Contribution to ITRF2008

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Faust

Newcastle University in-house precise orbit determination software

– Multi-satellite multi-arc
  • Dynamic and reduced dynamic modes

– Tracking data
  • SLR
  • microwave (DORIS, PRARE, Tranet)
  • Altimetry (heights, SXO, DXO)
  • Cartesian positioning from GPS
SLR: NCL v ASI Lageos 1/2 coordinates
SLR: NCL v ITRF2005 Lageos 1/2 coordinates

- TX mm
- TZ mm
- TY mm
- Scale mm
FAUST: DORIS

Heritage
   Capability from launch of T/P
   ENVISAT precise orbit calibration (reduced dynamic mode)

Force Model:
   IERS 2003 Convention

Results here used

Gravity field
   GGM02C – deg/order 70
Neutral air density
   MSIS83
   Satellite area : macro model (ENVISAT, SPOT)
Ocean Tides
   CSR4.0
Polar Motion
   C04 Daily values

Measurement Model
   Station coordinates
      DPOD2005
   Ocean tidal loading
      GOT00
   COM correction : DORIS data record
DORIS Data
ENVISAT, Spot2, Spot4, Spot5
1 Jan 2003 – 31 Dec 2007
Arcs
  7 day arcs corresponding to GPS weeks
  Arcs stopped/restarted before/after manoeuvre
  Arcs less than 24hr not used

Estimated parameters
Satellite position/velocity
6hr drag scale factors
Daily once rev along track and cross track empirical accelerations
(SRP coefficient fixed at $C_{SRP} = 1.0$)

Frequency offset per DORIS pass
Tropospheric scaling factor per DORIS pass (scaling of correction on DORIS data record)

DORIS Rejection Criterion
5.0 mm/s
No elevation cutoff
Drag scale coefficients
DORIS tracking residuals
ITRF2008 (SLR, DORIS)

ENVISAT  SPOT2  SPOT3  SPOT4

Sat 1  Sat 2i  Sat 3  Sat 4

Sat 2ii

? SPOT3 T/P Jason-1 ?

Geodyn. param
Freq offsets
Trop scaling

Geodyn. param
Freq offsets
Trop scaling
Station coords
Polar motion \((x_p, y_p)\)
UT1-UTC, lod

Sats 1-4

Reduced normal eq’s
Station coords
\(xp, yp, UT1-UTC(?)\), lod

SINEX
**Example**

**MJD 52644-52651 (5/1/03 – 12/1/03)**

<table>
<thead>
<tr>
<th></th>
<th>orbital param.</th>
<th>+station coords</th>
<th>+ ERP’s</th>
</tr>
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<tbody>
<tr>
<td>ENVISAT</td>
<td>0.564</td>
<td>0.551</td>
<td>0.551</td>
</tr>
<tr>
<td>SPOT2</td>
<td>0.498</td>
<td>0.470</td>
<td>0.470</td>
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<tr>
<td>SPOT4</td>
<td>0.523</td>
<td>0.494</td>
<td>0.494</td>
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<tr>
<td>SPOT5</td>
<td>0.559</td>
<td>0.507</td>
<td>0.507</td>
</tr>
</tbody>
</table>

rms tracking residuals mm/s

35 stations, daily ERP’s,
Conclusions: Towards ITRF2008

• **DORIS**
  – Software/scripts ready for DORIS run
  – Preliminary orbits computed 2003-2007
  – About to process multi-satellite/multi-arc 2003-2008 inclusive for ENVISAT, SPOT2, SPOT4, SPOT5
  – Additional sats/years as time permits!!

• **SINEX** – reduced normal equations for ITRF2008 (station coords, $x_p$, $y_p$, lod)