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Combination and analysis of subdaily ERPs from GPS and VLBI

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Today, space geodetic observations are able to provide information about variations of Earth rotation with high accuracy and high time resolution. This opens up the opportunity to study the influence of subdaily tidal excitation, short-periodic and episodic geophysical effects on Earth rotation. Harmonic analyses of GPS and VLBI time series provide subdaily tidal excitation amplitudes matching very well the estimations from geophysical models. 60 - 70% of the subdaily variations can be explained by subdaily tide models. The remaining variations in the GPS and the VLBI data are quite different and show outliers, offsets and short periodic, non-tidal signals. A combination of these two subdaily time series should reduce outliers and strengthen the common signals. Combining subdaily Earth rotation data, like polar motion parameters, can be done with a simple equalisation if the individual time series are smooth enough on the long periodic scale, more than 1 day. The available time series from GPS and VLBI mostly do not fulfil these requirements, because they are unequally spaced and contain large data gaps and long term drifts and offsets. A more appropriate combination method was developped by J. Vondrak using a Lagrange polynomial representation of the unknown combined curve and introducing a smoothness constraint in the least squares estimation. This method is also capable of using the first time derivative for one input time series, like ÄLOD from GPS instead of UT1-UTC. The socalled combined smoothing method works well, if the smoothing coefficients are large enough to bridge the data gaps and to suppress high-frequency noise. Applying the combined smoothing method to subdaily Earth rotation data, we have to use smoothing coefficients which eliminate most of the signal with frequencies higher than two days. In order to keep as high frequencies as possible we extended the procedure by dividing the subdaily time series into a low-frequency and a high-frequency part and adapting two different sets of smoothing coefficients to both frequency parts. The new combined subdaily

time series benefits from the longterm stability of VLBI and the continuity of the GPS data. Comparisons of spectral analyses and tidal harmonic analysis demonstrate the increased quality of the combined time series.