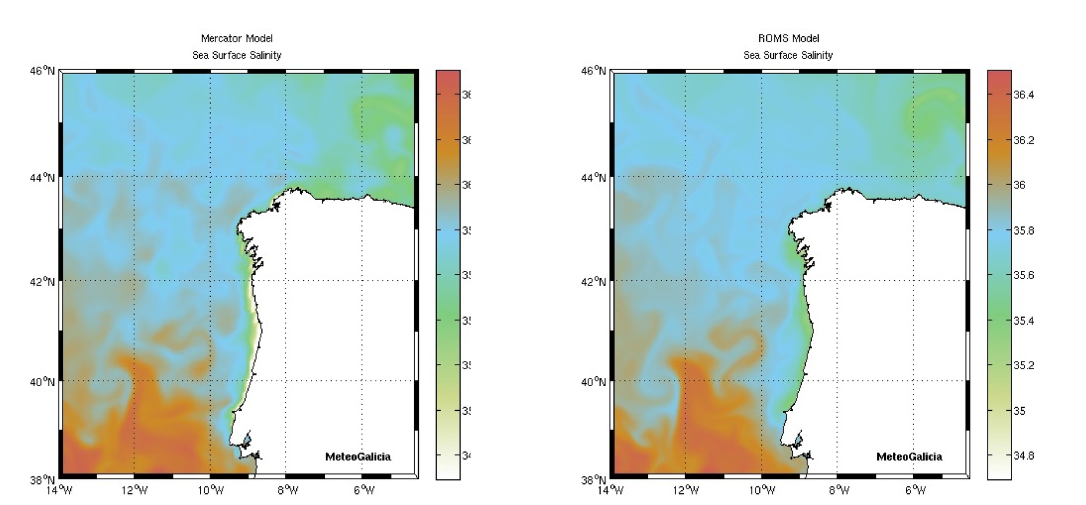
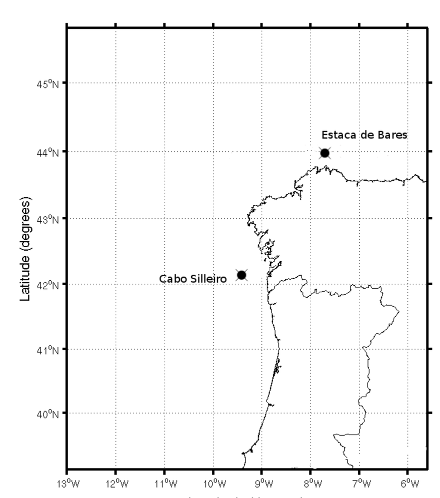


Figure4 – Above: Comparation between mercator model and roms model sea surface salinity (Reference time: 2009 12 02).

FUTURE WORK

The main attention will be focused on the inplementation of the operational ocean forecast (4 days prediction). Offline nesting, for example, Rias Baixas region with 0.002º resolution. 4DVAR data assimilation to assimilate both in situ and remote sensed data.



