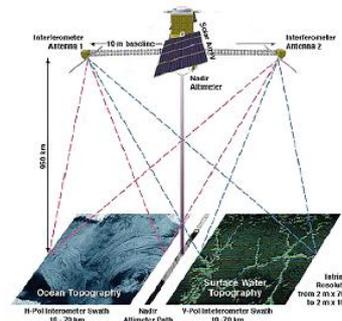


# Mercator Ocean status on OSE and OSSEs activities

- To measure the impact of the **current observation network**:
  - show the importance of maintaining / expanding the existing obs. network
  - make better use of the existing one (tuning of the system)
- To help **designing the future networks**, test future data sets (SWOT, SMOS) and new post-treatments (TAPAS “high res.” SLA data set), **improve the existing ones** (ARGO).

Specific **diagnostics** are currently developed (DFS, lagrangian diags,...).

We plan to use of the NEMO adjoint for sensitivity studies.



*Future SWOT mission*  
<http://smc.cnes.fr/SWOT/>

# Delayed Time OSE at Mercator Ocean in 2012

OSEs carried out in 2012:

- Impact of Envisat, Jason 1 and Jason2 on analyses
- The ARGO network (M. Benkiran, presented at 20YAlti symposium)

**Impact on Mercator analyses of the following altimetric satellite constellations:**

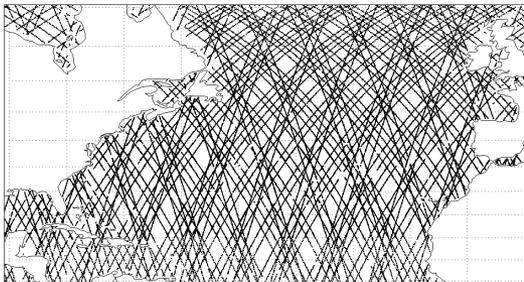
**EXP1: Envisat + Jason1 + Jason2**

**EXP2: ~~Envisat~~ + Jason1 + Jason2**

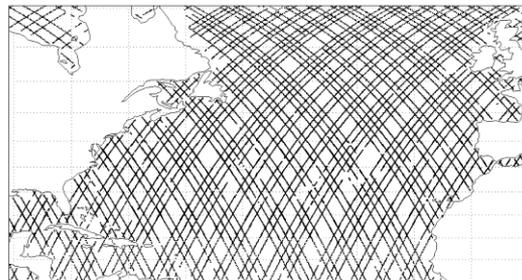
**EXP3: ~~Envisat + Jason1~~ + Jason2**

*Experimental setup:*

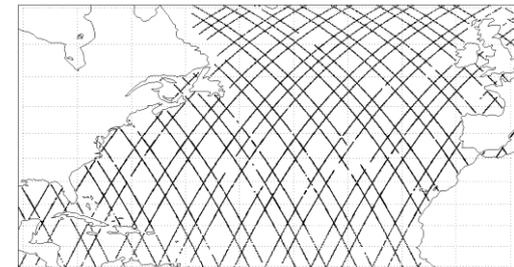
- one month experiment in August-September 2010
- use of the global system PSY3, at  $\frac{1}{4}^\circ$  spatial resolution
- SLA instrumental error set to: **3,5** cm for Envisat and **2** cm for J1 and J2.
- non assimilated data kept as verification data



