Envisat / Jason-1 cross calibration

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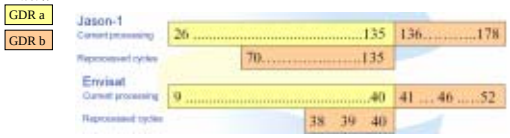
Introduction

More than four years of Envisat and Jason-1 altimetric measurements are available on a common period in GDR. The cross calibration of these two datasets are routinely performed at the CLS Space Oceanography Division in the frame of the CNES Segment Sol Altimétrie et Orbitographie (SSALTO), ESA French Processing and Archiving Center (F-PAC) activities. This poster presents the main Envisat/Jason-1 cross calibration results.

Data

A new configuration (version b) of Envisat and Jason-1 GDR has been operational since cycle September 2005. Several improvements in terms of data quality are included in this new version of GDR products, for instance a new orbit configuration and new geophysical corrections such as MOG2D. Note that the reprocessed products are not used here but that all the new corrections have been updated on the whole Envisat and Jason-1 period for this work



Main Jason-1 GDR b changes:
- New orbit configuration (EIGEN-CG03C)
- New retracking (MLE4)
- MOG2D

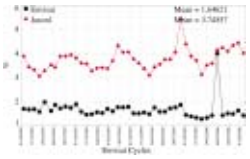
Main Envisat GDR b changes:
- New orbit configuration (EIGEN-CG03C)
- MOG2D
- New SSB model

⚠ A Jason-1 SSB model compatible with the new standards has been computed (Labroue, 2006). This model is not in the products yet. It has been updated here on cycles 136 to 178.

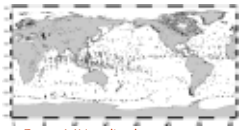
Edited Measurement

The editing ratios on Envisat altimeter parameters are very stable and lower than for the other missions (Jason-1, T/P). This might be due to the tracker used by Envisat Ra-2, the Model Free Tracker (MFT).

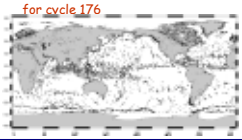
Ratio of Edited measurements



Envisat 1Hz edited measurements for 10 days of cycle 52



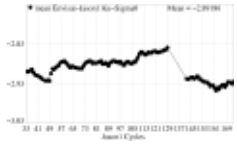
Jason-1 1Hz edited measurements for cycle 176



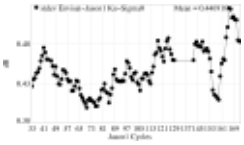
Long term monitoring of altimeter parameters

The cycle by cycle mean of Envisat-Jason-1 differences are plotted. The mean difference between Envisat and Jason-1 Ku-band Sigma0 is -2.9 dB. This mean difference has increased by 0.07dB between cycles 48 and 129 which corresponds to 0.04 dB/year. The drop observed after cycle 129 is due to the new Jason-1 retracking.

Mean [EN-J1] Sigma0

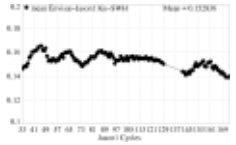


Stdev [EN-J1] Sigma0

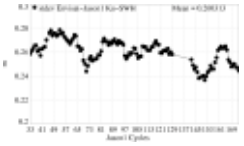


The cycle by cycle mean of Envisat-Jason-1 SWH differences are plotted. These differences are quite stable. Envisat SWH is 15 cm higher than Jason-1 SWH.

Mean [EN-J1] SWH



Stdev [EN-J1] SWH

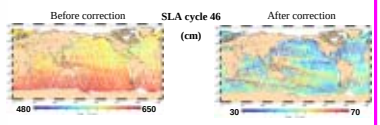


References

- Faugere et al., 2006, Envisat Ocean Altimetry Performance Assessment and Cross-calibration ***http://www.mdpi.org/sensors/papers/s6030100.pdf***
- Envisat and Jason-1 Cyclic and yearly quality assessment reports ***http://www.aviso.oceanobs.com/html/calval***

Envisat USO anomaly

In February 2006, the RA-2 Ultra Stable Oscillator (USO) clock frequency underwent, for an unknown reason, a strong change of behavior. The anomaly consists in a bias, superposed with an oscillating signal with an orbital period. Translated into range, the mean bias reaches 5.6m and the oscillating signal has an amplitude of about 30cm. The correction proposed by ESA is applied here.



