Global Jason-2 and Jason-1 Data Quality Assessment

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1: CLS 2: JPL 3: CNES
Objectives of altimetry validation activities over ocean are:

- To check the data availability and validity
- To analyze the physical content quality of product parameters
- To estimate the system performances
- To contribute to a better knowledge of the sea-level physical content
- To check the system improvement
- To provide information for users and production centre (My Ocean/DUACS, ...)

Since launch of Jason-1 and Jason-2, GDR products are systematically checked on CNES and JPL side before distribution to users.
Particular events during 2013

Events:
- Jason-2 Safe Hold Modes:
  - 25-03-2013 [cycle 174]
  - 30-03-2013 [cycle 174 & 175]
  - 05-09-2013 [cycle 190 & 191]
- Jason-1 Safe Hold Mode:
  - 28-02-2013 [cycle 527 & 528]
- Jason-1 was passivated and decommissioned on 1st July 2013:
  - Contact lost and last measurement: 21-06-2013 [cycle 537]

Data used:
- 1 Hz Jason-2 (*homogeneous dataset in GDR product*)
- 1 Hz Jason-1 (GDR-C)

Original groundtrack | Interleaved groundtrack | Geodetic phase
---|---|---
1 – 259 | 262 - 374 | 500 - 533
1-149 | 150-192 | 537
Check the internal consistency of an altimetric system by analysing the Sea Surface Height (SSH), its parameters and geophysical corrections.

Mono-mission analyses

Compute the SSH differences between altimeter data and in-situ measurements (tide gauges, Argo T/S profiles,...) to detect potential drifts or jumps on the long-term time series.

Cal/Val

Evaluate the coherence between two altimeter systems by comparing their SSH and estimate the potential improvement of the computation of a new altimeter standard in the SSH calculation.

In-Situ comparisons

Cross-comparisons
Mono-Mission Analyses
- Jason-1 (> 95 %) and especially Jason-2 (> 99%) have excellent data coverage

- only few data rejected (~3.5 %) after land and ice removal
Stability of the radiometer wet troposphere correction

- Daily monitoring of radiometer – model wet troposphere correction showed impact of more than 1 cm during Yaw fix periods after March 2013 safehold.
- GDR production was interrupted in order to allow generation of new calibration coefficients (JPL), which reduces the attitude dependent error of JMR.
- A pre/post safehold bias remains (to be addressed by an end-of-mission dedicated recalibration of the JMR).
Altimeter system error JA1/JA2 products after removing of instrumental noise for time scales < 10 days (using radiometer data):

<table>
<thead>
<tr>
<th>cm</th>
<th>Jason-1</th>
<th>Jason-2</th>
</tr>
</thead>
<tbody>
<tr>
<td>OSDR/OGDR</td>
<td>8.57</td>
<td>4.62</td>
</tr>
<tr>
<td>IGDR</td>
<td>4.06</td>
<td>3.77</td>
</tr>
<tr>
<td>GDR</td>
<td>3.60</td>
<td>3.49</td>
</tr>
</tbody>
</table>

- |latitude|<50
- bathy<-1000m
- low variability areas
Impact of standards on System error

- Using JPL GPS POE instead of GDR-D POE reduces the system error by 44 mm²
Multi-Mission Analyses
Geographical correlated errors between missions

Product standards
JA1: POE-C/D, GOT00, SSB
JA2: POE-D, GOT4V8, SSB

JA1 updated standards
JA1: POE-D, GOT4V8, SSB
JA2: POE-D, GOT4V8, SSB

+ updated SSB 2012 (for JA1 + JA2)

+ Doris only orbit (for JA1 + JA2) without down-weighting of SAA stations for JA1

JA1– JA2 mean at crossovers over year 2009 using model WTC

centered around 0.072, median = 0.072, std = 0.024 m

- 1.5 cm  1.5 cm
Temporal monitoring of Jason-1 – Jason-2 mean at crossovers shows a jump of several mm after switch to geodetic mission for JA1

- partly explained by small jump on JMR wet troposphere correction and more precise PRF
- Has to be corrected when computing global mean sea level trends for JA1

### JA1 updated standards
- JA1: POE-D, GOT4V8, SSB
- JA2: POE-D, GOT4V8, SSB

### JA1-JA2 Radiometer WTC
Mean = 10.4  StdDev = 0.2574

### JA1-JA2 Model WTC
Mean = 10.28 StdDev = 0.2136

**6.3 mm**
Global Mean Sea Level computed:
- over common period of Jason-1 and Jason-2
- bias between JA1 repetitive and JA1 geodetic corrected

~4.5 years (July ‘08 -> February ‘13) shows differences of about 0.7 mm/yr with radiometer wet troposphere correction.

The graph shows the comparison between Jason-1 and Jason-2 with the following slopes:
- Jason-2: slope = 2.87 mm/year [L.S.R. = 0.196]
- Jason-1: slope = 2.18 mm/year [L.S.R. = 0.2]

The graph also indicates that no GIA was applied.
Global MSL monitoring

Difference of Jason-2 GMSL – Jason-1 GMSL computed over Jason-2 cycles

JA1 updated, homogeneous solutions for:
- POE-D orbit,
- GOT4.8 tide,
- MSS 2011

Radiometer Wet Troposphere + JA1 product data: 0.71 mm/yr
Radiometer Wet Troposphere + JA1 updated: 0.63 mm/yr
Model Wet Troposphere + JA1 updated: 0.21 mm/yr
In-situ comparisons
Comparison to tide gauges

The error of Jason-1 & 2 GMSL trends is estimated thanks to comparison to tide gauges:

- Jason-1 GMSL drift: 0.1 mm/yr from 2002 to 2013
- Jason-2 GMSL drift: -0.2 mm/yr from 2008 to 2013
- Considering the error of the method (0.7 mm/yr), this drift is not significant

Jason-1 & 2 allow to estimate very accurately the GMSL
Synthesis/ Conclusion

Jason-1 and Jason-2 data coverage and quality are excellent for both satellites, with a very good consistency:

⇒ SSH error <= 4 cm for temporal scales < 10 days
⇒ Global MSL trend differences <= 0.3 mm/yr (with model WTC)
⇒ Correlated geographical bias < 1 cm

Some discrepancies have been detected:

⇒ Radiometer drifts ~0.4 mm/yr between JMR and AMR
⇒ Correlated geographical bias between orbit solutions and SSB solutions which changes slightly in time.

Although Jason-1 mission is ended, further work is needed to improve Jason-1 data in parallel to Jason-2 and SARAL/Altika missions for mesoscale and climate applications.

This work, as well as interactions between production teams, CalVal teams and experts contributes to the high quality of the Jason data.