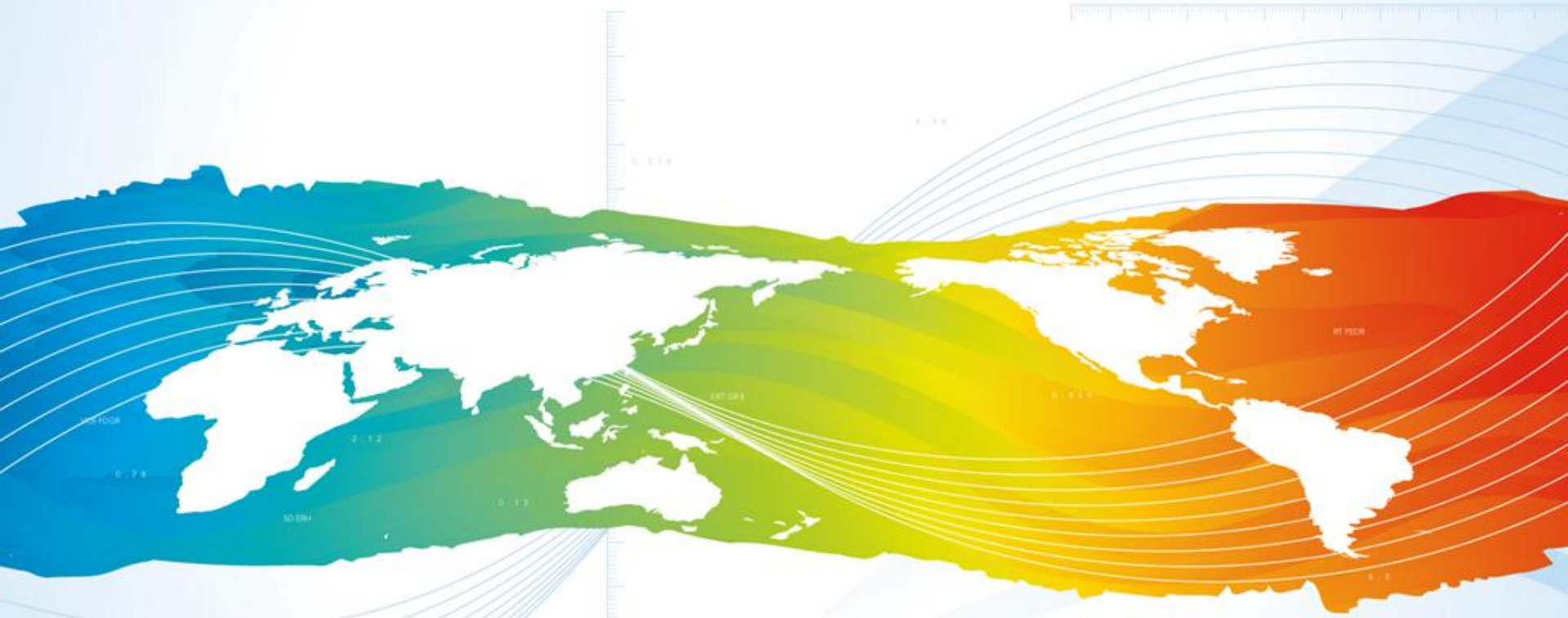
The IBI system



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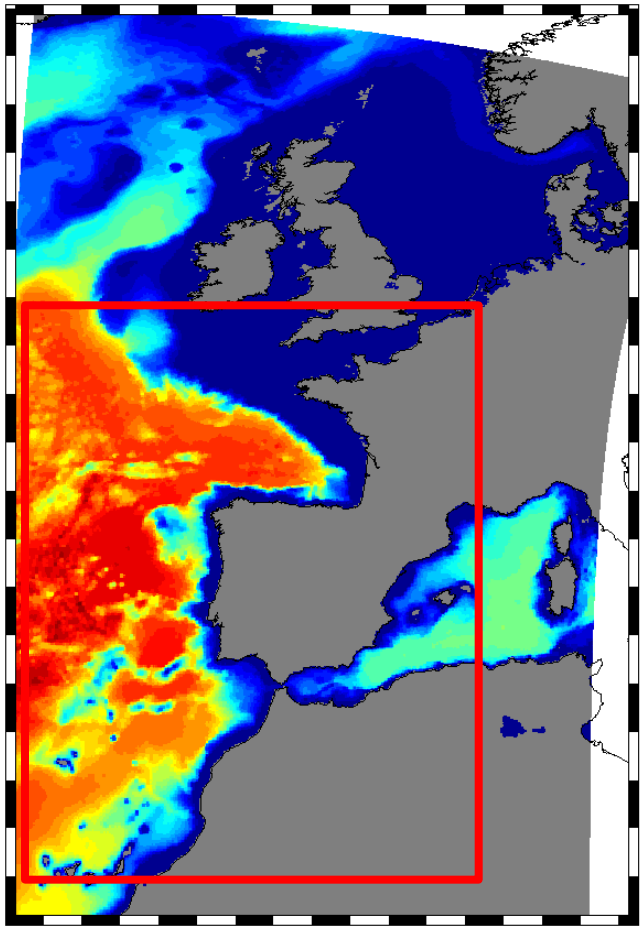
The operational system

- Operated by Mercator-Océan and Puertos del Estado.
- Operational since april 2011, delivered daily since june 2011 via MyOcean IBI36V1.
- Released in january 2012, IBI36V2.
- System started weekly from PSY2V4R2 with 2-week spin-up.
- Daily: « analysis » of the previous day, 5 days of forecast (started from the previous day analysis, with updated atmospheric forcing).



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Characteristics

- **Current Version (NEMO version 2.3)**
  - On ORCA grid, 1/36°resolution (1093 x 1894), 50 z vertical levels (partial cells)
  - Composite bathymetry from various sources (LEGOS)
  - ECMWF high frequency meteo fields (3h) including diurnal cycle and atm. pressure, CORE bulk formulae
  - 34 rivers runoffs as lateral point sources (PREVIMER, E-HYPE (SMHI), monthly climatology GRDC)
  - Tidal forcing at OB (TPX07.1, 11 tidal components) and astro. pot.
  - IC and OBC from PSY2V4R2
  - Explicit non-linear free surface, time-splitting
  - Advection scheme: QUICKEST + ULTIMATE
  - Model of turbulence: k-ε
  - Ocean colour dependant short wave penetration (merged Seawif/IFREMER climatology)
  - Wave mixing parameterization (Craig & Banner, 1994)

The system with assimilation (M. Benkiran, CLS)

Assimilated data: SLA (AVISO ALTO/DUACS), T & S profiles (CORA 3), SST (AVHRR ¼ x ¼ and L3S)

Initialisation : GLORYS2V1 (global, 1/4°, 1992-2010), 75 levels

DATA ASSIMILATION SYSTEM: SAM2v1, SEEK formulation

- SEEK Filter :
  - Innovation is calculated at the First Guess at Appropriate Time (FGAT) approximation
  - Control vector: [SSTLS, SSH, HBR, HBRST, T(k), S(k),U(k),V(k)]
- 3D-VAR Bias correction: for T and S
- Incremental Analysis Updates (IAU): Analysis J-2.5
- SST Correction in Bulk
- Quality Control of in situ observation, Keep the data based innovations
- Forecast error covariances: 3D modes from a set of anomalies (From Free run, 350 modes used)

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IBI Simulations

1/36 :

- Free Run (IBI36 FREE) : july 2007 – december 2010
- Operational Run (IBI36V1 then IBI36V2) : april 2011 – today

1/12 :

- Free Run (IBI12 FREE) : 2002 – 2009
- Realalysis with assimilation (IBI12 ASSIM) : 2002 – 2009

