Latest Results from Hartebeeshtoek

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ON SITE COMPUTATIONS

Polygons
Levelling
GPS

VLBI REFERENCE POINT
GLOBAL COMPENSATION
SINEX
On-site Polygons Validation

*For each polygon independantly*

- Checking of the observations:
  - in a local coordinate system,
  - by Least Squares adjustment,
  - with COMP3D.

- Detection of blunders

- Precision estimation
On-site Polygons Validation
On-site Levelling Validation

• Compensation between two successive benchmarks

• Trigonometric levelling computation

• Compensation of the 3 networks:
  – HartRAO Site
  – SAC Site
  – Link between the two sites (3km)

• Global levelling compensation
On-site GPS validation

- GPS Baseline processing with manufacturer software (Leica Ski Pro)

On each site:
- One GPS permanent station HRAO and HARB
- 2 pillars are equipped with Choke ring antennas and Leica SR500 GPS receivers
Reference Point

- Definition: intersection of the fixed axis with the plane containing the moving axis orthogonal to the fixed axis
Observations

• Equatorial radiotelescope
• Target at the apex of the feed horn intersected by 3 theodolites
• Stations set up on the different pillars determined by the polygon (and using them as orientation)

• Rotations about 10° by 10°
  – around declination axis (for 3 different H A positions)
  – around hour axis (for 2 different DEC A positions)

<table>
<thead>
<tr>
<th>DECLINATION AXIS</th>
<th>HOUR ANGLE</th>
<th>DECLINATION ANGLE</th>
<th>NUMBER OF POINTS</th>
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<tr>
<td>Position 1</td>
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<td>45° - 275°</td>
<td>14</td>
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<td>Position 2</td>
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<td>45° - 275°</td>
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<td>Position 3</td>
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<table>
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<tr>
<th>HOUR AXIS</th>
<th>Position 1</th>
<th>85° - 275°</th>
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<td>85° - 275°</td>
<td>334.112°</td>
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Planes and Circles Fits

- Computations in a local network

- Least Squares Adjustments processed with Matlab 6.1:
  - fitting plane for each one of the 5 rotations
  - fitting circle for each one of the 5 rotations
Reference Point

- Coordinates determination in the local system by taking into account:
  - precision of each pillar coordinates (given by the polygon adjustment)
  - precision of each VLBI points

- **Axis offset**: 6.6954 m ± 0.0025m

- **Standard deviation computed by Monte Carlo Method**
  \[ \sigma_e = 5.2 \times 10^{-4} \text{ m} \]
  \[ \sigma_n = 1.6 \times 10^{-3} \text{ m} \]
  \[ \sigma_h = 1.1 \times 10^{-3} \text{ m} \]
Fictive observations

- As if VLBI reference point was intersected from five pillars (those were used to point out the VLBI target)
- Precision of each horizontal and vertical angles were determined from the design matrix and Monte Carlo results.
- Fictive observations are introduced in the global compensation with their respective standard deviation.
ON SITE COMPUTATIONS
VLBI REFERENCE POINT

GLOBAL COMPENSATION
GPS Data
Input Data
Adjusted Coordinates
Confidence Region

SINEX
GPS Network

- BERNESE 4.2
- Baselines
- Covariance Matrix
Input Data

• Software: Geolab Microsearch  (rapportgg)

• Observations :
  – HartRAO polygon
  – SAC polygon
  – HartRAO levelling network
  – SAC levelling network
  – Levelling link between the 2 sites
  – GPS network

• Geoid Model extracted from EGM 96

• Fixed point: HRAO, IGS station
• Geodetic System: ITRF 2000 epoch
## Input Data

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<thead>
<tr>
<th>PARAMETERS</th>
<th>OBSERVATIONS</th>
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<td>Description</td>
<td>Number</td>
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<td>--------------------------</td>
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<td>No of Stations</td>
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<td>Translation Pars.</td>
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</table>

| Total Parameters         | 273     | Total Observations | 684    |

Degrees of Freedom = 411
Compensation Results

Standardized Residuals Distribution

Histogram of Standardized Residuals (694 residuals)
### ITRF 2000 Coordinates

<table>
<thead>
<tr>
<th>CODE</th>
<th>FFN</th>
<th>STATION</th>
<th>X-COORDINATE</th>
<th>Y-COORDINATE</th>
<th>Z-COORDINATE</th>
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Confidence Regions

Drawing Scales (1:nnn)

Network: 10 000.0

Error ellipses: 0.5
ON SITE COMPUTATIONS
VLBI REFERENCE POINT
GLOBAL COMPENSATION

SINEX FILES
Input Data

• Extraction of the points of interest
  – HRAO GPS permanent station reference point
  – HARB GPS permanent station reference point
  – SLR mark
  – DORIS reference point
  – VLBI reference point

• Extraction of the covariance matrix