3.6.2.8 Institut Géographique National (IGN)

Space Geodesy techniques make available station positions and EOPs on a regular basis. For many years, IERS has shown the interest of combining data coming from various techniques to improve overall reliability. It is now time to study the implications of realizing terrestrial reference systems through a consistent time series of station positions and EOPs. This is exactly what the IERS Combination Research Centre of IGN aims at.

Some preliminary tests have been made after having developed a new software during the year 2001. The software deals with a mixed filtering and deterministic approach. A test combination of 3 months of GPS, SLR and DORIS data has been done including time series of station positions and EOPs. The results have been presented at EGS general assembly in Nice (2002) and a detailed paper should be published in EGS proceedings (*Multi-technique combination of terrestrial reference frame time series*, by P. Sillard, Z. Altamimi and C. Boucher).

The basic model of the combination, for a parameter P (say a station coordinate or an EOP) is the following:

$$\begin{aligned} P(t) &= P(t - \delta t) + \varepsilon(\delta t) \\ \mathrm{E}[\varepsilon(\delta t)] &= 0 \\ \mathrm{var}[\varepsilon(\delta t)] &= [\sigma(\delta t)]^2 \end{aligned}$$

As usual, $\sigma(\delta t)$ is a random variable with zero mean and standard deviation depending on δt. E and var are respectively mathematical expectancy and variance. All the parameters are modelled as random walk whose prediction covariance is increasing with time. This covariance is adjusted through an Helmert variance component estimation process. Physically, previous equation says that the process P is continuous in time and the continuity is transcribed stochastically through a time dependent constraint.

In addition to the previous state model, observation equations hold between parameters and observations (which in case of set of station coordinates combination are more or less of similar types).

The main original idea is the estimation of the random walk covariance (the term $[\sigma(\delta t)]^2$ in the above equation). The main conclusion of this first test is that the principle of filtering that is made only on EOPs up to now should be extended to station coordinates. This is what we intend to do in the year 2002.

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