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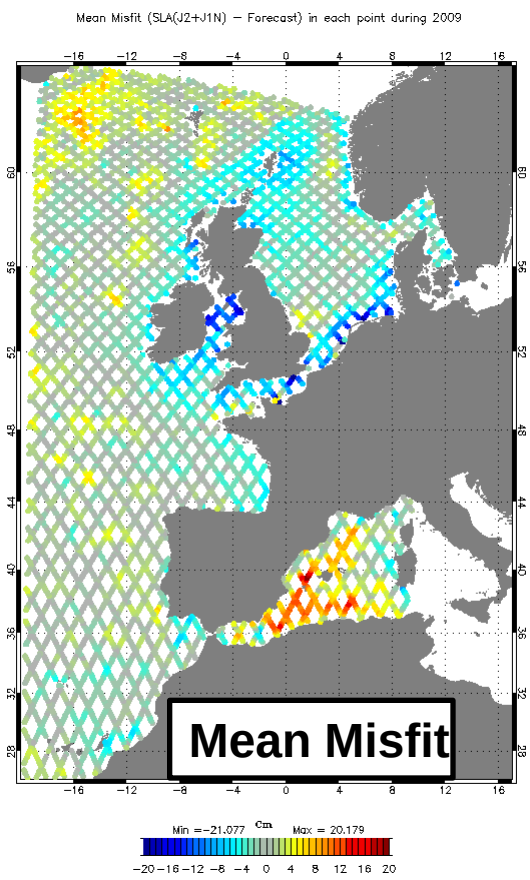
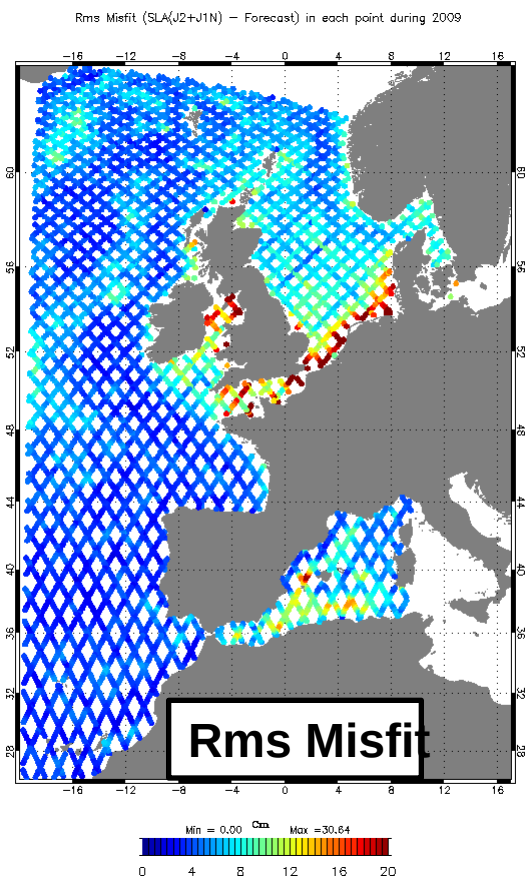
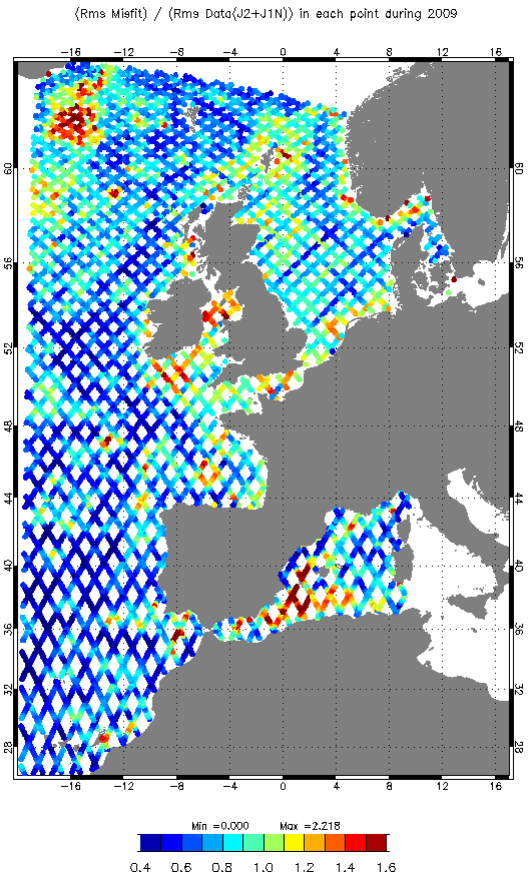
SLA : J2, J1N (2009)

Misfit = Data – Model $_{FCST}$

(Rms Misfit)/(Rms Data)







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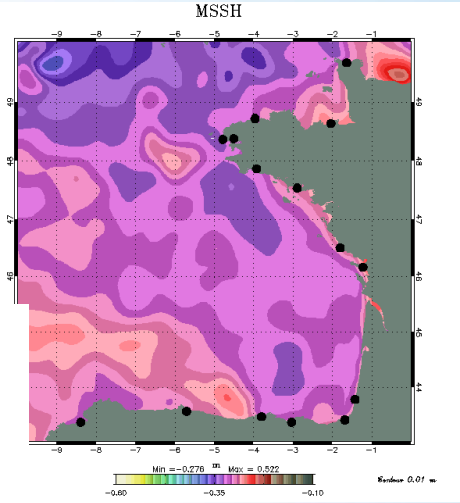
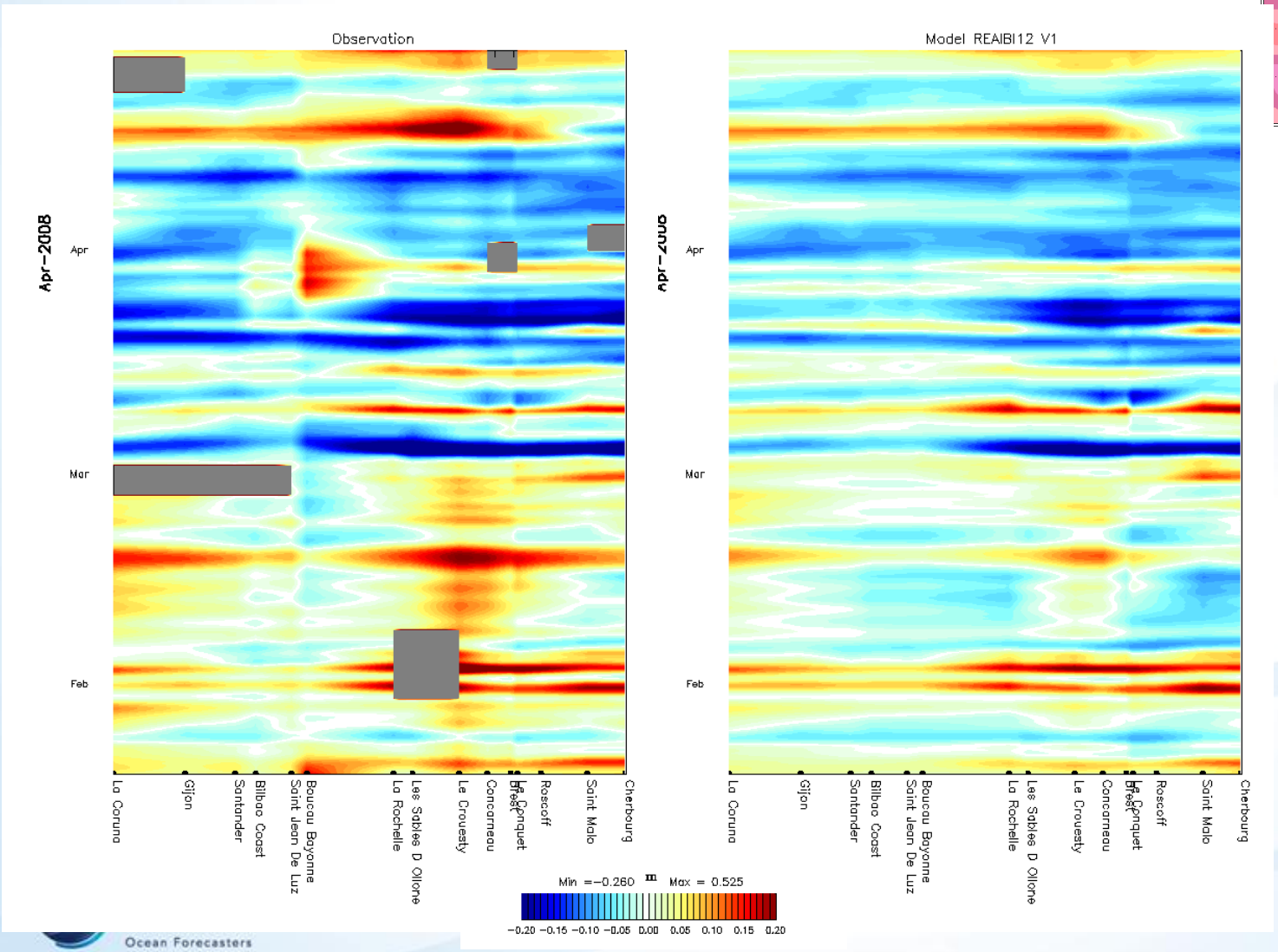
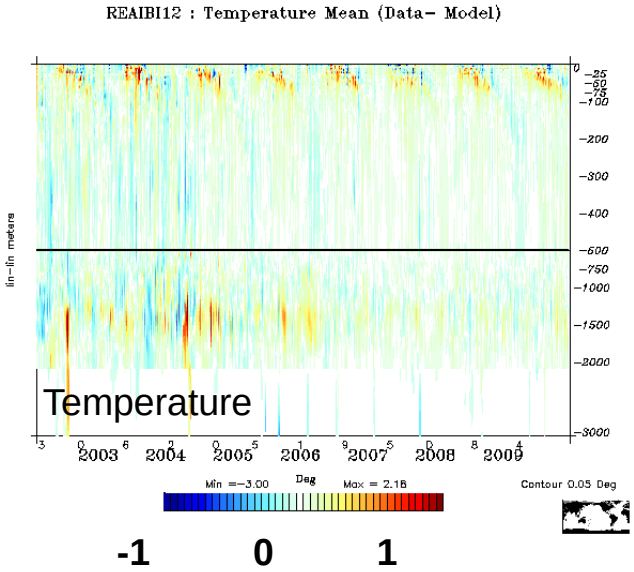
SLA (BF) : tide-gauge vs model

