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Retrieving diurnal and semi-diurnal signals in Earth rotation from VLBI observations

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Abstract. We discuss the issue of retrieving diurnal and semi-diurnal signals in Earth rotation from VLBI observations.

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Polar motion and UT1 contain physical signals within the diurnal and semi-diurnal frequency bands. The dominant part (< 1.0 mas) is due to the gravitationally forced ocean tides. There is also a small variation (< 0.1 mas) caused by the direct influence of the tidal gravitation on the triaxial structure of the Earth. The remaining part (< 0.1 mas) comprises the atmospheric and nontidal oceanic influences driven by the daily cycle in the solar heating.

The modeling efforts and observations concern mostly the purely harmonic tidal variation which is the dominant effect in the diurnal and semi-diurnal bands. The high frequency geophysical signals, which are either irregular or quasi-harmonic, have rather poor observational evidence. Here we discuss how the diurnal and semi-diurnal signals in polar motion and UT1 can be estimated from the routine VLBI observations with one session in 3 to 5 days. The method relies upon the so-called complex demodulation technique.

We demonstrate its application to real data by using the VLBI analysis software SteelBreeze. Spectral analysis of the demodulated time series reveals significant corrections to the conventional model of the ocean tide variations as well as the broad band variability with excess of power near the frequencies of the tidal lines S1 and S2. These series are suitable for the time domain comparisons with the available sub-diurnal estimates of the atmospheric and oceanic excitation.