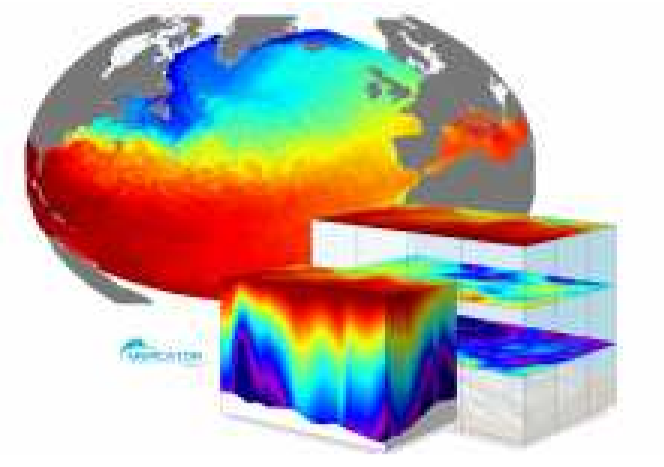


GLORYS - GLObal Ocean Reanalyses and Simulations project:

How lessons learnt from GODAE are used for global ocean reanalyses



N. Ferry¹, B. Barnier^{2,6}, L. Parent¹, S. Belamari³, M. Drevillon¹, Y. Drillet¹, G. Garric¹, H. Giordani³, E. Greiner¹, F. Hernandez¹, T. Penduff^{2,6}, G. Reverdin⁴, C.-E. Testut¹, A.-M. Tréguier^{5,6}.

¹ Mercator-Ocean, Ramonville St Agne, France, ² MEOM LEGI, Grenoble, France, ³ CNRM Météo France, Toulouse, France, ⁴ LOCEAN, Paris, France, ⁵ LPO, Plouzané, France, ⁶ DRAKKAR consortium. Contact: nferry@mercator-ocean.fr, barnier@hmg.inpg.fr

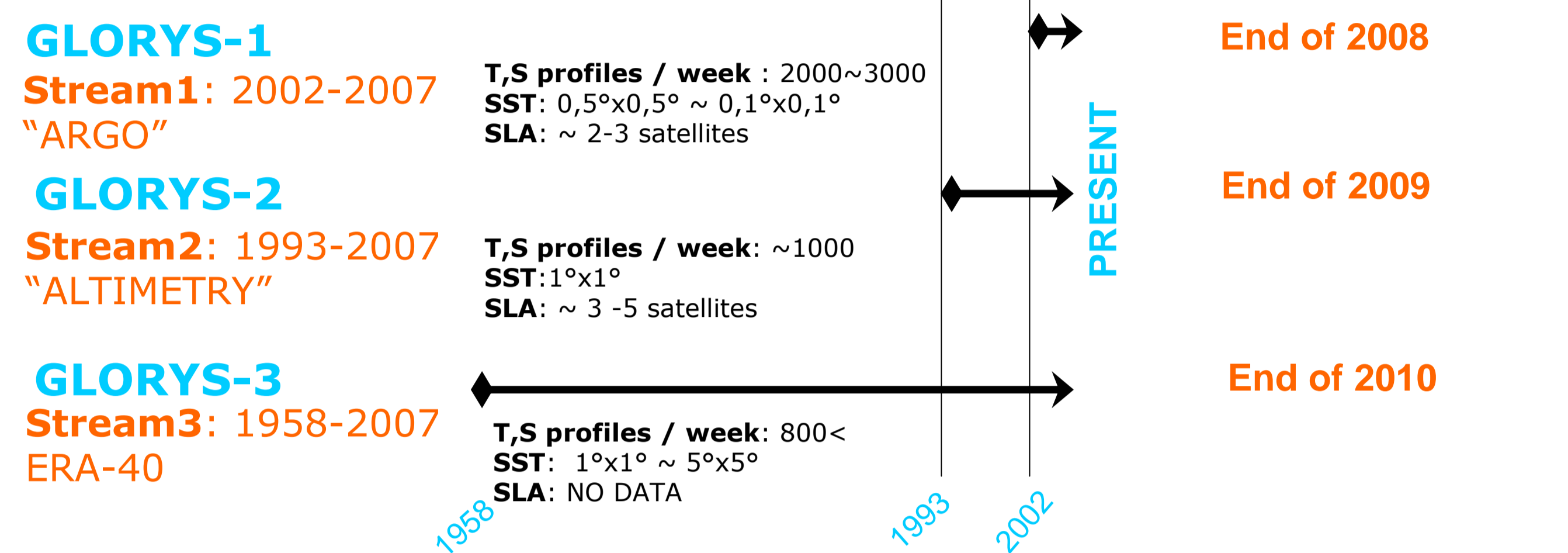
Introduction

We present here a French initiative for **GLobal Ocean Reanalyses and Simulations (GLORYS)** which aims at producing a set of simulations (constrained and unconstrained by assimilation of observations) describing at eddy-permitting resolution or better the space-time evolution of the ocean state and air-sea fluxes. This project is motivated by the needs expressed by the oceanographic and climate science communities for improved data bases and reference data sets describing the time-varying state of the ocean over the past several decades.