Exp0: En+J1+J2



Exp1: J1+J2

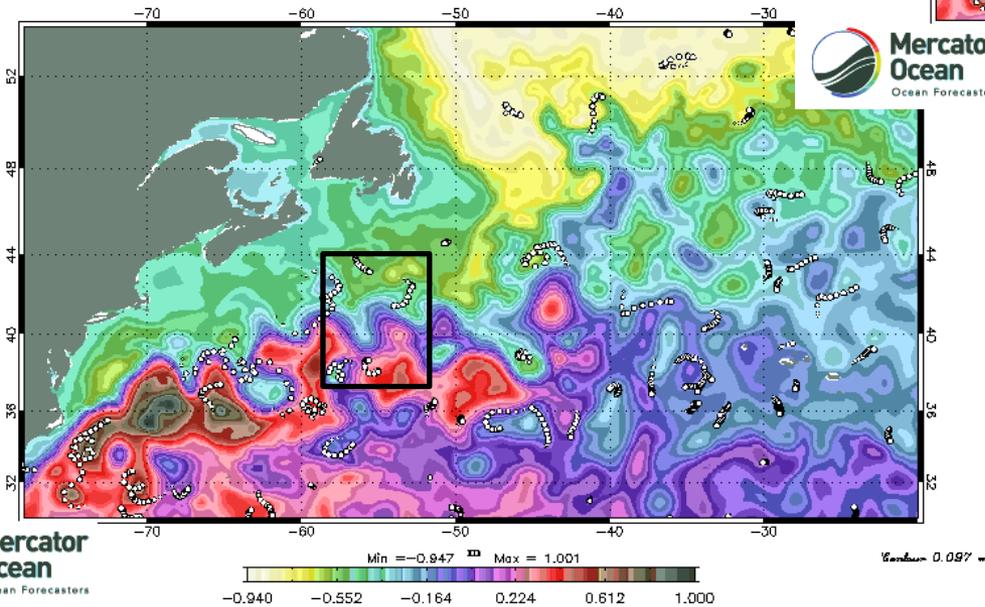
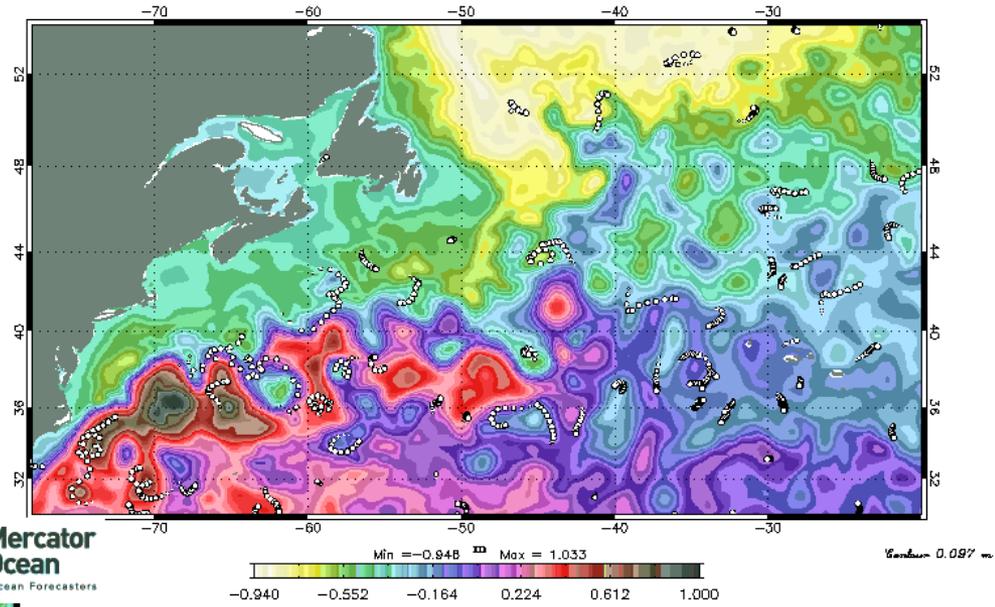


