(A) SSALTO CALVAL Performance assessment Jason-1 data

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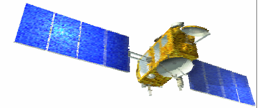

Introduction

Since the beginning of the mission, Jason-1 data have been analyzed and monitored in order to assess the quality and the performances of Jason-1 GDR products for oceanographic applications. This work routinely performed at CLS under contract with the CNES, includes careful monitoring of all altimeter and radiometer parameters, performance assessment, geophysical evaluation and cross-calibration with T/P measurements. This poster is basically concerned with the more relevant results, and specific studies linked to these activities.

Context

Jason-1 data (GDR: geophysical data record) were processed until current cycle 185. From cycle 136 onwards, current GDRs are processed in version 'B'. The main evolutions in the GDR 'B' were the implementation of a new retracking algorithm[1] (order 2 MLE-4), a new precise orbit[2] based on a GRACE gravity model and new geophysical corrections (tidal models, MOG2D, Sea State Bias). A reprocessing of the GDR in version 'B' was done last year from cycle 1 to 21 and 128 to 135. In order to provide an homogeneous data set in version 'B', a GDR reprocessing in version 'B' is on-going from cycle 22 to 127.

A) SSH performances

SSH performances is monitored in order to assess the global system performances since the beginning of the Jason-1 mission. GDR used to provide these statistics are in version 'A' from cycle 1 to 135 and in version 'B' from cycle 136 onwards. Even if T/P mission is finished since November 2005, SSH T/P performances are superimposed to compare both missions.

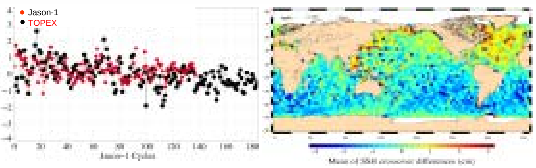

Figure 1: Mean differences [cm] of SSH at crossover: cyclic monitoring (left) and map (right, only GDR 'B' cycles)

The cyclic mean differences of SSH crossover (figure 1 left) is stable and similar with T/P ones. The map of mean differences shows weak signal (< 2 cm). However an hemispheric bias is detected thanks to the very good quality of new orbits (see "Reprocessing in version B").

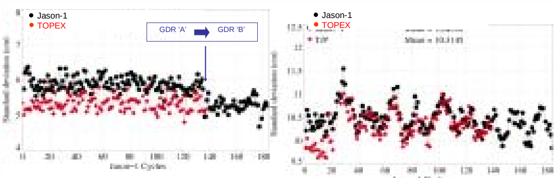

Figure 2: Cycle by cycle standard deviation [cm] of SSI

The cyclic standard deviation of SSH differences at crossover and along-track (figure 2) is stable and similar to T/P ones. However different ground processing between T/P and Jason-1 explain the slightly lower statistics for T/P. After applying similar retracking algorithms for both missions (RGDR T/P, Calahan 2007), same SSH high frequency content is obtained (see Faugere poster or presentation – retracking splinter).

B) Reprocessing in version 'B'

Last year (in 2006), GDRs were reprocessed in version 'B' from cycle 1 to 21 and 128 to 135. The reprocessing of all GDRs is on-going (from cycle 22 to 127). The quality of the reprocessed GDR 'B' is monitored cycle by cycle, and compared with the former GDR 'A'. Here are presented the SSH performances at crossovers.

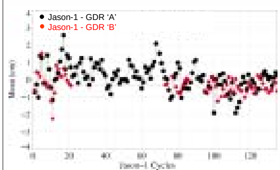

Figure 5: Cycle per Cycle mean of SSH differences at crossover

The crossover mean is more stable with the GDR 'B' (figure 5) especially for the first cycles thanks to the new orbit. With new orbit quality, small signals can now be detected such as an hemispheric bias at crossovers (figure 1 right) using GDR 'B' data. A time shift of 0.173 ms has been added in the GDR 'B' L1-B processing. The sign of this correction has been checked and not explains the observed hemispheric bias even if the pseudo time-tag bias estimated is about -0.3 ms.

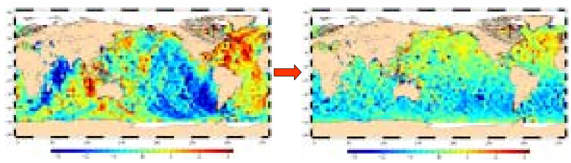

Figure 6: Mean of SSH crossover differences when using GDR 'A' data on the left and GDR 'B' on the right (cm²)

The crossover standard deviation using geographical selections (bathy < -1000m, |latitude| < 50° and ocean variability < 20 cm) decreases from 6.1 cm to 5.2 cm with the GDR 'B' (figure 7) : MOG2D HF correction, new orbit and MLE-4 retracking are the main sources of improvement.

Finally, the use of GDR 'B' data allows us to decrease significantly the variance at crossover in comparisons with the GDR 'A' (figure 8): the variance has dropped by 35% (3.9 cm rms).

