CalVal Jason-3

Jason-3 validation and cross calibration activities

2018 executive summary

By succeeding to TOPEX/Poseidon, Jason-1 and Jason-2 on their primary ground track, Jason-3 has extended the high-precision ocean altimetry data record [1]. It was launched on January 17th 2016. During the tandem phase with Jason-2 (February 12th to October 2nd 2016), both satellites were on the same ground-track (with only 80 seconds delay), which is a unique opportunity to precisely assess parameter discrepancies between both missions and detect geographically correlated biases, jumps or drifts. OGDR and IGDR products have been publicly available since June 30th 2016. OGDRs were generated in version “T” until cycle 18/pass 137, and then turned into “D” version. Concerning IGDRs, they turned from “T” to “D” version at cycle 14/pass 143 on June 27th. GDR products have been available in version “T” on [2] or via [3] since early October 2016 (more details on products versions on Jason-3 handbook [4]). During each cycle, missing measurements were monitored, spurious data were edited and relevant parameters derived from instrumental measurements and geophysical corrections were analysed for OGDR, IGDR and GDR.
Jason-3 can use two on-board tracking modes: Diode/DEM (open loop) and median tracker (more details in complete annual report). In addition, a tracking automatic transition is possible, which means that when authorized: acquisition mode switches automatically from autonomous DIODE acquisition mode over land to Diode/DEM over ocean and referenced inland water. During 2017, an update of DEM (Digital Elevation Model) was uploaded on August (cycle 057). It aims at adding new hydrologic targets such as rivers and lakes: 110 lakes and more than 2700 virtual stations over lakes and rivers have been added (from 1644 virtual stations up to 4366). **Please note this year the change in orbit standard solution available in the products:**

- **until Jason-3 cycle 094, POE-E (MOE-E) orbit standard is available in GDR (IGDR) products**
- **from Jason-3 cycle 095 onwards, orbit standard “F” is used for both POE and MOE.**

Data availability

Data availability is excellent for Jason-3. Jason-3 presents 100% of data availability over ocean after removing specific events (99.96% for Jason-2, see figure 1). Such events occured twice over Jason-3 full period:

- during cycle 3, where 21.02% of measurements are missing due to the GPS platform upload,
- during cycle 57, where 1.76% of measurements are missing due to the DEM-onboard upload.

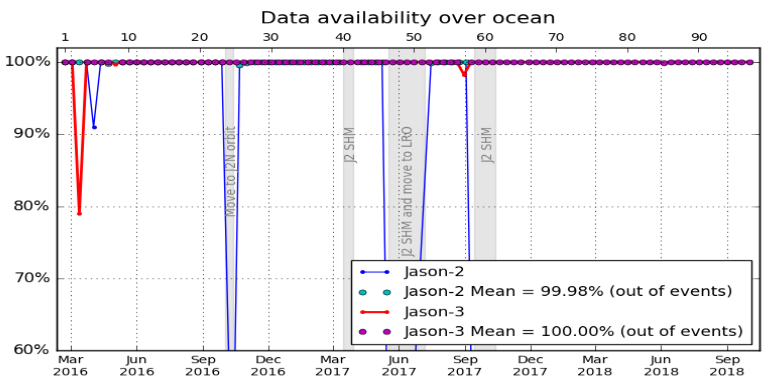

Figure 1 – Jason-2 and Jason-3 GDR data availability over ocean (per cycle)

[1] https://www.aviso.altimetry.fr/?id=601&L=0
[2] ftp://ftp.jason3.oceanobs.com
[3] http://www.class.noaa.gov
[4] https://www.aviso.altimetry.fr/fileadmin/documents/data/tools/hdbk_j3.pdf

Sea Level Anomalies

Over the tandem phase, mean SLA differences between Jason-2 and Jason-3 data is stable in time with variations close to 1 mm rms (left of figure 2) and shows no drift. It presents only a weak hemispheric bias as both satellites measure the same oceanic features only 1'20" apart (figure 2) that corresponds to orbital signatures observed on sea surface height. The global average SSH bias is close to 2.98 cm using SSH corrections (2.84 cm when using ECMWF instead of radiometer wet troposphere correction) and 2.23 cm without.

