Envisat / Jason-1 cross calibration

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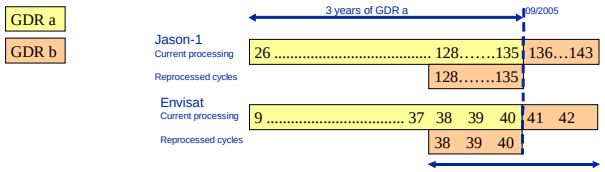
Introduction

More than three 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 have 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 all these corrections have been updated on the whole Envisat and Jason-1 period for this work



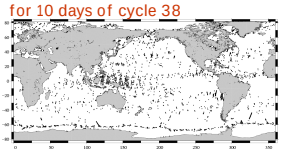
Main Jason-1 GDR b changes:
- New orbit configuration (EIGEN-CG03C)
- New retracking (MLE4)
- MOG2D
- New SSB model

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

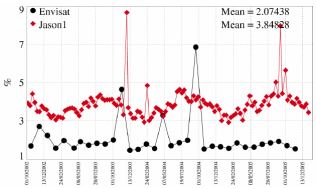
Edited Measurement

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).

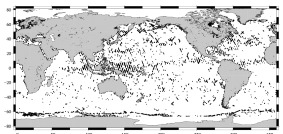
Envisat 1Hz edited measurements for 10 days of cycle 38



Ratio of Edited measurements



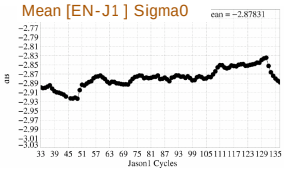
Jason-1 1Hz edited measurements for cycle 128



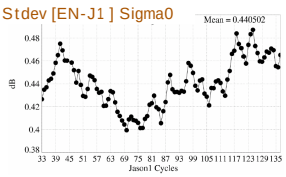
Long term monitoring of altimeter parameters

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

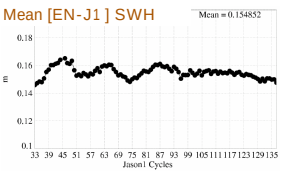


Stdev [EN-J1] Sigma0

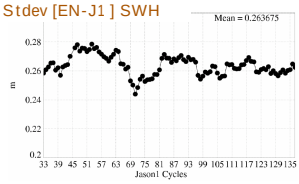


The cycle by cycle mean of Envisat-Jason-1 differences are plotted. These differences are quite stable. Envisat SWH is 15 cm higher than Jason-1 SWH.

Mean [EN-J1] SWH



Stdev [EN-J1] SWH



References

ØFaugere et al., 2006, Envisat Ocean Altimetry Performance Assessment and Cross-calibration http://www.mdpi.org/sensors/papers/s6030100.pdf

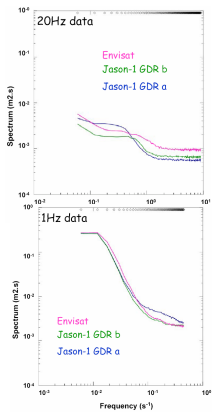
ØCyclic and yearly quality assessement reports
http://www.aviso.oceanobs.com/html/calval

SSH performance assessment

Spectral analysis

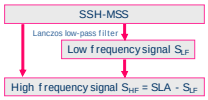
On 20Hz data, at frequencies higher than 3Hz, the Envisat signal is hidden by a plateau at $10^{-3}m^2s$. This plateau is the signature of a 9.2 cm white noise. Assuming uncorrelated 20 Hz noise, it is equivalent to 2.1 cm for the 1 Hz averages. This value is fully consistent with the results obtained from the RMS of elementary measurements. The Jason-1 (GDR a and b) spectra have a similar shape as Envisat but with a lower plateau (7.3 cm for version a and 7.9 for version b)

From 1 Hz data, there is no clear plateau at high frequencies. Envisat is more consistent with the version b of Jason-1 GDR (MLE4 retracking) in the [0.1-0.4Hz] range, than with version a.

