

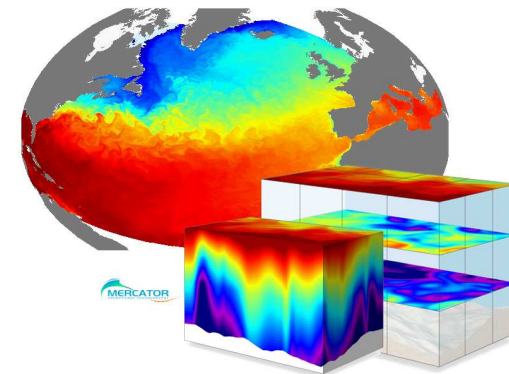


Strategy for the validation of the IBI regional system

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Outline

The IBI system

‘Metrics’ and diagnostic definition for the IBI system

- Comparisons with observations
 - “Quantitative” validation
- Index
 - Independent from the observations
 - Monitoring of physical processes (Navidad occurrences, transport in the Gibraltar Strait...)
- Diagnostics for the study of specific physical processes
 - Scientific qualification (internal tides, overflows, submesoscales...)
- Comparison with other models



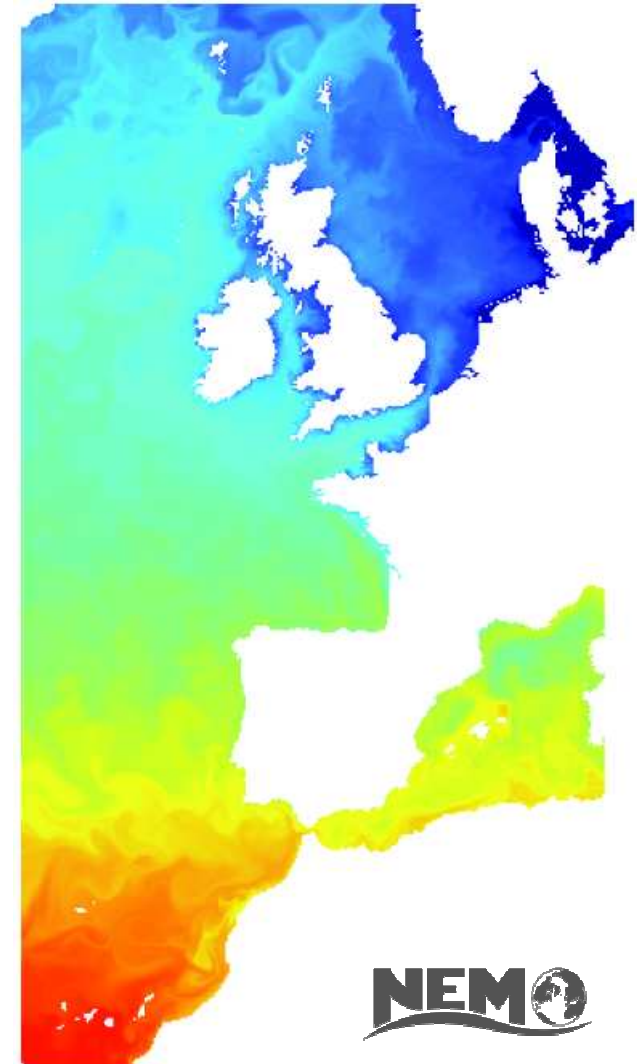
MERCATOR IBI regional system (1)

- **My Ocean** project (WP8): deliver by 2012 a high resolution regional operational system over the IBIROOS area (France, Ireland, Portugal, Spain)
2 core partners: Mercator Ocean, Puerto del Estado (Spain)
2 research partners: CNRS (POC, Toulouse), NERC (POL, Liverpool)
- Expected: great improvement of initial/boundary conditions provided to coastal modelers
- Developments in NEMO: tides, runoff, advection schemes, vertical physics, ...
=> validation needed



MERCATOR IBI regional system (2)

- NEMO 2.3
- Horizontal resolution: 1/36 (~2 km)
- Vertical resolution: 50 geopotential levels
- Bathymetry: GEBCO 08 + regional datasets (IFREMER, SHOM, BODC, ...)
- Explicit free surface with time splitting
- Tidal forcing (OBC + potential)
- HF atmospheric forcing (3h) from ECMWF; diurnal cycle
- Light penetration from climatology
- No assimilation
- Monthly climatological runoff



