

ENVISAT ocean altimetry performance assessment

End of life and overview of a successful mission

A. Ollivier¹, M. Guibaud¹, N. Picot², P. Féménias³

¹CLS, Space Oceanography Division, Toulouse, France

²CNES, Centre National d'Etudes Spatiales, Toulouse, France

³ESA, European Space Agency, Frascati, Italy

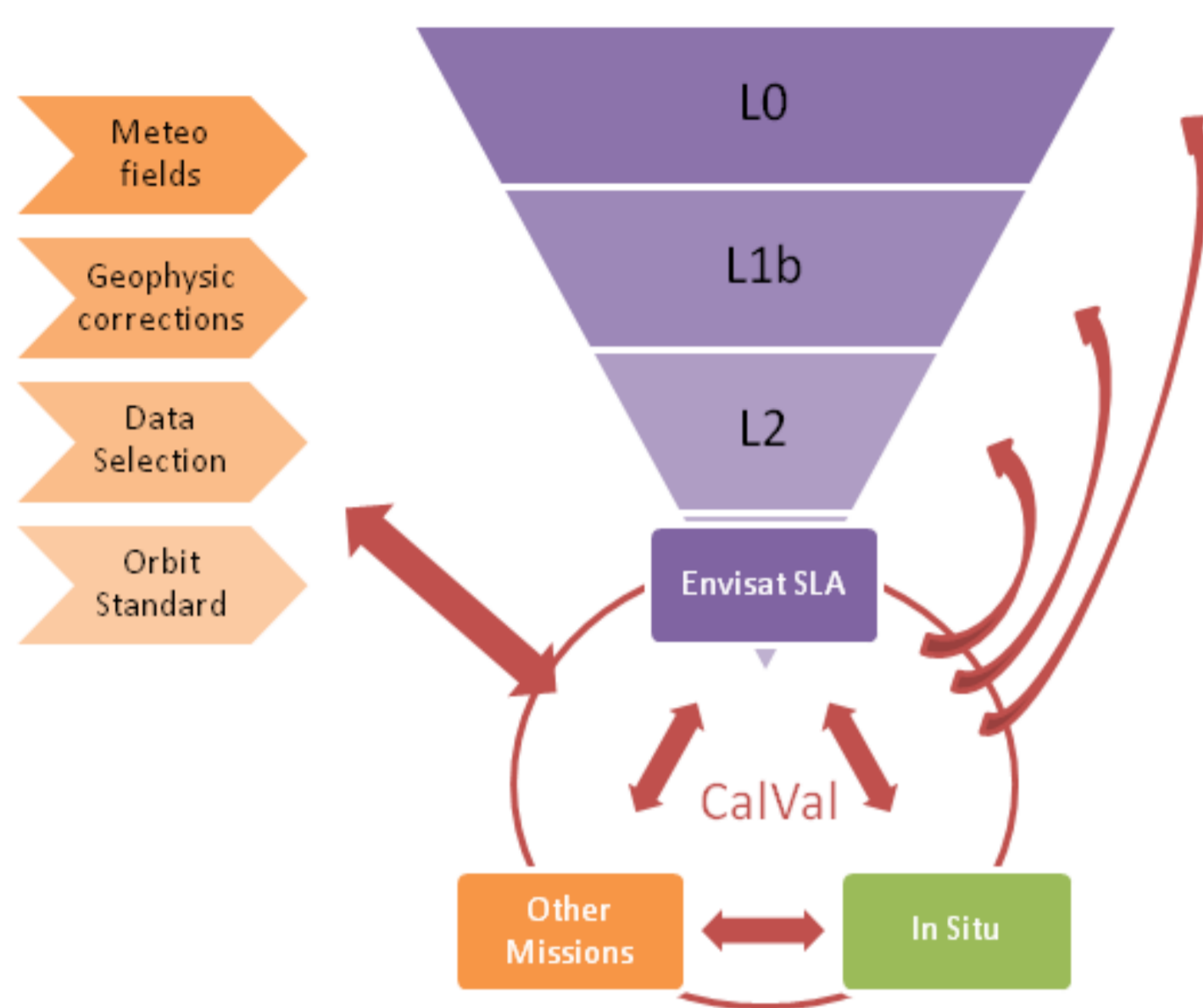


Performance assessment

Performance assessment enables to characterize **data coverage** and **availability**. It allows to compute mission error budget at different scales and concerning different applications.

