2017 executive summary on Jason-2

By succeeding to TOPEX/Poseidon and Jason-1 on their primary ground track, Jason-2 has extended the high-precision ocean altimetry data record.

Please note that 2017 annual report is the last provided on CNES side for Jason-2.

History

The OSTM/Jason-2 satellite was successfully launched on June, 20th 2008. Since July, 4th, Jason-2 was on its operational orbit.

– Until January 2009, it was flying in tandem with Jason-1, only 55s apart.

– From May 2012 onwards, Jason-1 was on a geodetic orbit until its last measurement on 21st June 2013, after about 11.5 years in orbit. Cross-calibration results with Jason-1 are available in Jason-1 GDR-E reprocessing[1]

– Jason-3 was launched on 2016, January 17th. Cross-calibration analyzes between Jason-2 and Jason-3 are performed and shown in Jason-3 annual report[2].

– Jason-2 was moved from its original groundtrack to its new interleaved groundtrack on October 2016.

– Jason-2 was moved to a Long Repeat Orbit (LRO) at the beginning of July 2017.

CalVal activities

Since the beginning of the mission, Jason-2 data have been analyzed and monitored in order to assess the quality of Jason-2 products. 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. Cycle per cycle reports are available on AVISO webpage[3].

The more of 9 years of Jason-2 data show excellent quality.

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[1] Roinard H., Philipps S.: Jason-1 GDR-E release. Global assessment over ocean. SALP-RP-MA-EA-22426-CLS. Available at http://www.aviso.altimetry.fr/fileadmin/documents/calval/validation_report/J1/Jason1_ReprocessingReport_GDR_E.pdf

[2] H. Roinard, E. Cadier. Jason-3 validation and cross calibration activities (Annual report 2017). SALP-RP-MA-EA-23187-CLS. https://www.aviso.altimetry.fr/en/data/calval/latest-results.html

[3] http://www.aviso.altimetry.fr/en/data/calval/systematic-calval.html

Main processing events summary

End of 2008 Jason-2 data were already available to end users in OGDR (3h data latency) and IGDR (1-2 days data latency).

− They were first released in version T and switched at cycle 015 to version C.

− They stayed in this version till cycle 149 (till 2012/07/31 12:01:59 for OGDR).

− GDR data were released in standard version C during August 2009.

− During 2012 the whole GDR dataset was reprocessed in GDR-D version.

→ **A description of the different Jason-2 products is available in the OSTM/Jason-2 Products handbook** [4]

As concerned mission events that impact processing, note that :

− Since 5th of April 2013 (cycle 175), platform moduleB has been used.

− During cycle 226 and 227, the precise orbit ephemeris (orbit in GDR) was based on DORIS and SLR only due to payload GPS unavailability. Since cycle 228, GPS-B (instead of GPS-A) is operational.

− Since cycle 254, POE-E orbit standard has been applied.

− Jason-2 was moved from its original groundtrack to its new interleaved groundtrack on October 2016 (from October 2nd at 11 :53 UTC (end of cycle 303) until 13-10-2016 at 20:00:00 (cycle 305, pass 164)).

− After several Safe Hold Modes in March and May 2017, Jason-2 was moved to a Long Repeat Orbit (LRO) at the beginning of July 2017. In order to improve data quality, mean sea surface solution in products has been modified to CNES/CLS 2015 solution [5] from cycle 500 (first cycle on LRO) onwards.

New Long Repeat Orbit [LRO] During the exceptional JSG held on 2017 June 20th, due to the gyro 1 and 2 status that will need more investigations, the global ageing of the spacecraft, and the already existing recommandation from OSTST to move Jason-2 to a new orbit at 1309.5km, it was decided to start the maneuvers to that new orbit. Jason-2 has been moved in early July to a new LRO (Long Repeat Orbit) orbit. The new orbit was reached on July 8th and the onboard instruments have resumed nominal operations on July 11th.

The Jason-2 data products in the LRO phase follow a similar naming convention as was used when Jason-1 was moved to the LRO phase. Specifically, data products are provided in about 10-days cycles, with cycle numbering beginning at cycle number 500 and each cycle containing 254 passes (half orbit revolutions). The product version remain as version "D".

The Jason-2 Long Repeat Orbit is approximately 27 km below the historical T/P orbit still used by Jason-3. The very long repeat cycle yields a fine grid of approximately 8-km: it is beneficial for marine geodesy (e.g. improvement of bathymetry and mean sea surface models).

