

Unified Analysis Workshop 2007

Position Paper Session 5

“New Products Based on Inter-Technique Combinations”

Chair: SCHUH H.

Co-Chair: GURTNER W. DOW J. TAVERNIER G. MA C. MÜLLER J.

1. Session definition

Session 5 deals with the identification of new products based on inter-technique combinations that are useful for the international community (IERS, IGFS, GGOS, ...). When talking about new products, we have to distinguish between combined products whose generation has already been tested or which are already available and products being recently in a development or identification phase. So far, most of the inter-technique combination has been done on the results level but a few examples of combination on the normal equation matrix level also exist.

The main focus of the session is on combination w.r.t. Earth rotation, atmospheric parameters, and station coordinates. First ideas concerning the combination or at least validation of geodetic measurements with geophysical models and combined estimation of geodynamic parameters are also treated. Additionally, considerations on the conjunction of different global measurements for the corporate treatment of a global height reference and sea level change are given. Finally further possible combination products that can be thought of in the future, such as combined celestial reference frames, combined satellite orbits and geocenter coordinates are mentioned. For the sake of clarity the products are divided into the following groups.

2. Product groups:

- 1) Earth orientation parameters (EOP)
- 2) Troposphere
- 3) Ionosphere
- 4) Station coordinates
- 5) Gravity and geometry
- 6) Global height definition
- 7) Geodynamic parameters
- 8) Reference frames
- 9) Miscellaneous

2.1. EOP

2.1.1. “Final” products:

- Daily resolution: Nutation, polar motion, dUT1
- Hourly resolution: polar motion, dUT1
- Input observations: VLBI , GNSS – GPS, GLONASS, (GALILEO), DORIS, SLR, LLR, Ringlaser

2.1.2. “Rapid” products (i.e. in near real-time):

- dUT1 – hourly resolution?
- Input observations: VLBI (1h IVS-Intensive sessions) , GPS (IGS rapid)

- Other possible data: SLR, AAM
- Time delay:
 - Int. IVS sessions: INT1/2 2-5d, INT3 <24h, ultra-rapid e VLBI sessions 1h
 - IGS rapid products: 17h
 - IGS ultra-rapid products: 3h → performance still not satisfactory

2.2. Troposphere

- Combined long-term series
- Routine combination: along with station coordinates and EOP combination
- Input observations: VLBI, GNSS (IGS reprocessing), DORIS, radio occultation measurements from CHAMP and GRACE, eventually numerical weather model data?
- Parameters to be combined:
 - Zenith wet delay (ZWD)
 - Zenith total delay (ZTD)
 - Gradients

2.3. Ionosphere

- Combined global ionosphere maps (GIM)
- Input observations: GNSS – GPS, GLONASS, Satellite Altimetry, DORIS, VLBI, CHAMP, COSMIC/FORMOSAT-3
- Parameters to be combined:
 - Vertical total electron content (VTEC)
 - Technique specific instrumental biases (like DCB)

2.4. Station coordinates and velocities

- Low resolution: for ITRF2005 – weekly combination of coordinate time series from satellite techniques + 24 h sessions from VLBI, consistent with EOP (combination only w.r.t. polar motion)
- Higher resolution: daily coordinate time series → new future product?
 - Possible input observations: VLBI, satellite techniques
 - Rigorous combination including EOP, troposphere parameters and CRF.

2.5. Gravity & Geometry & Earth rotation

- Comparison/Integration of geodetic measurements and geophysical models
- Measurements:
 - CHAMP, GRACE, ...
 - Terrestrial gravimetry (absolute and superconducting gravimeters)
 - Earth Rotation (GPS, VLBI, ...)
 - Global deformation (GPS, ...)
 - Geocenter (SLR)
- Models (for determination of spherical harmonics):
 - Atmospheric surface pressure
 - Ocean bottom pressure
 - Land hydrology
 - Global surficial fluid mass conservation
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2.6. Global height reference and sea level change

- Interlace global measurements:

- Global geoid (by combination of various techniques)
- Satellite altimetry
- Tide gauges
- GPS heights
- Levelling
- Differences of gravity potential from clock readouts (satellite missions: EGE, ACES)

2.7. Geodynamic parameters

- Free Core Nutation
 - Parameters: period, Q, resonance strength
 - Deduced from observations of: VLBI nutation, Earth tides
- Love and Shida Numbers
 - Deduced from observations of: VLBI, GNSS, SLR - tidal site displacements, gravity tides

2.8. Reference frames

- Combination of celestial reference frames:
 - Inertial reference frame
 - Dynamical reference frame (LLR)
 - Frame tie
 - Combination of satellite orbits
- Combination of geocenter coordinates
 - Satellite and laser techniques
 - Global absolute gravimeter network

2.9. Miscellaneous

- Relativity parameters
 - Lense-Thirring (SLR, LLR)
 - Space curvature (LLR, VLBI)

3. Further aspects and ideas

- Possible clients?
- Establishment of “combination centers”
- Time frame for generating the new products
- Possible resolution today/in the future
- Possible accuracy of the products
- Checking the technical feasibility by campaigns and pilot projects

4. Draft programme

Programme Session 5 (Version of November 25, 2007)

Thursday, December 6, 2007:

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Session 5 New Products Based on Inter-technique Combinations

Chair: **SCHUH H.**

CO-Chair: **GURTNER W., MÜLLER J., DOW J., TAVERNIER G., MA C., FORSBERG**

R.,

15:30 – 15:50 H. SCHUH

NEW PRODUCTS BASED ON INTER-TECHNIQUE COMBINATIONS – AN OVERVIEW

15:50 – 16:00 E. PAVLIS

NEW ILRS PRODUCTS AVAILABLE NOW AND IN THE NEAR FUTURE

16:00 – 16:10 J. MÜLLER

LLR PERSPECTIVES

16:10 – 16:20 G. TAVERNIER

THE ROLE OF DORIS IN INTER-TECHNIQUE COMBINATION (TBC)

16:20 – 16:30 V. TESMER

COMPARISON AND COMBINATION OF LONG TROPOSPHERE TIME SERIES FROM GPS
AND VLBI

16:30 – 17:00 Discussion, Action Items