Jason-1 GDR-E reprocessing

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Service Altimetrie & Localisation Precise

Context

Jason-1 was launched in December 2001 and routinely monitored the ocean until June 2013, date of its final measurement. It first flew on the historical ground track, as a successor of TOPEX/Poseïdon mission. In February 2009, Jason-1 assumed a new orbit midway between its original ground track but with a time lag of approximately 5 days with Jason-2 to provide an optimal coverage for Near Real Time (NRT) applications. In May 2012, it left its repeat track orbit for a geodetic phase until it was finally decommissioned.
Jason-1 time series continued the extraordinary sea level record first initiated by TOPEX/Poseïdon mission.

Data sets

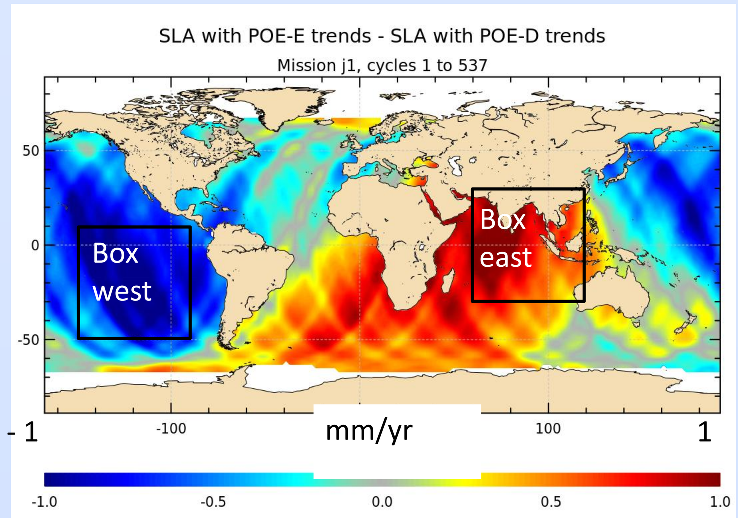
Even if this mission is finished, the quality of such a record can still be improved, as science progresses are continuously made. In 2014, CNES and NASA have started work on the reprocessing of the new Jason-1 GDR-E release. The main improvements concern the geophysical content of the products. Here is presented an overview of the first GDR-E products, and particularly:

- The assessment of the standard E orbits which use a new gravity field model that should enhance the regional mean sea level by reducing the basin scale discrepancies.
- The impact of the new ocean tides and mean sea surface.

Orbit

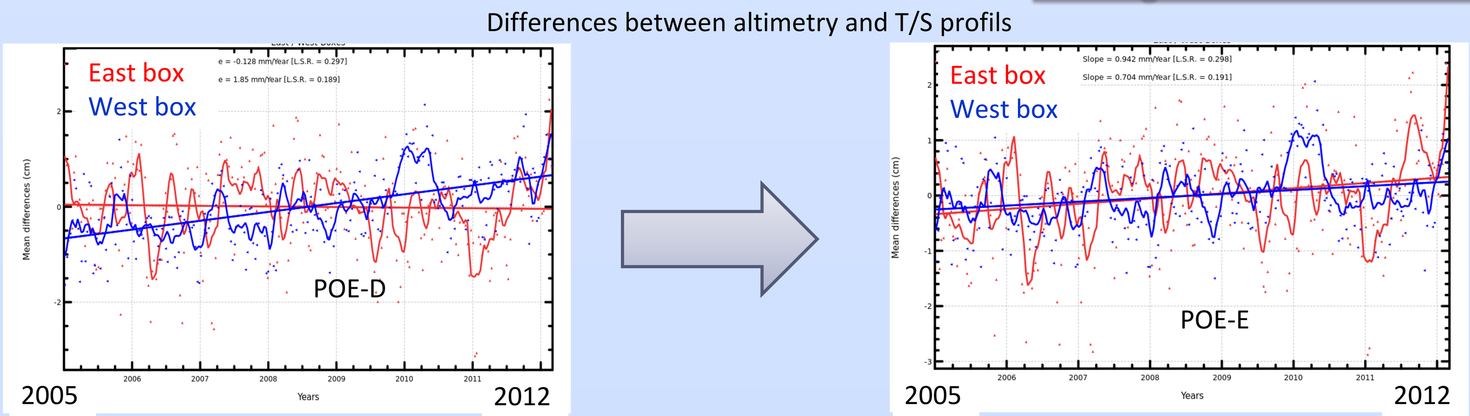
- POE-E orbit is close of POE-D orbit in terms of quality.
- Concerning the Mean Sea Level (MSL) evolution:

⇒ Low impact for the global MSL
⇒ Strong impact for the regional MSL trends (+/- 1 mm/yr) East/West patterns on geographical trends is highlighted.
⇒Comparison between altimeter data and temperature/salinity profiles show that regional MSL trends discrepancies between Jason-1 and T/S are reduced with POE-E CNES orbit solution



Significant impact detected on Regional Mean Sea Level trends

Differences between altimetry and T/S profils

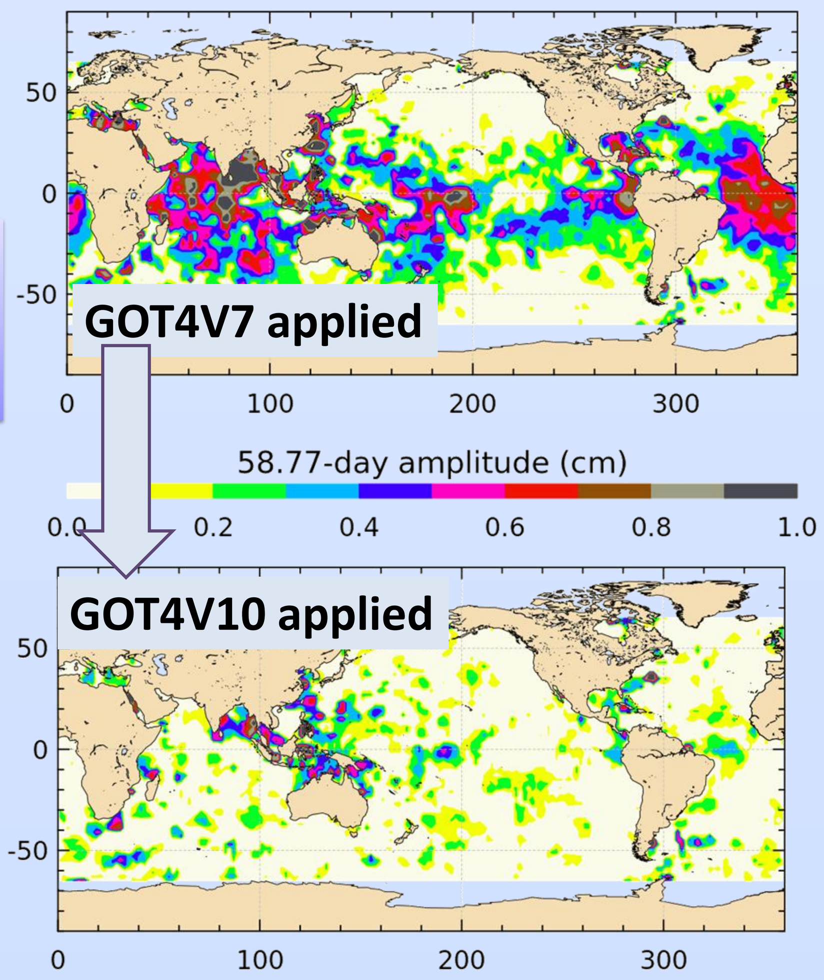


Ocean tide and 58.77 day signal reduction

GOT4.10 and FES2014 are two valid solutions to ensure a low 58.77-day error (linked to the aliasing of S2 wave) on Jason-1 MSL (<1mm) (Zawadzki, OSTST 2015)

The reduction of the 58.77 day signal error will allow us to observed better the mesoscale content of Jason-1 sea level.