The strategy is inherited from Jason-1 EOL with a try to optimize all sub-cycles, shorter ones for sea-state and mesoscale, and longer ones for geodesy (detail about sub cycles in 2017 annual

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[4]Available at http://www.aviso.oceanobs.com/fileadmin/documents/data/tools/hdbk_j2.pdf.
[5]Mean Sea Surface CNES/CLS model https://www.aviso.altimetry.fr/en/data/products/auxiliary-products/mss.html

report). More details can be found in the JA1-GM [6] and JA2-EOL papers [7].

Note that Jason-2 first measurements on Long Repeat Orbit is on 11/07/2017 10:32:39 (cycle 500, pass 033).

Data availability

Data availability is excellent for Jason-2. Jason-2 presents more than 99% of measurements available over ocean and after removing specific events or big anomalies (see right of figure 1). The main anomalies on red curve of left side of figure 1 are:

– During 2013, Jason-2 entered safe hold mode twice in March (from 25/03/2013 to 29/03/2013 and from 30/03/2013 until 05/04/2013, during cycles 174 and 175) and a third time in September (from 05/09/2013 to 12/09/2013, during cycles 190-191).

– During 2016, data are missing between April, 5th at 13:35:10 and April, 6th at 12:02:40 as no altimeter measurements have been performed (altimeter in wait mode) during this period to allow the upload of new GPS onboard software.

– Jason-2 was moved from its original groundtrack to its new interleaved groundtrack on October 2016: During move to interleaved ground track, there is no measurement from October 2nd at 11:53 (end of cycle 303) until the end of the orbit change nominal sequence on 13-10-2016 at 20:00:00 (cycle 305, pass 164).

– Several Safe Hold Modes happened in March and May 2017
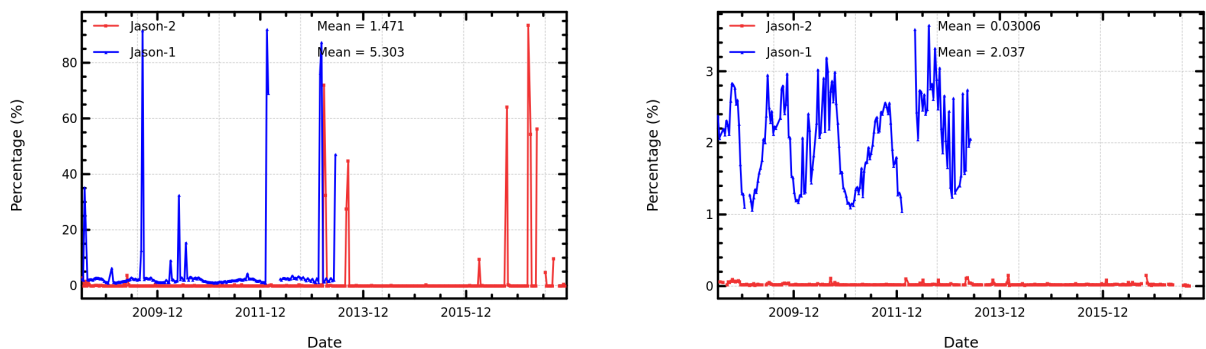

Figure 1 – Jason-2 and Jason-1 GDR data availability over ocean (per cycle). On the right side cycles with missing data due to event or anomaly are excluded.

A selection is done to reject bad points before compute statistics. It leads to a mean of 3.3% of Jason-2 measurements that are rejected on each cycle (after having selected only ocean/lakes measurements, without land and ice flagged points).

[6]JA1-GM http://dx.doi.org/10.1080/01490419.2012.717854
[7]JA2-EOL http://dx.doi.org/10.1175/JTECH-D-16-0015.1

Sea Level Anomalies

The monitoring of SLA standard deviation has been computed and plotted in figure 2. Standard deviation of daily SLA average differences is about 10.4 to 10.9 cm against MSS solution that is used.
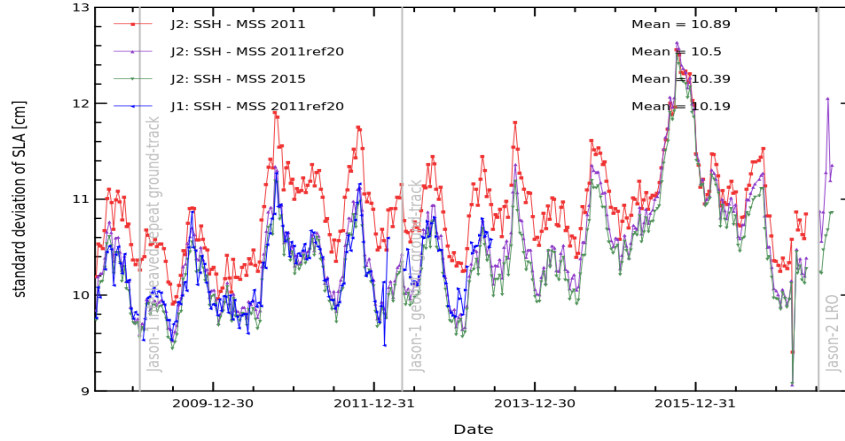

