

Impact of Argo data and quality control in Mercator Ocean regional reanalysis systems

M. Benkiran⁽¹⁾, N.Ferry⁽²⁾, E. Greiner⁽¹⁾
V.Turpin⁽²⁾
and The Mercator Ocean team.



**Mercator
Ocean**

Ocean Forecasters

(1) CLS Space Oceanography Division 8-10 Rue Hermes 31526 Ramonville St Agne Cedex

(2) MERCATOR Ocean 8-10 Rue Hermes 31526 Ramonville St Agne Cedex

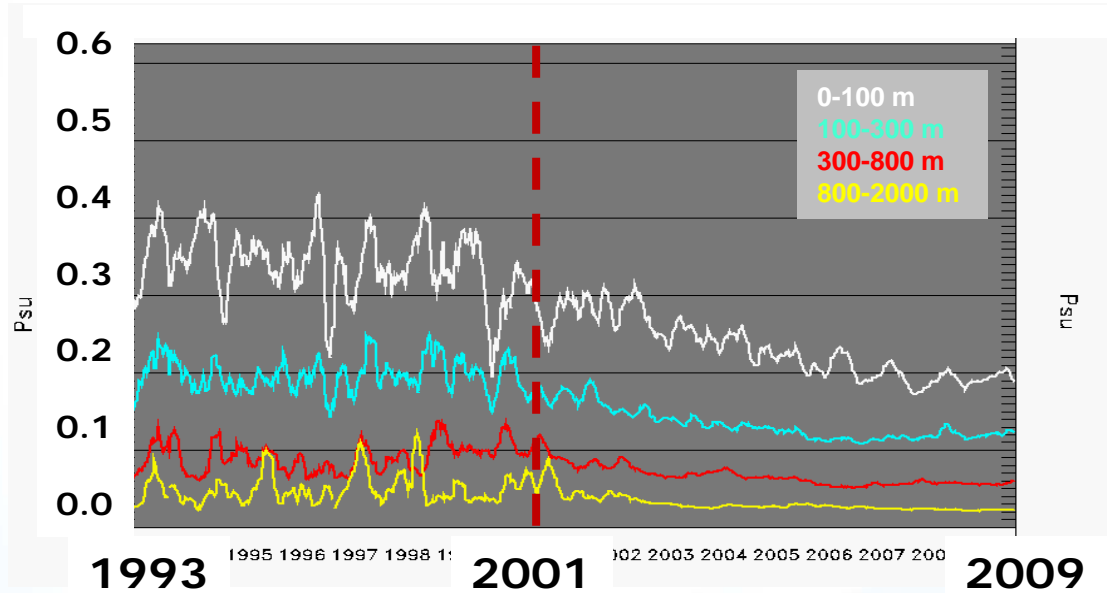
- Importance of in situ data networks (including ARGO) in Mercator Ocean systems.
- Quality Control (QC) on these data in the global and regional Mercator reanalysis systems.
- Impact of ARGO data assimilation in regional Mercator system (IBI12).
- Conclusions & Perspectives

GLORYS2 : reanalysis 1993-2009 (1)

Importance of in situ data networks (including ARGO) in Mercator Ocean systems.



RMS **Salinity** innovation (observation minus model forecast) for the GLORYS reanalysis (1993-2009) in different layers (0-100m, 100-300m, 300-800m, 800-2000m).



Argo network begins to be implemented and assimilated in 2000

Argo : decrease by 70% the salinity 7-day error forecast in the first 100m

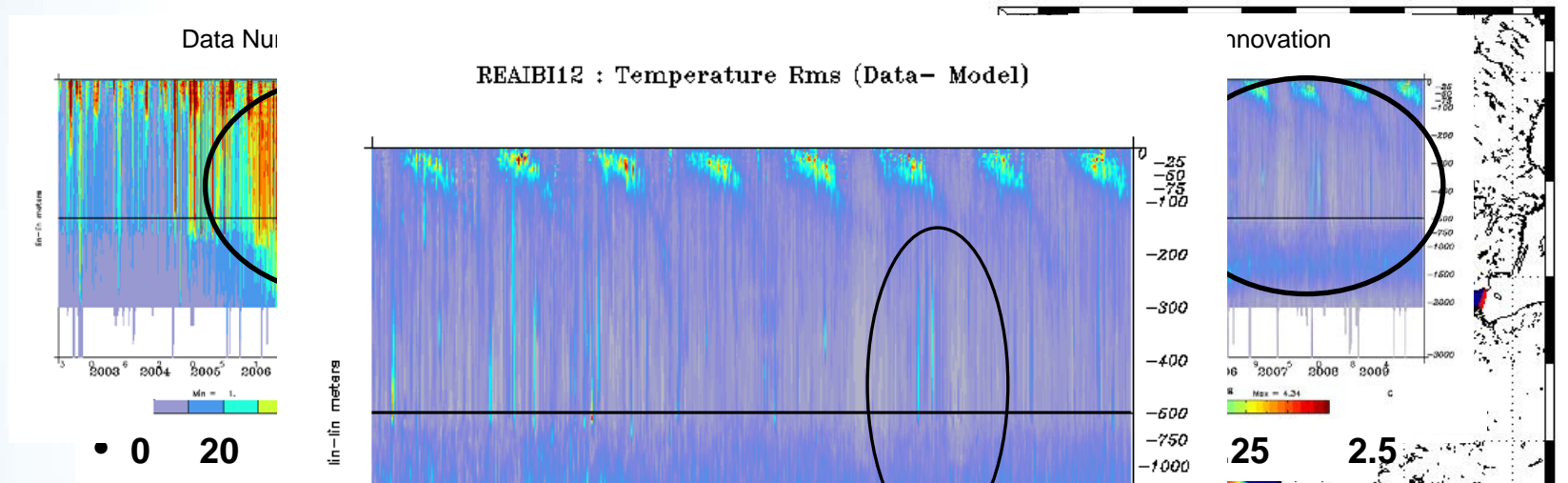
- Importance of in situ data networks (including ARGO) in Mercator Ocean systems.
- **Quality Control (QC) on these data in the global and regional Mercator reanalysis systems.**
- Impact of ARGO data assimilation in regional Mercator system (IBI12).
- Conclusions & Perspectives