The main objective of the project, which we intend to achieve over the next 3 years (2008-2010), is to carry out global ocean reanalyses over different periods between the 1960s and the present, using the 1/4° resolution ocean/sea-ice global NEMO ORCA025_LIM configuration and the Mercator data assimilation system.

Reanalysis roadmap

GLORYS will produce an Ensemble of improved ocean and sea-ice high-resolution data sets. This should be important for the cross evaluation and combined use of unconstrained and assimilated simulations. The project proposes to carry out reanalyses along 3 Streams:



The setting of the data assimilation system and the ORCA025 configuration (including atmospheric forcing data), are likely to differ between streams, to make the best use of all available ocean surface and surface observations.

Reanalysis system

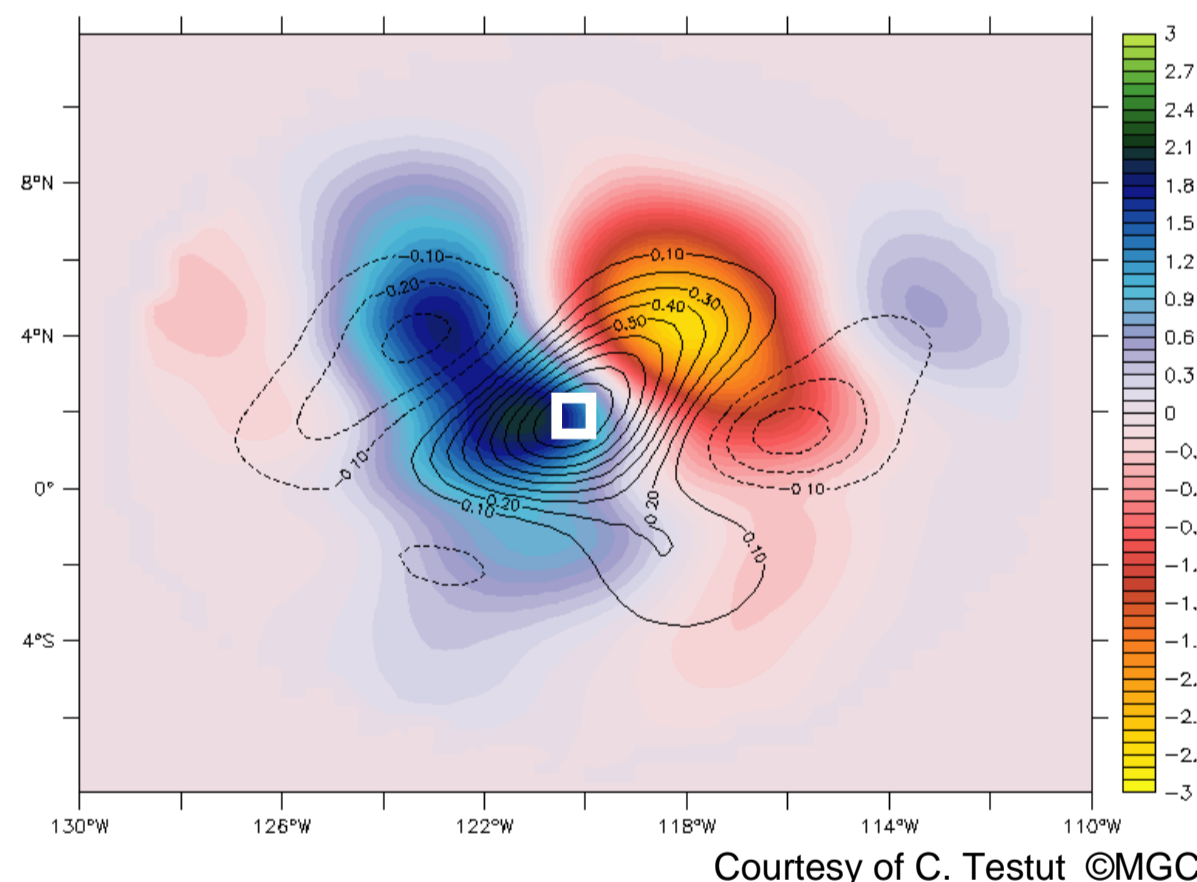
OGCM: The OGCM used in GLORYS is based on **NEMO ORCA025_LIM** model configuration (jointly developed by Drakkar and Mercator). The model uses an ORCA grid (2 poles in the northern hemisphere) at 1/4° and is coupled to **LIM2+** an enhanced version of LIM2 ice model (LIM2 + EVP + improved ocean-ice stress calculation). The main innovative parameterizations used are:

- 50 vertical levels with surface refinement (dz ~ 1m near surface)
- Partial cells
- Energy enstrophy conserving scheme
- Bulk formulae forcing function

More information can be found on poster **S3.6-96**.

