

A high resolution eddy resolving model of the North-Western Mediterranean Sea

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Free Surface Model MARS3D nested in rigid lid OGCM

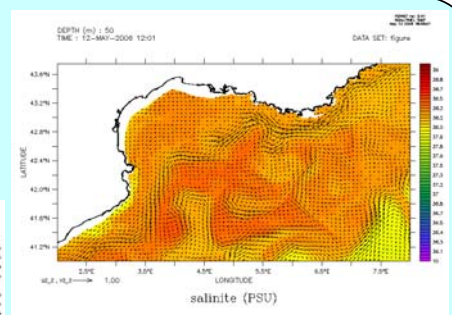
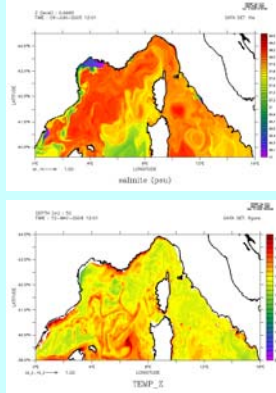
Free Surface Model : 30 levels sigma-coordinate model / semi-implicit barotropic mode / mode splitting technic using an iterative procedure / Time step 300s / resolution, 1.2 km

Boundary condition

Using an Arakawa C-grid allows to prescribe either the pressure gradient field (buoyancy forcing and sea surface elevation) through the momentum equation or the water fluxes through the mass conservation equation. The nested chain here performed is a simple one-way off-line embedding method. At the open boundary, the sea surface elevation is simply prescribed, but to allow radiation of perturbations, a contribution of the prognostic interior solution is added, following the flow relaxation scheme (FRS) proposed by (Martinsen and Engedhal 1987; Roed and Cooper, 1986):

$$\eta(x,t) = \alpha \eta_{prescribed}(x,t) + (1-\alpha) \eta_{prognostic}(x+\Delta x, t-\Delta t)$$

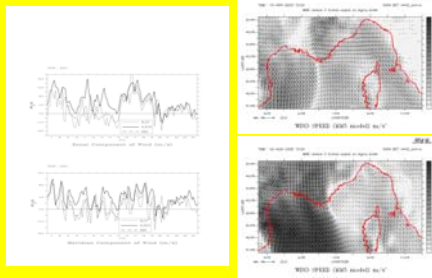
where x is the location of the boundary and Δx the grid spacing.



Sea surface salinity (note the Balearic front and the Rhone plume) Temperature at 50 meter (warm filament due to surface convergence) Current and salinity at 50 m depth (thin -25 km- and strong -4m/s)

Improvement of the Wind Forcing using MM5 meteorological model

The Fifth-Generation NCAR / Penn State Mesoscale Model (MM5) in which the influence of orography is introduced, among other particularities, is performed to estimate wind fields with a 3.0 km resolution. For a test period of one month (July 2001) over the Gulf of Lion, MM5 estimates are closer to measurements than Aladin estimates at Dyfamed Buoy location (43°25' N-7°52' E). East from Toulon, for significant periods, MM5 simulates wind fields favourable to downwelling, conversely to Aladin or Arpege results. Therefore, overestimated upwellings may be induced by inaccurate wind fields and MM5 estimates is now used. MM5 model is performed by ACRI-ST



Comparison between modelled and measured wind velocity at Dyfamed.

Of Toulon, during mistral events the wind can sharply stop or reverse.

OPERATIONAL CHAIN

Every week :

-Boundary conditions are provided by MFS/MOON model of the Mediterranean Basin

Every day :

-The meteorological model MM5 is running from day-1 (using analyse of NCEP model as initial and boundary condition) to day+3 (using forecast of the NCEP Model)

-The Coastal Model is running from day-1 to day+3. Using the forecast of Mercator as boundary conditions.

Results : Results since february are available on the ftp site :

<http://ftp.ifremer.fr/ifremer/dyeco/OGCM/>

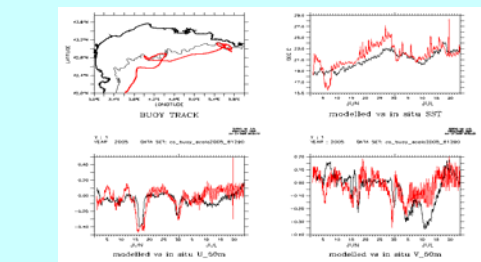
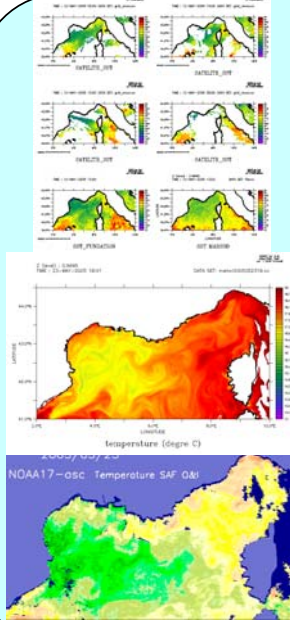
<http://www.pseuim.fr>

<http://www.ifremer.fr/mauricamed/index.htm>

Zoom :

- off line zoom may be embedded in this coastal model. For instance a zoom of the PACA (from Marseille to Nice) is currently running. The resolution is 400m.

Perspective : Using Arome from MétéoFrance. Taking into account the modelled Sea Surface temperature in the meteorological model.



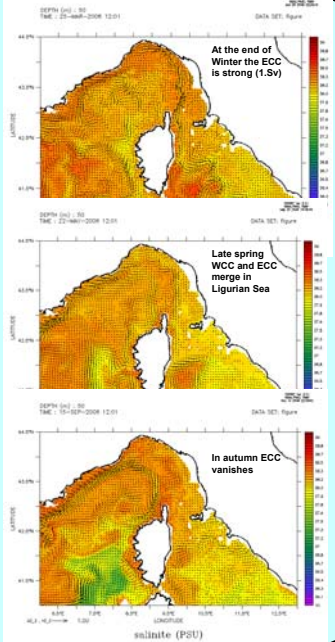
RESULTS

Comparison of physical properties (velocities, température) along buoy tracks during ECOLO cruise.

Seasonal behavior of the East Corsica Current (ECC)

Systematic synoptic comparison of the modeled SST and satellite data are performed. SST_FUNDATION is a product of Medspiration combining the best outputs of independent SST sources.

Sometime the model can reproduce fine structures as eddies and filaments. At the eastern entrance of the gulf of Lion both model and satellite SST exhibit a separation of the North Current in 2 parts.



CONCLUSION :

An operational forcing of a large coastal model by OGCM Rigid Lid Boundary Condition has been built
The use of a refined meteorological model improves the results and is necessary for more local model (bay of Toulon or Marseille)
The high resolution allows a « free » behaviour of the North Current and generates clearly a West Corsica Current

