Dealiasing high frequency ocean response to atmospheric forcing

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Outline

- Global correction improvements
  - Processing overview
  - Model v IB improvements
  - LR v HR improvements

- Regional correction perspectives
  - Regional platforms
  - Performances

- Summary
Processing chain to filter HF signal (de-aliasing)

ECMWF
6-hourly Pressure
6-hourly Wind

S1/S2 filtering

S1/S2 Monthly climatologies

detided Pressure

IB correction
(without S1, S2)

Low-pass filter (20 days)

IB \( \text{LF} \)

MOG2D model

High-pass filter (20 days)

MOG2D \( \text{HF} \) + IB \( \text{LF} \) = DAC

Tide models
non gravitational S1, S2

Dry tropo. correction
S1, S2 model (Ray)

MOG2D \( \text{HF} \) + IB \( \text{LF} \) = DAC

2nd generation
Jason-1 & ENVISAT
GDR

MOG2D \( \text{HF} \) + IB \( \text{LF} \) = DAC

IB \( \text{LF} \)
Crossover differences:

- With IB: std = 7.04 cm
- With DAC: std = 6.41 cm
- Variance reduction:
  - $8.47 \, \text{cm}^2$ (2.91 cm RMS)
  - 17%
From Low resolution to High resolution global correction
### Dynamic Atmospheric Correction (DAC) HR / LR

#### Gain in altimeter crossover variance relative to IB

<table>
<thead>
<tr>
<th>Region</th>
<th>CO-DAC_BR</th>
<th>CO-DAC_HR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Global ocean</td>
<td>16.56</td>
<td>20.24</td>
</tr>
<tr>
<td>High Latitudes</td>
<td>18.5</td>
<td>22.56</td>
</tr>
<tr>
<td>Low Latitudes</td>
<td>5.3</td>
<td>6.04</td>
</tr>
<tr>
<td>Deep ocean</td>
<td>12.5</td>
<td>15.73</td>
</tr>
<tr>
<td>Shallow waters</td>
<td>28.28</td>
<td>32.94</td>
</tr>
</tbody>
</table>

#### Gain in variance at tide gauges, relative to IB

<table>
<thead>
<tr>
<th>Region</th>
<th>Obs</th>
<th>Obs-IB</th>
<th>Obs-MOG2D_HR (%)</th>
<th>MOG2D_HR (%/IB)</th>
<th>MOG2D_BR (%/IB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Global ocean</td>
<td>32.37</td>
<td>17.54</td>
<td>8.22</td>
<td>53.1%</td>
<td>51.26%</td>
</tr>
<tr>
<td>High Latitudes</td>
<td>57.22</td>
<td>28.71</td>
<td>12.24</td>
<td>57.4%</td>
<td>55.35%</td>
</tr>
<tr>
<td>Low Latitudes</td>
<td>8.38</td>
<td>6.75</td>
<td>4.35</td>
<td>35.6%</td>
<td>34.51%</td>
</tr>
</tbody>
</table>

Residual variance at Tide Gauges, in the 2-20 day period band (3 left columns)  
Gain in variance at tide gauges, relative to IB (2 right columns)
High Resolution DAC / Low Resolution DAC

Preliminary results from the PISTACH coastal altimetry project:

• dedicated editing applied to coastal regions
• gain in variance of HR DAC relative to LR DAC, as a function of distance to shore
Dealiasing HF ocean response to atmospheric forcing

Mog2D/T-UGO 2D regional modelling platforms (LEGOS)

Caspian Sea

Amazonian shelf
Regional models performances

- Regional mesh
- Mog2D Global model forcing (OBC)
- Regional atmospheric forcing (Meteo-France)

Residual bias: 5.6 cm rms (TG), 5.2 cm rms (T/P) (0<T<20 days)

Roblou (2003)

Residual bias at TG: 5 cm rms (0<T<20 days)

Lamouroux (2004)
Med model comparisons to tide gauges and altimetry

Comparisons to tide gauges data:
- ✓ Gain vs IB: 46%
- ✓ Gain vs Mog2D-G correction: 5%

Similar results w.r.t T/P altimetry (Bouffard)

Application to in situ Cal/Val activities (T/P, J-1, J-2, ENVISAT-RA-2)
Summary

- New global, high resolution Mog2D/DAC correction has led to improvements over continental shelves
- But we need to develop regional barotropic models for significant improvements!
- Routine production/distribution and operational systems applications will need financial supports (CNES/ESA/GMES programs? Operational centres?)
- Integration in AVISO products in the future?
- Perspectives: investigate HF baroclinic effects