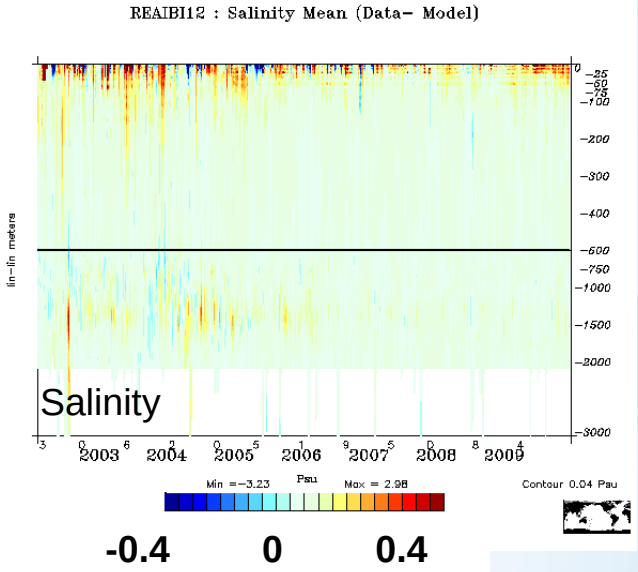




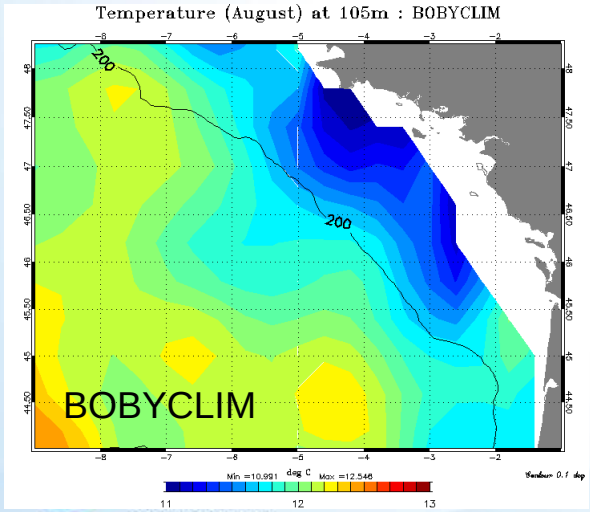
Comparison in-situ profiles / climatology

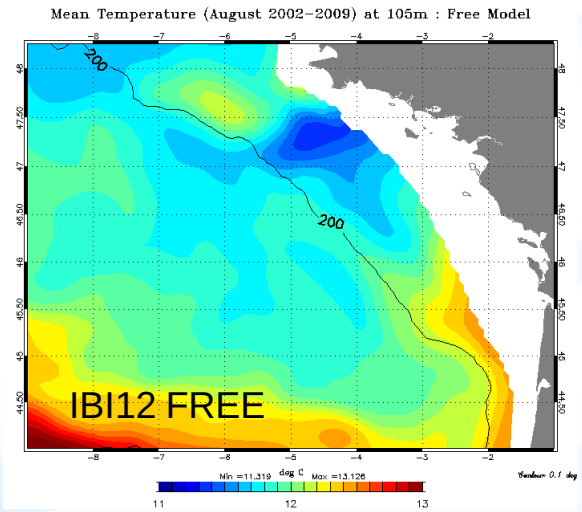
T & S profiles

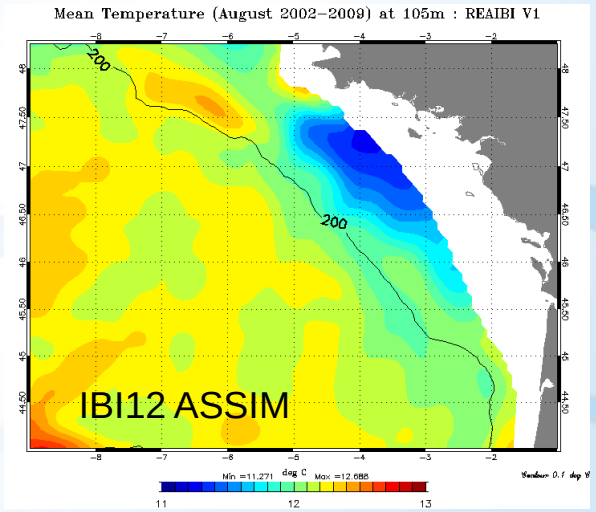




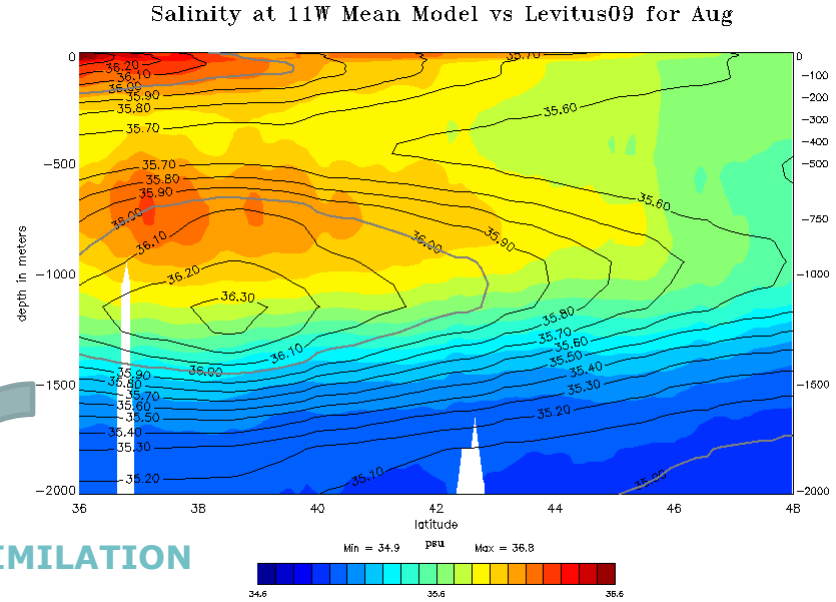
« Bourrelet froid »: mean temperature (august) at 100 m

