Jason-2 mission performance

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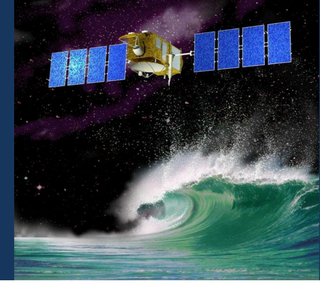
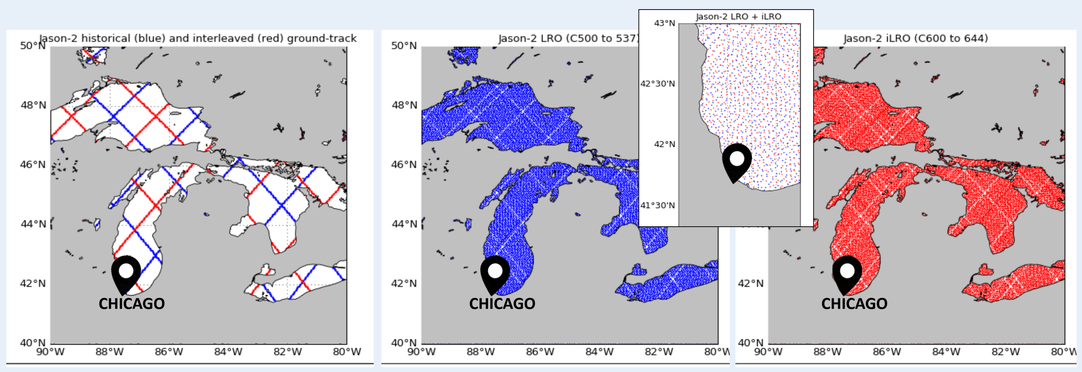


The Jason-2 is the reference mission on TOPEX/Poseidon historical ground track for mean sea level applications from 2008 et 2016. It is also used to observe mesoscale ocean dynamics. Over the last 3 years many events occurred on Jason-2 mission. As for Jason-1 and TOPEX/Poseidon before it, Jason-2 was first moved to an interleaved but at the same altitude orbit in October 2016. Due to several gyro anomalies, system Safe Hold Modes (SHM) occurred and Jason-2 was moved to a Long Repeat Orbit (LRO) in July 2017. This orbit is approximately 27 km below the previous orbit still used by Jason-3. Thanks to this first year flying over Long Repeat Orbit, along-track data are available following an 8km resolution grid. During this period SHM occurred twice (in September 2017 and February 2018). Since its move in July 2018 to an interleaved LRO (i-LRO) SHMs have again occurred by four times (in oct-18, dec-18 and twice in feb-19). In addition to data from first year on LRO, this i-LRO will allow to provide data on a 4km resolution grid thanks to a complete second year of measurements, which is of great interest for geodesic community. It was so decided to enter a hibernation phase for about 3 months, and to develop and then apply a strategy to switch between operational and healthy gyros, in order to reduce the SHM events risk.
Since 22nd May 2019, Jason-2 has been re-operating, and has provided telemetry measurements.
Finally, mission ended this month after more than 11 years in flight.
Data are analyzed and monitored in order to assess the quality of the products and how the system performance and data quality are affected (or not) by the last years events. The objective of this presentation consists in giving an overview of Jason-2 data coverage and data quality concerning altimeter and radiometer parameters, but also the performance of products at mono-mission crossovers and along-track over the whole mission lifetime.

Jason-2 timeline

Topex/Jason historical orbit	Interleaved orbit	First drifting orbit	Second drifting orbit
C001 → C303	C305 → C327	C500 → C537	C600 → C644
12/07/08 → 02/10/16	13/10/16 → 17/05/17	11/07/17 → 18/07/18	25/07/18 → 01/10/2019

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 : thanks to 1 year on Long Repeat Orbit, spatial resolution from J2 data is approximately 8-km, and reach 4-km thanks to iLRO: this high density of measurements is beneficial for marine geodesy (e.g. improvement of bathymetry and mean sea surface models).