Compared to GOT4.8 (and previous versions), local 58.74-days amplitude has decreased by a few mm (Indian and tropical Atlantic mostly) with GOT4.10. There is also reduction of the variance of SLA for GOT4.10 compared to GOT4.8 for Jason-1, especially in the Indian ocean. There is small improvement of SSH performance at cross-over points. No impact on global MSL, negligible impact on regional MSL except locally.



Evolutions in GDR-E:

- Orbit solutions are from so-called version "E" standards (Jalabert, OSTST 2015; Ollivier, OSTST 2015), based on ITRF08 . (details on dedicated part)
- Time tags are adjusted to correct for the datation bias that existed in previous versions (A, B, C) of the Jason-1 products.
- Altimeter range instrument correction and associated Ku- and C-band range account for error in internal path delay. (+63.9 mm compared to version C)
- Recalibrated radiometer data, and application of near-land path delay algorithm. (Brown, OSTST 2014)
- Altimeter wind speeds are recomputed using recalibrated atmospheric attenuations from radiometer.
- New Ku-band C-band sea state bias models (Tran,OSTST2012), and values that are computed using revised wind speeds. (details on dedicated part)
- The ionosphere correction is recomputed using updated altimeter ranges and sea state bias correction. (details on dedicated part)

Evolutions on geophysical models:

- Ocean tides from FES2014 (Carrere, OSTST 2015) and GOT4.10 models. (details on dedicated part)
- Mean sea surface from MSS_CNES-CLS11 (Schaeffer et al., 2012), computed from a 20-year reference period. (details on dedicated part)
- Mean dynamic topography from MDT_CNES-CLS13.
- Geoid from EIGEN2008.