It is possible thanks to different loops and **comparisons** including multimissions and comparison with external data such as models or in situ data.

For Envisat mission, this work allowed to **identify errors** and to **correct** them thanks to expert support.



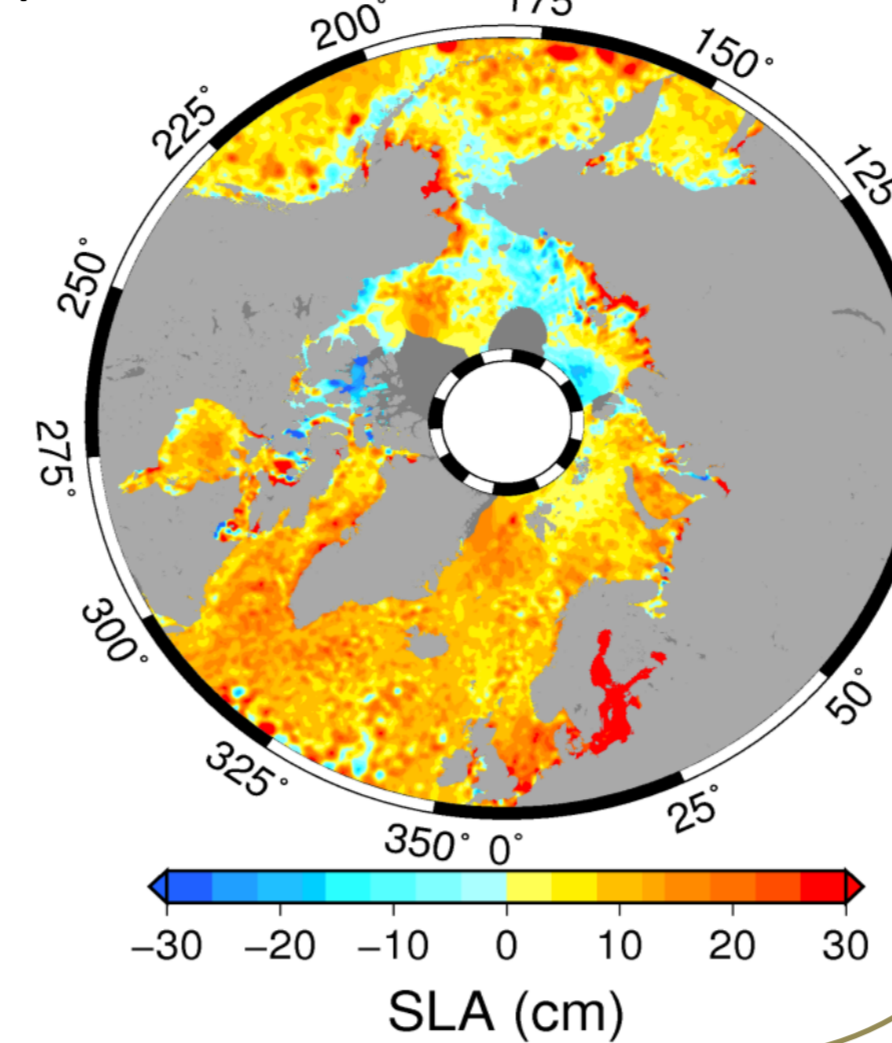
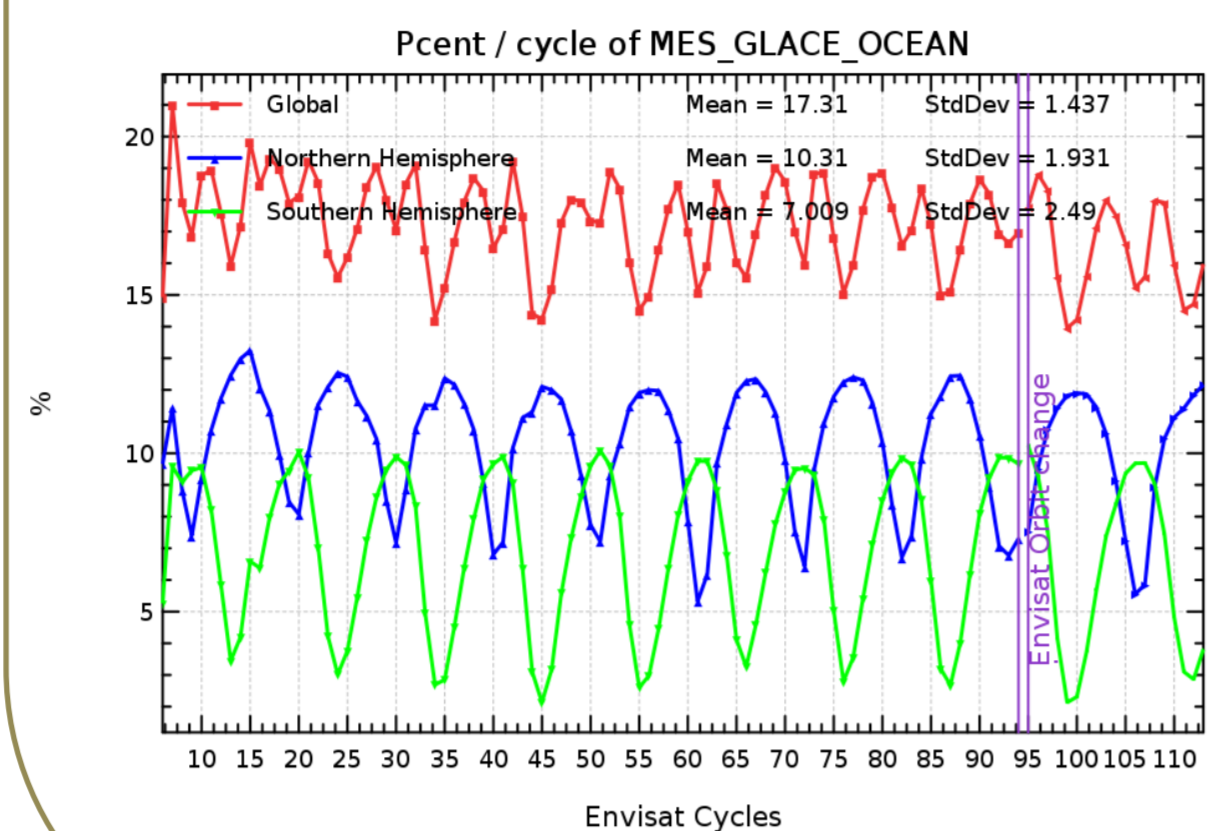
Different scales for Envisat performance analysis

