HIGH-FREQUENCY VARIATIONS OF THE EARTH ROTATION FROM THE VLBI AND GPS OBSERVATIONS

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ABSTRACT. High frequency variations of UT1-UTC in diuarnal and subdiurnal frequency band were detached with use of Panteleev's filter from the series of the Earth Orientation Parameters (EOP) estimations provided by the Center for Orbit Determination (CODE), which is a part of the International GPS Service (IGS). This series with 1-hour resolution is available in the time span from 02.01.1995 to 14.02.1998. The comparison of the UT1-UTC variations with Ray's model, recommended by the International Earth Rotation Service (IERS) for ocean tidal effect calculation, showed existence of regions of disagreement, where the differences reach a level of 150 microseconds. Periodograms of differences contain harmonics with frequencies from 3 to 11 cycles per day and residual energy in diuarnal and semidiurnal frequencies. All these effects we found artificial rely upon the analysis of errors, information about the IGS network (Rothacher et al., 2001) and from the comparison with the independent estimations of the high frequency EOP variations derived from the weekly VLBI observations. For this the OCCAM 5.0 package with some modifications was used.

1. RESULTS OF ANALYSIS

The Center for Orbit Determination, provided the series of Earth Orientation Parameters estimations with 1-hour resolution in the interval from 02.01.1995 to 14.02.1998. High frequency variations of the UT1-UTC were detached from these series using Panteleev's filter (Panteleev, Tchesnokova, 2003) and were compared with Ray's model of influence of the global ocean tides on the rotation of the Earth. The results of comparison are represented by Fig. 1. The regions of disagreement up to 150 microseconds can be seen. The analysis of errors of CODE-series (Fig. 2) reinforced by the information upon the IGS network (Rothacher et al., 2001) allowed us to conclude, that some of this regions (at least in September 1997, MJD 50700) are connected with changes in the number of IGS observing stations.

Power spectrum estimates (Fig. 3) of the differences between CODE EOP and Ray's model contain some residual energy with periods of about 12 and 24 hours, which can be connected with an orbital resonance (GPS satellites period is close to 12 h). In the spectra there also present some harmonics with periods from 3 to 11 cycles per day.

For comparison the high-frequency EOP estimations were independently derived from the weekly VLBI observations (Fig 4). For this the OCCAM 5.0 software package was used (Titiov, Schuh, 2000).

Figure 1: High-frequency CODE UT1-UTC comparison with R.Ray's model.

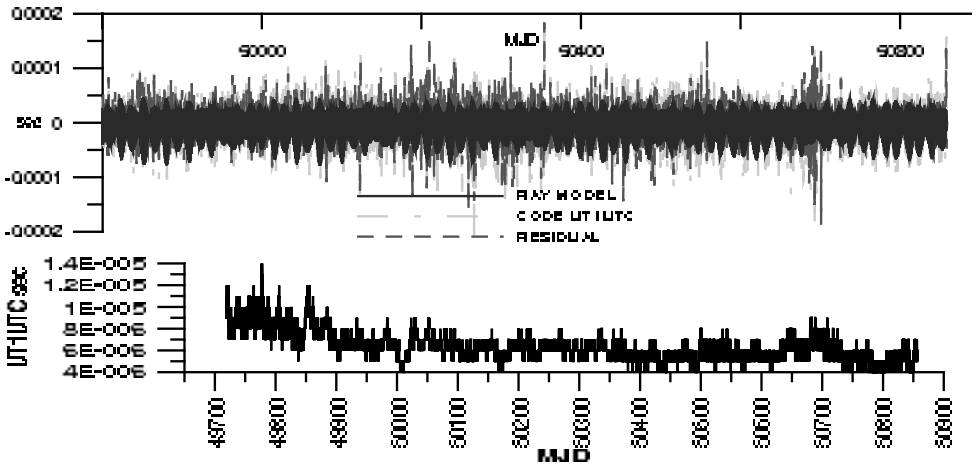

Figure 2: Errors of CODE UT1-UTC estimations.

Figure 3: UT1-UTC residual spectra (left) and Ray's model spectral components (right).

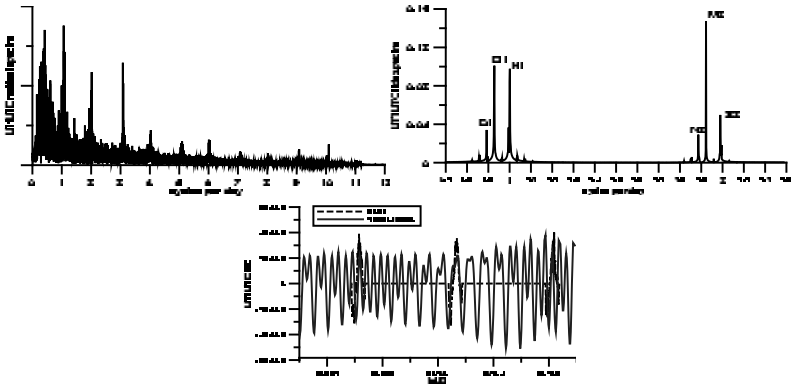

Figure 4: UT1-UTC estimations from VLBI in comparison with Ray's model, September 1997.

We came to the conclusion, that most of the effects described above, observable in the satellites data, have an artificial cause.

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2. REFERENCES

Zharov V. E., Gambis D., Bizouard Ch., 2000, Diurnal and sub-diurnal variations of the Earth rotation, *IERS TN 28*, Observatoire de Paris, 5.

Rothacher M., Beutler G., Weber R., Hefty J., 2001, High-frequency variations in Earth rotation from Global Positioning System data, *J. Geophys. Res.*, **106**, 13, 771-13, 778.

Panteleev V. L., Tchesnokova T. S, 2003, Mathematical models of the gravimetrical data processing, *Geology and Prospecting*, Moscow.

Titov O., Schuh H., 2000, Short period in Earth rotation seen in VLBI data analysed by the least-squares collocation method, *IERS TN 28*, Observatoire de Paris, 33.