CROSS-CALIBRATION between ENVISAT and JASON-1/2

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Plan

- Data, processing, performances on Envisat mission

- Further improvements concerning geographically correlated biases: Impact of preliminary CNES GDR-D orbits

- Further improvements concerning global trend: major impact of a correction of an instrumental correction
Envisat GDR dataset

- Excellent coverage for the last 2 years in GDR and IGDR
- No impact of orbit change on coverage

In this work:
All SSH Correction have been homogenized
USO auxiliary correction used

Beginning of drifting phase:
22-26 November 2010
⇒ 30 days pseudo cycles instead of 35 days cycles
Reprocessing: Early 2011, the GDR reprocessing (2.1) exercise started.

- Essential to homogenize the GDR time series and to take into account the updates performed off line until now (ex Duacs products, Aviso).
- ~70% of the reprocessing have been performed
- All GDR, SGDR data + Cyclic reports available at:
  ftp://diss-nas-fp.eo.esa.int
directory : altimetry_dataset_v2.1

Preliminary results:

- Data quality and coverage improved for the beginning of the mission
- GDRC Orbit strongly improve the Geographically correlated biases

• Instrumental correction impacts range and SWH
  - Range: Long term drift modified
  - SWH: Bias reduced with models/Jasons with slight inconsistency observed on small SWH

Envisat GDR V2.1 reprocessed dataset

OSTST 2011, San Diego
New drifting Orbit

- Pseudo repetitivity 30 days instead of 35
- the observed drift is slightly higher: Min/Max drift estimated = 0km/yr at 38° / 20km/yr at 50°
- Envisat data quality are still very good

Variance of SLA filtered: wavelength <50km and >500km are removed

The slight degradation expected is observed. It is due to the shift of passes compared to the theoretical passes (MSS is now used instead of the mean profile).

More information, See Envisat related web sites: http://earth.eo.esa.int/pcs/envisat/ra2/
• Data, processing, performances on Envisat mission

• Further improvements concerning geographically correlated biases: Impact of preliminary CNES GDR-D orbits

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Remaining Est/West bias explained

- In 2010, several authors showed an East/West signature drifting in time on the Jasons and Envisat data (using GDR-C orbit standard).

- This discrepancy highlighted a strong sensibility to the gravity field model used as an input of orbit solutions.

- New CNES orbit with GDR-D standards (as well as the V7 ESOC solution) have been tested:
  - EIGEN_GRACE_RELEASE2Bis Gravity field estimated over 2002-2010 instead of 2003-2005
  - Additional drift component
  - ITRF2008 instead of ITRF 2005

Mean SSH difference at crossovers (2010)
EN GDR-C / J1 GDR-C (cm)
Envisat – Jason-1 at crossovers

Using GDR-C orbits

Centered Maps
Great improvement of GDR-D standards: removes the East-West discrepancy and its temporal variation! Remaining errors are likely to be due to a mix of errors on both missions.
Using GDR-D orbit for Envisat and Jason-1 removes the East/West Bias.
Regional Mean Sea Level trend differences
JASON-1-Envisat and orbit standard impact

- Thanks to multimision analysis, Geographically correlated bais were observed on Envisat and Jasons missions.
- Notably, the gravity field used in the orbit solution was shown to have a great impact on the long term drift for all missions. With the latest standard (futur GDR-D), regional consistency between mission is largely improved.
- See also talk from M. Ablain (Regional MSL), S. Philipps (Orbit) and Poster from JF Legeais (In situ)
• Data, processing, performances on Envisat mission

• Further improvements concerning geographically correlated biases: Impact of preliminary CNES GDR-D orbits

• Further improvements concerning global trend: major impact of a correction of an instrumental correction
Envisat Mean Seal Level Evolution

• The difference with Jason-1 is **about 2mm/year over 2003-2011** using the GDR 1 data set + Aviso updates
• An error in one of the **RA-2 instrumental correction (PTR)** has been demonstrated (P Thibaut and M Roca) this year.
• A new PTR correction has been tested within the ESA CCI project

![](image)

• The new PTR correction increases the Mean Sea Level trend by 1.8mm/year reducing drastically the differences with Jason-1. **This is a major progress in the understanding of Envisat / Jason-1 discrepancies**
• The reprocessed GDR 2 data will not contain this correction
• Differences still remain: differences at interannual scales are clearly visible:
  - The reprocessed data may correct a part of these discrepancies – TBC
  - The erroneous behavior of the first year is not corrected, still unexplained and will remain after reprocessing

<table>
<thead>
<tr>
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<th>Slope (mm/yr) over 2003/2010</th>
<th>Slope (mm/yr) over 2004/2010</th>
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<tbody>
<tr>
<td>Envisat GDR1 + Updates</td>
<td>0.7</td>
<td>1.1</td>
</tr>
<tr>
<td>Envisat + CCI PTR</td>
<td>2.5</td>
<td>3.1</td>
</tr>
<tr>
<td>Jason-1</td>
<td>2.6</td>
<td>2.6</td>
</tr>
</tbody>
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EN-J1=-0.1 mm/yr          EN-J1=+0.5 mm/yr

• Removing year 2003 strongly increases the EN/J1 differences
• These are **preliminary results** and further analyses have to be performed on the PTR correction impact
• Fine Calval and Cross-calibration studies including the tests of new standard have to continue in order to understand the remaining differences

OSTST 2011, San Diego
• **Ra-2 altimetry system has good performances, even on its new orbit**
  - A very good availability
  - Good metrics at crossovers, at the same level as Jason series
  - Improved with the reprocessing in terms of coverage and performance

• **Reprocessing of the GDR in version 2.1 will be completed very soon**
  - improved with the reprocessing in terms of coverage and performance
  - Crucial to have an homogeneous dataset for climate studies

• **Global and regional MSL trend discrepancies between EN and the Jason’s are getting understood/reduced**
  - Envisat /Jason-1 East West differences are removed using GDR-D orbit
  - The CCI PTR correction increases the Mean Sea Level trend by 1.8mm/year reducing drastically the differences with Jason-1. This is a major progress in the understanding of Envisat / Jason-1 discrepancies

• **Once more multi-mission analyses enabled to highlight fine errors on all altimetry datasets.**