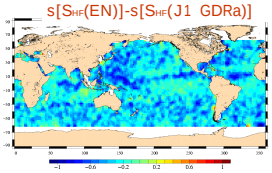


Filtering technique

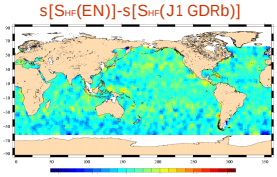
Using a filtering technique allows us to know the geographical distribution of the high frequency content for Envisat and Jason-1 over cycles 128-135. The consistency between Envisat and Jason-1 is improved in wet areas.



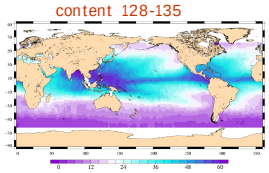
s[S_{HF}(EN)]-s[S_{HF}(J1 GDRa)]



s[S_{HF}(EN)]-s[S_{HF}(J1 GDRb)]



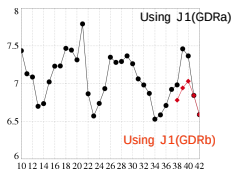
EN mean water vapour content 128-135



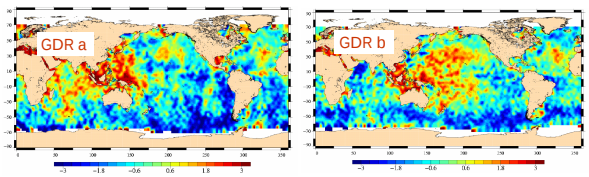
10-day dual crossovers

The improvement of the consistency between Envisat and Jason-1 is clearly visible. The geographically correlated differences have been reduced mainly due to new Grace Gravity fields used in orbit calculation.

Cyclic standard deviation



EN-J1 Mean difference over cycles 128-135 (cm)

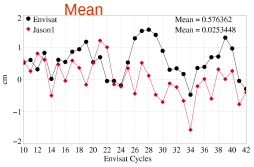


EN/EN and J1/J1 crossovers

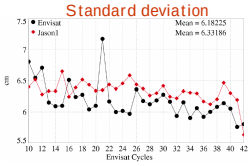
Envisat and Jason-1 crossovers have been computed on the same area excluding latitudes higher than 50°, shallow waters and using exactly the same interpolation scheme to compute SSH values at crossover locations.

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 6.2 cm and 6.3 cm.

Mean



Standard deviation

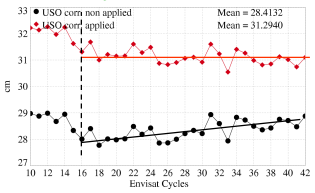


Envisat SSH Bias and Mean Sea Level

To estimate accurately the Envisat bias and trend, one has to take care of the following features:

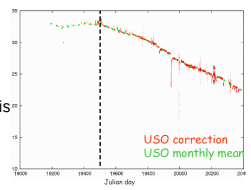
- The range is corrected to compensate for the Ultra Stable Oscillator drift SSH=Orbit-[Range-USO]-SCorrection
- The ECMWF model is used both on Envisat and Jason-1 as no major change in the model has impacted the data since the beginning of the Envisat mission. This allows us to avoid the effect of the MWR drift and the jumps on JMR.

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

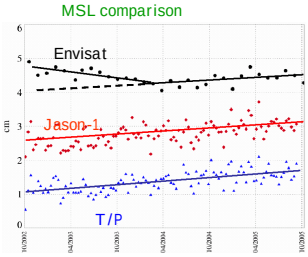


Mean of USO correction

The USO behavior on first EN cycles is under investigation



MSL comparison



MSL trends from Envisat, Jason-1 and T/P 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 T/P and Jason series. The Envisat MSL trend is clearly not linear, decreasing on the first year, and increasing after. On the last two years, the Envisat slope is fully consistent with Jason-1 and T/P.

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OSTST meeting
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