IBI12 reanalysis 2002-2009

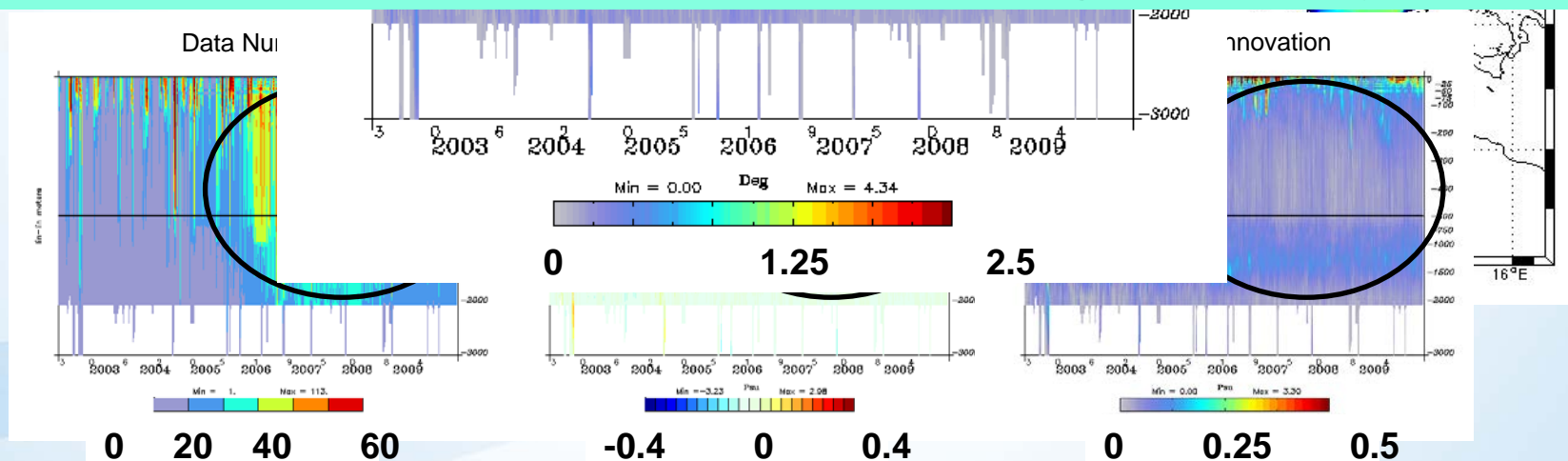
(IBI: Iberia, Biscay and Irish)

Innovation = Data - Model_{FCST}

Temperature



We need to check the data before assimilating into the systems.



Argo data Quality Control in the global and regional reanalysis systems.

The goal is: **not assimilate potential “bad” observations** in the system.

For that, a Quality Control has been carried out on the T/S vertical profiles.

This QC is in addition to the QC procedures performed by the data producers.