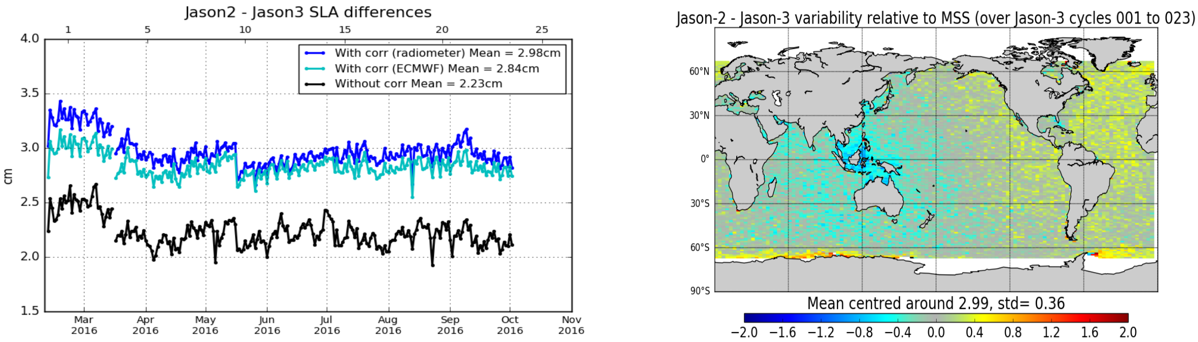

Figure 2 – Jason-3/Jason-2 tandem phase: until 02-10-2016. ***Left:*** *Daily monitoring of SSH bias between Jason-2 and Jason-3 before Jason-2 moved to interleaved ground-track in October 2016: SSH bias without applying geophysical corrections (**black**) and with corrections using radiometer wet troposphere correction (**blue**) or using ECMWF model wet troposphere correction (**cyan**).* ***Right:*** *Map of SLA difference between Jason-2 and Jason-3 over tandem phase*

During the formation flight (i.e. over cycles 25 to 46 from 12-10-2016 to 17-05-2017) and over Jason-2 LRO phase (until Jason-3 cycle 58, on 14-09-2017), average difference of gridded SLA for Jason-2 and Jason-3 shows high variability regions as Gulf Stream and Antarctic circumpolar currents are visible (figure 3). This difference is quite noisy as both satellites are shifted in time and sea state changes especially in regions of high ocean variability.

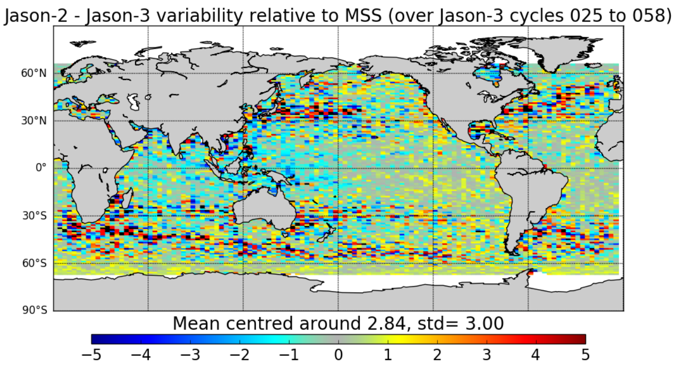

Figure 3 – GDR data. Map of Jason-2 and Jason-3 SLA differences for Jason-3 cycles 025 to 058

Performances at crossover points

Looking at SSH difference at crossovers (figure 4), a 120 day signal is visible on the mean for Jason-3 GDR data. Concerning SSH error at crossover points (standard deviation/$\sqrt{2}$), Jason-3 missions show very good and stable performances with an error of 3.48 cm (3.47cm for Jason-2).