Exp2: J2

# Estimation of the SSH field in the Gulf Stream region (01/09/2010)

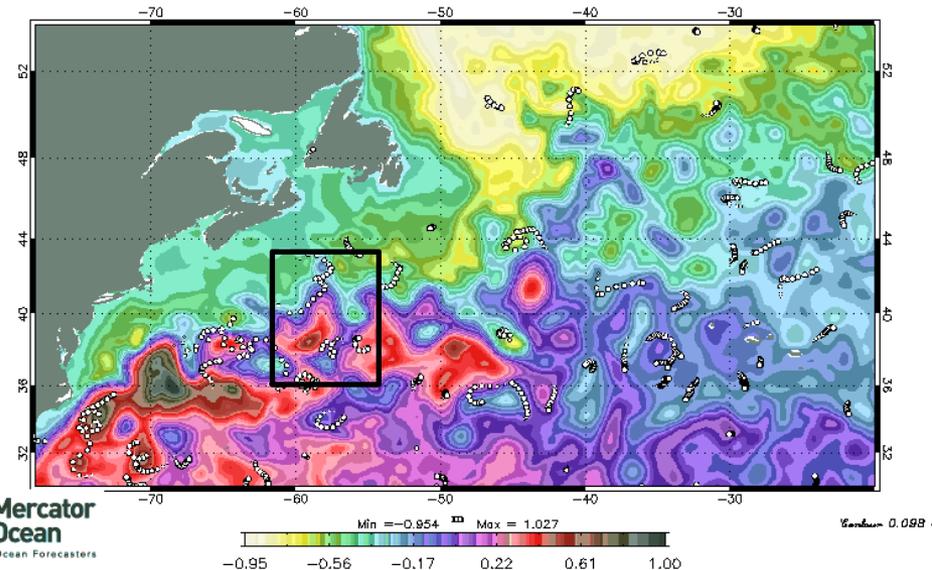
**En+J1+J2**

Drifters trajectories are superimposed in white dots.

