Confidence envelop of the Global MSL time-series deduced from Jason-1 and Jason-2 altimetric missions.

M. Ablain, L. Zawadzki (CLS), A. Cazenave, B. Meyssignac (LEGOS)
Knowledge of the errors impacting Mean Sea Level computation is needed in order to respond to users’ requirements:

- Work performed in SL_cci phase 1

<table>
<thead>
<tr>
<th>Spatial Scales</th>
<th>Temporal Scales</th>
<th>User Requirements</th>
<th>Altimetry errors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Global Mean Sea Level (10-day averaging)</td>
<td>Long-term evolution (&gt; 10 years)</td>
<td>0.3 mm/yr</td>
<td>&lt; 0.5 mm/yr</td>
</tr>
<tr>
<td></td>
<td>Inter annual signals (&lt; 5 years)</td>
<td>0.5 mm over 1 year</td>
<td>&lt; 2 mm over 1 year</td>
</tr>
<tr>
<td></td>
<td>Periodic signals (Annual, 60-days,…)</td>
<td>Not defined</td>
<td>Annual &lt; 1 mm 60-day &lt; 5 mm</td>
</tr>
</tbody>
</table>

User Requirements (URs) (GCOS, 2011) with respect to temporal scales (nb: altimeters scientific goals have lower requirements than URs)
Objectives (SL_cci phase 2)

→ Providing the instantaneous error of GMSL time series
→ Releasing a confidence envelop is an adequate means to monitor errors in time.
→ Interpret the confidence envelops

**GMSL derived from TP, Jason-1 and Jason-2**
*(GIA applied)*

-3.27 mm / year

Date: 17-Oct-2014
Approach:

Generate a set of GMSL time-series that a priori have equivalent qualities by tuning identified parameters.

→ Choices made to design the GMSL set requires exhaustive preliminary studies.

→ Dispersion of time-series will draw confidence envelopes which will need to be adapted according to analyses’ objectives.
Generate a set of GMSL time-series with equivalent qualities

4 uncertainty families are tuned

- Standards
- Data Selection
- Average Mesh Grids
- Missions Linking

Sea Level CCI – Phase II 1st annual review – Jan. 29th – 30th 2015
Generate a set of GMSL time-series with equivalent qualities

4 uncertainty families are tuned

Standards

Data Selection

Average Mesh Grids

Missions Linking

Generation of a set of GMSL time-series by choosing several combinations of standards that have equivalent qualities:
- MSS (CNES/CLS, DTU), Tidal models, etc…
Generate a set of GMSL time-series with equivalent qualities

4 uncertainty families are tuned

Standards + Data Selection + Average Mesh Grids + Missions Linking

Selection of near-coast measurements is a cause for uncertainty:

→ data is selected in 3 different ways (bathymetry > 0, 100 or 200 m)

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Methodology

Generate a set of GMSL time-series with equivalent qualities

4 uncertainty families are tuned

Standards + Data Selection + Average Mesh Grids + Missions Linking

Several mesh grids with a priori the same relevance are used in the set to compute the average grid at each cycle:

- 1° x 3°, 1.5° x 3°, 1° x 3.5°, etc...
Generate a set of GMSL time-series with equivalent qualities

4 uncertainty families are tuned

Standards + Data Selection + Average Mesh Grids + Missions Linking

The choice of inter-mission linking bias is sensitive to the period → several strategy a priori similar are taken into account

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Methodology

Generate a set of GMSL time-series with equivalent qualities

4 uncertainty families are tuned

Standards

Data Selection

Average Mesh Grids

Missions Linking

More than 18000 time-series are produced in the set, allowing a significant statistical approach.
The approach allows the computation of an instantaneous uncertainty envelop.
→ One may notice the error remains relatively stable over time. It rises mainly during strong La Niña or El Niño episodes (e.g. 2011, 2013).
Deducing the long-term error from the instantaneous uncertainty requires: the propagation in time of systematic errors (e.g. linking errors) and setting a common reference for each time-series (e.g. averaged at 0 over 2002).
The resulting envelop allows to verify CCI GMS time series products stay within envelop error.

It is also the case for other products: AVISO, University of Colorado, …
GMSL uncertainty due to each tuning parameter for Jason-1/Jason-2 confidence envelop

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GMSL confidence envelops permit a complementary approach to estimate altimetry errors in agreement with former studies (combining mass and steric components).

They could be calculated at smaller basin scales: e.g., Mediterranean Sea...

They could be refined by taking into account altimeter instrumental instabilities (very low for Jason1&2 but neglected here), and extended to other missions (T/P, Envisat, ERS, ...).

They could be specifically designed according to other users' needs: therefore users' feedbacks are essential.

« Error Report version 2.0 » updated with this study and delivered to ESA.

Study presented at OSTST (Konstanz, 2014) and 5th CCI collocation meeting (Frascati, 2014).