Two methods

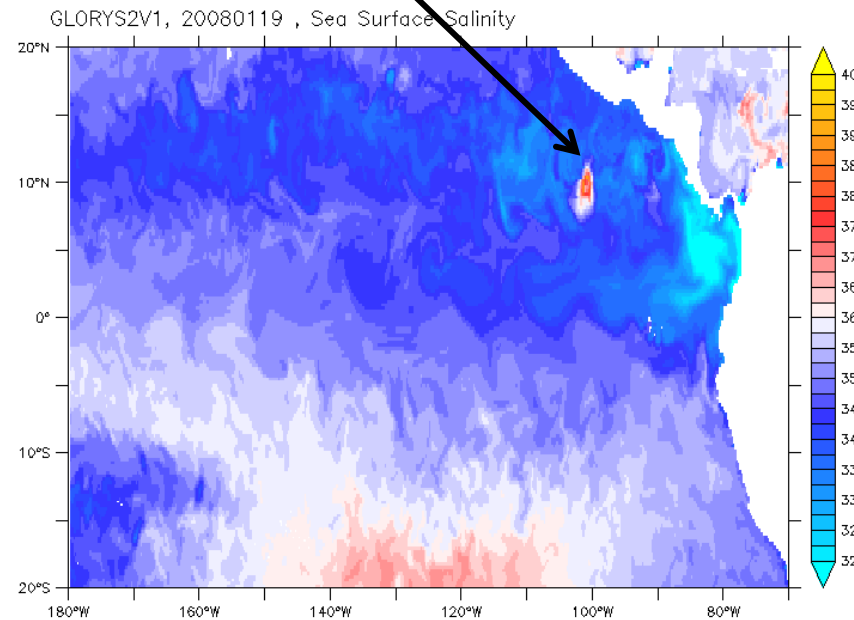
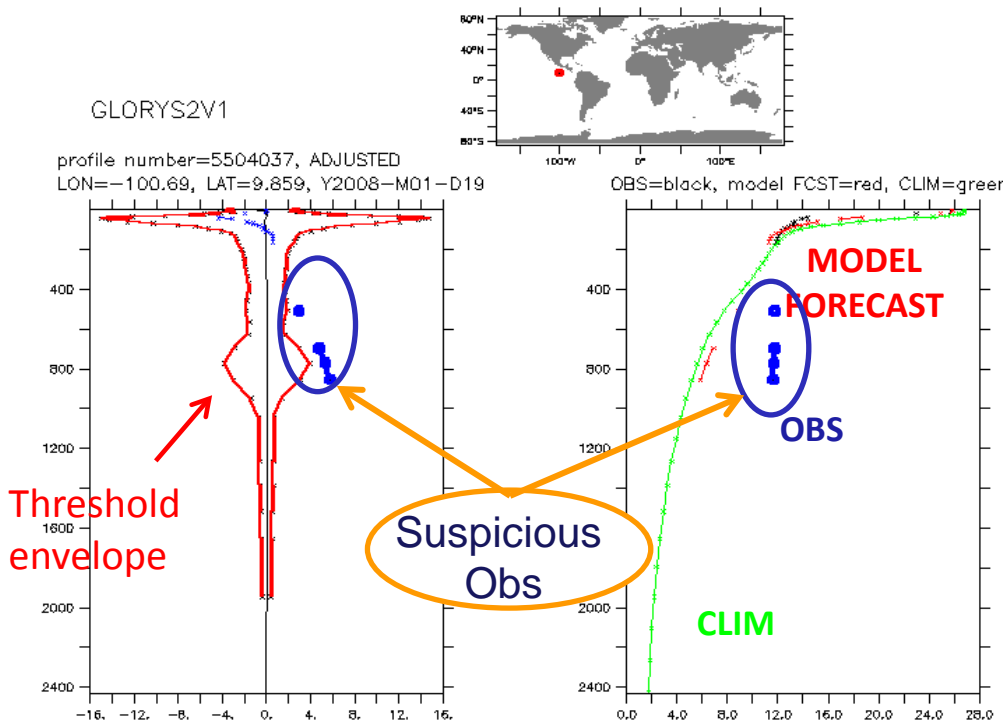
Method 1 : Based on T & S innovation statistics
→ detection of spikes, large biases

Method 2 : Based on dynamic height innovation statistics
→ detection of small vertically constant biases

Method1

Local and seasonal Threshold from GLORYS T /S innovations

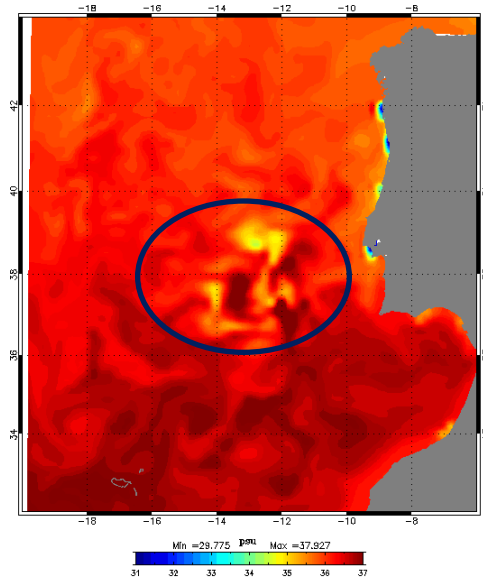
Bad SSS value due to multivariate
assimilation method



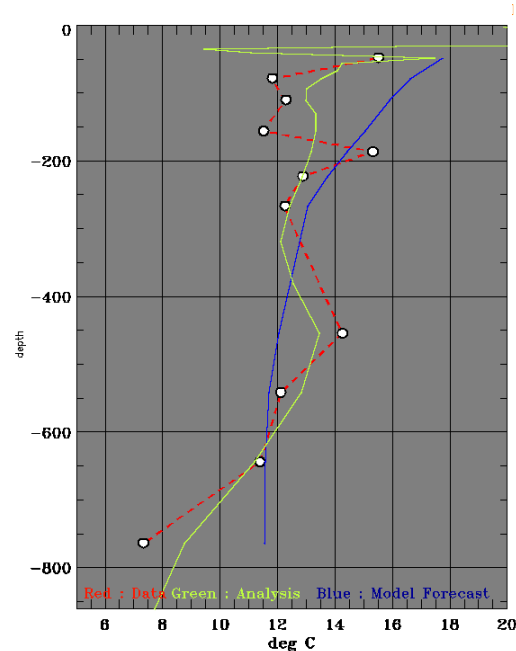
➔ This temperature profile is rejected by this QC

Method2 : Regional system (1)

Sea Surface Salinity 23/07/08



Temperature : 12.42°W, 37.5°N 23/07/08



Suspicious T profile

**Analysed SSS :
Impact of a wrong profile**

Data Analysis Forecast

Method2 : Regional system (3)

