JASON-2 global error budget for time scales lower than 10 days

S. Phillips\textsuperscript{1}, M. Ablain\textsuperscript{1}, H. Roinard\textsuperscript{2}, E. Bronner\textsuperscript{3}, N. Picot\textsuperscript{2}

\textsuperscript{1}CLS, Space Oceanography Division, Toulouse, France
\textsuperscript{2}CNES, Centre National d’Etudes Spatiales, Toulouse, France

Overview:

The objective of this study is to describe the JASON-2 error budget derived from altimeter level 2 products (OGDR, IGDR, GDR), for each component used in the sea-level calculation.

Although errors on altimetry measurements exist on several temporal and spatial scales, we have only focused our analyses on errors lower than 10 days and at global scale. Altimetry errors at climate scales have already been described by [Ablain et al., 2012].

The second objective is also to compare this error budget with JASON-2 mission requirements and to scientific goals.

Methods:

In order to assess the errors, several approaches are used:

- taking advantage of the formation flight phase of JASON-2 with JASON-1 (cycles 1 - 20)
- spectral analysis
- analysis of the rms of 20 Hz data
- comparison with other corrections
- consulting the available literature.

Global JASON-2 error budget for time-scales < 10 days

The global error budget of JASON-2 has been synthesized from the parameters and corrections. Sometimes errors are defined only with a lower bound because the exact error or the upper bound has not been estimated yet.

JASON-2 specifications and scientific goals have also been added. However figures are not easily comparable, since for instance specifications describe sometimes only the "white noise" contribution, but not all the error content < 10 days.

<table>
<thead>
<tr>
<th>Error budget</th>
<th>Specifications</th>
<th>Error (&lt;10 days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Altimeter range</td>
<td>&lt;1.7 cm</td>
<td>&lt;1.6 - 1.7 cm</td>
</tr>
<tr>
<td>Ionosphere</td>
<td>1 cm</td>
<td>0.5 cm</td>
</tr>
<tr>
<td>Dry troposphere</td>
<td>0.3 cm</td>
<td>2 cm</td>
</tr>
<tr>
<td>Wet troposphere</td>
<td>0.7 cm</td>
<td>0.4 cm</td>
</tr>
<tr>
<td>NASA mission corrections</td>
<td>1.2 cm</td>
<td>&lt;0.2 cm</td>
</tr>
<tr>
<td>Error budget</td>
<td>10 cm</td>
<td>2.5 cm</td>
</tr>
<tr>
<td>Sea surface height</td>
<td>0.7 dB</td>
<td>0.11 dB</td>
</tr>
<tr>
<td>Raw sea surface height</td>
<td>11 cm</td>
<td>3.9 cm</td>
</tr>
<tr>
<td>Final sea surface height</td>
<td>2 cm</td>
<td>&lt;0.5 cm</td>
</tr>
</tbody>
</table>

Wet troposphere correction (AMR)

The error of the radiometer wet troposphere is at least 0.2 cm. Long-term monitoring shows that JASON-2 radiometer is subject to jumps and drifts within a 10-day window (especially for IGDR).

Example:

The mean STD differences between AMR (JASON-2) and JMR (JASON-1) during the JASON-2 formation flight phase is 0.3 cm, therefore there is a minimal error of 0.2 cm for each radiometer.

Dry troposphere correction

The error of the dry troposphere is between 0.3 cm (comparison between models) and 0.7 cm (theoretical considerations, Solstein et al., 2008) for IGDR and GDR products. For GDR products the error ranges between 0.4 cm (comparison between analyzed and predicted fields) and 0.7 cm.

Summary & Conclusions

In this study, a rigorous and formal approach has been developed to provide the error budget of JASON-2 altimeter level 2 products for time scales lower than 10 days and over the global ocean:

- "White noise" (when useful) and all error content < 10 days have been estimated separately
- Errors has been estimated with the systematic definition of a lower bound

This study could be improved in future refining the estimation of error with an upper bound and focusing on regional scales.

Currently, the time and spatial scales of the altimeter mission specifications (as JASON-2) are not described separately clearly the different time and spatial scales, nor give specifications distinguishing the types of applications (mesoscale, climate, ...)

Ideally, future altimeter mission should contain error specifications more detailed and separated for the different temporal and spatial scales, respecting a form approach such as this in study.