OSTM/Jason-2 sea surface height bias by regional in situ CalVal technique

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Status on method
Status on result
Status on CalVal activity

Seattle-2009-06-22

Image from www.nasa.gov
### In situ calibration:
- Regular long term control of SSH measure: independent way from altimetry
- Interest to increase the number of usable altimeter data
- Using a set of satellites to propose an inter calibration of altimeter missions.
- Extend the principle of the in situ calibration by using satellite passes located far from the CalVal site.

### Direct application => multi missions, multi passes computation of absolute SSH bias => continuity between altimetry missions (Ostst-2006, Venice)

<table>
<thead>
<tr>
<th>ant</th>
<th>2002</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006/...</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>-0.4 cm (rms=1.9cm)</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>7.2 cm (rms=4.6cm)</td>
<td></td>
<td>GFO</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>45.4 cm (rms=4cm)</td>
<td>ENVISAT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>9.5 cm (rms=1.5cm)</td>
<td></td>
<td></td>
<td>Jason-1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Topex-Poseidon</td>
<td></td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

**Envisat**
- B= 45.4 cm, rms=4 cm (merge method)
- B= 43.3 cm, rms=7.3 cm Ajaccio
- cycles 12 to 31
 Increasing the distance between dedicated site and pass sets the problem of the measures co-localisation.

- Increase the measures density
- Two main effects: the geoid slope and the ocean dynamics.

The method brings back to the CalVal site, a distant altimetric ssh by following a path defined by the succession of known mean passes, taking into account of the spatial gradient due to the marine geoid (on map).

Ocean dynamics differential effect: Sea level difference, due to ocean dynamics, between cross-over points and tide gauge point.

Method is applicable to any altimeter satellite, assuming that there is an accurate mean profile available over the CalVal site to connect offshore altimeter data with in situ data.
How the merged method (regional + coastal) can improve the sea surface height bias estimation and reinforce it statistically?

1 CalVal site = possible calibrations of N1 satellites (Jason1,2, Topex - Poseidon, GFO, ENVISAT) and N2 passes for 1 satellite calibration

The method makes possible ssh bias computation for several altimeters:

OSTM/Jason-2, Jason-1 new orbit, T/P & GFO, ENVISAT, future altimeter missions (ssh bias referred to ellipsoid)

Follow on: Multiply the calibration opportunities: SSH bias at ocean regional scale and error budget using this method
**Results on Ssh bias**

<table>
<thead>
<tr>
<th>unit=cm</th>
<th>OSTM/JA-2</th>
<th>JA-1 GDR-c</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pass n°</td>
<td>85</td>
<td>85</td>
</tr>
<tr>
<td>ssh bias</td>
<td>18.2, 17.4</td>
<td>10.3, 9.6</td>
</tr>
<tr>
<td>std</td>
<td>2.8, 2.4</td>
<td>4.3, 4.4</td>
</tr>
<tr>
<td>cycles</td>
<td>14, 23</td>
<td>15, 154</td>
</tr>
<tr>
<td>% cy used</td>
<td>70.0%, 88.5%</td>
<td>78.9%, 59.4%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>OSTM/JA-2</th>
<th>JA-1 GDR-c</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 cycles on 20 (Ja1, ostm/Ja2 common period)</td>
<td></td>
</tr>
</tbody>
</table>

Mean bias = 18.2 cm, STD = 2.8 cm, 14 cycles on 20

Mean bias = 17.4 cm, STD = 2.36 cm, 23 cycles on 26

Mean bias = 9.6 cm, STD = 4.4 cm, 154 cycles on 259

Seattle-2009-06-22
Sig0_ku (dB) Jason-1, Ostm/Jason-2 (JA-2)

Coastal asc. pass JA-2

Coastal asc. pass JA-1

009 asc. Pass JA-2

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222 JA-2
Sig0_ku (dB) OSTM/ Jason-2.

Donc la diff sur ssb vient de swh ou vent. Nbre de cycles + complet
Ssb_corr (m) JA-1, Ostm/Jason-2 (JA-2)

Coastal asc. pass JA-2

Coastal asc. pass JA-1

009 asc. Pass JA-2

Less dispersion on JA-2 mean value
SwH (m) Jason-1, Ostm/Jason-2 (JA-2)

Coastal asc. pass JA-2 (#085) Diff treatment Jason-1 & 2: -> 3m difference on max swh.
Weaker dispersion on mean swh for JA-2. Max value are higher

Coastal asc. pass JA-1 (#085)

desc. pass JA-2 (#222)

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WindSpeedAlt (m/s)

JA-2 / asc. Coastal (#085)

JA-1 / asc. Coastal (#085)

JA-2 / desc. Offshore (#222)
Sea state from local data

Marégraphe

Altimètre

Station météo

Histogramme des hauteurs de mer enregistrées en M4

Histogramme des hauteurs de vagues altimétriques

Histogramme des vitesses de vents mesurées par la station météorologique
For coastal pass: cycle discard is often associated with an IB corr. ~zero or strong, Sigma0 near maximum values.

For offshore passes: discard cycles, aren’t frequently synchronous with an IB corr ~zero or strong.

Coastal passes: IB is a good candidate for ssh bias discard. (observed on Jason-1, still on OSTM/Jason-2)

Status: Calval tide gauges and GPS mean sea surface


- 2009-06: in situ data reprocessed (Senetosa) from 2002 to 2009-05.

- 2009-07 ->... Sea level files used for Senetosa in situ CalVal activity: FTP access for OSTM community / or anonymous server FTP. Definitions, validations, delivrable time in 2009 to be determined.
THANK YOU

MERCI
Vents et vagues JASON-1 à Senetosa

Comparaison vent/vagues altimétriques

Hauteur des vagues (m)

Vitesses du vent (m/s)

Vitesses du vent local (m/s)

Vitesse du vent alti (m/s)

Comparaison vent altimétrique/station météo

Vents JASON-1 et station météo à Senetosa