Coverage and sampling

On ocean, very good **availability > 80% over the mission and >95% after a data dissemination improvement in 2008**.

Thanks to its tracker mode, Envisat is one of the best current altimeter in terms of signal tracking on transition zones (coasts, ice, land...)

ice shelves areas up to 82°

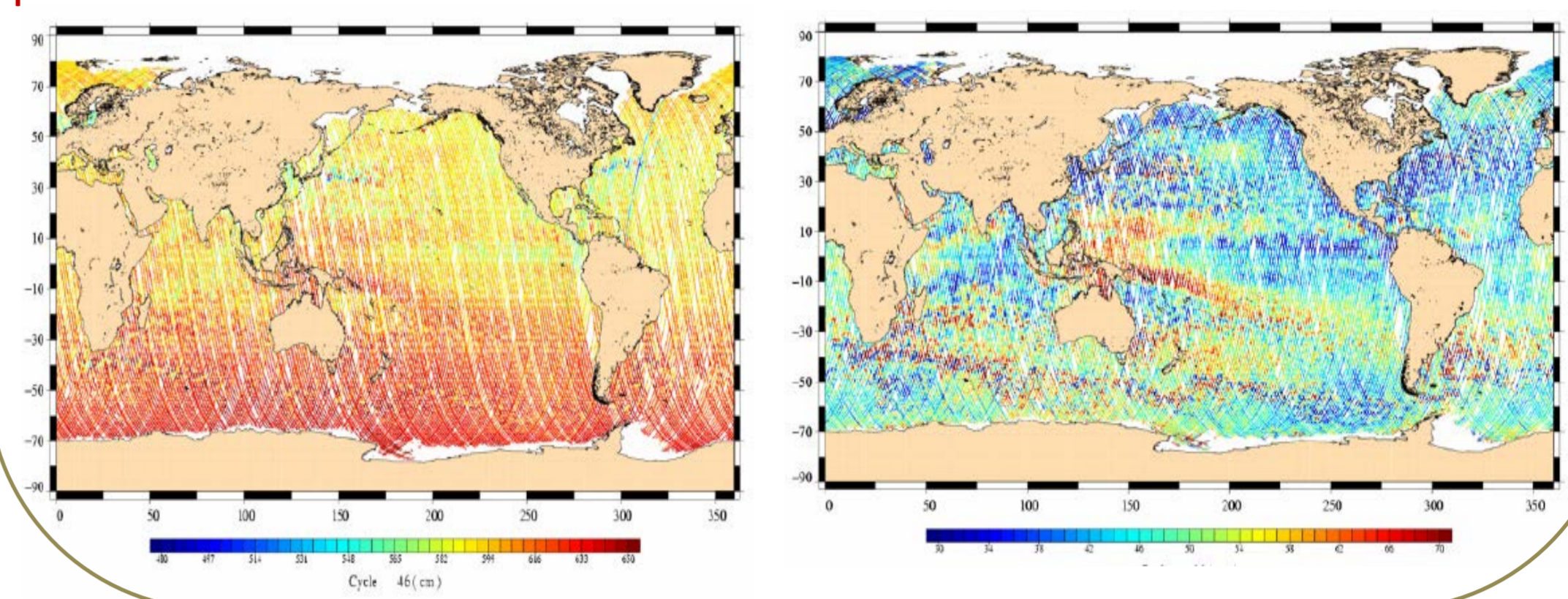


Example of unexpected anomaly managed

In 2006, Envisat encountered a serious event that **could have degraded dramatically the data at all scales** (problem in the Ultra Stable Oscillator clock). The problem was rapidly detected and the reprocessed dataset was corrected by the performance assessment team.