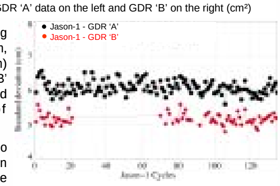

Figure 7: Cycle per Cycle standard deviation of SSH differences at crossover

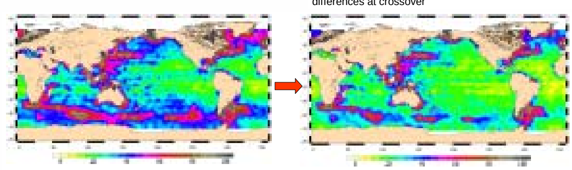

Figure 8: SSH crossover variance when using GDR 'A' data on the left and GDR 'B' on the right (cm²)

C) Radiometer wet troposphere correction

The JMR correction provided in the GDR 'A' (red curve in figure 3 top) contains several anomalies when looking at JMR-ECMWF model differences: a drift of 5 mm between cycles 27 to 32, a jump of 9 mm at cycle 69, and 60 days signals of almost 5 mm amplitude due to yaw mode transitions.

PODDAC provides a JMR correction[3] (same as in GDR 'B') for whole Jason-1 mission (black curve). It corrects partly the anomalies: the jump at cycle 69 is very well corrected, but the drift is still visible as well as yaw mode transitions (especially in the end).

Figure 3 bottom shows daily mean differences of radiometer and ECMWF model wet troposphere corrections for different missions. Daily mean values for Jason-1 are noisier than those for the other missions. This apparent noise is linked to signals generated by yaw mode transitions.

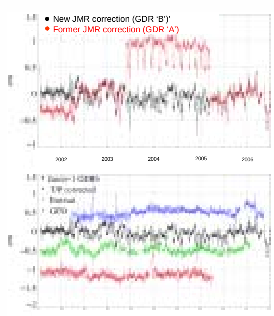

Figure 3: Daily mean differences between radiometer and ECMWF model wet troposphere correction for Jason-1 (top) and in comparison to other missions (bottom).

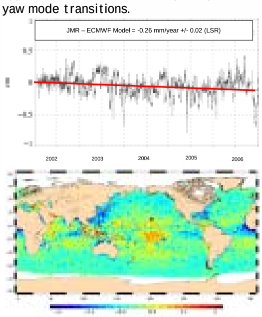

Figure 4: Global (top) and local (bottom) slope estimation of the difference between radiometer and model wet troposphere correction.

New JMR correction could now be used in MSL calculation instead of ECMWF model whose stability is not warranty (a jump of ECMWF model is observed for the first Jason-1 cycle). But the analyze of the slope between both corrections leads to an increase of 0.26 mm/year for the estimation of the global MSL (see Figure 4 top) and the local slopes can reach 5 mm/year (see figure 4 bottom). Considering that the JMR correction is not completely well tuned, the use of the ECMWF model is probably preferable for the MSL estimation.

Finally this analyze shows that the wet troposphere correction is an important item in the error budget of the Jason-1 MSL.

D) Mean sea level (MSL)

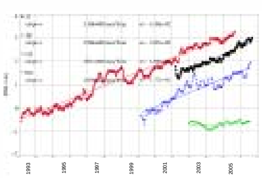

Figure 9: MSL over global ocean seen by different missions after removing of annual, semi-annual and 60-day signals.

T/P and Jason-1 MSL have to be fitted together since T/P mission is finished (November 2005). This is possible applying homogeneous corrections and the J1/TP SSH bias. The T/P+Jason-1 MSL shows a slope of 2.8 mm/year (figure 10). However some discrepancies exist between both missions: TMR correction is used for T/P instead of the ECMWF model for T/P and Jason-1 orbits are not homogeneous over the whole period. Other corrections could impact the MSL as for example the ECMWF pressure fields in the T/P data. Studies on going are shared between GOHS/LEGOS and CLS to estimate a more realistic error budget of the MSL due to these differences.

Peculiar attention is paid for the MSL slope estimation which is a sensitive subject. The Jason-1 MSL is calculated using the wet troposphere ECMWF model (see section C) showing a MSL elevation of 3.3 mm/year (figure 9). T/P and GFO MSL slopes are very similar with respectively 2.9 and 3.0 mm/year. Only Envisat MSL shows an inconsistency probably due to ground processing anomalies: USO drifts, … (for more details see Faugere poster – Calval splinter)

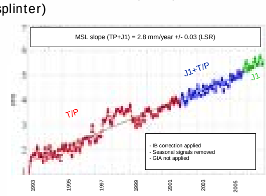

Figure 10: MSL over global ocean seen T/P + Jason-1 after linking up both missions.

Complete MSL results are available at (http://www.aviso-oceanobs.com/msl), see also dedicated AVISO MSL poster.

Referecences: 1: Amarouche, L., P. Thibaut, O.Z. Zanife, J.-P. Dumont, P. Vincent and N. Steunou, 2004: Improving the Jason-1 Ground Retracking to Better Account for Attitude Effects. Marine Geodesy, Vol. 27, pp. 171-197.

2: Choi, K.-R., J.C. Ries, and B.D. Tapley, 2004: Jason-1 Precision Orbit Determination by Combining SLR and DORIS with GPS Tracking Data, Marine Geodesy, Vol. 27, pp. 319-331.

3: Desai, S.: JMR replacement product available at ftp://podaac.jpl.nasa.gov/sea_surface_height/jason/jmr_replacement