Figure 2 – Cycle by cycle monitoring of SLA standard deviation for Jason-1 and Jason-2 (using different MSS solutions)

Performances at crossover points

At crossovers Jason-2 shows very good and stable performances for both IGDR and GDR products. The standard deviation of differences at crossover points of 4.9 cm represents a system error of 3.5 cm.
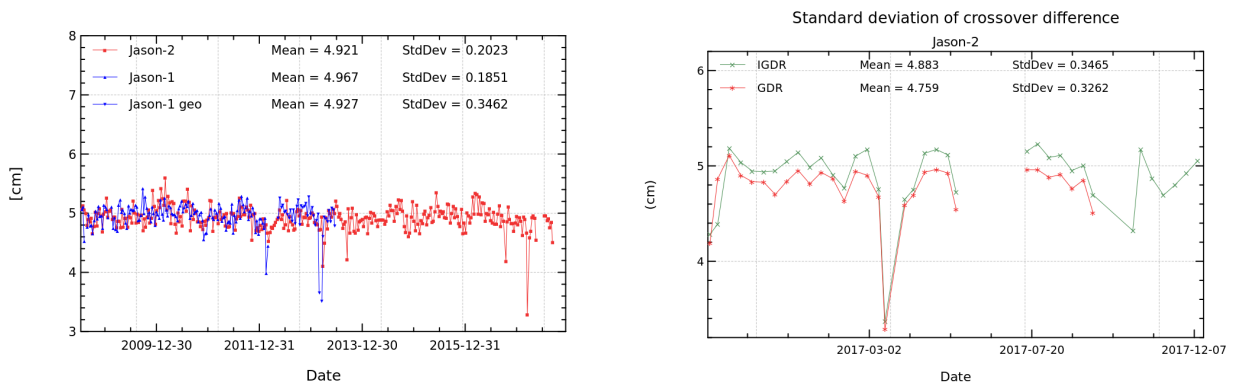

Figure 3 – Cycle by cycle standard deviation of SSH crossover differences for Jason-2 and Jason-1 (left) and Jason-2 GDR versus IGDR (right). Only data with abs(latitude) < 50°, bathymetry < -1000m and low oceanic variability were selected.

Contribution to Global Mean Sea Level

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 [8] and annual report for this activity[9].

Jason-2 contibutes to the reference GMSL indicator between October 2008 and June 2016. Over this period, its stability is excellent, and no anomalies has been detected as shown on comparison to tide gauges on figure 4. Note that since it has been replaced by Jason-3 data, Jason-2 is no more used to compute the reference serie on historical TOPEX-Poseidon ground track.
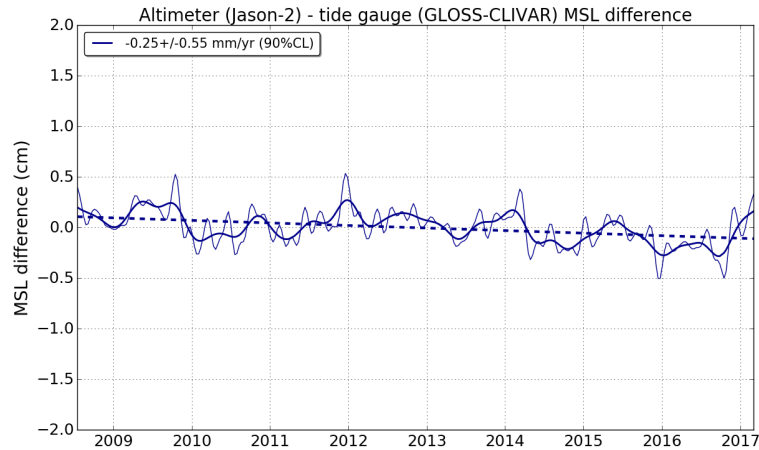

Figure 4 – Jason-2 / tide gauge (GLOSS/CLIVAR network) comparisons. Periodic signals are removed and resulting time series are 2-month (thin line) and 6-month (thick line) low-pass filtered. Dotted line represent a linear regression fit of the time series; slope values are indicated in the legend

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

[9]M. Ablain. SALP annual report (2017) of Mean Sea Level Activities (SALP-RP-MA-EA-23189-CLS)