UNUSABLE: Envisat Sea Level affected by the USO anomaly pattern

Back to **NOMINAL QUALITY** on Sea Level thanks to a dedicated processing

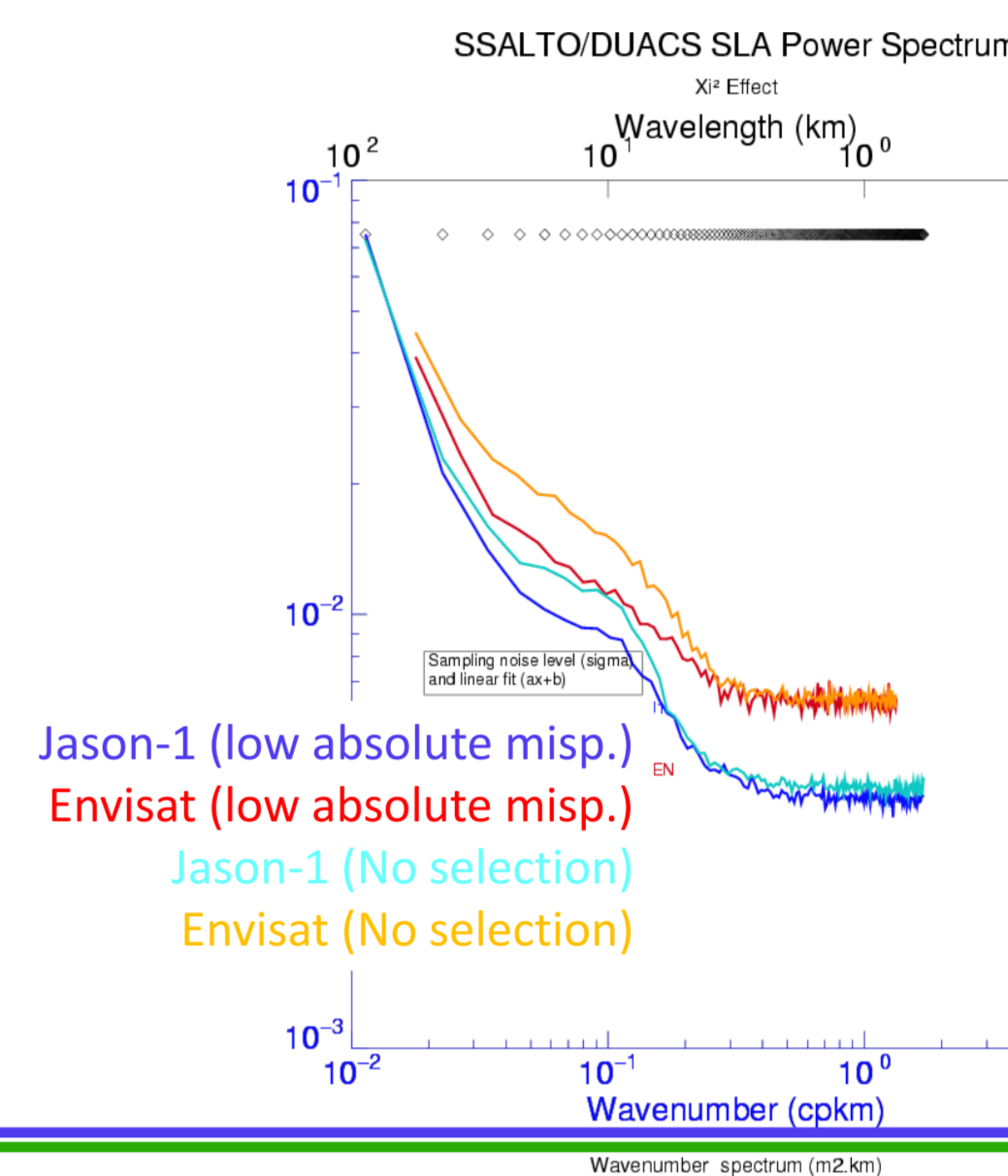


High frequency content

Envisat is a good candidate for high frequency content analysis and short scales observation.

2 cm noise at 1Hz (7km) and 9cm at 20Hz (350m)