DATA ASSIMILATION: The Système d'Assimilation Mercator version 2 (SAM2) is inherited from the operational system PSY3V2R2 (see poster **S3.6-96**) which is a multivariate multi-data reduced order extended Kalman filter based on the SEEK formulation (Pham, 1998). The forecast error covariance is based on the statistics of a collection of 3D ocean state anomalies (typically a few hundred) and is seasonally variable. As a consequence it is possible to model anisotropic error covariances (see below). Last, the increments are applied using a backward IAU scheme : the model is run twice over the same assimilation window: once to perform the forecast and second to apply the increment with an IAU scheme.

FIG: Representer function relative to a +1°C SST observation located at 2,25°N, 120°W (white square), in the Pacific. The contour lines is the SST covariance and in color the SLA covariance relative to the +1°C SST observation. (C.I in °C and cm)



The control vector is (HBAR, T, S, U, V).

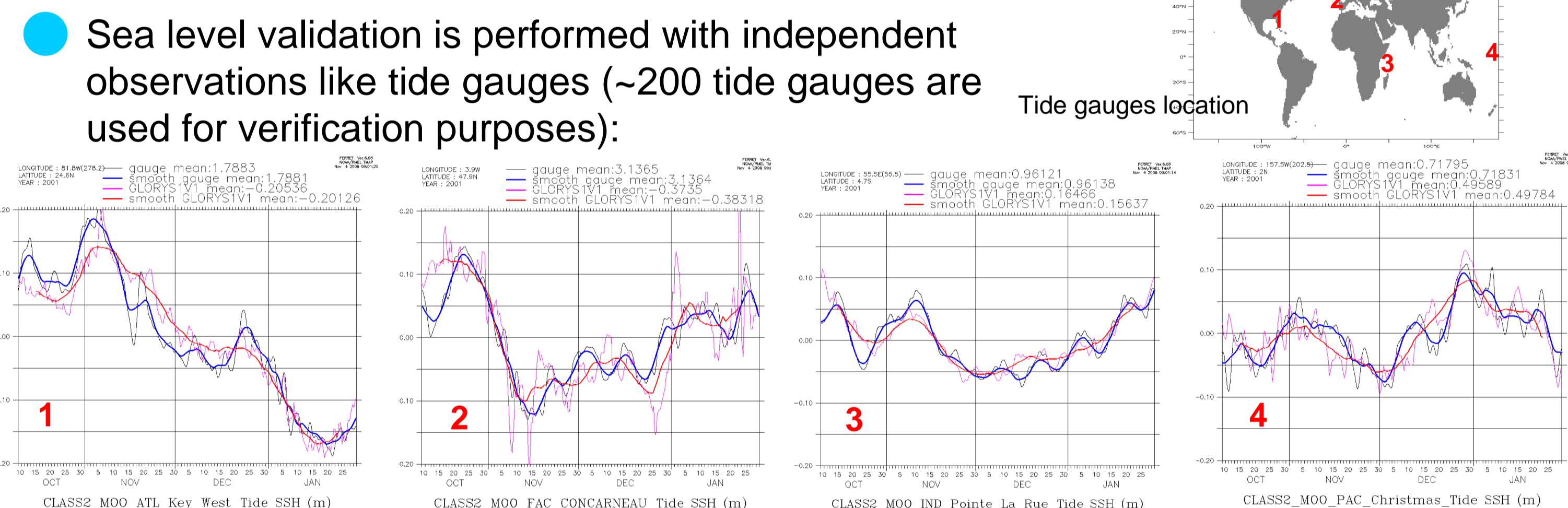
SAM2 assimilates:

- SST data (NCEP 1/2° RTG analyses)
- Temperature and Salinity profiles provided by CORIOLIS GDAC (CORA-02)
- along track satellite altimetric data. To compute the model SLA, we use RIO-05 Mean Dynamic Topography.

More information can be found on posters **S3.6-96** & **S4.60-114**.

