Barotropic tides in the Southern Indian Ocean.

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Introduction

Sub-cm accuracy of tidal model in the deep non polar ocean

Challenges for new tidal models
coastal regions
high latitudes (66°S cut-off)
ice shelf areas

Southern Indian Ocean
lack of in-situ data
seasonal records
complex tides
Barotropic modelling

TUGO/MOG2D
(2D gravity waves model)

barotropic
non linear
finite element method
shallow water equations

Configuration

tidal forcing
OBC : FES2004
AIS particularities

13 tidal constituents
Bathymetry

Kerguelen

GEBCO  Data  New bathymetry

AIS

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Data for the validation

TP cross over points
x-track (NOVELTIS, CTOH)
North to 60°S
Up to 200 points

In-situ data
- Coastal TG (ROSAME, Australia, China)
- Moorings (ROSAME, SHOM, IFREMER)
- GPS (Australia)
Effects of the new bathymetry

Statistics: \[ \sigma_{\text{comb}} = \sqrt{\frac{1}{2N_{\text{obs}}} \sum_{i=1}^{N_{\text{constituents}}} \sum_{j=1}^{N_{\text{obs}}} (Z_{j,\text{mod}} - Z_{j,\text{obs}})^2} \]

<table>
<thead>
<tr>
<th></th>
<th>Kerguelen TG</th>
<th>All Kerguelen data</th>
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<tbody>
<tr>
<td>GEBCO</td>
<td>4.8</td>
<td>2.2</td>
</tr>
<tr>
<td>GEBCO + improvements</td>
<td>1.6</td>
<td>1.3</td>
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<thead>
<tr>
<th></th>
<th>Prydz Bay</th>
<th>AIS with BVL</th>
<th>AIS without BVL</th>
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<tbody>
<tr>
<td>GEBCO</td>
<td>1.6</td>
<td>2.9</td>
<td>2.1</td>
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<tr>
<td>GEBCO + improvements</td>
<td>1.5</td>
<td>2.2</td>
<td>1.7</td>
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Comparisons with other models

GLOBAL
FES 2004
TPXO7.0

ANTARCTICA
CADA00.10

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<thead>
<tr>
<th></th>
<th>In-situ data</th>
<th>Altimetric data</th>
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<tbody>
<tr>
<td></td>
<td>All</td>
<td>North to 56°S</td>
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<tr>
<td></td>
<td>All</td>
<td>South to 56°S</td>
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<tr>
<td>HUGO</td>
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<tr>
<td>FES2004</td>
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Conclusion

Tides equivalent in the deep ocean with models assimilating data and better in coastal regions

Improvement beneath the AIS

Results without assimilation → we can expect results to be good for regions well away from data