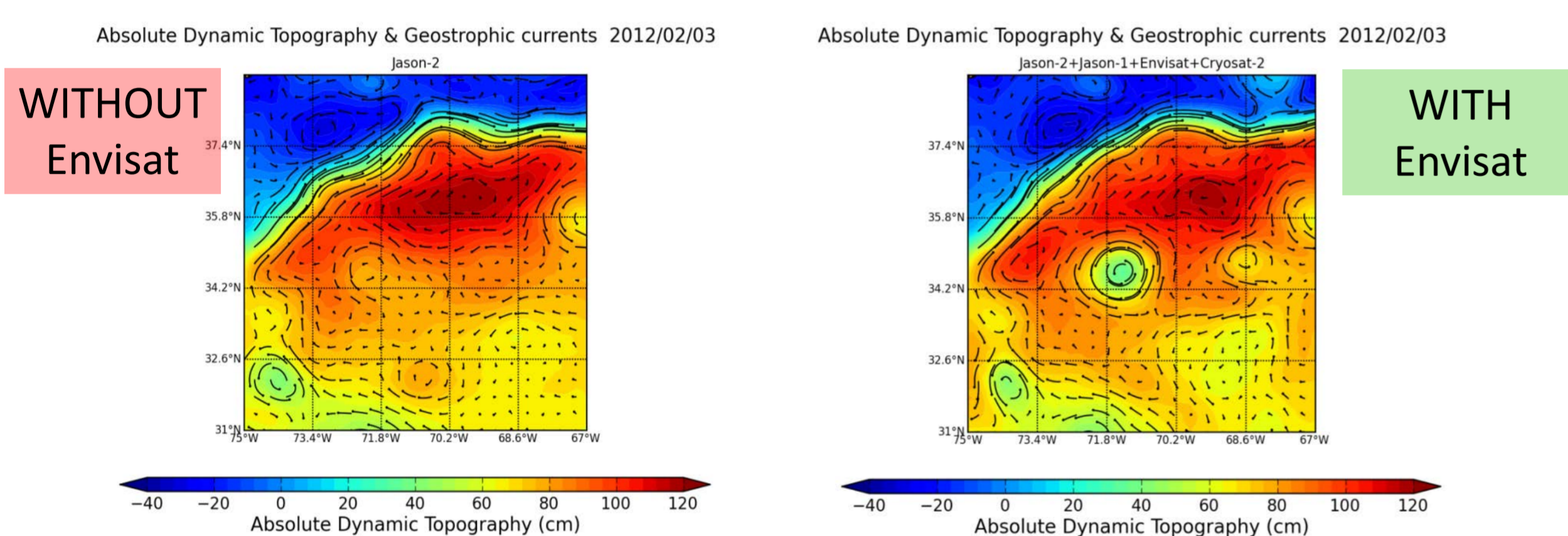
Here, an example of investigation performed to analyze the sensitivity of the 70km bump to the waveform apparent mispointing in 2008. 5 years later, Crosat2 (and its SAR mode) and AltiKa (and its Ka band) comparison help us to understand more about the bump problematic (CNES spectral studies in the frame of C2 SAR, Dibarboure et al.)