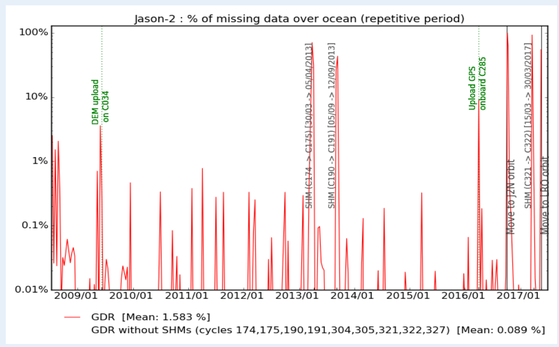
Cycle 001 to 303
Cycle 305 to 327

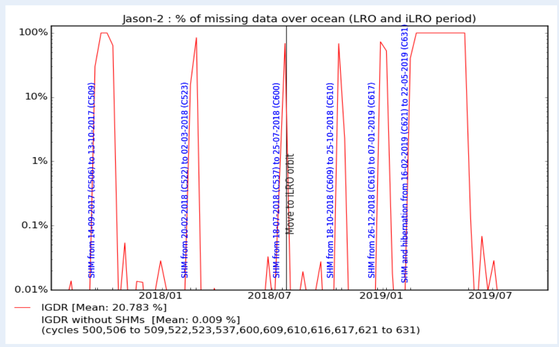
LRO, Cycle 500 to 537

iLRO, Cycle 600 to 644

Data coverage and quality

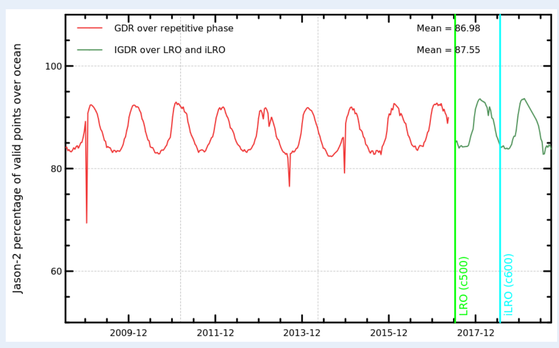
Data availability





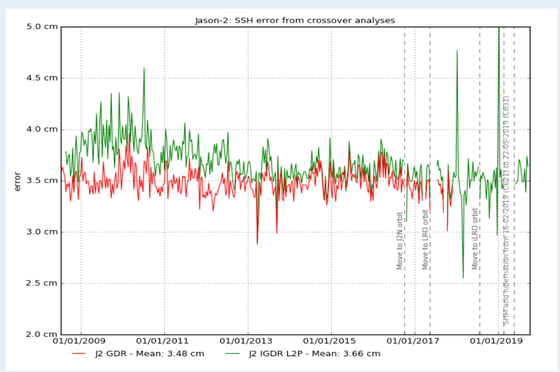
Very good data availability over ocean:
98.4 % over repetitive phase, calibrations and incidents included
After removing calibrations and incidents :
>99.9 % data are available over ocean over all repetitive, LRO & iLRO phases

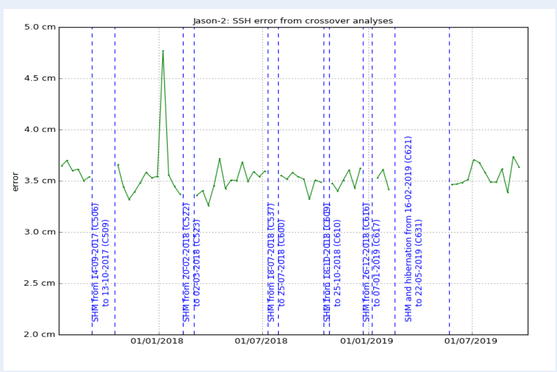
Valid data over ocean



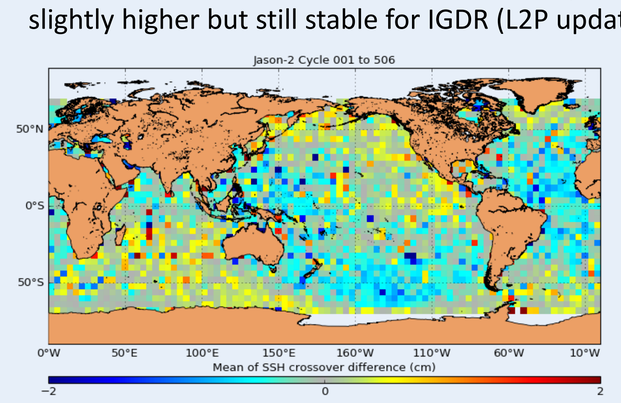
An annual signal due to ice coverage cycle is visible (~9% of rejected data in average). Out of these rejected points, the editing process removes between 3% and 4% of data when no anomaly. This level is consistent for Jason-2 over each period (historical ground track, interleaved, then LRO and i-LRO).