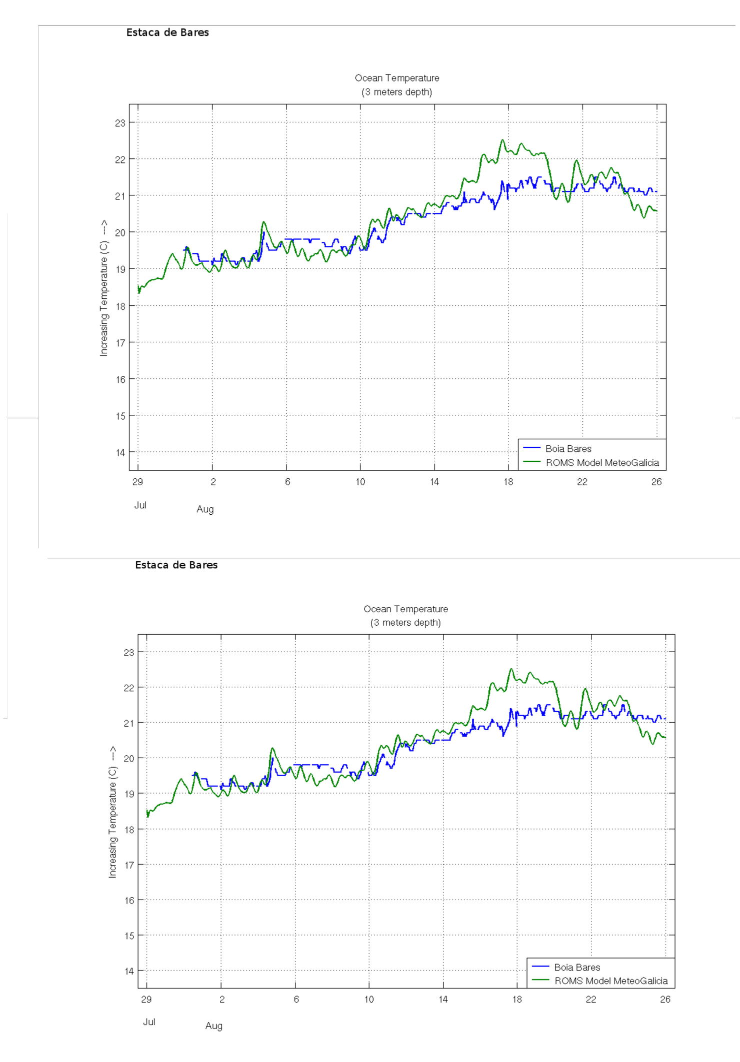


Figure5 – Above: Time series of comparation betweem model surface temperature and oceanographic buoys. (Reference time: 2009 06 29).

RESULTS

The comparison between the sea surface salinity of model mercator and roms (figure4), close to northwest shore, show us significant differences: probably consequence of the big differences on bathymetries. It´s important not to forget that the operational analysis is only forced with temperature and outflows from rivers.
Comparations between model roms stations output and Bares/Silleiro buoys are quite good. The temperature near the coast has similar behavior to the reality.
The results below show us clearly, despite the differences in resolution, that the sea surface obtained from the model roms has the same patterns as the ones from the satellite SST.
Finally, the computation of parameter BIAS of the sea surface temperature (Figure6 - right) for ninety one days of simulation show little biased positive (0.4ºC-0.5ºC) along the coast, meaning the tendency to overestimate the temperature in this particular region.

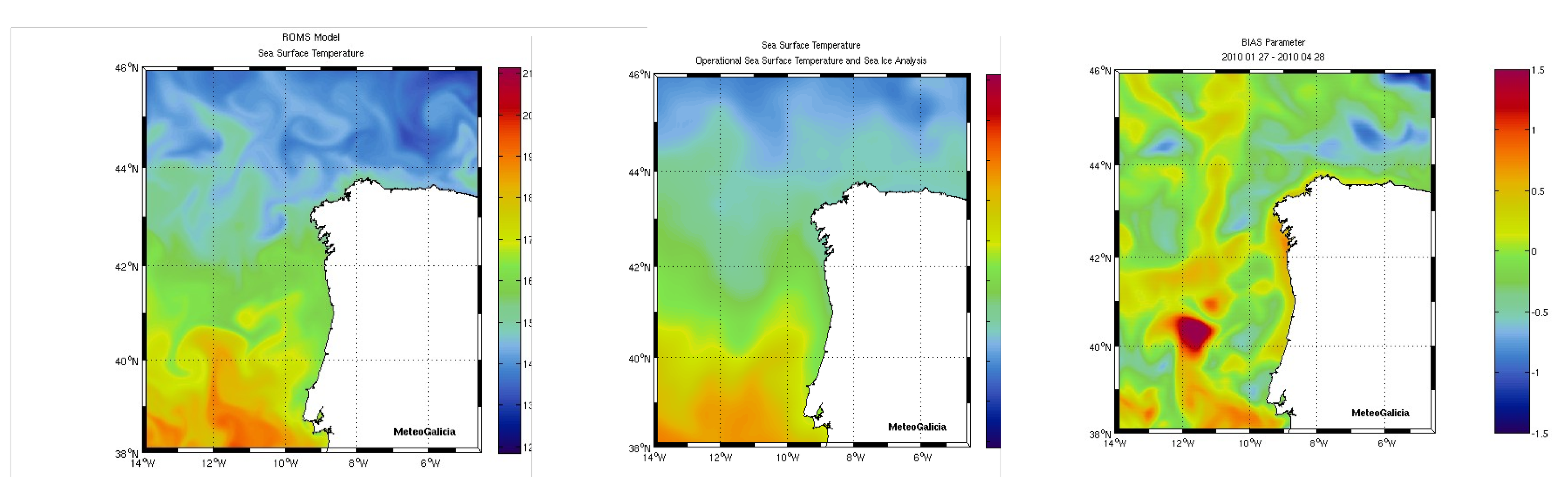


Figure6 – Left: Model roms sea surface temperature (Reference time: 2009 12 02); Center: Sea surface temperature from the operational surface temperature and sea ice analysis (Reference time: 2009 12 02 , 0.05º resolution); Rigth: BIAS parameter of the sea surface temperature for nineth one days (Reference time: 2010 01 27 to 2010 04 28

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