Mesoscale content

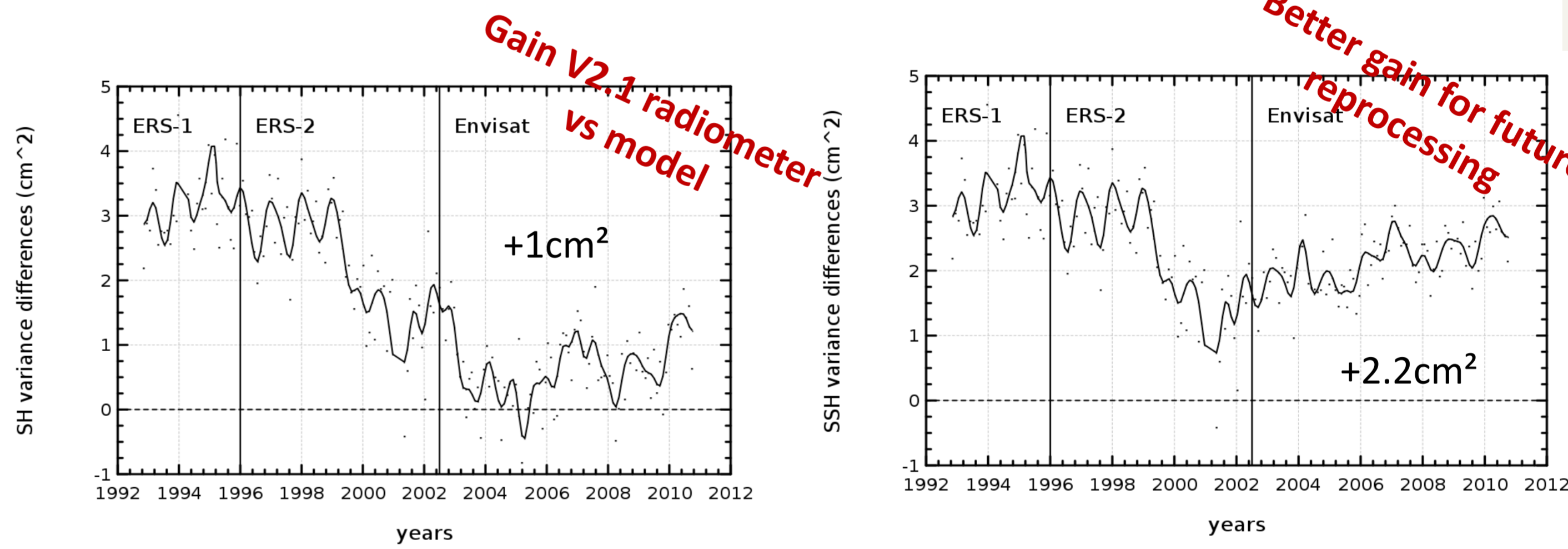
Computing the **variance of sea level at crossovers** allows to better estimate the asc./dsc. data consistency under 10 days time scale. This estimation is below 6cm² for Envisat with open ocean selection, equivalent to the other precise altimetric missions.

For **multimission merging** these scales are complementary to the other missions and enable to better characterize eddies, for example:



Absolute Dynamic Topography and Geostrophic current on 2012/02/03 - Courtesy G. Dibarboure 2012

Comparisons with models are also performed. Here is quantified the gain of embarking a radiometer on board instead of using an external model (here ERA-Interim): around **1cm² with v2.1 processing** and **2,2cm² for the future version** (2.6cm² and 3cm² for the 3 channels radio-meters of J1 and J2).