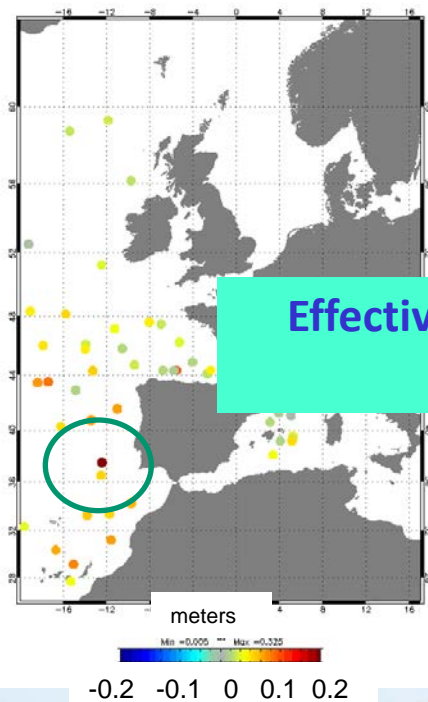
QC based on dynamic height computation from T and S innovations:

QC criterion:

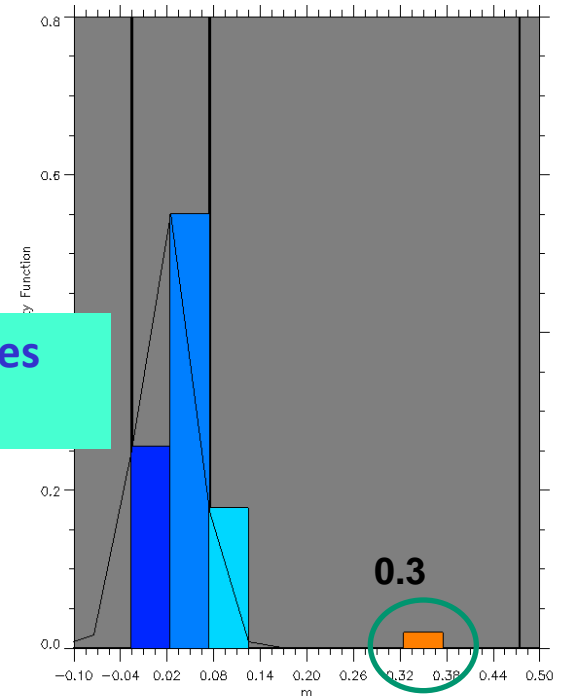
for temperature: $|H_{dyn}(\delta T)/h| > 0.3$

for salinity: $|H_{dyn}(\delta S)/h| > 0.3$

$H_{dyn}(\delta T)$ for 23/07/08

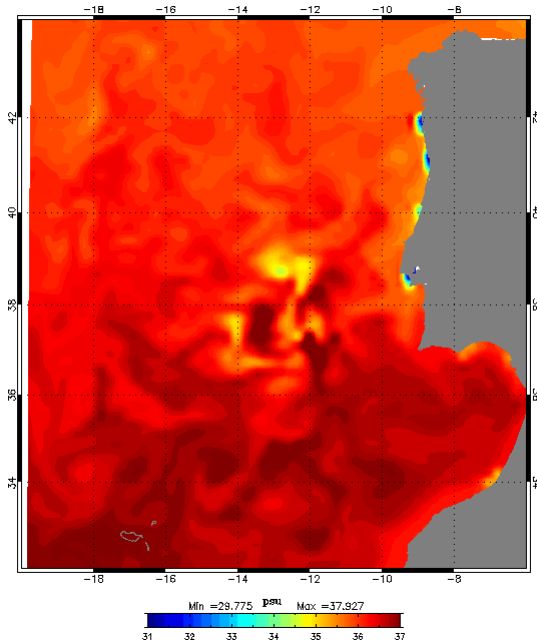


PDF of $H_{dyn}(\delta T)$ for 23/07/08



Method2 : Regional system (3)

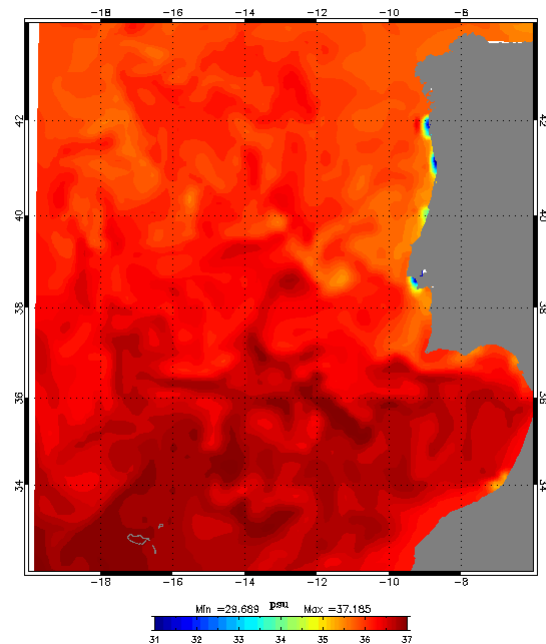
Sea Surface Salinity 23/07/08



QC



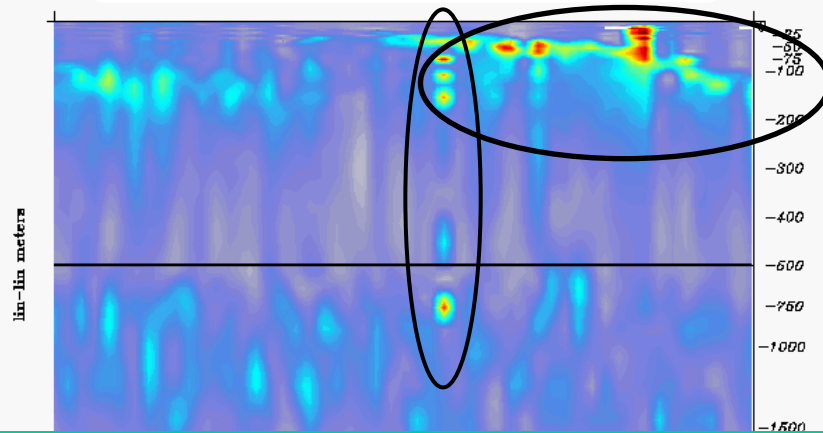
Sea Surface Salinity 23/07/08



Method2 : Regional system (4)