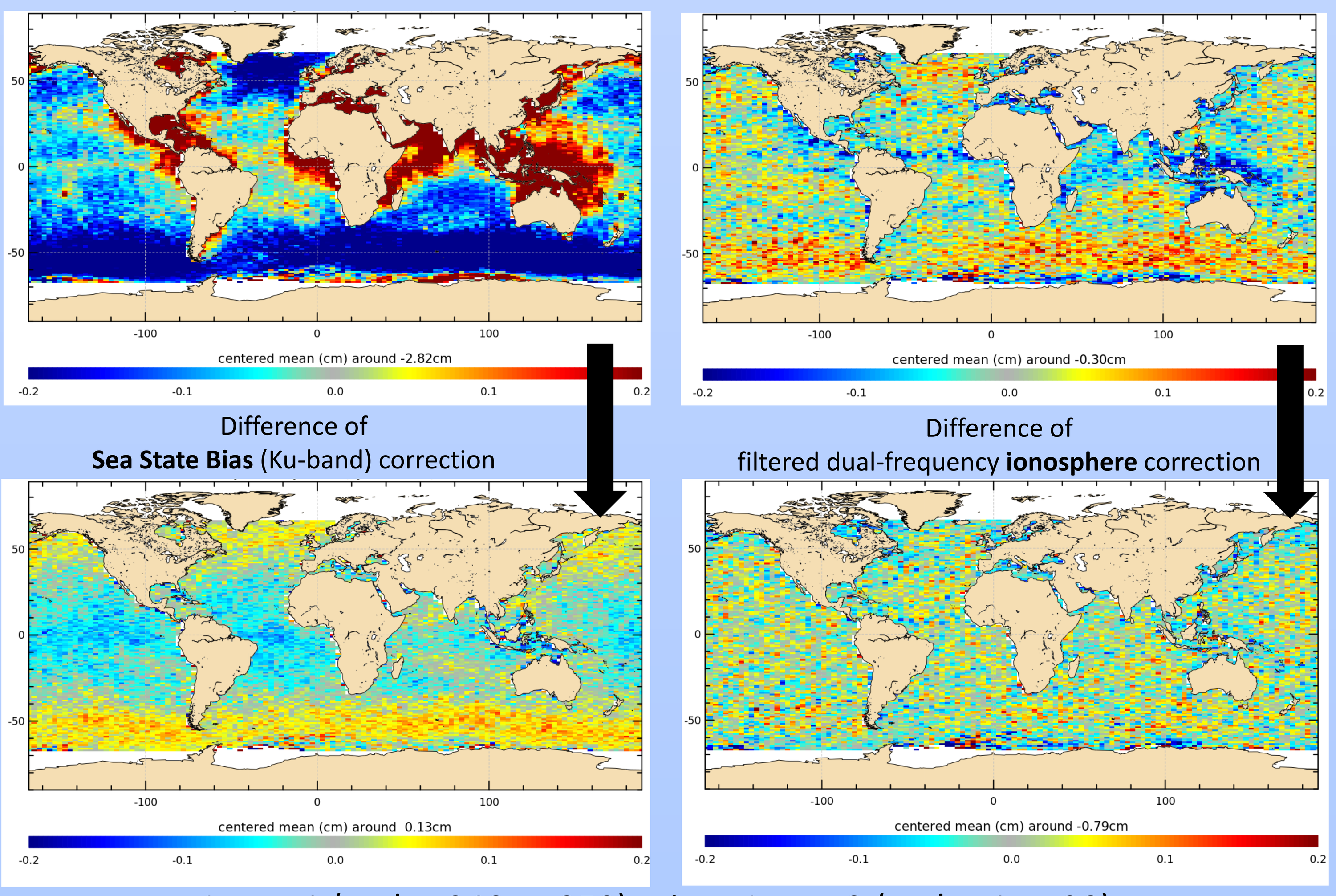
- ERA interim models (Dee et al, 2011) in addition to previously available operational ECMWF:
  - ✓Model dry troposphere correction from ECMWF Reanalysis (ERA)
  - ✓Model wet troposphere corrections from ECMWF Reanalysis (ERA) (Legeais et al, 2015)
  - ✓Model wind speeds from ECMWF Reanalysis (ERA)
  - ✓Inverse barometer and high-frequency corrections using ECMWF Reanalysis (ERA)

Jason-1/Jason-2 comparison

Using OSTST2012 Sea State Bias (i.e. Jason-1 GDR-E algorithm solution) and corresponding ionospheric corrections will significantly improve the consistency between the two missions

J1: GDR-C
J2: GDR-D

J1: OSTST2012 Tran solution (with GDR-C wind speed and swh)
J2: OSTST2012 Tran solution (with GDR-D wind speed and swh)

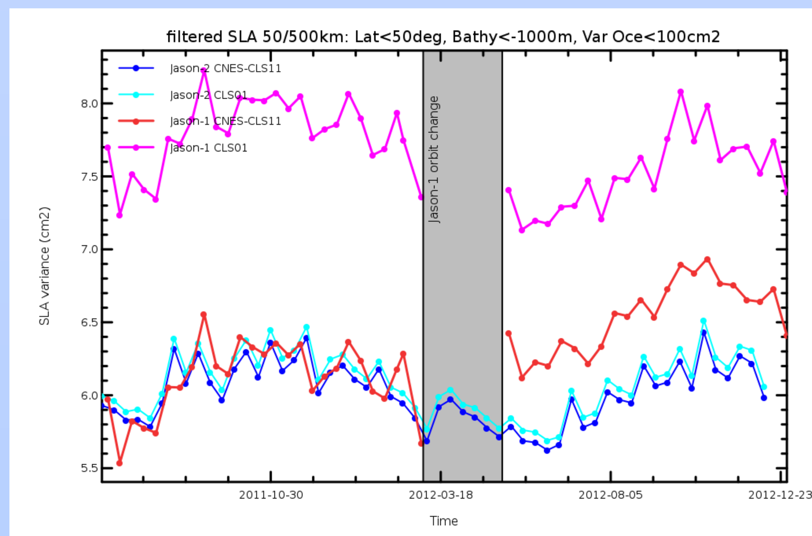


Jason-1 (cycles 240 to 259) minus Jason-2 (cycles 1 to 20)