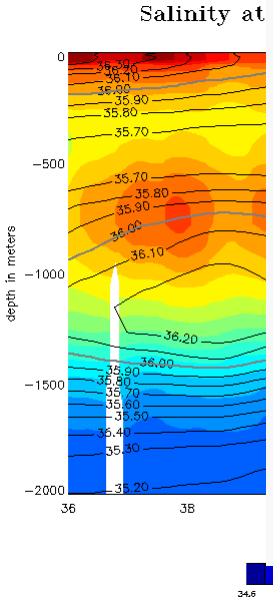


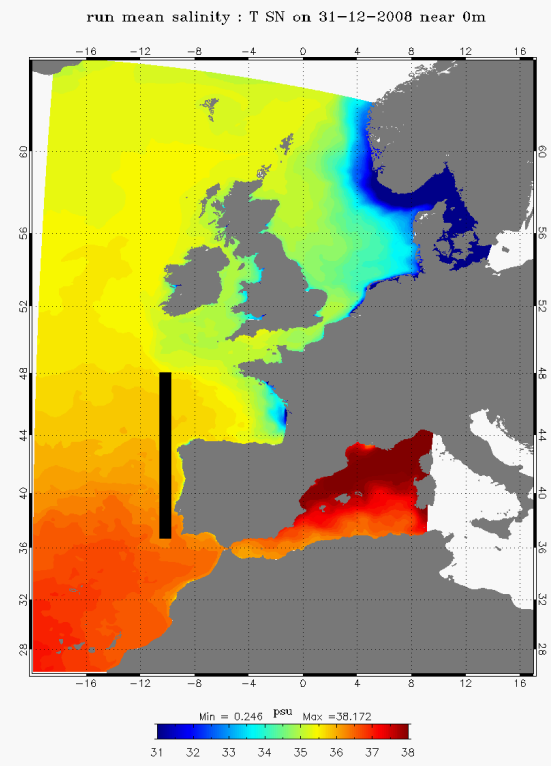




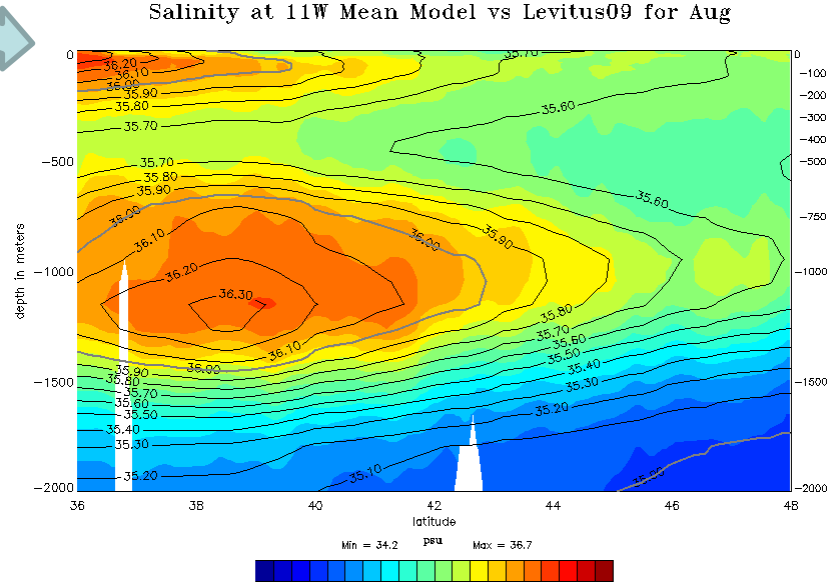
Mediterranean Water

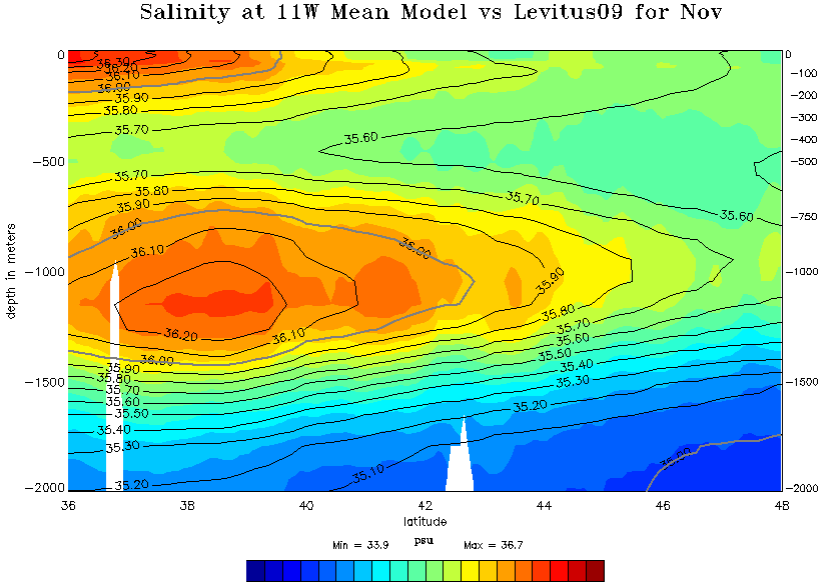






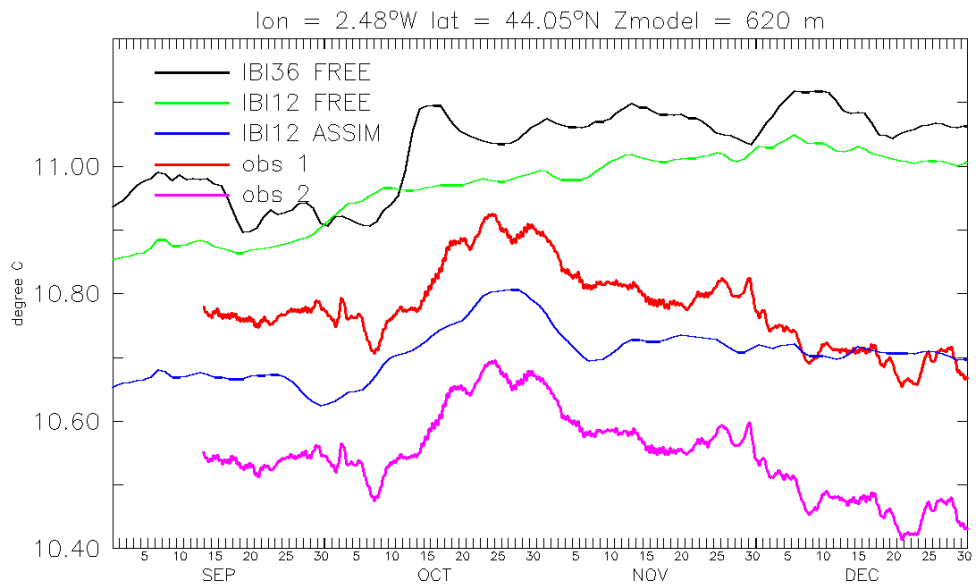
ASSIMILATION



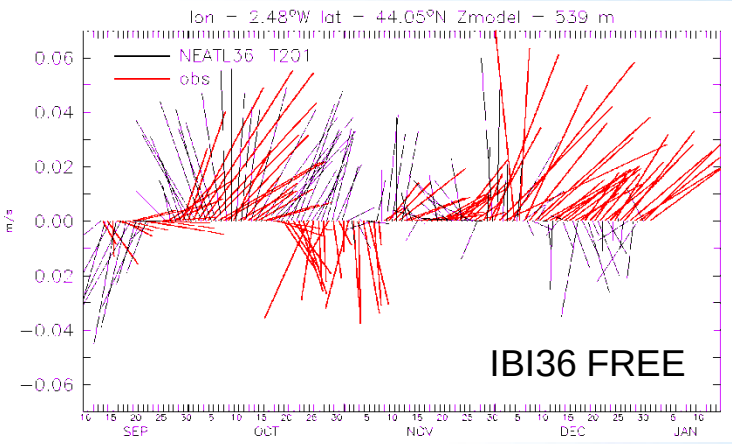


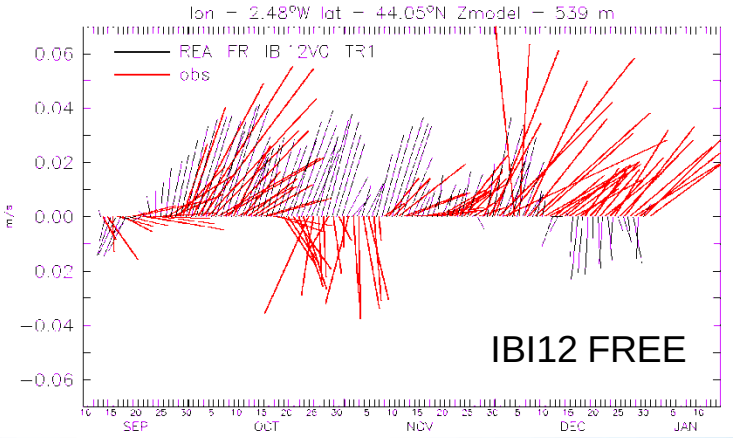
ASPEX 2008/2009 (L. Marié)

