BAY OF BISCAY

INSTITUTE: AZTI
MODEL NAME: ROMS- $N_2P_2Z_2D_2$-type model
(ROMS-PISCES simulation on going)
MODEL DOMAIN: Bay of Biscay: 40.5ºN – 52.5ºN / 13ºW – 0.5ºW

STATE VARIABLES

$N_2P_2Z_2D_2$ model state variable (all variables in mmol N m^{-3})
Small phytoplankton (SPhyto)
Large phytoplankton (LPhyto)
Small zooplankton (SZoo)
Large zooplankton (SZoo)
Small detritus (SDet)
Large detritus (LDet)
Nitrate (NO_3^-)
Ammonium (NH_4^+)

OBJECTIVES

Hydro-climate processes in the Bay of Biscay, as haline-stratification and nutrients inputs both due to rivers discharges, mesoscale activity over the slope, mixing or stratification, are thought to be largely responsible for the high variability in planktonic production and dynamics.
Then the objectives are:

- To emphasize the seasonal to interannual variability in the planktonic production and ecosystem structure, and processes which are dominant or limiting in the region.
- To analyze the climate changes impacts and anthropogenic effects on the pelagic ecosystem for planktonic productivity and structure, performing scenarios simulations.
- To analyze anthropogenic drivers impacts, as eutrophication from rivers inputs, on the pelagic ecosystem.

Coupled physical-biogeochemical simulations

- Hindcast simulation with realistic atmospheric forcing NCEP 1980-2010 (1997-2009 done) – in progress
- IPSL-past forced scenario (LU20C2, years 1980-2000) – planned in autumn 2011
- IPSL-future forced scenario (LUA1B2, years 2080-2100) – planned in winter 2012

VALIDATION

We have been collecting numerous datasets in the Bay of Biscay domain:

- Vertical profiles from different cruises (Bioman, Triennal, Ecoanchoa, MarinEggs, Juvena, Prestige)

- Circulation observations from RADAR (AZTI)
- Satellite images (SST and chl*a* from AVHRR, Seawifs amd MODIS)
- Climatology BoBY-clim (Ifremer)

Validation of the 1997-2009 hindcast simulation with NCEP atmospheric forcing:

- **Temperature and salinity**
  o Monthly mean simulated SST *vs* AVHRR climatology / month: Taylor diagram and P*bias* (Figure 1).
  o Monthly mean simulated SSS *vs.* BoBY-clim / month: Taylor diagram and P*bias* (Figure 2).
  o Vertical profiles of temperature: scatter plots, RMSE and MRD *vs. in situ* CTD data (from cruises) – each point of observation has been compared to the model at the same time and location.
  o Vertical profiles of salinity: scatter plots, RMSE and MRD *vs. in situ* CTD data – each point of observation has been compared to the model at the same time and location.

- **Circulation**

  o ROMS/RADAR visual comparison of monthly mean surface circulation in the south-eastern Bay for the year 2008.

  o ROMS/RADAR visual comparison of the daily surface current, during spring 2008 and 2009 (May-June-July), for 3 transects: latitudinal transects at 44ºN and 45ºN (France), longitudinal transect in front of Matxitxako (2.78 ºW, Basque Country, Spain).

- **Nutrients**

  o Vertical profile of nitrate: ROMS/ *in situ* data visual comparison and scatter plots.

- **Chlorophyll *a***

  o Comparison of domain-averaged and monthly mean simulated surface chl*a* biomass and observed surface chl*a* biomass from MODIS (Figure 3).

  o Visual comparison of horizontal maps of simulated surface chl*a vs.* SeaWiFs and MODIS satellite images (to be done: RMSE versus surface chl*a* from satellite).

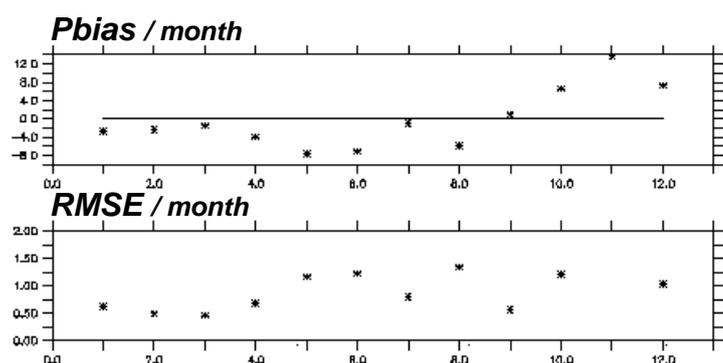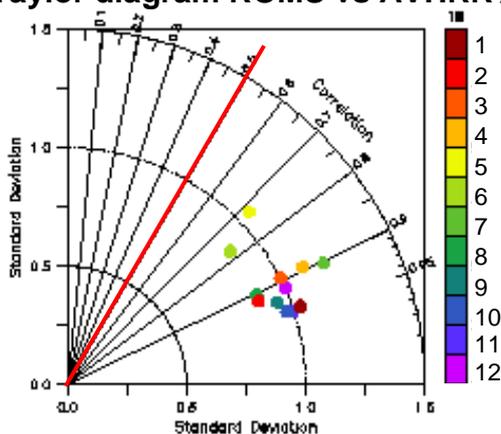## Taylor diagram ROMS vs AVHRR */ month*

Figure 1: Taylor diagram of ROMS simulated SST *vs.* AVHRR climatology per month. The monthly mean simulated SST (1997-2009 simulation) is compared to the AVHRR monthly climatology from Sauquin and Gohin (2010, ECOOP project).

