DORIS SATELLITES ANTENNA MAPS DERIVED FROM LONG-TERM RESIDUALS TIME SERIES

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SUMMARY

• Motivations
  – Improvements in GPS/Jason POD using GPS derived maps

• Generating DORIS antenna maps
  – Basis principle / differences with GPS
  – Proposed physical interpretation

• DORIS antenna maps inter-comparisons
  – same satellite / different years
  – different satellites / mean values

• Use of antenna maps / tests for POD and Geodesy
Jason-1 GPS antenna PCV map

- Developed from on-orbit data (post-fit tracking residuals)
  - Both ionosphere-free carrier phase (LC) and pseudorange (PC) represented
- Explain significant fraction of energy in the postfit residuals.
- Feature stable, coherent patterns (antenna frame) regardless of s/c attitude
- Obviate need to model any additional offset of mean phase-center location
- Improve POD performance, particularly during fixed-yaw periods
  - Important element of 1-cm POD strategy for Jason-1
BASIC PRINCIPLE (DORIS CASE)

- Each DORIS data generates an individual residual (from the satellite point of view: Azimuth, Elevation)

- Data are stacked over long periods (bilinear interpolation)
PHYSICAL INTERPRETATION

• In the case of GPS
  – Multi-path due to receiver (ground or satellite) or transmitter environment (satellite)

• In the case of DORIS
  – On the satellite: Derivative in the direction of the satellite velocity of on-board multi-path
  – On the station: more complex (difference in time of multi-path map)
DORIS ANTENNA MAP ESTIMATION

- Data period investigation: 1993.0-2004.0
- 1 map per satellite and per year
EXAMPLE OF DORIS ANTENNA MAP
What goes inside 1 pixel / stations?

DORIS/SPOT2/2003
(90<AZ<100, 55<EL<60)

All stations
Mean = -0.10 mm/s

All stations but THUB
Mean = -0.11 mm/s
What goes inside 1 pixel / stations?

Pixel =
SPOT2/2003
90 < az < 100
55 < el < 60

Geographic
distribution of
DORIS/SPOT2
postfit residuals
What goes inside 1 pixel / day?

Almost no seasonal effect detected
DORIS ANTENNA MAPS RESULTS

- Long-term evolution of estimated maps

- SPOT2  11 yr
- SPOT3  2 yr
- SPOT4  5.5 yr
- SPOT5  1.5 yr
- TOPEX  11 yr
- JASON  2 yr
- ENVISAT 1.5 yr
ANTENNA MAPS COMPARISONS

- Maps from all satellite (1 year per satellite)
USING ANTENNA MAP CORRECTIONS FOR PRECISE ORBIT DETERMINATION

POD results:
- small reduction in DORIS residuals (0.4%)
- small improvement in daily overlaps

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<th>H (mm)</th>
<th>C (mm)</th>
<th>L (mm)</th>
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USING ANTENNA MAP CORRECTIONS FOR GEODESY

Weekly stations positioning

DORIS/SPOT2 only

January-April 2004

Using 2003 map
CONCLUSIONS

• Yearly antenna maps were derived for all DORIS satellites (from 1993.0 to 2004.0)

• A simple antenna map interpretation is proposed

• DORIS satellites antenna maps are
  – satellite specific
  – consistent with time

• Preliminary results for SPOT2 show slight improvement for POD and Geodesy