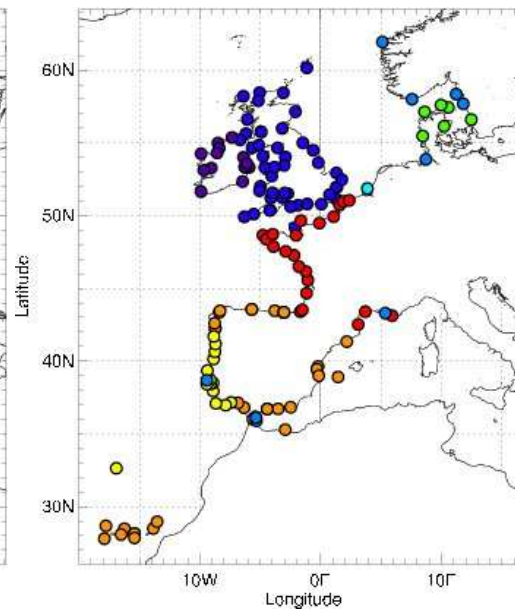
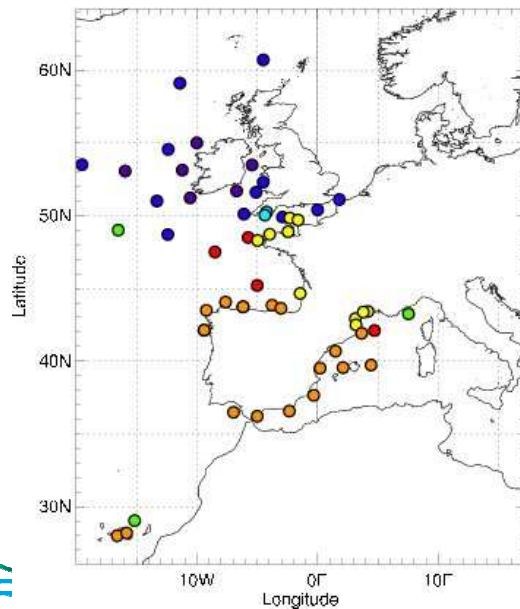


Comparison with observations

Online

Already existing protocols (MERSEA)

- Frequently sampled data at fixed locations (class 2)
 - T&S moorings
 - Current meters
 - Tide gauges
- Volume transport across fixed sections (class 3)



Left: location of the buoys and current meters from Puertos del Estado (orange), Météo France (red), Cetmef (yellow), Marine Institute (violet), UK Metoffice (blue), Western Channel Observatory (turquoise blue) and Eurosite (green).

Right: Location of the coastal tide gauges from Puertos del Estado (orange), SHOM (red), Marine Institutue (violet), BODC (dark blue), Instituto Hidrografico (yellow), Hydro Meteo Centrum Zeeland (turquoise blue), Danish Meteorological Institute (green) and GLOSS (blue).



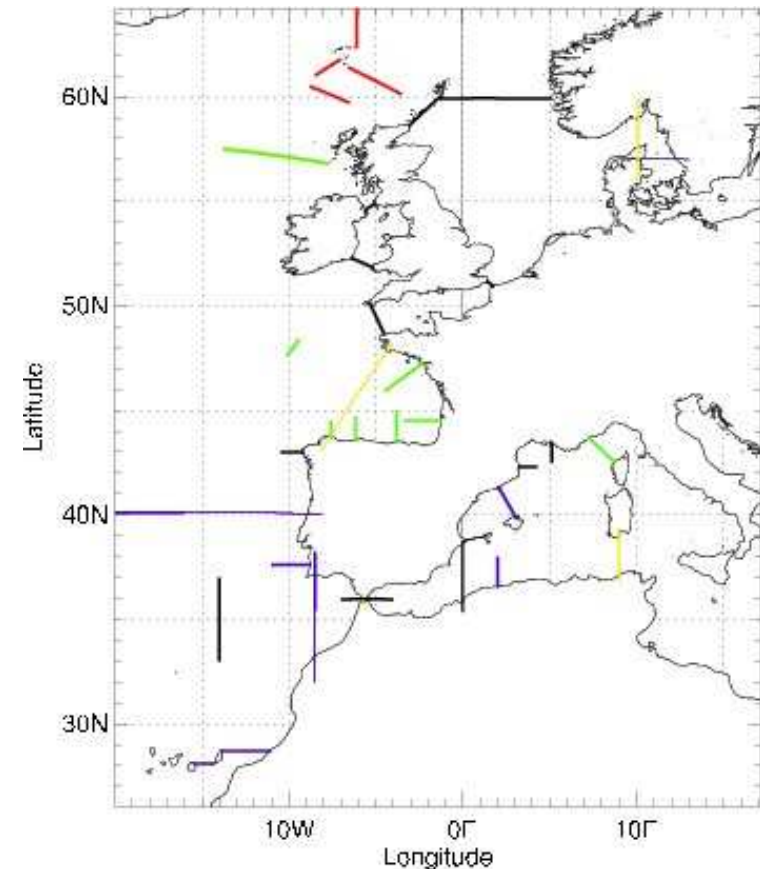
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Volume transport sections defined for the IBI system. In black: sections without specific class of computation on the vertical. Then transports computed with classes: temperature (red), salinity (yellow), density (blue), and depth (green). Thin lines represent the MERSEA sections, and thick lines are set for the new sections.