SSH performance assessment

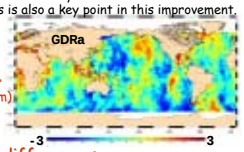
EN/J1 SSH differences at 10-day dual crossovers

10-day Envisat/Jason-1 dual crossovers have been computed excluding shallow waters. Both systematic differences and time varying differences are noticed on the Evisat-Jason-1 SSH differences at crossovers.

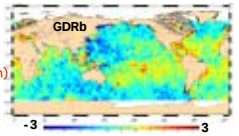
Systematic differences

The improvement of the consistency between Envisat and Jason-1 in the new configuration is clearly visible on the mean differences. The geographically correlated differences have been reduced mainly thanks to the use of new Grace Gravity fields used in the orbit calculation. The use of the SSB J1 compatible with the new standards is also a key point in this improvement.

EN-J1 Mean difference over cycles 31-40 (cm)



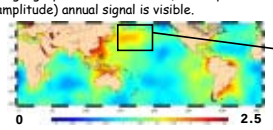
EN-J1 Mean difference over cycles 41-50 (cm)



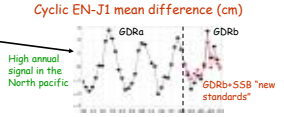
Time varying differences

Additionally to these systematic differences, a temporal signal is visible on the difference. This temporal signal has not a homogeneous geographical distribution (see map of standard deviation). In the North Pacific area, a strong (up to 2 cm of amplitude) annual signal is visible.

Map of standard deviation of the cyclic EN-J1 mean differences on cycles 11-40 (cm)

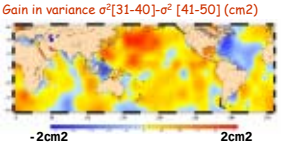


Cyclic EN-J1 mean difference (cm)



Again, a reduction of the time-varying error is observed on the new products on most of the globe. The error is notably reduced by more than 2cm2 in the North Pacific. As previously, the use of a J1 SSB compatible with the new standards is critical in the improvement of the consistency.

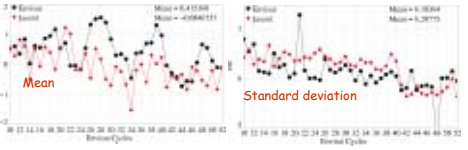
Gain in variance σ^2[31-40]-σ^2 [41-50] (cm2)



EN and J1 performances on the same space/time sampling

Envisat and Jason-1 crossovers have been computed on the same area excluding latitudes higher than 50° , shallow waters and using exactly the same interpolation scheme to compute SSH values at crossover locations.

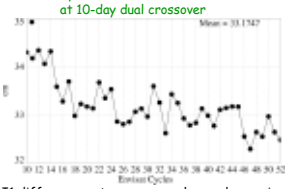
Periodic signals are visible on mean curves: Annual signal for Envisat and 60-day signal on Jason-1. The standard deviation values for Envisat/Envisat and Jason-1/Jason-1 SSH crossover differences are very similar: respectively 6.1 cm and 6.2 cm



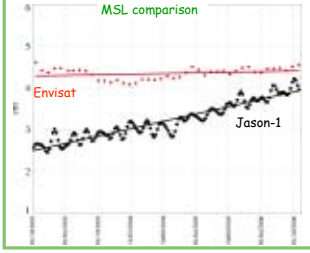
Envisat SSH Bias and Mean Sea Level

To estimate accurately the Envisat bias and trend, one has to take care of the following features:
- The range is corrected to compensate for the Ultra Stable Oscillator drift
- The ECMWF model is used both on Envisat and Jason-1 as no major change in the model has impacted the data since the beginning of the Envisat mission. This allows us to avoid the effect of the MWR drift and the jumps on JMR.

Cyclic EN-J1 mean differences at 10-day dual crossover



MSL comparison



The cyclic EN/J1 differences at crossovers show a decreasing trend, especially on the first cycles. This behavior is not explained yet.

MSL trends from Envisat, Jason-1 are compared using the same corrections. The results are obtained after area weighting and removal of annual and semi-annual signals. An additional 60-day period sinusoid has been fitted and removed for Jason series. The MSL trend estimated on Envisat is very different from Jason-1 one when considering the whole period. However, the two trends are consistent during the 2004-2005 period of time.

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OSTST meeting
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