Mean Sea Surface

Compared to 2001 solution, CNES-CLS 2011 solution shows improvement of the shortest wavelengths (λ<20 km), as analysis based on gradient differences between MSS and mean profiles are better (lowest rms for each bathymetry levels).

For Jason-1 historical orbit (until cycle 259), MSS-2001 shows quite good results. For Jason-1 interleaved orbit (cycles 262-374), SLA variance is reduced using MSS-2011 solution showing equivalent results as for Jason-2 (on historical orbit). Finally, for geodetic orbit, MSS-2011 solution is better than MSS-2001 (even if results on SLA variance are not as good as on a repetitive orbit).

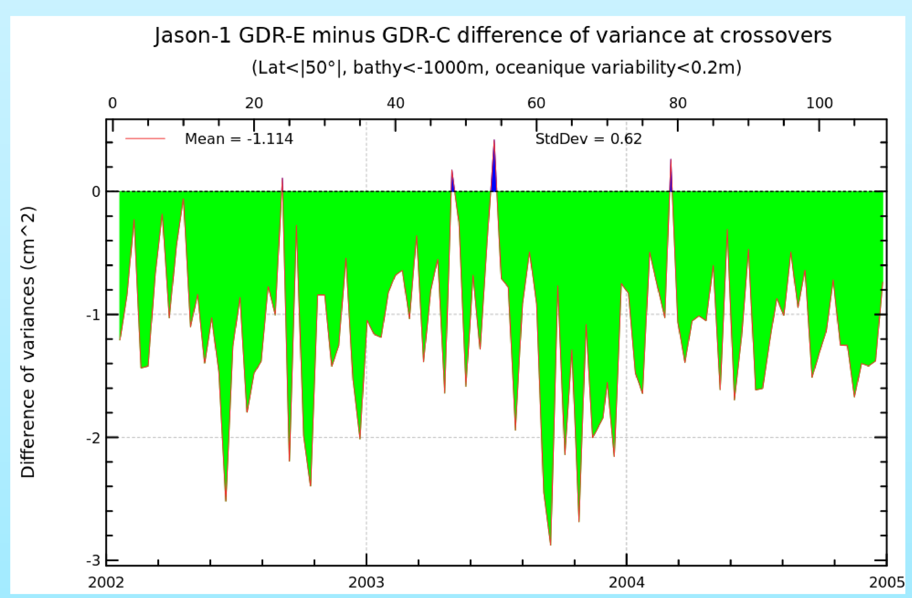


FIRST RESULTS OF JASON-1 GDR-E PERFORMANCES

Ascending / descending sea surface height (SSH) differences are computed at crossover points for time differences less than 10 days between ascending and descending tracks.

The standard deviation of SSH differences is lower for GdrE than for GdrC data , leading to a global SSH reduction of variance of 1.1 cm²

➔ **Variance at SSH crossovers is lower using GDR-E data than GDR-C.**



Jason-1 GDR-E products availability :

Data available on: ftp://avisoftp.cnes.fr/AVISO/pub/jason-1/
Handbook available on: ftp://avisoftp.cnes.fr/AVISO/pub/jason-1/documentation_gdr_e/Handbook_Jason-1_v5.0_Sept2015.pdf

Year	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Cycles	001 - 036	037 - 073	074 - 110	111 - 146	147 - 183	184 - 220	221 - 257	258 - 294	295 - 331	332 - 368	369-374, 500-521	522 - 537
GDR-E Availability	Released on AVISO and PODAAC			Release scheduled by end of October 2015				Release scheduled by end of November 2015				