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New protocols

- Frequently sampled observations
 - Current meter: analysis of the tidal currents and the residual currents (Protocol used by Puertos del Estado)
 - Tide gauges: analyses of the tidal elevations
- Transport: comparisons with estimations of the tidal residual transport (Gibraltar, English Channel)



Comparison with observations

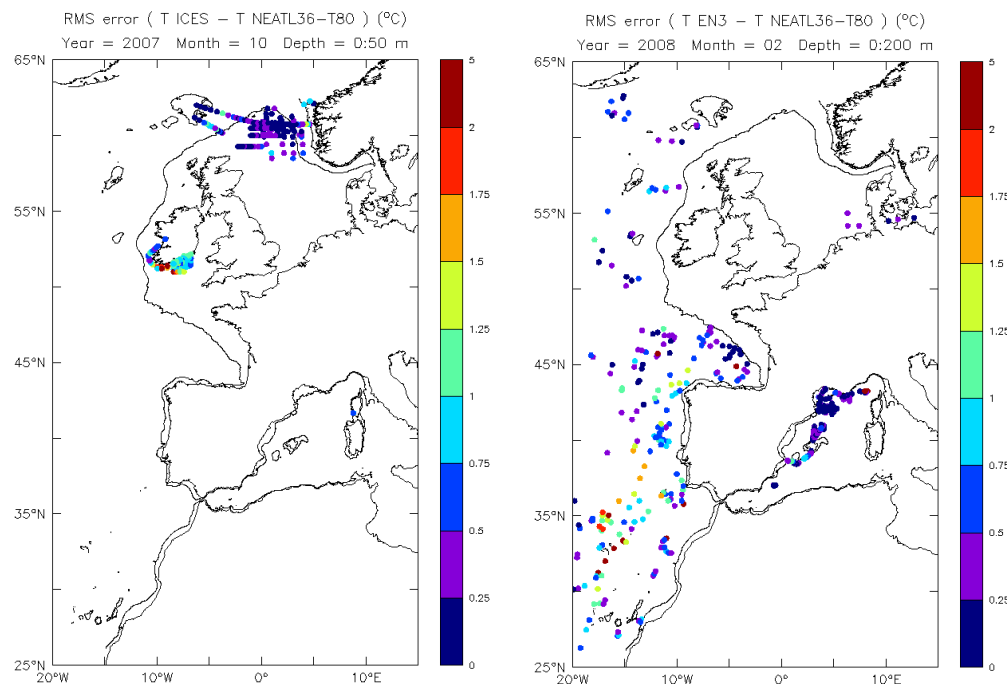
Offline

Already existing diagnostics performed in delayed mode (class 4-like)

- Frequently but irregularly sampled data (drifting buoys, Argo, gliders...)
Data base: EN3 and ICES
- SST data (daily products)
Data base: OSTIA, TMI-AMSRE, PATHFINDER, SEVIRI, ODYSSEA (down to 1/20°)
- Surface currents
SURCOUF

The colocalization tools are taken from Juza M. (LEGI) for the offline comparisons.

RMS error (in °) (0-50 m) in temperature profiles beetwen data and model. Right: EN3 (feb. 2008). Left: ICES (oct. 2007).





