Estimating daily Solar Radiation Pressure coefficients

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SUMMARY

• Method used
• Estimated SRP coefficients (1/day, 1/satellite)
• Fixing vs estimating : Impact on results
  - TZ-geocenter
  - Station heights (Terre Adelie)
  - Precise Orbit Determination
• Conclusions
Method used

• We have this equation

\[ \gamma_{SRP}^{Estimated}(t) = CR \cdot \gamma_{SRP}^{Model}(t) \]

Model = -macro model (this study)
- dedicated model (eg UCL)

• Estimated parameters:
  - SRP coefficient = CR (1/day)
  - Station positions (independent from ITRF)

• Fixed parameters: (to avoid correlation)
  - 1/rev accelerations = 0 (dynamic orbit)
Solar radiation pressure coefficients

Estimated parameter (1/day) = station position + SRP coefficient
Fixed parameter = 1/rev empirical accelerations = 0

T/P break observed on July 27, 1993
change in receiver (chained vs unchained mode). Explanation?

IDS meeting, Paris, June 5, 2008
Solar radiation pressure coefficients

Estimated parameter (1/day) = station position + SRP coefficient
Fixed parameter = 1/rev empirical accelerations = 0

IDS meeting, Paris, June 5, 2008
Solar radiation pressure coefficient : SPOT-5 satellite

SPOT 5 break observed on January 14, 2008
Solar panel re-oriented by CNES

\[ \theta \approx 36.5^\circ \pm 1^\circ \text{ (estimated)} \]
CNES value = 25°+10°+5°=40°
Re-orientation of : SPOT-5 satellite
### Proposal for IDS SRP coefficients
(averages over complete data set)

<table>
<thead>
<tr>
<th>SATELLITE</th>
<th>Mean SRP</th>
<th>A priori SRP model</th>
<th>COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOPEX</td>
<td>1.03</td>
<td>macro-model</td>
<td>0.96 (&lt; 23JUL-1993)</td>
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<td>JASON</td>
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<td>SPOT-2</td>
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<tr>
<td>SPOT-5</td>
<td>1.03</td>
<td>macro-model</td>
<td>0.83 (&gt; 14-JAN-2008)</td>
</tr>
</tbody>
</table>
Fixing vs estimating: Impact on results

- TZ-geocenter
- Station heights (Terre Adelie)
- Precise Orbit Determination
TZ-Geocenter (multi-satellite)  
Estimating vs fixing daily SRP

1 year

118 days

IDS meeting, Paris, June 5, 2008
Station height time series
Terre Adelie, Antarctica (high-latitude)

118-day Problem detected before: Williams and Willis, 2006; Le Bail and al, 2006; Feissel-Vernier and al., 2007; Almavict and al; in press
Validation for Precise Orbit Determination

ENVISAT 2005

- $H(m) - SRP estimated$
- $H(m) - SRP fixed$

Fixed: 1.61 cm (RMS)
Estimated: 1.66 cm (RMS)

Improvement 5%

Radial overlap (m)

Day of Year (2005)

IDS meeting, Paris, June 5, 2008
CONCLUSIONS

• Fixing SRP coefficients provide better results:
  - TZ-geocenter
  - Station height (high latitude)
  - Precise Orbit Determination (smaller improvement)

• Proposal to adopt common values for IDS (ITRF 2008)

• Need for better SPOT SRP models (UCL initiative)
• Understanding the SRP breaks (SPOT-5 ✓ +T/P ?)