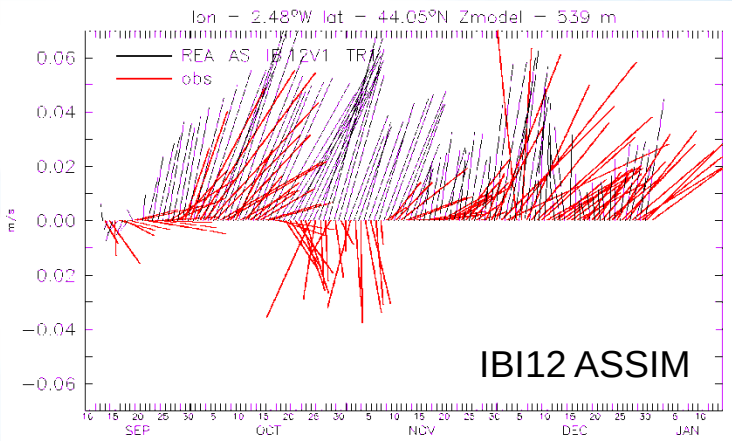
Temperature at 620 m



Currents at 540 m







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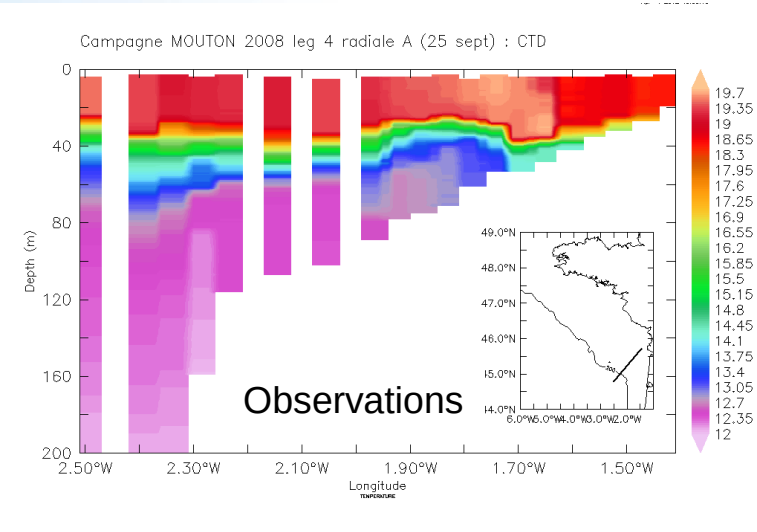
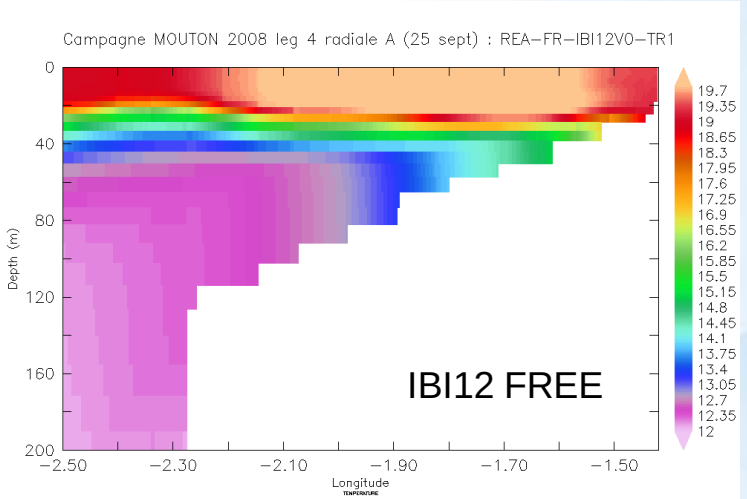
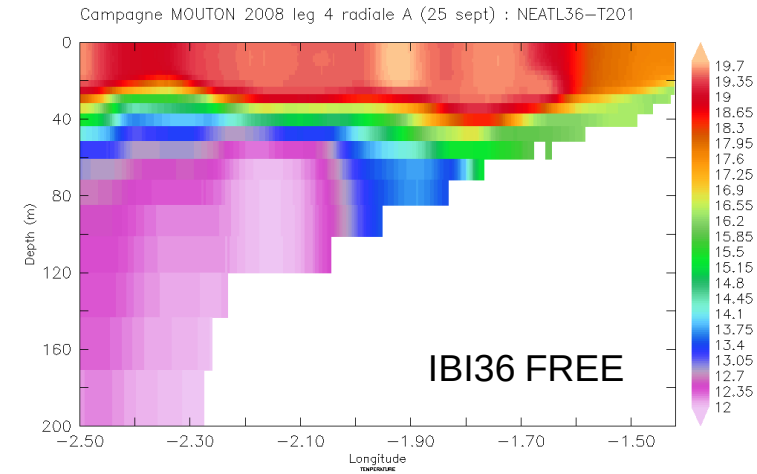
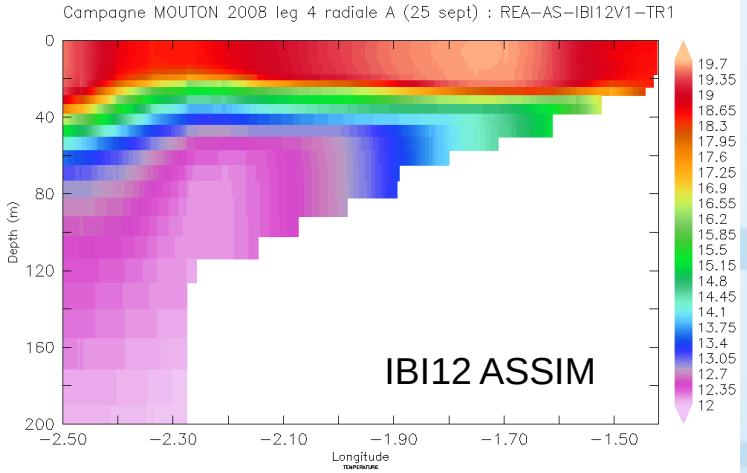
MOUTON (SHOM), automn 2008, section A









