

RAIA PROJECT. OPERATIONAL IBERIAN MARGIN HYDRODYNAMICAL MODEL

Costa P1, Carracedo P1, Perez E1, Venâncio A1, Vilasa L1

IMeteoGalica – Consellería de Medio Ambiente, Territorio e Infraestruturas – Xunta de Galicia | numeric@metecgalicia.es

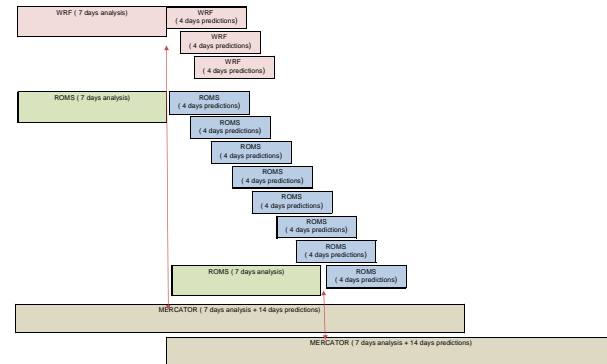
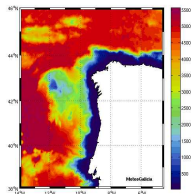
INTRODUCTION

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 14°W and 4.5°W, between 38.0°N to 46.0°N (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.



INTERPOLATION METHOD

The model boundary and initial conditions has been obtained from Mercator Model with 0.05° of resolution, to achieve that, five steps could 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.

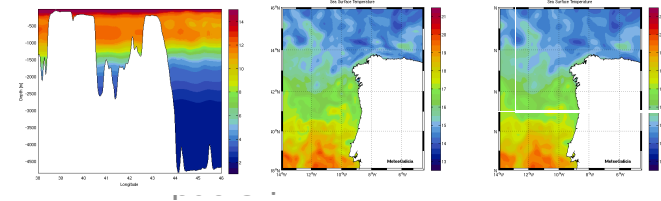


Figure 3 – Interpolation product example. Mercator output in time initial forcing temperature. (Reference time: 2009-11-25). Left: Vertical profile time-averaged potential temperature (5.5°W). Centre: Mercator model sea surface temperature. Right: Rom model sea surface temperature.

OPERATIONAL OCEAN ANALYSIS

An operational ocean analysis with 0.02° resolution is running since 27th of January 2010, meaning that every Wednesday is performed 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.

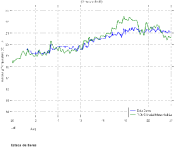
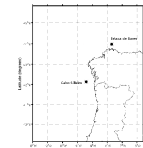


Figure 4 – Above: Comparison between mercator model and roms model sea surface salinity (Reference time: 2009-12-02).

FUTURE WORK

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

Figure 5 – Above: Time series of comparison between: model surface temperature and oceanographic buoy. (Reference time: 2009-05-25).

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.

Comparisons 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 (0.4°C-0.5°C) along the coast, meaning the tendency to overestimate the temperature in this particular region.

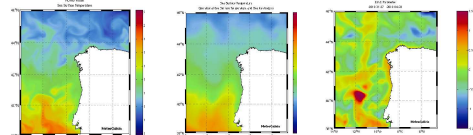


Figure 6 – Left: Model runs on surface temperature (Reference time: 2009-12-02). Centre: Sea surface temperature from the operational surface temperature and sea ice analysis (Reference time: 2009-12-02). Right: BIAS parameter of the sea surface temperature for each one day. (Reference time: 2010-01-27 to 2010-04-26).

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