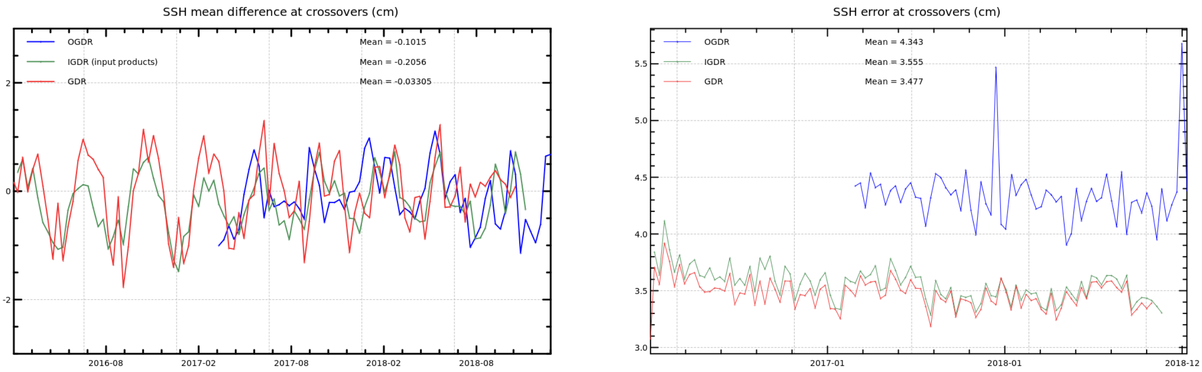

*Figure 4 – Monitoring of SSH difference at crossovers for Jason-3 OGDR, IGDR and GDR. Mean of difference (**left**) and error at crossovers (**right**). Only data with $|latitude| < 50°$, bathymetry < -1000m and low oceanic variability were selected.*

Mean SSH differences at Jason 3/Jason 2 crossovers is quite stable and around 3cm in average (figure 5, left). The geographical pattern indicates some hemispheric biases: positive to the west, negative to the east (figure 5, right). It corresponds to orbital signatures observed on sea surface height.

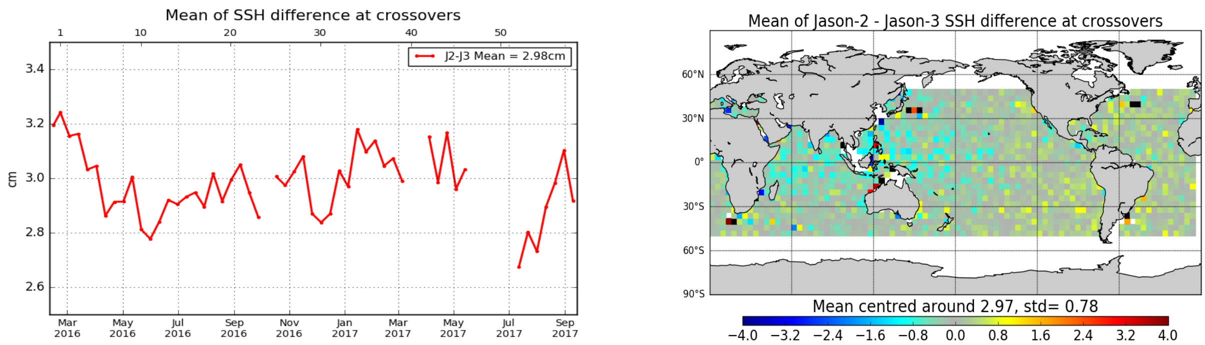

Figure 5 – Cyclic monitoring of Jason-2 - Jason-3 SSH crossover differences mean (left) and map over cycle 1 to 58 (right). Only data with $|latitude| < 50°$, bathymetry < -1000m and low oceanic variability were selected.

Contribution to Global Mean Sea Level

Since May 2016 (Jason-3 cycle 11), Jason-3 has been the reference altimetry mission to estimate the Global Mean Sea Level (GMSL), replacing Jason-2. Regional and global biases between missions have to be precisely estimated in order to ensure the quality of the reference GMSL serie. For more precisions, see the dedicated section on AVISO+ website [[5]].

[5] https://www.aviso.altimetry.fr/en/data/products/ocean-indicators-products/mean-sea-level.html