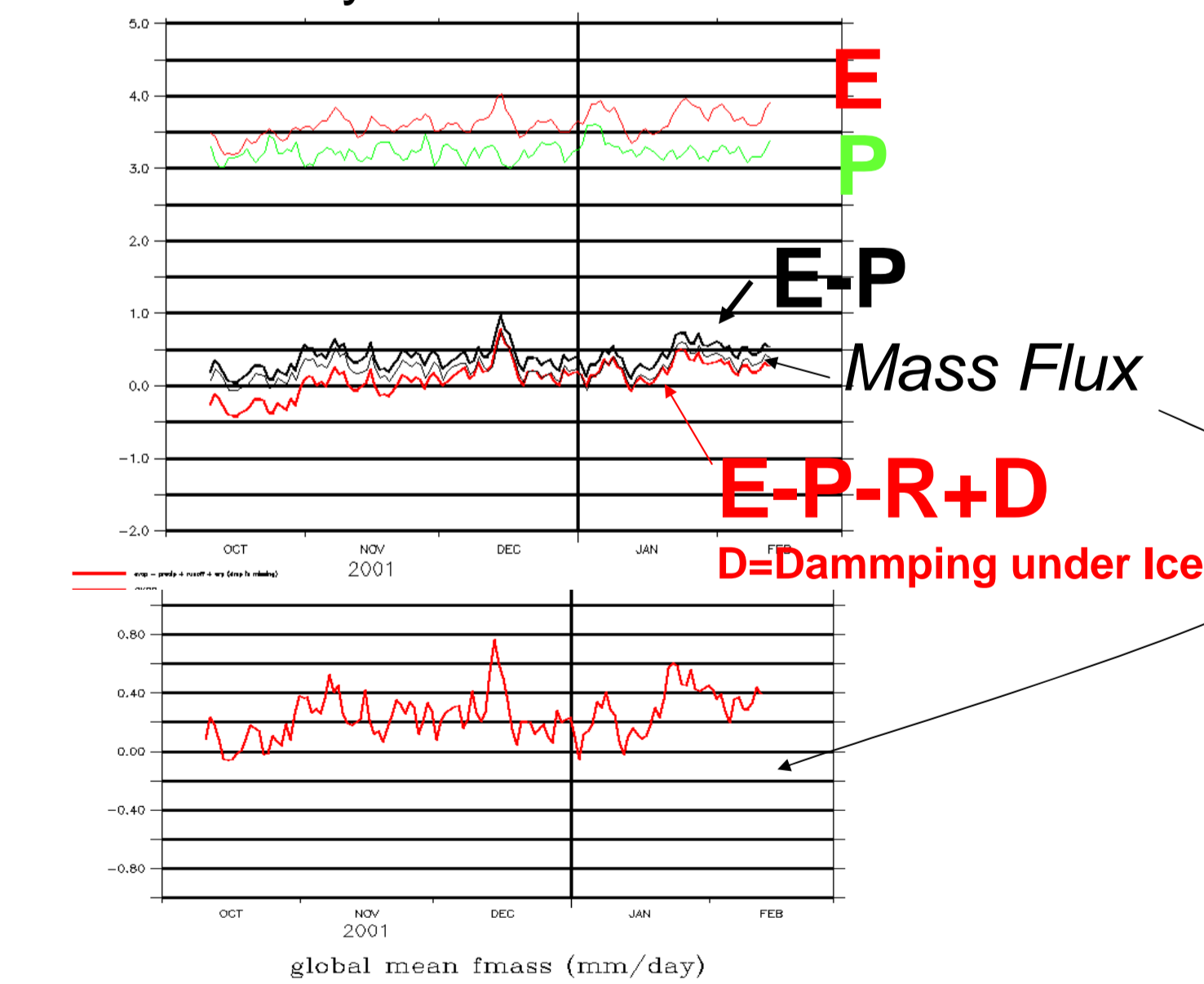
Preliminary results

GLORYS-1 (Stream 1) is running over the 2002-2007 period. The results of the first months of reanalysis integration are shown below.

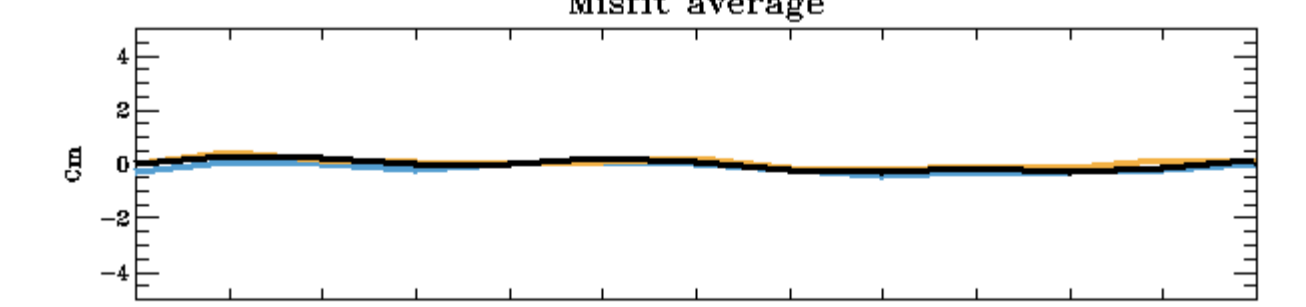


- The global ocean sea level and mass changes (water budget) are monitored to assess the realism of the reanalysis :