Comparison with observations

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New protocols: ongoing work

- **Ferry Box data** (SST, SSS)
- **High-frequency SST data** (SEVIRI, 3-hour sampling)
Diagnostics for the diurnal cycle.
- **SLA maps** (AVISO)
Tidal elevations and atmospheric pressure effects have to be removed.
- **Along track SLA** (dedicated SL TAC IGDR product)
Tidal elevations and IB effects are separately estimated.
- **Drifter trajectories** (ARIANE)
- **Surface currents** (Radar HF)



Index

- Detection of anomalies in the simulation (e.g. SST too warm...).
Can be done in real time.
- Interests for end-users
 - Ushant Front: occurrence, intensity...
 - River plume: surface, position, direction of the propagation
- Climatic indices allowing the monitoring of specific processes
 - Extreme surges
 - Navidad event along the Cantabrian coast
 - Coastal upwelling (Portugal, Galicia)
 - Mesoscale activity (intensity, eddy propagation, preferred eddy generation areas)
 - Slope current (e.g. Cantabrian coast, Armorican slope)



Validation dedicated to physical processes

The following list is not exhaustive

- Mixed layer properties (depth, temperature and salinity)
- Thermocline depth
- Upper heat content
- Bottom boundary layer depth

- Coastal waves
- Transport at specific locations (Gibraltar Strait, monitoring of the slope current)
- Sub-mesoscale
- Overflows (Gibraltar, Faeroe)
- Diurnal cycle
- Internal tides

We will focus on one or two physical processes as a first step



Comparison between models

Intercomparison with other models

- Define class 1 grid (area, size, depth level).
- Define variables of interest (MERSEA + tidal elevations...)
- Analyze class 1 for:
 - impact of resolution
 - tidal solutions
 - ...

V1 system (MERCATOR IBI) as accurate as VO system (Polcoms ESEOAT, 1/10) ?

IBI system better than PSY2 ?

Comparisons with data

- Use class 4 with several models

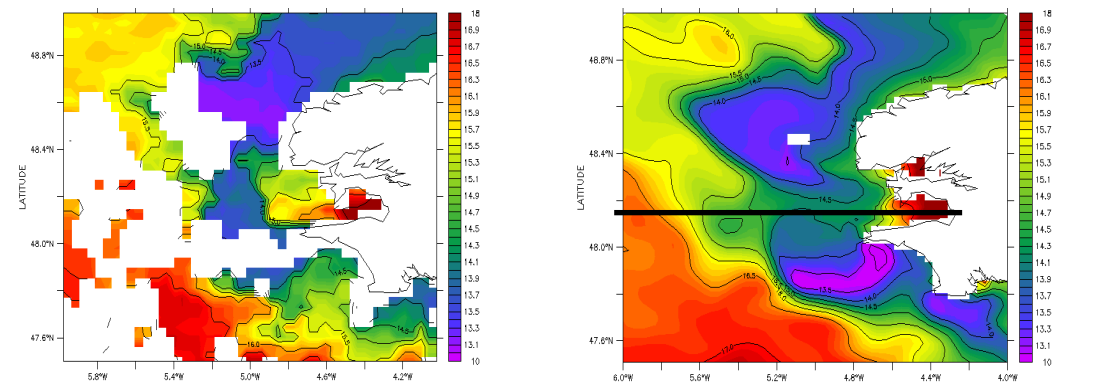
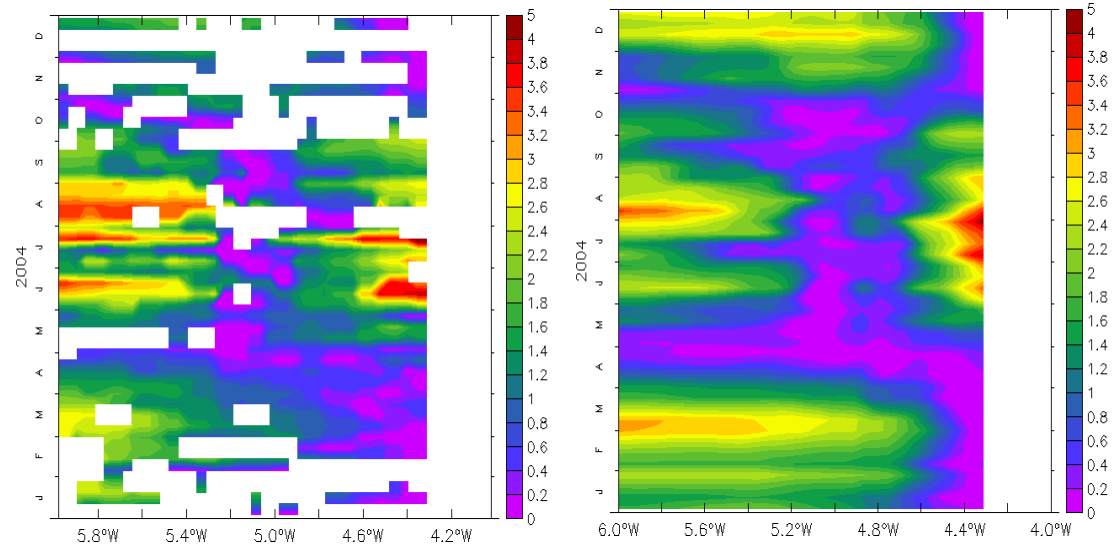