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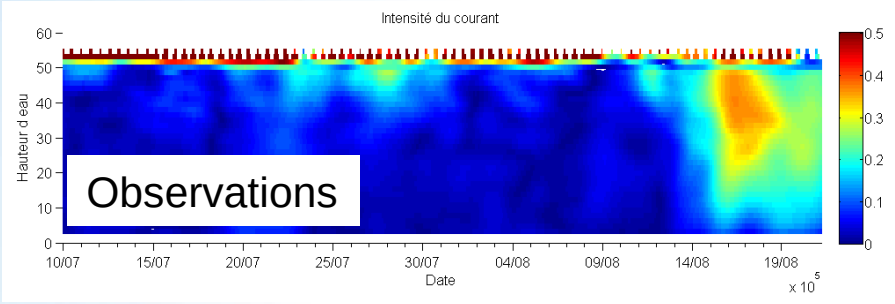
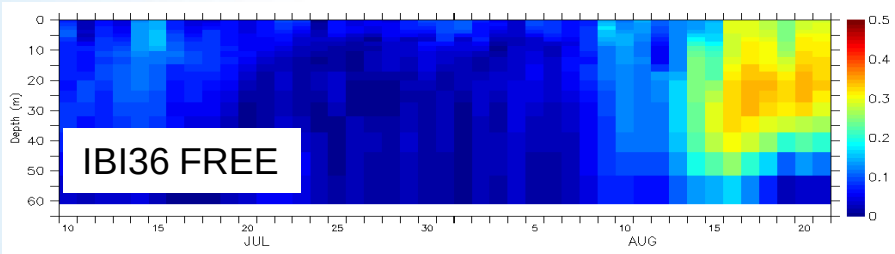
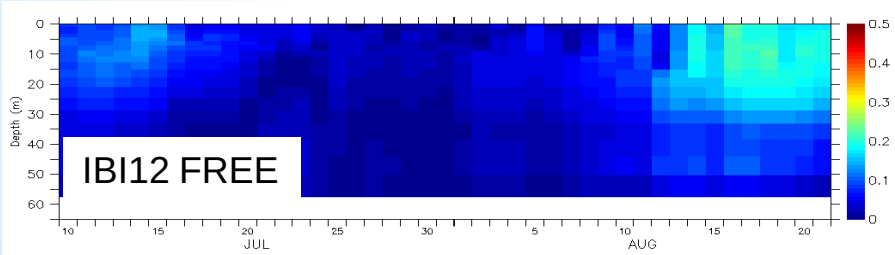
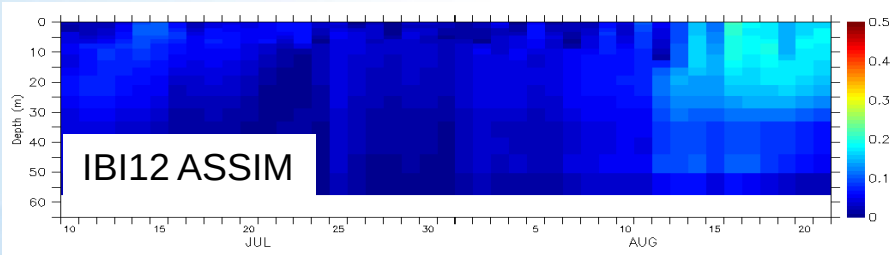
Plateau des Landes, august 2008 (P. Lazure)