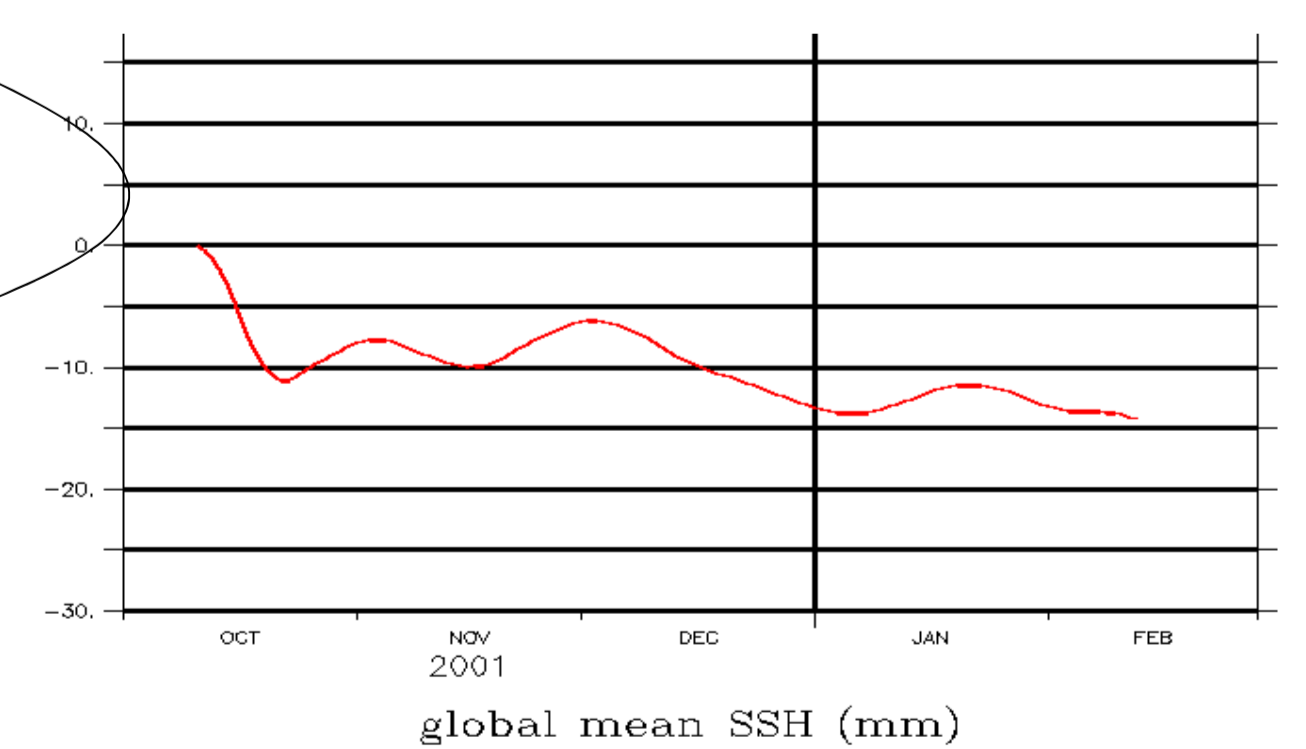
Components of the fresh water budget before analysis:



SLA misfit w.r. to Jason-1, ENVISAT & GFO:

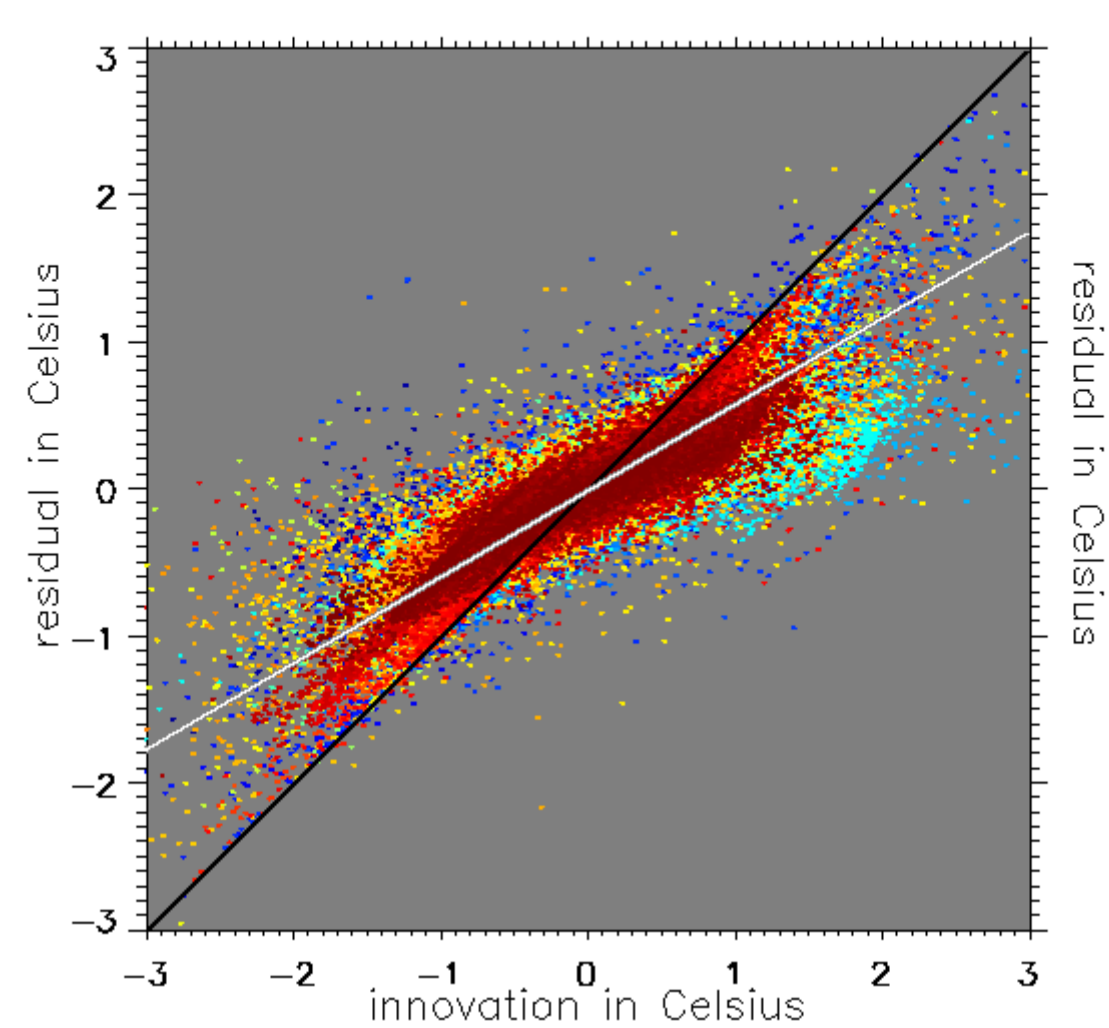


Global mean sea level in GLORYS-1:

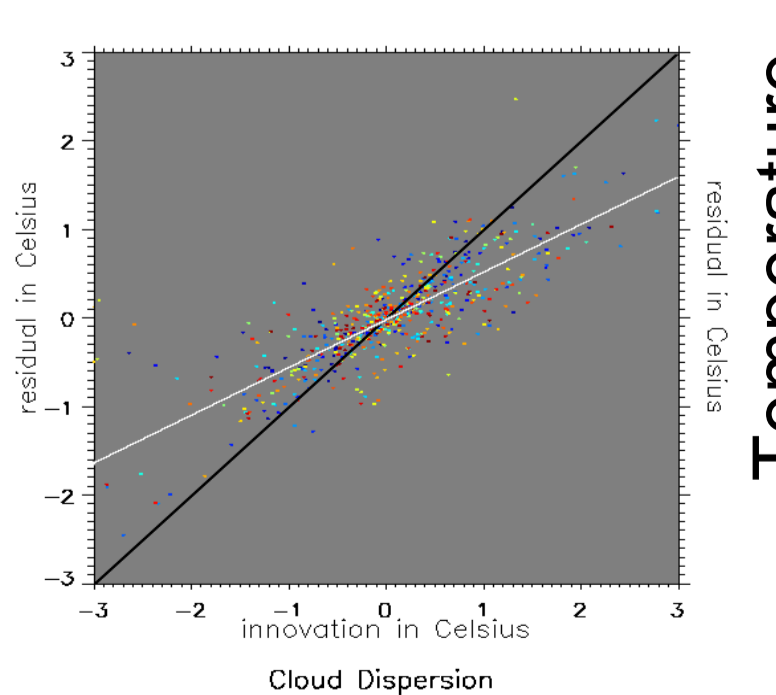


- Monitoring of the data assimilation efficiency:

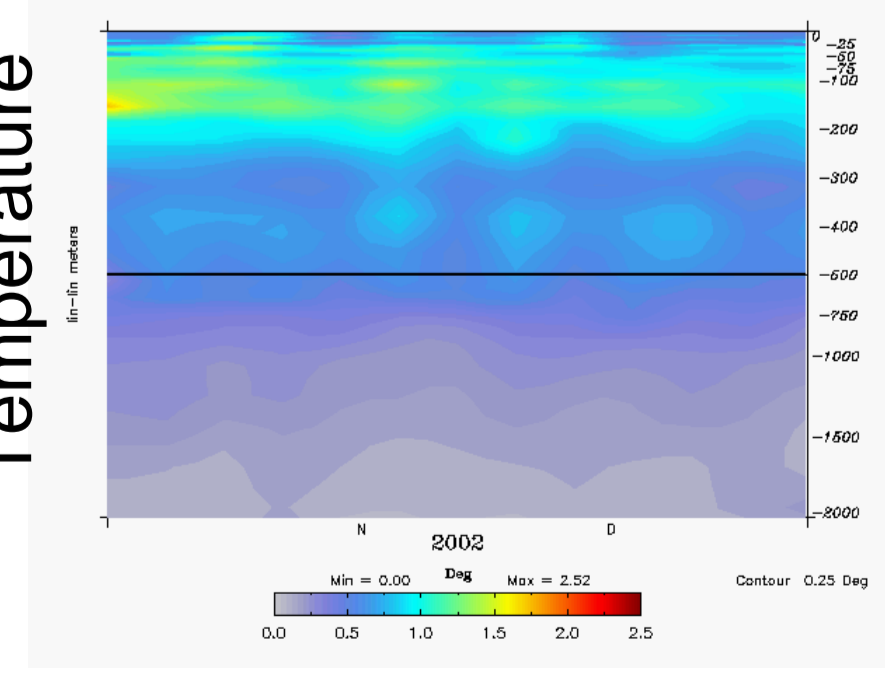
Cloud Dispersion residual vs innovation in SST on 20020102



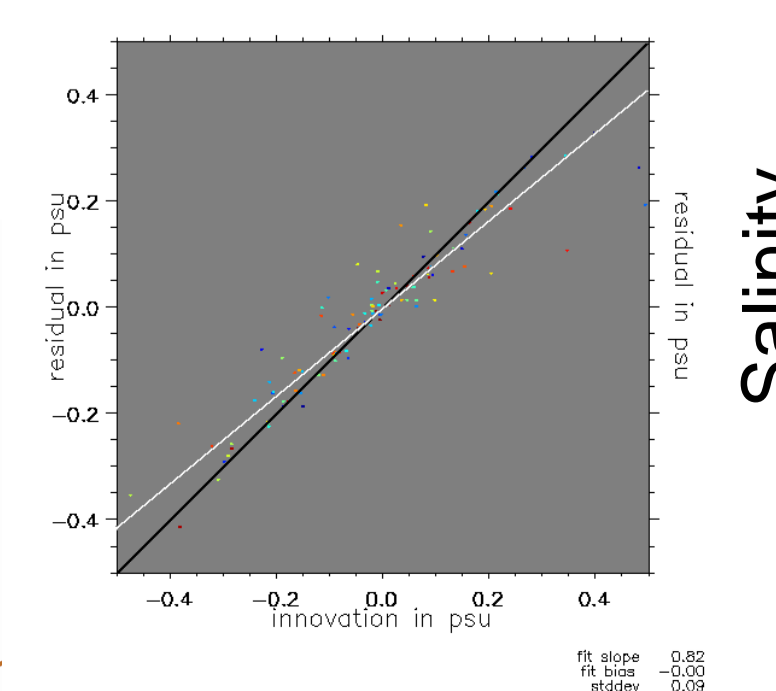
Cloud Dispersion residual vs innovation in T on 20020102 at 92m