Comparison between models

Intercomparison project (ended 2008)

- 4 models (HYCOM, MARS3D, NEMO, SYMPHONIE)
- One year simulation in the bay of Biscay
- Common horizontal grid, bathymetry, forcing
- Physical processes:
 - Ushant's front
 - Internal tides
 - Cold water pool
 - Warm pool
 - Rivers plumes
 - Upwelling

EPIGRAM (2009-2012)



MODIS

NEMO

SST in Ushant's front





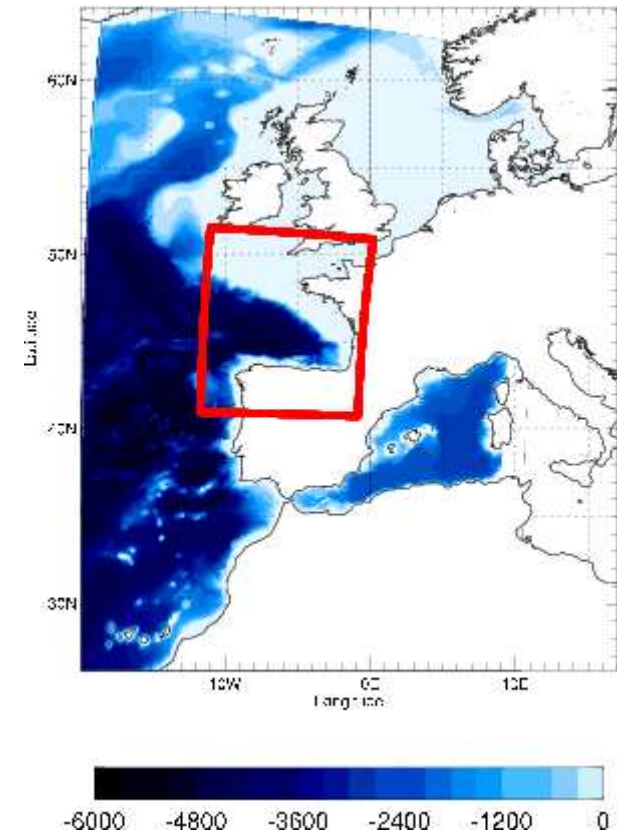
Comparison between models

Comparison with the Symphonie model dedicated to coastal applications (Gaëlle Herbert, Patrick Marsaleix, Nadia Ayoub)

- o focus on specific processes (surface circulation, response to high winds, mixed-layer properties, occurrences of Navidad events)
- o period of interest: June 2007 – February 2009

Set-up of a smaller NEMO configuration in the Bay of Biscay matching the Symphonie domain and dedicated to test changes in the model physics

- o 1/36° resolution
- o OBC: PSY2V3, tidal elevations and velocities (MOG2D), IB elevations
- o Tidal forcing
- o Atmospheric forcing (including atmospheric pressure)





Conclusion

- Most of the data are collected for the model validation
- Most of the protocols for the model validation are set up
 - Particular attention has been given for the new diagnostics to validate tides
- Indices are defined
- Validation dedicated to physical processes
 - Processes identified (list not exhaustive)
- Comparison between models: to be done

This validation plan is designed for the validation in hindcast mode and delayed time, more diagnostics have to added for the system with assimilation.