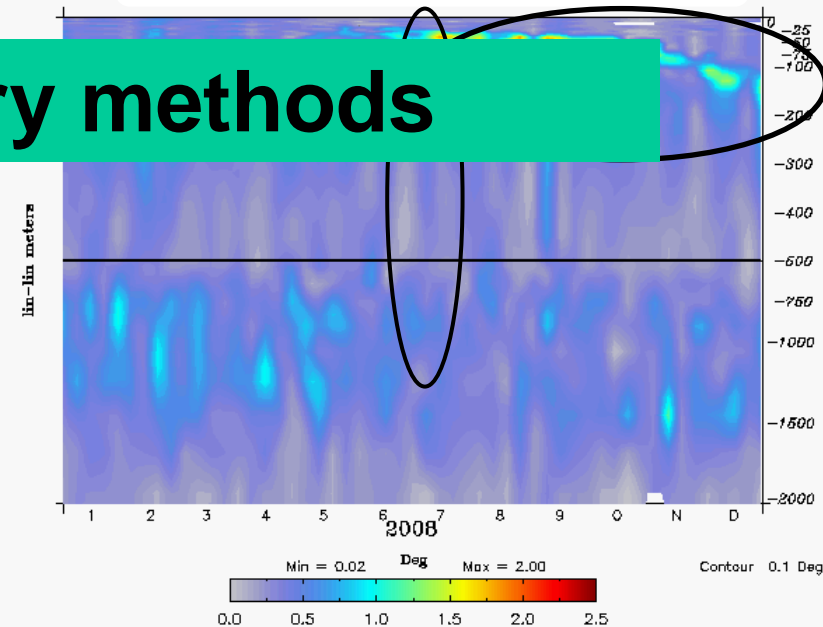
Impact of QC on assimilation scores in the Açores area

No QC



2 complementary methods

With QC



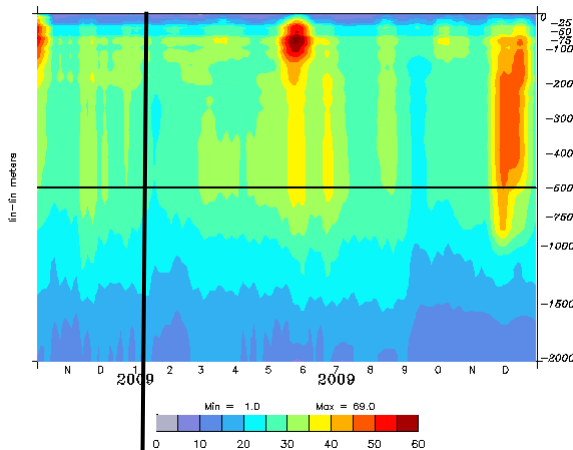
**Rms Innovation in
Temperature (2008)**

- Added value of in situ data networks (including ARGO) in Mercator Ocean systems.
- Quality Control (QC) on these data in the global and regional Mercator reanalysis systems.
- **Impact of ARGO data assimilation in regional Mercator system (IBI12).**
- Conclusions & Perspectives

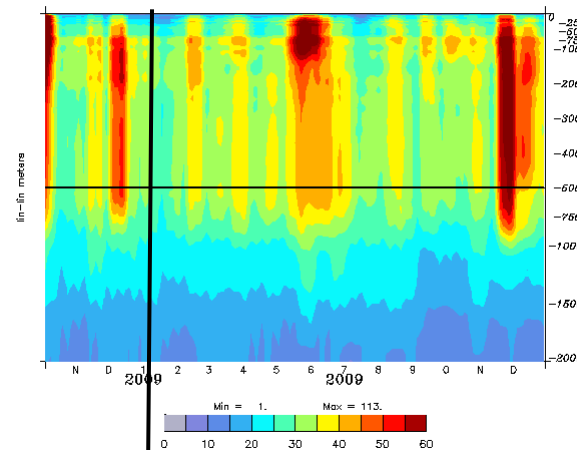
Impact Of Argo Data in regional model

Data Number (01/10/2008-31/12/2009)

