DORIS data processing with Bernese GPS Software
at GOPE: tests, initial results and future prospects

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DORIS in Bernese software

- CDDIS DATA FILES
  - DOROBS (Internal format Simulated data)
  - GPSEST (NEQ System)
  - ADDNEQ

- ORBITS
  - DORIS (Internal format)
  - ORBGEN (Elements)

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Measurement 1
\[ \rho(T1) = 100 \text{ km} \]

Set-up of unknown
Ambiguity \( A \)
\[ A \sim 100 \text{ km} - \rho(T1) \]

Measurement 2
\[ \rho(T1 + \Delta T) = -\Delta T V + 100 \text{ km} \]
Tests

- processing with fixed POE orbit (network estimation)
- processing with fixed network (orbit estimation)
- low constrained solution (network, EOP)

used data: CDDIS, format 2.1, September 2004
Data processing with fixed orbit

- CDDIS troposphere corrections or Estimated troposphere
- Mutual comparison of monthly mono-satellite solutions: Spots and Envisat 1-2 cm, Spot and Topex 2-3 cm. Higher differences in East component in the case of Estimated troposphere (3 cm, 5 cm in the case of Topex).
- Comparison with ITRF2000 CDDIS tropo N 2.8 cm E 2.1 cm U 1.6 cm
  Estimated tropo N 3.0 cm E 3.4 cm U 2.3 cm
- Scale vs. ITRF2000: Topex -9 ppb, spots around -5 ppb, Envisat -3 ppb
Orbit estimation

- Fixed network
- Troposphere - CDDIS corrections X estimated
- Reduced dynamical (GPS) model
- No exact models for non-conservative forces
- 9 Empirical parameters (3 constant + 6 harmonic)
- Stochastic parameters (set per 15 min, constraints $\sim 10^{-5}$ m/s)
  
  Topex, Jason - radial

  Spots, Envisat - radial, along track, out of plane
Comparison with POE

Comparison of Estimated DORIS orbit and POE in radial component

- TOPEX/CDDIS tropo
- SPOT-5/CDDIS tropo
- TOPEX/Estimated tropo
- SPOT-5/Estimated tropo

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Low constrained solution

• 3 weekly solutions
• 5 satellites (except Jason)
• 10 m network constraints, ITRF2000 apriori
• comparison with corresponding IGN/JPL and LCA solutions
• Estimated: Network, Xpole, Ypole
• Preeliminated: Orbit, Beacon frq. offset, Troposphere ZTD
Coordinates comparison with ITRF 2000

<table>
<thead>
<tr>
<th>Latitude</th>
<th>Longitude</th>
<th>Height</th>
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<tr>
<td>RMS (cm)</td>
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Topex  Spot-2  Spot-4  Spot-5  Envisat  Comb.

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Scale vs. ITRF 2000

Topex

Spot-2

Spot-4

Spot-5

Envisat

Komb.

Scale (ppb)
Translation vs. ITRF 2000

Translation (cm)

Tx                  Ty                  Tz

Topex                Spot-2               Spot-4               Spot-5               Envisat               Comb.

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Comparison of the network estimation results with current IDS results

Repeatability

Repeatability (cm)

Latitude          Longitude          Height

GOPE             IGN             LCA

Coordinates comparison with ITRF2000

RMS (cm)

Latitude          Longitude          Height

GOPE-ITRF          IGN-ITRF          LCA-ITRF

Mutual comparison of coordinates

RMS (cm)

Latitude          Longitude          Height

GOPE-IGN          GOPE-LCA          IGN-LCA

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Translations vs. ITRF2000

X- translation vs. ITRF2000

Y- translation vs. ITRF2000

Z- translation vs. ITRF2000

GOPE/AIUB
IGN
LCA

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A posteriori RMS of observations

RMS (mm)

Topex  Spot-2  Spot-4  Spot-5  Envisat

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Comparison of the pole estimation results with current IDS results

X-Pole comparison with IERS C04

Y-Pole comparison with IERS C04

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Outlook

• Several technical steps
• Semi-automatic data processing
• Processing of longer data time-series
• Routine data processing, weekly and/or monthly solutions.
• Orbit model improvement