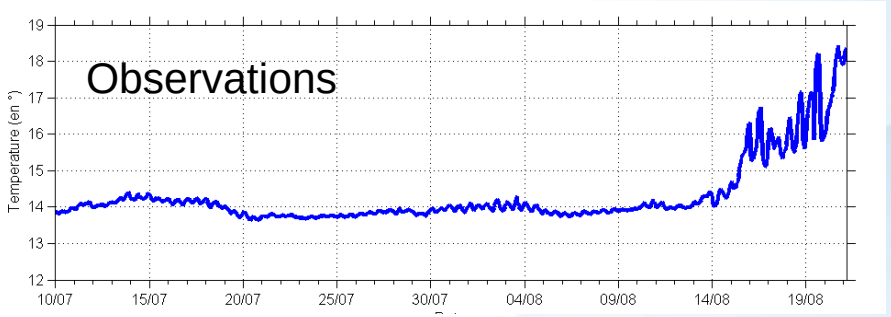


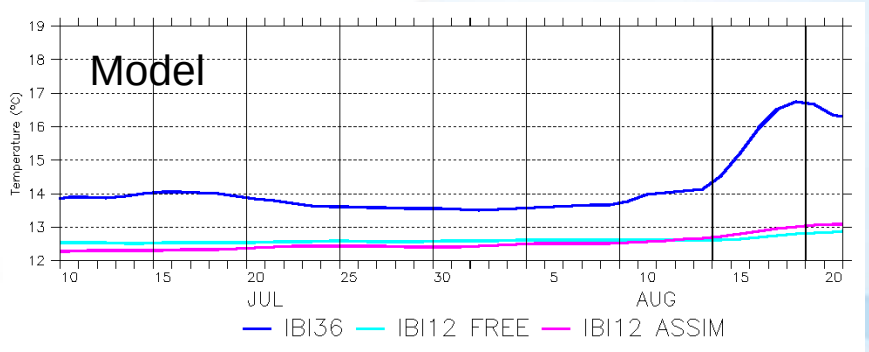




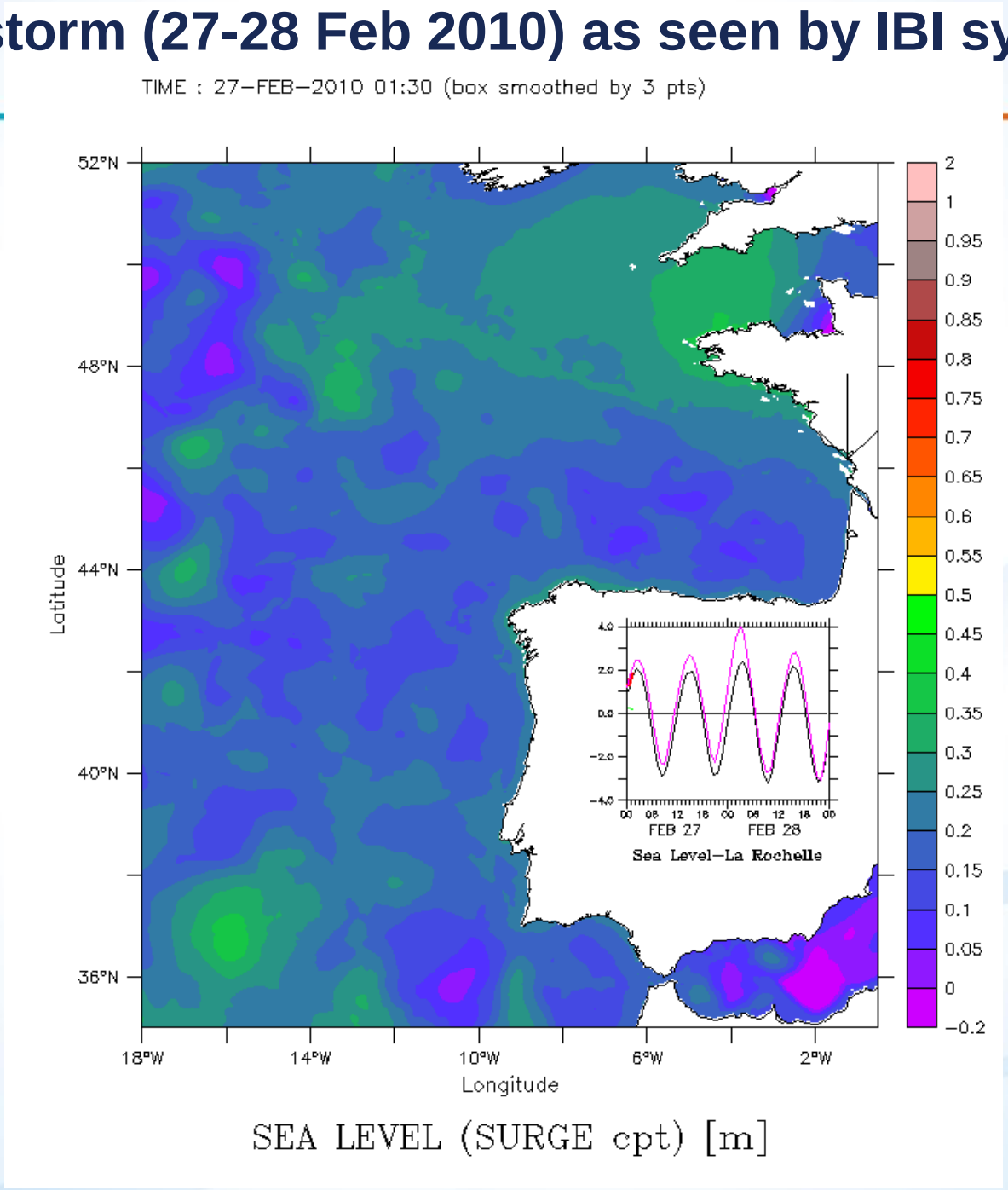


Bottom temperature





Xynthia storm (27-28 Feb 2010) as seen by IBI system



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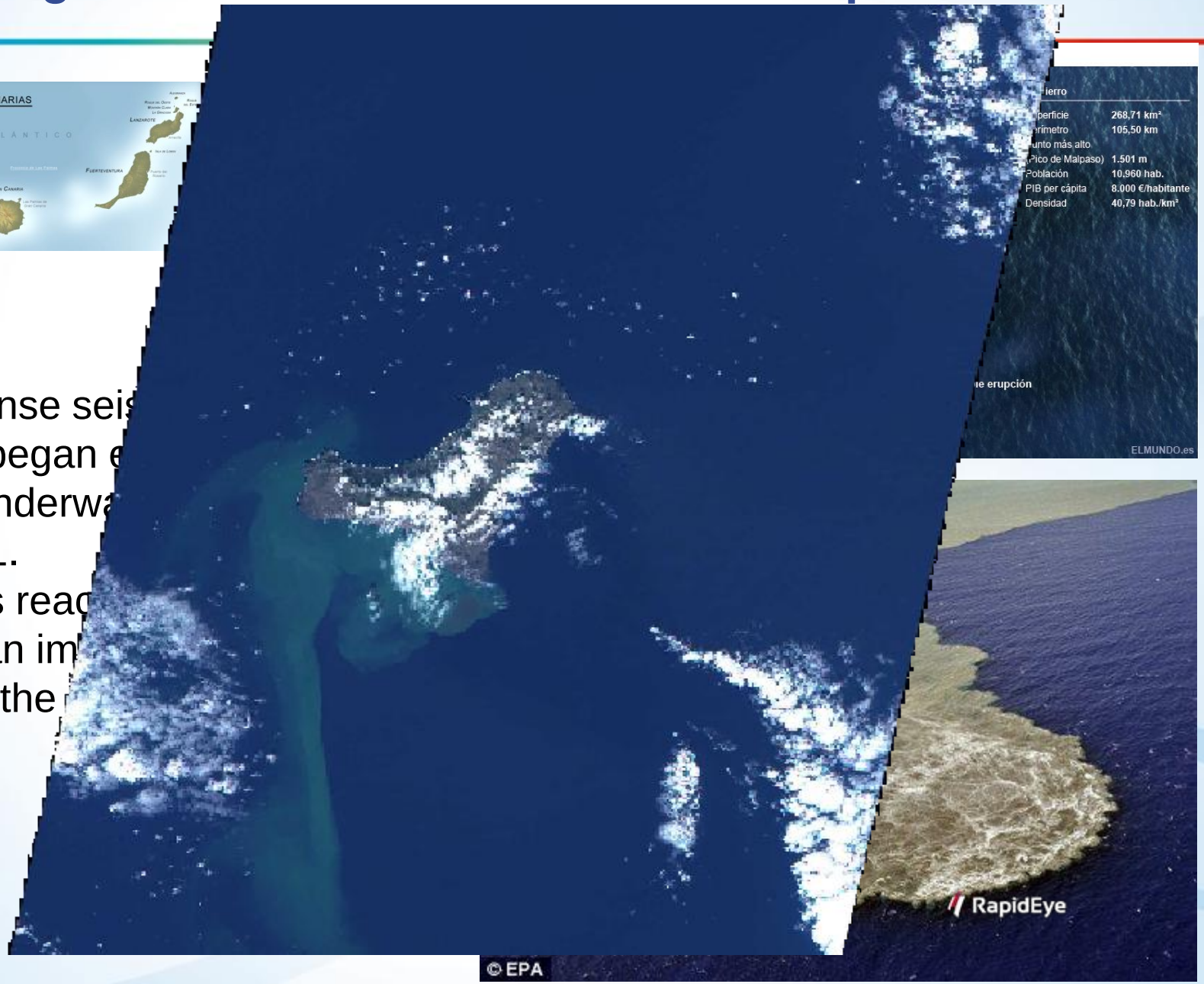
Monitoring El Hierro underwater volcano dispersal ?

- After intense seis
  volcano began e
  meters underwa
  11th 2011.
- Hot vents reac
  created an im
  plume at the



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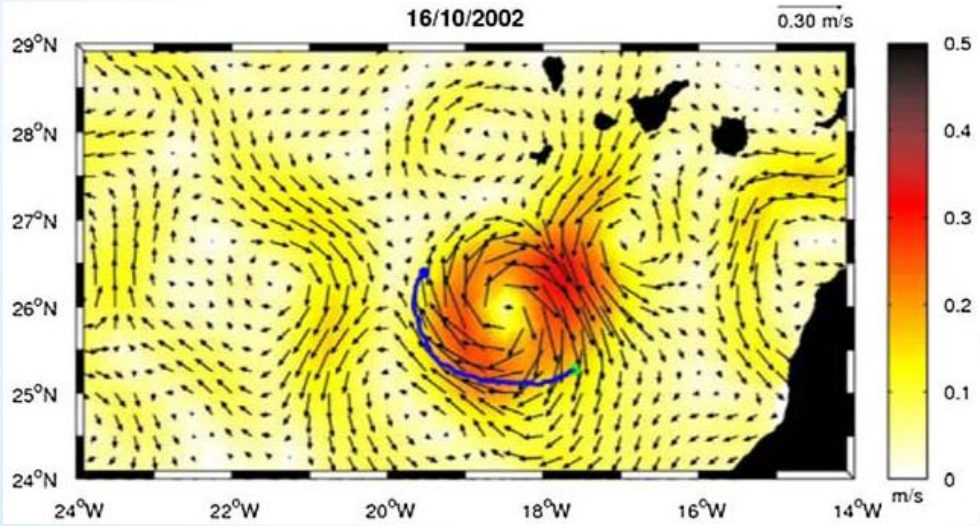
Monitoring El Hierro underwater volcano dispersal ?

A challenging situation:

- Currents largely impacted by the strong wind curl in the island lee due to orography.
- Proximity with « Canary eddy corridor ».
- Impact of local instability processes.