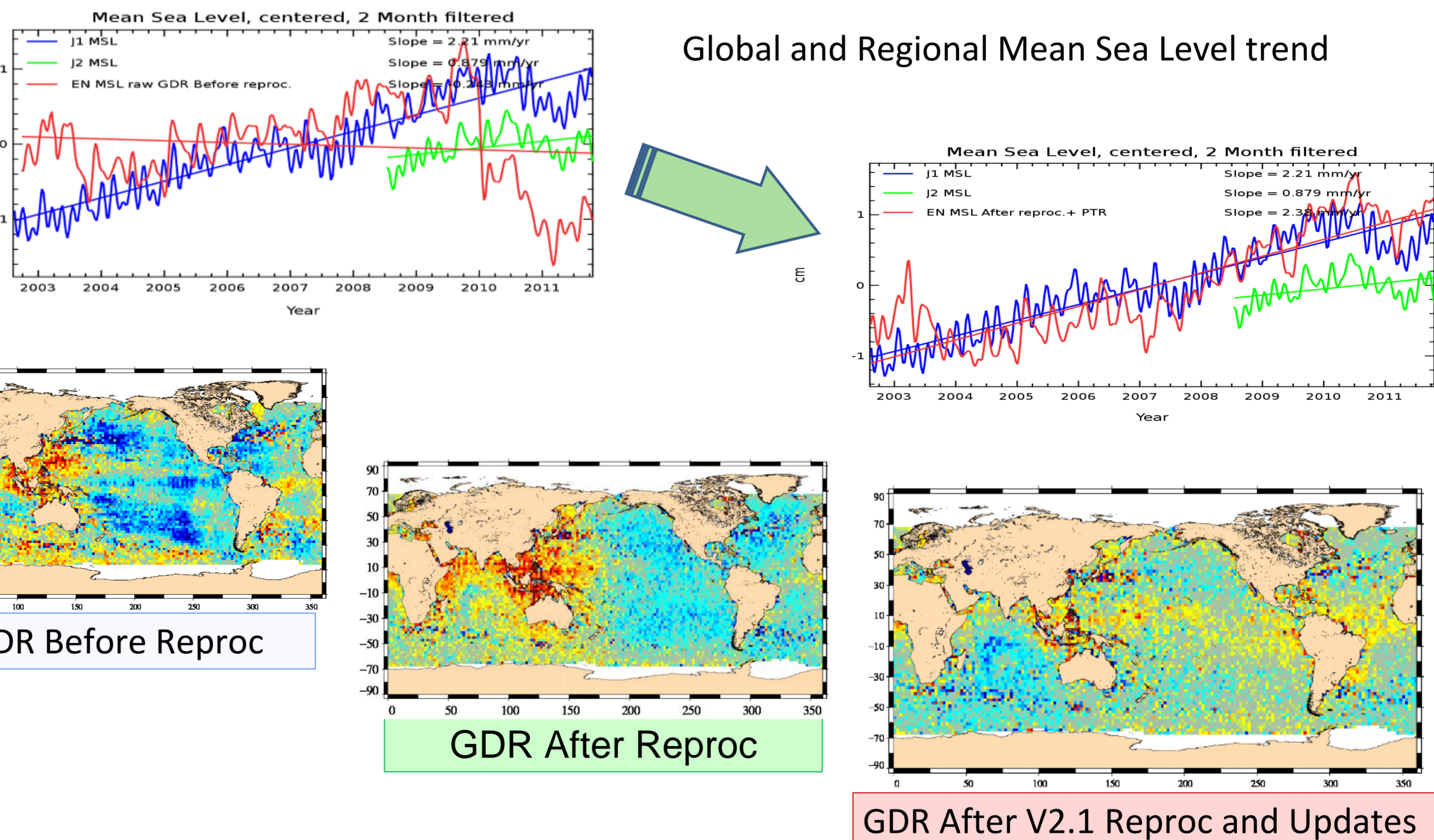


Long term trends and relevance for climate scale studies

The Envisat 10 years time series offered a great opportunity to develop studies dedicated to **climate**.

Thanks to **comparisons to Jason-1,2 tide gauges and in situ data**, an error was found on an instrumental correction. Once corrected, and in synergy with instruments experts, **Envisat has become more relevant for climate scales**, even if some inter-annual signals remain under studies.

Multimission comparison enabled to evidence geographic errors due to the gravity field modeling in Orbit determination. Because its lower altitude, the impact of gravity field was 3 times higher than on J1. This could also be demonstrated thanks to in-situ Argo Profiles. After **news inputs and fruitful exchanges** with POD experts, **all missions could benefit from this improvement**



The Envisat historical time series is dedicated to evolve again, learning from future missions studies. As a consequence, dataset needs to be maintained up to date. Regular reprocessings allow to improve the global quality of data, enabling Envisat to be an external reference for other missions. Cross calibration of Jason-1 and 2 with another precise mission as Envisat is useful to improve and characterize the global quality of altimetric system.

Envisat performance assessment constitutes and will remain a reference for future altimetric missions, at different scales.