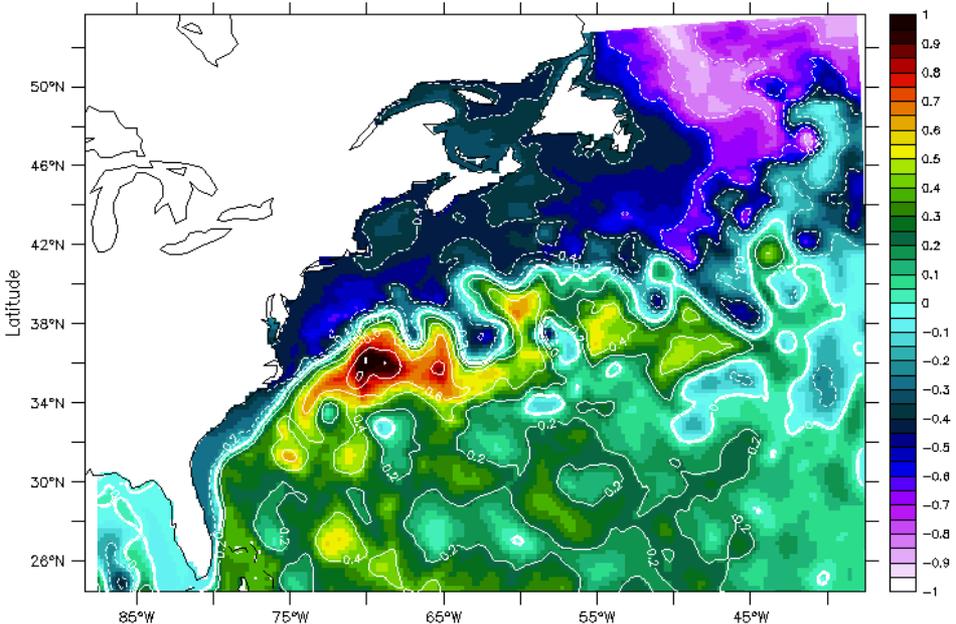


**J1+J2**

**J2**

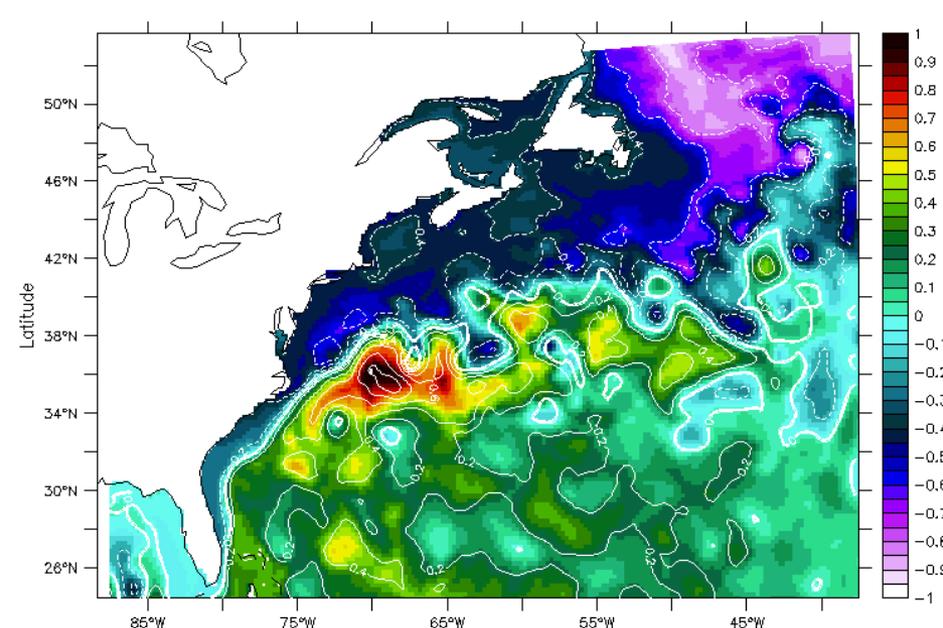


# Estimation of the SSH field in the Gulf Stream region (01/09/2010)



Color:  $E_n + J_1 + J_2$

White:  $J_1 + J_2$

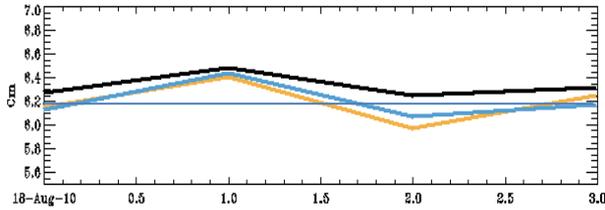


Color:  $E_n + J_1 + J_2$

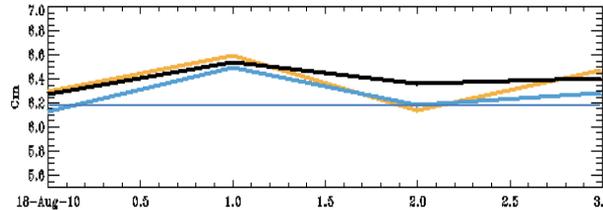
White:  $J_1$

# OSE - Envisat loss: SLA misfit statistics in August 2010

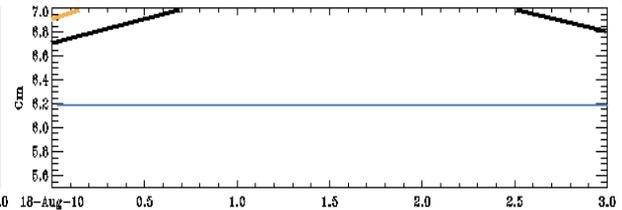
RMS Misfit



En + J1 + J2



En + J1 + J2



En + J1 + J2

**RMS misfit to observations: --- Envisat in yellow, --- Jason2 in black, --- Jason1 in blue.**

What we have learnt:

- The Envisat impact on analysis is smaller than Jason1 or Jason2 mainly due to instrument error level.
- J1 and J2 still offered a good level of constraint for the  $\frac{1}{4}^\circ$  global system, the loss of Envisat is only visible in regions of strong eddy activity,
- When only one satellite remains, the system is not able anymore to stand the lack of SLA information: the quality of the analyses quickly deteriorates (in situ data also).

More specific/regional diagnostics are required to better understand the impact of an additional satellite on analysis and forecast :

integrated diags, error spectra, eddies and filaments reconstruction...

# Other diagnostics, cheaper than OSEs

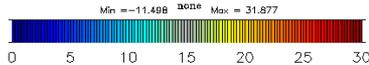
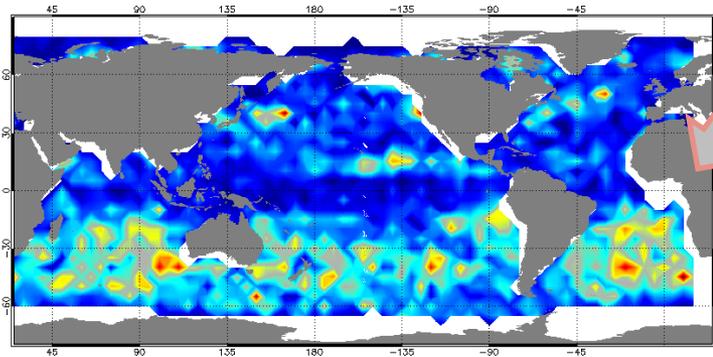
- Degree of Freedom