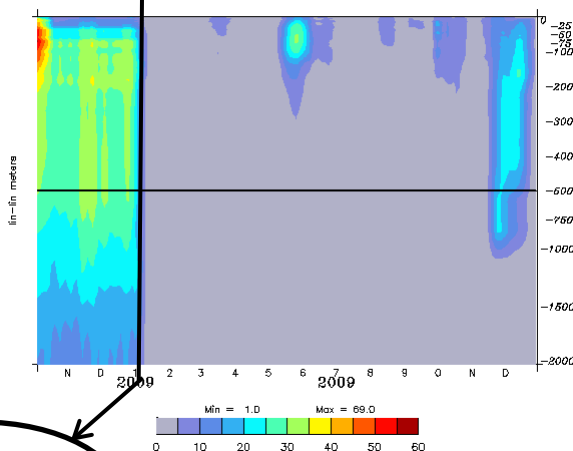
Data Number : Salinity



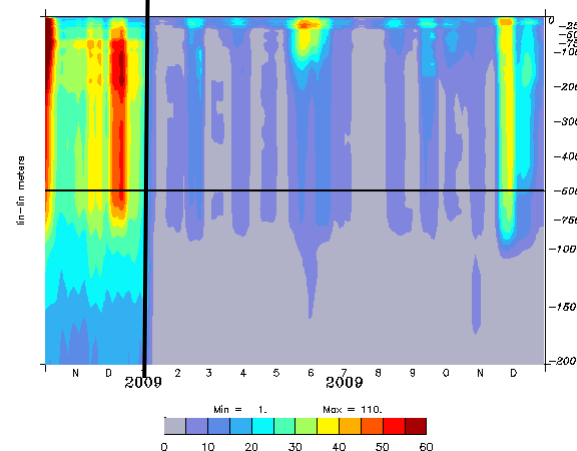
Data Number : Temperature



Data Number : Salinity



Data Number : Temperature



Reference :
First simulation
with all data

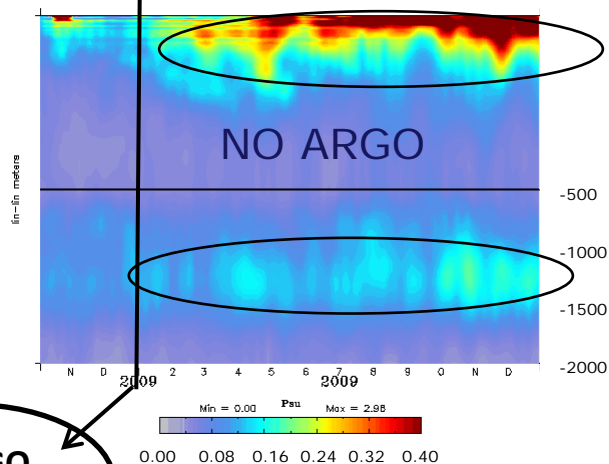
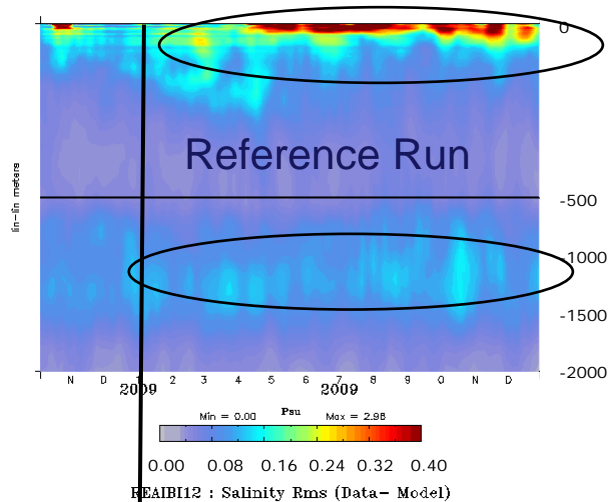
Second simulation
NO ARGO data

No ARGO
assimilation

Impact Of Argo Data in regional model

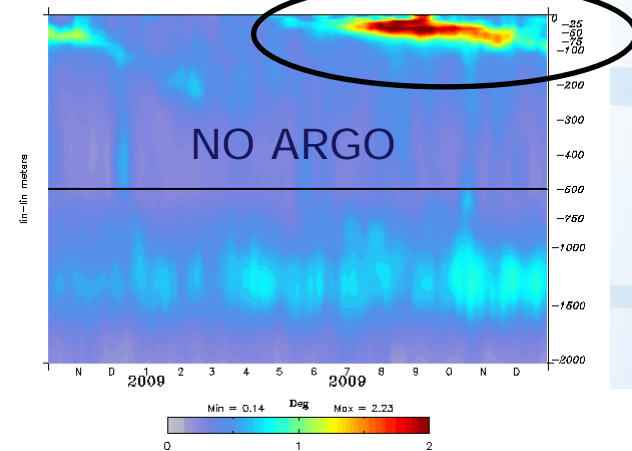
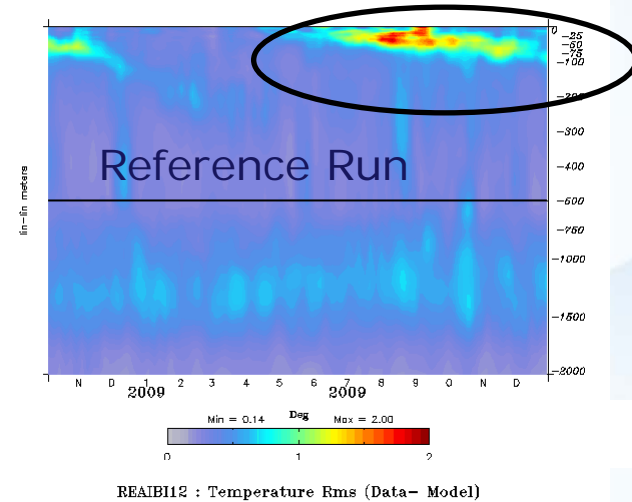
Statistics are made relative to the same data

Salinity Rms (Data – Model)



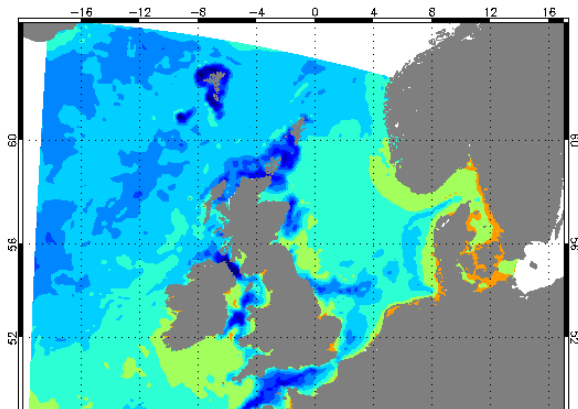
No ARGO
Assimilation

Temperature Rms (Data – Model)