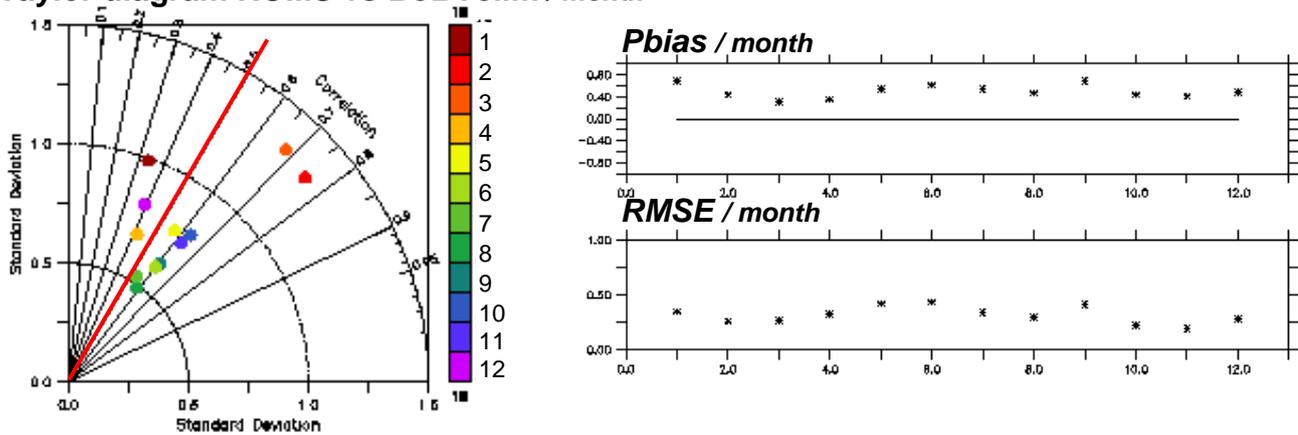## Taylor diagram ROMS vs BoBYclim / month

Figure 2: Taylor diagram of ROMS simulated SSS *vs.* BoBY climatology per month. The monthly mean simulated SSS (1997-2009 simulation) is compared to the BoBY monthly climatology from Ifremer (Vandermeirsch *et al.*, 2010). The river plumes are not enough extended in the model, which allow to an over-estimation of the SSS by the model (above all on the shelf). *Vandermeirsch F., Charraudeau M., Bonnat A., Fichaut M., Maillard C., Gaillard F. and Autret E., 2010. « Bay of Biscay's temperature and salinity climatology." XII International Symposium on Oceanography of the Bay of Biscay, 4-6 May 2010, Plouzané, France.*
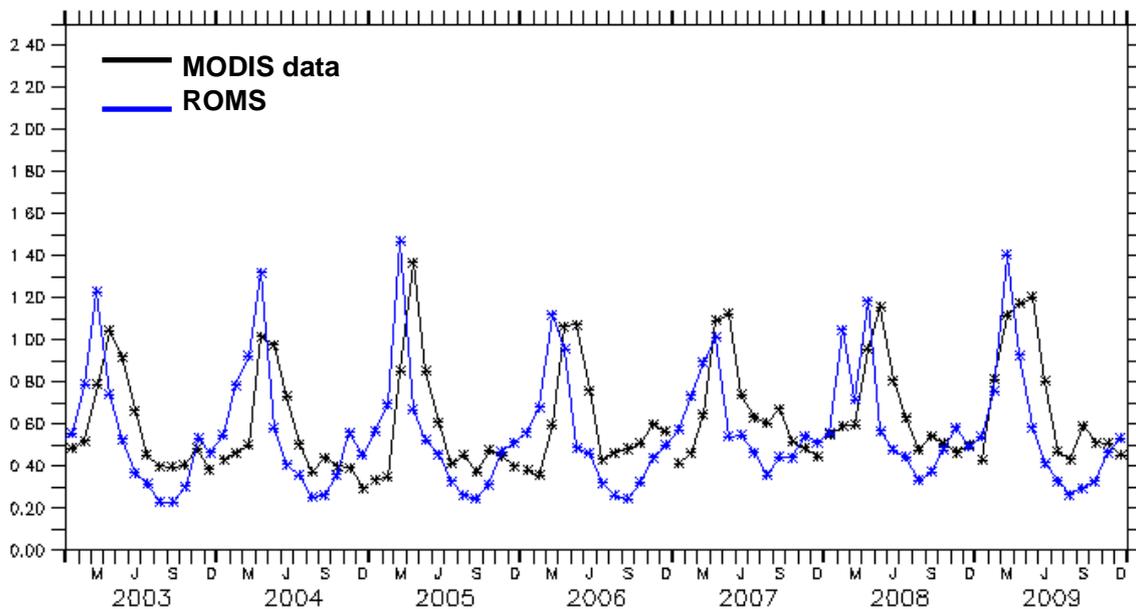

Figure 3: Domain-averaged and monthly mean simulated surface chl*a* compared to MODIS monthly climatology. The simulated bloom is too early in the season, but the inter-annual variability is simulated (ex: 2005: hight chl*a* biomass, earlier in the season). Nevertheless, as a new PISCES simulation is on going, the comparison and validation of chl*a* with the new results will be checked in autumn 2011.