From Sangra et al, DSR II, 2009

Image courtesy of RapidEye

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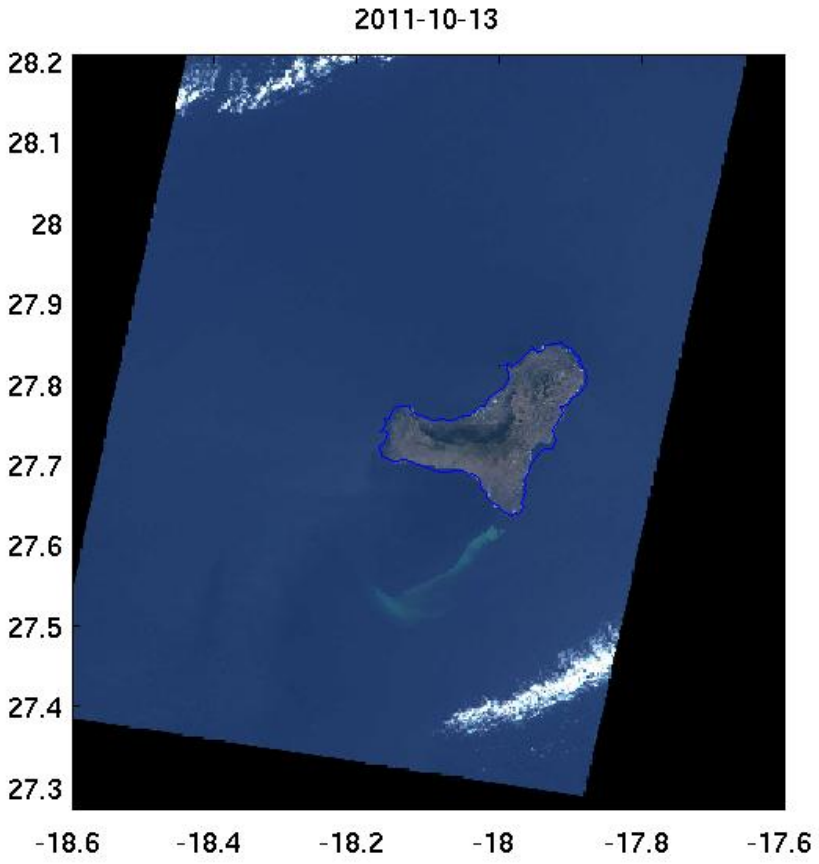
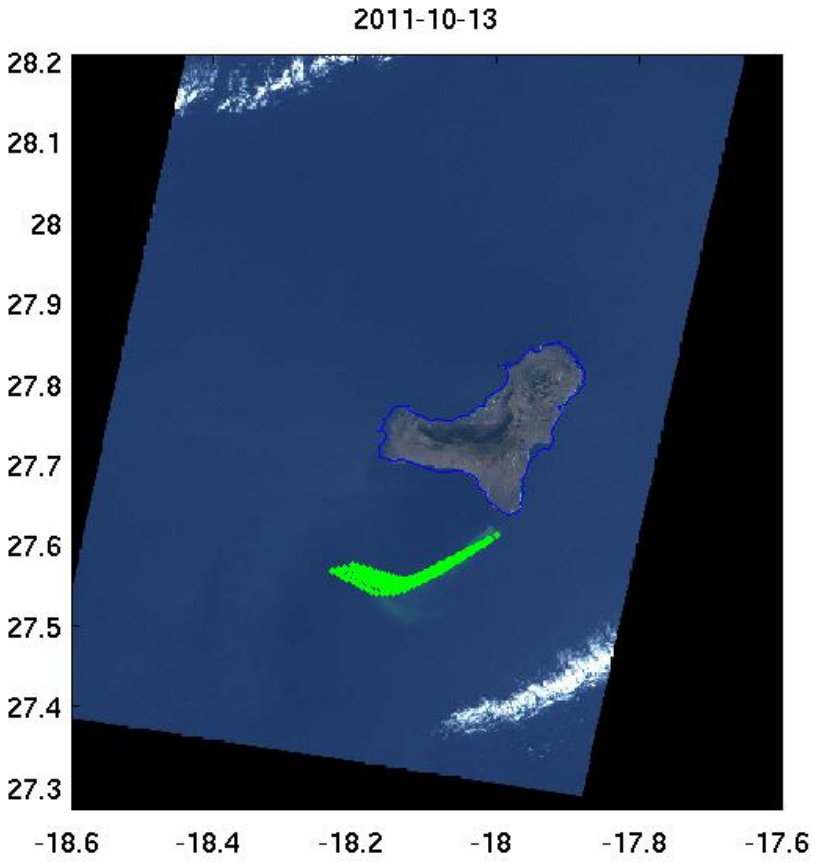
Monitoring El Hierro underwater volcano dispersal ?



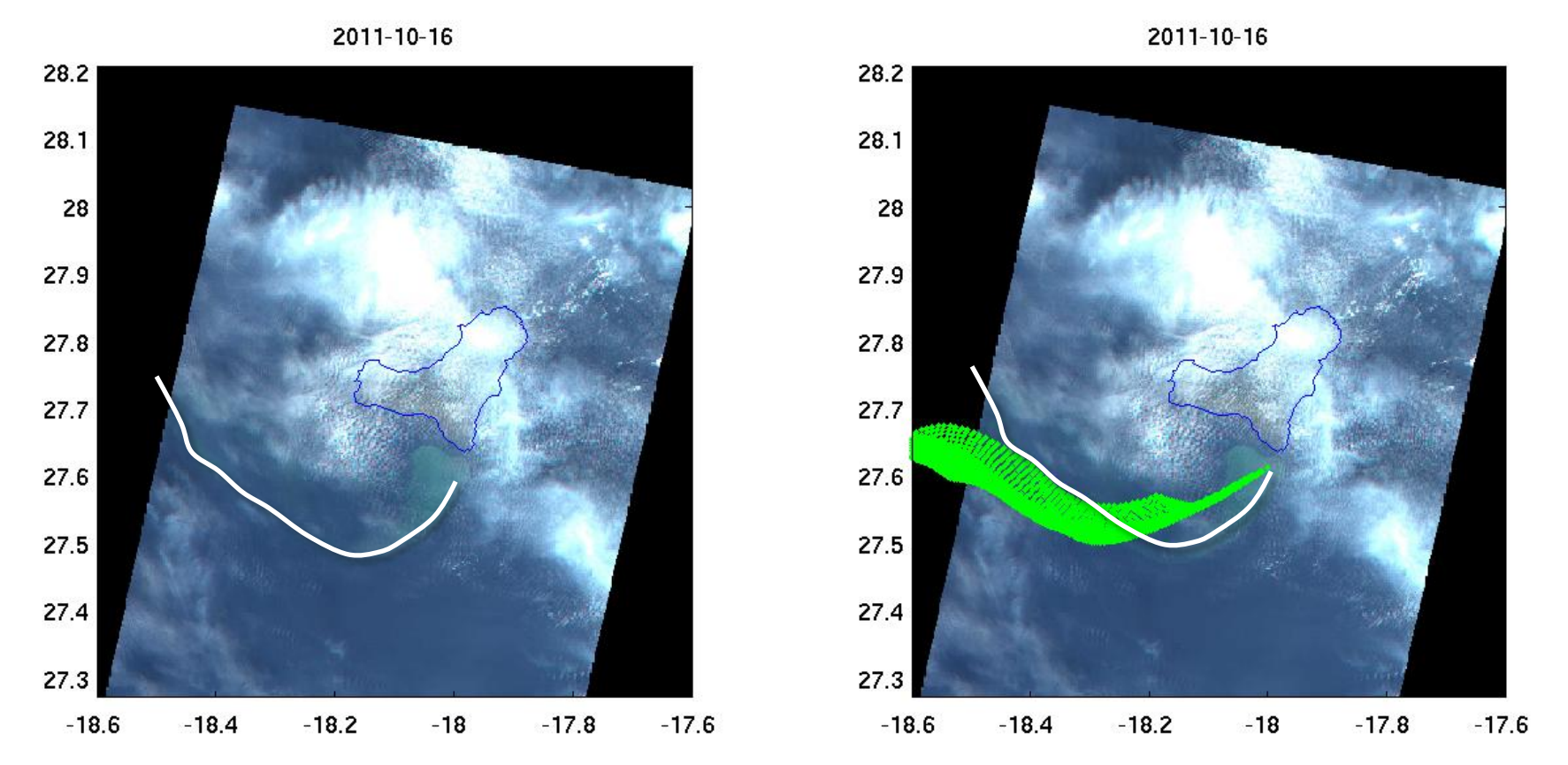


Continuous seeding of lagrangian particules from estimated date and location of eruption. Currents from IBI V2.

Results at T0+1 day

Image courtesy of RapidEye

Monitoring El Hierro underwater volcano dispersal ?



Continuous seeding of lagrangian particules from estimated date and location of eruption. Currents from IBI V2.

Results at T0+4 day

Image courtesy of RapidEye

Next developments (in collaboration with PdE)

- Nudging for spin-up

- Waves coupling: wave dependent wind drag, Coriolis-Stokes forcing, Langmuir mixing

- Assimilation

References :

- S. Cailleau et al. *Towards a Regional Forecasting System for the IBI (Ibera-Biscay-Ireland area): Developments and improvments within the ECOOP Project framework*. Ocean Sciences 2011.
- C. Maraldi et al. *NEMO on the shelf: assessment of the Iberia-Biscay-Ireland configuration*. Reviewed.

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