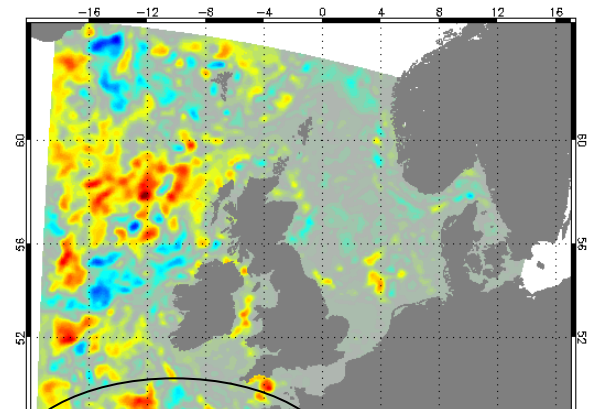


Impact of Argo Data on Depth of the Mixed Layer 09/2009

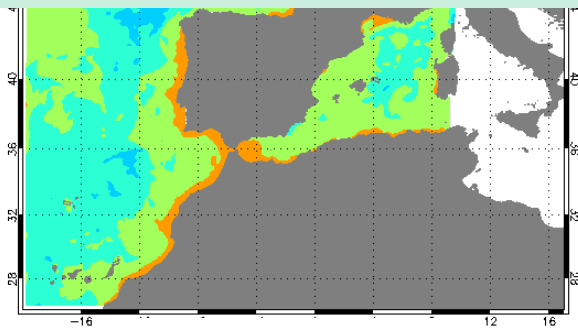
Mixed Layer Ref Run



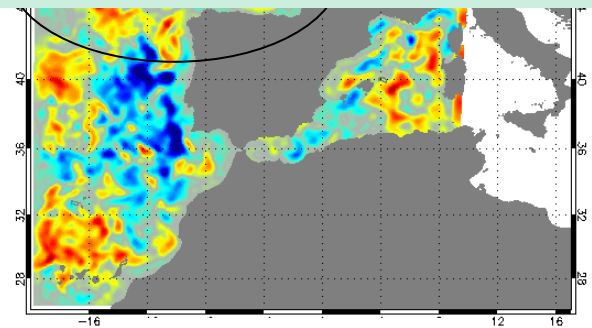
(Ref Run – NO ARGO) Mixed Layer



→ Impact on the biogeo-chemical primary production.



