DORIS satellite phase center determination and consequences on the derived scale of the Terrestrial Reference Frame

Pascal Willis (1,2), Bruce Haines (2), Da Kuang (2)

(1) Institut Geographique National, Saint-Mande, France, Em: pascal.willis@ign.fr
(2) Jet Propulsion Laboratory, California Institute of Technology, Pasadena, USA

July 16-23, 2006 36th COSPAR Scientific Meeting Beijing, China
Goals

- Estimate DORIS satellite phase center offsets
  Satellite-by-satellite basis
  Daily determination over 1 year (2004)

- Compare DORIS to GPS estimates for common satellites
  Jason and TOPEX/Poseidon

- Apply DORIS correction and investigate consequences
  Terrestrial Reference Frame (TRF) geocenter and scale
Estimating DORIS phase center offset (per satellite and per 24hr)
SPOT2 mean = -19 mm
SPOT4 mean = -17 mm
SPOT5 mean = -10 mm

ITRF2000
with ITRF2000 = -19 mm
with ITRF2005P = -10 mm
ENVISAT estimated radial offset
vs new flight software
(switch from waiting mode to self-programming mode)

See also Doornbos and Willis, Acta Astronaut., in press
### Estimated DORIS mean offsets (in 2004) using ITRF2000

<table>
<thead>
<tr>
<th>Satellite</th>
<th>X_OFF (mm)</th>
<th>Y_OFF (mm)</th>
<th>R_OFF (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENVISAT (*)</td>
<td>-24</td>
<td>N/A</td>
<td>19</td>
</tr>
<tr>
<td>Jason (**)</td>
<td>2</td>
<td>17</td>
<td>-37</td>
</tr>
<tr>
<td>SPOT-2</td>
<td>N/A</td>
<td>-13</td>
<td>-19</td>
</tr>
<tr>
<td>SPOT-4</td>
<td>N/A</td>
<td>-17</td>
<td>-17</td>
</tr>
<tr>
<td>SPOT-5</td>
<td>N/A</td>
<td>2</td>
<td>-10</td>
</tr>
<tr>
<td>TOPEX/Poseidon</td>
<td>5</td>
<td>-17</td>
<td>-24</td>
</tr>
</tbody>
</table>

(*) different orientation convention (**) affected by SAA

July 16-23, 2006 36th COSPAR Scientific Meeting Beijing, China
GPS-only results

Using anechoic chamber values

Jason-1: Estimated GPS Antenna Phase Center Offset
Nominal Offset wrt CG: Jason-1 POD Standard (X = +1.434 m, Y = −0.218 m, Z = −0.5042 m)
Jason PCV from anechoic chamber (prelaunch)
GPS satellite PCV from Grace-based solution (Haines et al., 2005)

Using GRACE-derived values

Jason-1: Estimated GPS Antenna Phase Center Offset
Nominal Offset wrt CG: Jason-1 POD Standard (X = +1.434 m, Y = −0.218 m, Z = −0.5042 m)
Jason PCV from map developed with in-flight data
GPS satellite PCV from Grace-based solution (Haines et al., 2005)
Applying DORIS corrections

For correlation between Y_OFF SPOT and TZ-geocenter, see Willis et al., J. Geod., 2006

July 16-23, 2006 36th COSPAR Scientific Meeting Beijing, China
Applying DORIS phase center correction and estimating ground station coordinates

Geocenter: < 1 mm difference

Scale: -2.5 ppb --> -0.5 ppb

XYZ residuals: 1-2% improvement
CONCLUSIONS

DORIS phase center corrections were derived for all DORIS satellites in 2004.

All DORIS satellites show a 10-20 mm radial offset (linked with TRF scale) that are significantly reduced with ITRF2005P.

All SPOT satellite show < 20 mm cross-track offset (linked with TRF Z-component for SPOTs).

GPS-DORIS corrections are not similar and can vary broadly (ITRF2000 vs ITRF2005 for DORIS and PCV models for GPS).

Important impact on TRF (geocenter and scale).

Small improvement on station coordinates accuracy.

July 16-23, 2006 36th COSPAR Scientific Meeting Beijing, China