Recent improvements in DORIS data processing at IGN: corrections for Cryosat-2 and inclusion of HY-2A data

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Summary

- Cryosat-2 physical models
  - Problem detected earlier by Frank Lemoine (empirical accelerations)

- HY-2A Precise Orbit Determination
  - Newly available DORIS data (old format)
### Cryosat-2 physical models (1)

Once-per-revolution empirical acceleration amplitudes

Cryosat 2, 2010

<table>
<thead>
<tr>
<th>Doris Center</th>
<th>No. of accels</th>
<th>Alg (avg/median) x 1e09</th>
<th>Crs (avg/median) x 1e09</th>
<th>Adjust period (days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>GSC</td>
<td>208</td>
<td>3.61 / 3.54</td>
<td>2.57 / 2.48</td>
<td>1</td>
</tr>
<tr>
<td>ESA</td>
<td>217</td>
<td>2.79 / 2.68</td>
<td>2.92 / 2.77</td>
<td>1</td>
</tr>
<tr>
<td>GAU</td>
<td>193</td>
<td>3.51 / 3.43</td>
<td>2.97 / 2.81</td>
<td>1</td>
</tr>
<tr>
<td>IGN</td>
<td>214</td>
<td>12.94 / 14.03</td>
<td>7.00 / 5.75</td>
<td>1</td>
</tr>
<tr>
<td>INA</td>
<td>214</td>
<td>13.92 / 13.86</td>
<td>6.93 / 4.86</td>
<td>1</td>
</tr>
<tr>
<td>LCA</td>
<td>58</td>
<td>9.42 / 7.61</td>
<td>3.41 / 2.76</td>
<td>3.5</td>
</tr>
<tr>
<td>CNES POD</td>
<td>247</td>
<td>4.81 / 4.83</td>
<td>3.01 / 2.74</td>
<td>1</td>
</tr>
</tbody>
</table>

Frank G. LEMOINE, OPR Summaries by Satellite
Cryosat-2 physical models (2)

SRP coefficient
Cryosat-2, 2010-2011

Avg = 0.82 (too far away from 1.0)
Stdev = 0.11 (signal still present)
SRP models available for Cryosat-2

7-face model = CNES
6-face model = ESA
Both implemented in GIPSY/OASIS
Cryosat-2 physical models (4)

Error found in satellite orientation (fortran namelist, sign error nadir/zenith)

--> single-satellite reprocessing
Cryosat-2 physical models (5)

Empirical accelerations – 2011 - Long track

<table>
<thead>
<tr>
<th></th>
<th>Wrong CNES Model</th>
<th>ESA Model</th>
<th>True CNES Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avg (nm.s⁻²)</td>
<td>11.99</td>
<td>7.61</td>
<td>2.82</td>
</tr>
</tbody>
</table>

2 signals: 120 and 240 days
Cryosat-2 beta-prime period: 480 days
Cryosat-2 physical models (6)

Correlation between long-track accelerations and SRP coefficient (ESA Model)
Cryosat-2 physical models (7)

- Improvements:
  - Long-track accelerations reduced (Avg: 11.99 → 2.82)
  - SRP coefficient close to 1 (Avg: 0.82 → 1.05)

- Cross-track accelerations still too large (Avg: 6.36)

- No significant effect on orbit overlap and geodetic solutions (station coordinates and polar motion)
HY-2A Precise Orbit Determination (1)

Altitude : 971 km

Inclination : 99.3°

Macro model : 6 faces

Empirical drag parameter reset each hour
HY-2A Precise Orbit Determination (2)

SRP Coefficient

Orbit Maneuver: 2012/02/14; 2012/02/24

Avg = 0.89
HY-2A Precise Orbit Determination (3)

Radial overlap (m)

Avg = 1.27 cm
Add a constant term on the cross-track acceleration

\[ \text{CONST\_ACC\_C} = 17 \text{ nm.s}^{-2} \]
HY-2A Precise Orbit Determination (5)

Empirical accelerations
Long track

Avg = 2.19 nm.s⁻²
Conclusions

Cryosat-2
- problem understood
- but cross-track opr still too large
- -> other problem to be solved?

HY2A
- first results are encouraging
- multi-satellite results still under investigation