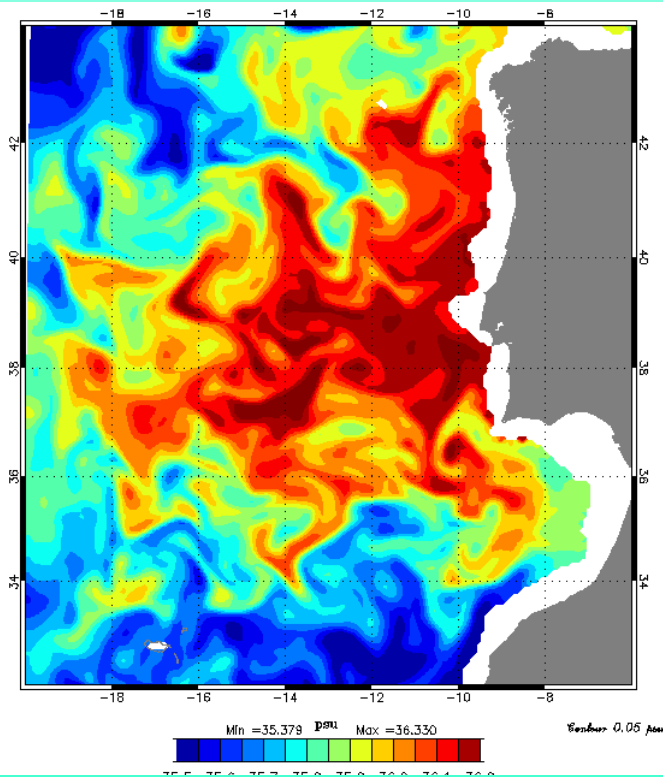
meters
0 20 40 60 80 100



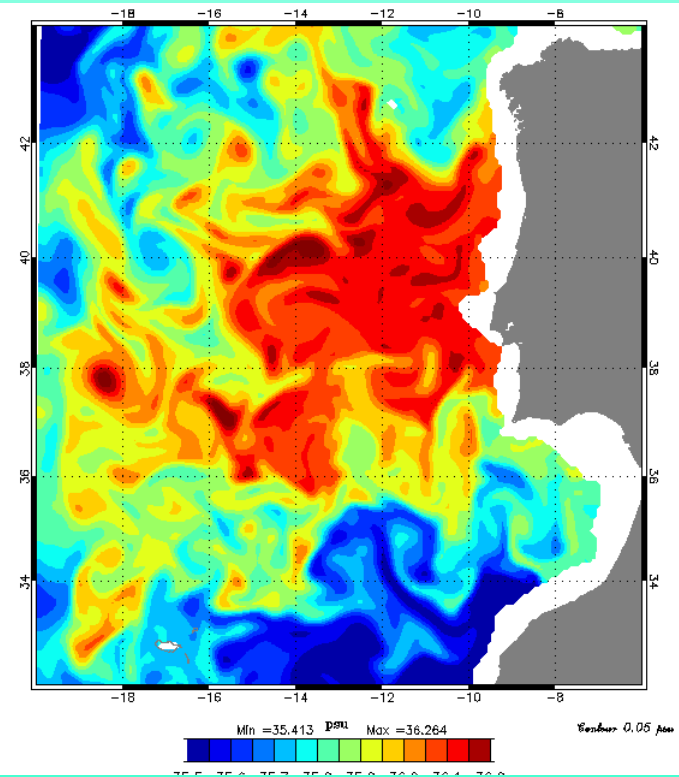
meters
-10 -5 0 5 10

Impact of Argo Data on MW: Salinity at 1000m for 13/09/2009

Salinity 13/09/2009 at 1000m **Reference Run**



Salinity 13/09/2009 at 1000m **Run Without ARGO**

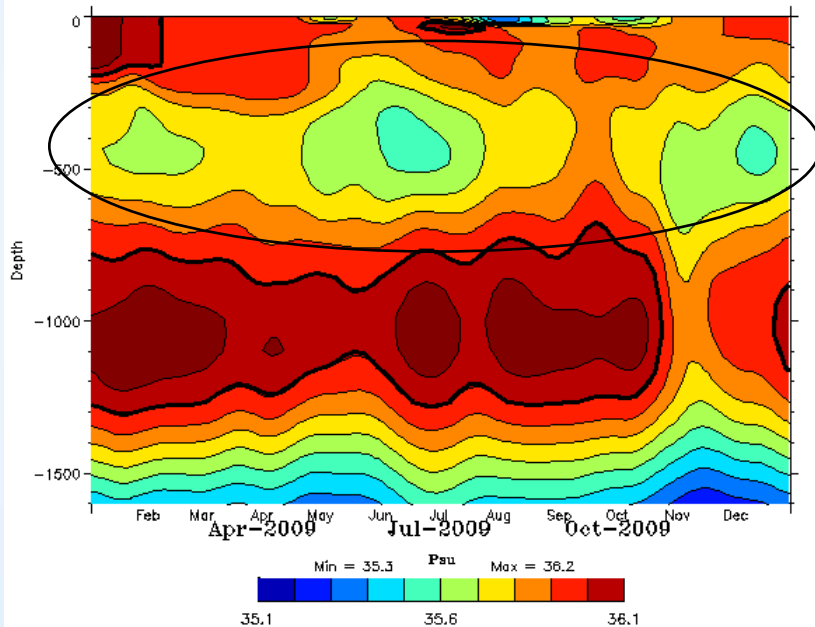


➔ **WITHOUT ARGO :**

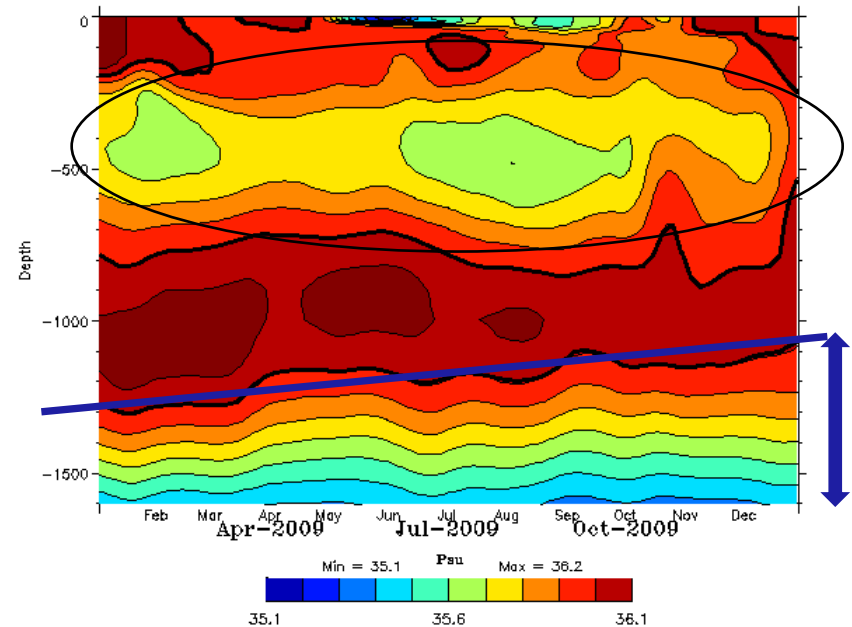
Mediterranean & Intermediate Atlantic Water are lost

Impact of Argo Data on MW: Salinity (mooring) at 11°W 40°N

Mooring Salinity at 11°W 40°N (**Reference Run**)



Mooring Salinity at 11°W 40°N (**Run Without ARGO**)



- Mediterranean and Intermediate Atlantic Water masses lose their characteristics in terms of amplitude and depth
- The Water vein becomes thinner and saltier.
- MW becomes fresher and shallower.

Conclusions & Perspectives

- **Argo observations are a key component of the present ocean observing system:**
 - Depth of Mixed Layer : The biogeo-chemical primary production.
 - Control the deep water masses
 - Thermocline, Stratification....
- **Effective QC can be done on in situ data**
Different methods exist:

Based on T & S innovation statistics: (method 1)
→ detection of spikes, large biases
Based on Hdyn innovation statistics: (method 2)
→ detection a small vertically constant biases
- **QC methods 1 is already implemented in the operational systems**