In agreement with UKMet OSE (D. Lea OSE rep., cf fig 6.3 ) and with adjoint sensitivity studies of forecast error (E. Rémy)

$$IC = 100 \times \frac{DFS}{NbObs} \text{ (Girard)}$$

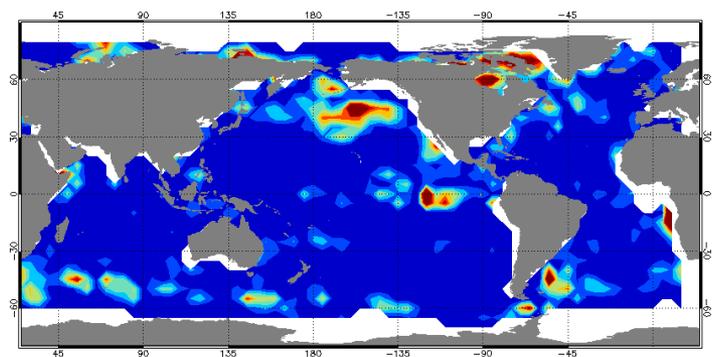
$$\frac{\partial(H(x_a))}{\partial y_{obs}}, IC = 100 \times \frac{DFS}{NbObs}$$

$$DFS/NbObs \text{ (Lupu)}$$



?

≠



DFS for an SST analysis in *August* 2010:

- Using a simulation where all the observations are perturbed:

$$DFS_{Girard} = (y_{obs}^* - y_{obs})^T R^{-1} (H(x_a^*) - H(x_a))$$

- Without any additional simulation:

$$DFS_{Lupu} = E[(H(x_a) - H(x_b))^T R^{-1} (y_{obs} - H(x_a))]$$

We need to understand the differences and/or possible miscomputation (R is approx.)

(Lupu et al, 2011: Evaluation of the Impact of observations on analysis in 3D and 4D-var Based on Information content, vol. 139, MWR)

# NRT OSE activity: Work plan (E. Rémy)

## Technical choices:

- Operational global  $\frac{1}{4}^\circ$  system (PSY3V3R1) is “doubled”
- Both reference run + run with obs. withheld are run in parallel and DT
- Do we need to turn off the T,S bias correction computed on longer time windows (3 months) when in situ data are withheld?

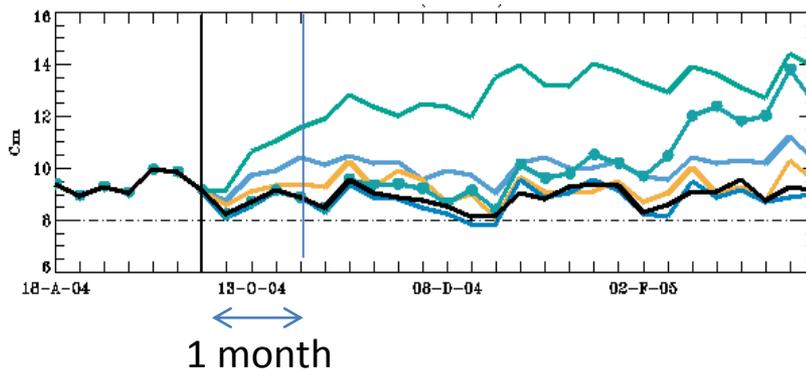
## Calendar:

- Currently set up of the parallel system,
- First OSE planned in December 2012 / January 2013.

If an intercomparison is planned:

- Do we plan common diags ? How ? What ? ... “Class4” diagnostics are welcome. No one is producing the RMS/Mean misfit statistics in the same way, integrated diagnostics : transports, HC300...
- 1 month simulation gives a rough estimate of the tendency

*RMS misfit, global ocean.*



*Green line: No altimetry,  
Light blue line: Jason 1,  
Orange line: Jason 1 + Envisat,  
Black line: Jason 1 + Envisat + GFO,  
Blue line: Jason 1 + Envisat + GFO + T/P,  
Green dotted line: Progressive loss  
(Benkiran, 2005, internal report).*