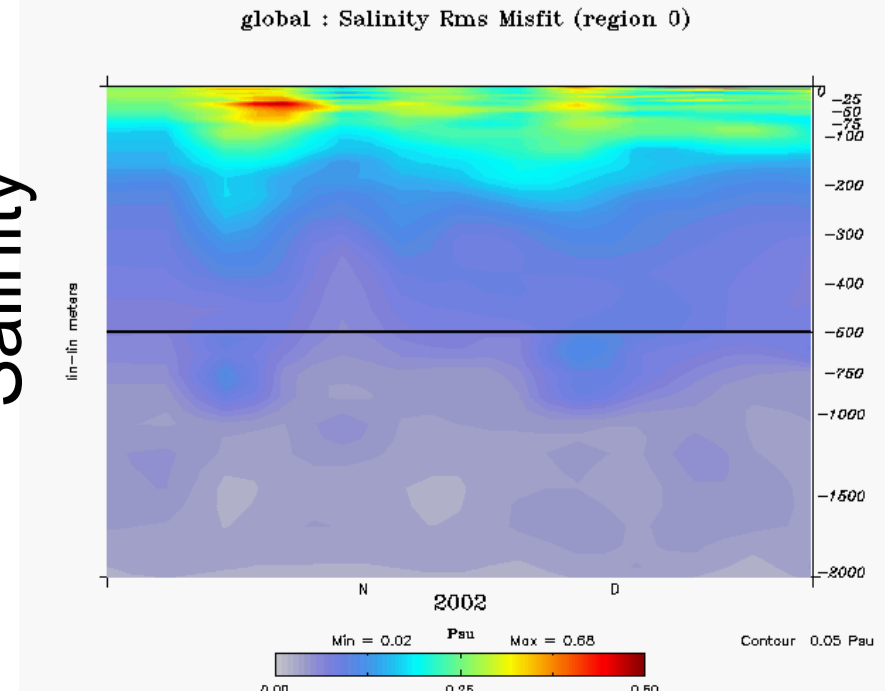
global : Temperature RMS Misfit (region 0)



Cloud Dispersion residual vs innovation in S on 20020102 at 92m

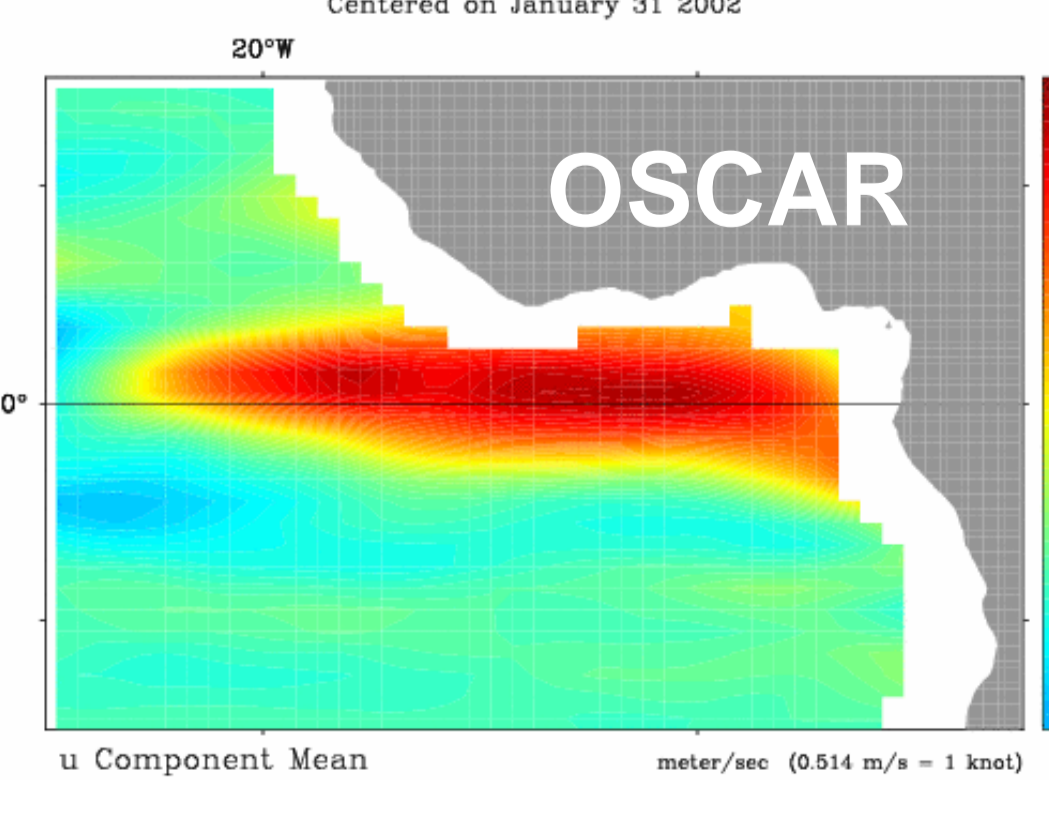


global : Salinity RMS Misfit (region 0)



- Comparison with OSCAR currents in the Tropical Atlantic

5-Day Interval Ocean Surface Currents (meter/sec) Centered on January 31 2002



30 indicated parcel velocity : U on 30-01-2002 near 16m