SSH differences at crossover points





Sea Surface Height (SSH) error for Jason-2 is deduced from crossovers analysis using radiometer data and selecting |latitudes| < 50°, bathy<-1000m, oceanic variability < 20 cm.
⇒ Error from SSH differences at crossover points analysis is close to **3.5 cm** for GDR data, and slightly higher but still stable for IGDR (L2P updates included) during Long Repeat Orbits phases.

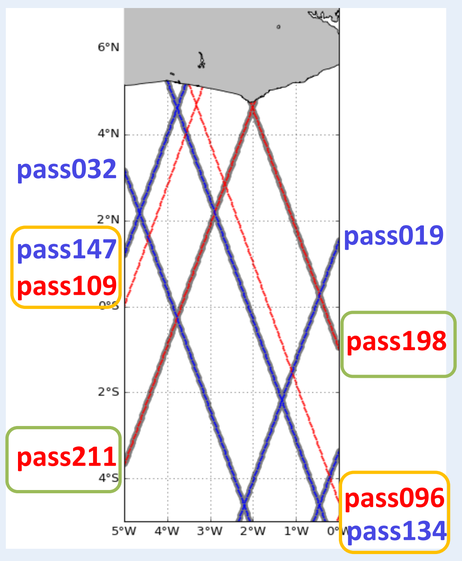


Spatial distribution of mean SSH differences shows geographically correlated patterns with differences remaining below 2 cm.

⇒ Crossovers analysis demonstrates the good performance of Jason-2 mission.

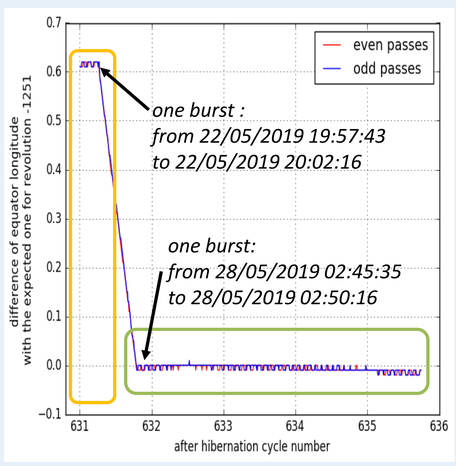
Focus on rewinding after hibernation

Cycle631: available points
Cycle621: available points
Cycle621: expected (theoretical) points



Jason-2 entered Safe Hold Mode on 2019/02/16. The last available IGDR points is on **cycle 621 pass 151**, at 13:25:51.
After the hibernation period of about 3 months, the first IGDR data happened on 2019/05/22 at 11:27:54, over **pass 056 of cycle 631**.

Thanks to a couple of maneuvers, a kind of rewinding on theoretical drifting ground track has been done.



Following the difference between equator longitude for a revolution and the expected one for the 1251st revolution before, shows that differences are around 0.62° from restart (at cycle 631 pass 056) to around cycle 631 pass 066 (*one burst : from 22/05/2019 19:57:43 to 22/05/2019 20:02:16*) . On the map, this is the case :

- between **cycle 621 pass 096** and **cycle 631 pass 134**.
- between **cycle 621 pass 109** and **cycle 631 pass 147**.

From cycle 631 pass 198 (2019/05/28) onwards, this difference drop under 0.01° (*one burst: from 28/05/2019 02:45:35 to 28/05/2019 02:50:16*).
Therefore, **cycle 631 pass 198** exactly cover the expected **cycle 621 pass 236**, and **cycle 631 pass 211** correspond to expected **cycle 621 pass 249**.

Conclusions

After more than 11 years in orbit, Jason-2 mission ended this month.
Jason-2 mission shows excellent performances in terms of data availability and quality.
Jason-2 LRO and iLRO data quality will allow to improve mean sea surface models out of historical ground track .
Jason-2 data greatly contributed to ocean dynamics understanding and climate sea level monitoring.
Its great quality of data and coherence with other missions will be improved by a future reprocessing in line with actual works over SARAL, TOPEX, and Jason-3 GDR-F.

OSTST Conference, Chicago, USA
Oct 21st – Oct 25th, 2019