Subdiurnal polar motion from GNSS observations

S.D. Petrov, E.A. Bashakova, D.A. Trofimov, S.S. Smirnov, S.A. Fetisov

St.Petersburg State University

Outline

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Motivation

- Accuracy of EOP by space geodetic technics approaches 0.1 mas.
- Temporal EOP resolution is stalled at one sample per day.
- Geophysical excitation (ocean, atmosphere) is known at least four times per day.

Background

- Continous VLBI campaigns:

  CONT96 – CONT08.
- Subdiurnal EOPs from VLBI, M.Eubanks.
- Subdirunal EOPs from GPS, M.Rothacher.

Model

Low long term accuracy of GNSS orbits. Thus, IERS Conventions ICRS to ITRS transformation (x, y, UT1, dPsi, dEps) not suitable for GNSS.

Option 1: LOD and nutation rates instead of UT1 and dPsi, dEps.

Option 2: Estimate EOP in ITRS only, then decompose into polar motion and nutation.

Methods

- Piecewise least squares:

  simple, but needs large number of

  measurements.
- Least squares collocation or Kalman filter:

  accurate, but needs an a priori EOP

  covariance functions.

GNSS observations

- Pseudoranges and phases from about 20 IGS stations sampled every 30 seconds.
- IGS final ephemeris and clock solutions, tropospheric zenith path delays and ionospheric TEC grid.
- IAU2000/2006 precession-nutation.

EOP estimates

- Resulting variance of hourly EOPs too high (about 0.6 mas).
- EOP variance after subtraction of diurnal ocean tide still too high (about 0.3 mas)
- Possible systematic effect (terdiurnal wave?)

Conclusions

- Modern GNSS allow to estimate hourly EOPs.
- Two ways to improve accuracy of hourly EOPs:

  1. Intensive (more pseudoranges);

  2. Extensive (Kalman filter with adequate model).
- Possible subdiurnal effects in GNSS orbits and signal propagation.