3.6.2.8 Institut Géographique National (IGN)

Intra-technique combination

The stacking procedure implemented in the Combination and Analysis of Terrestrial Reference Frames (CATREF) software is based on a Euclidian similarity. This relationship links every individual frame with the stacked frame, which is estimated simultaneously with the 7 Helmert parameters that parameterize this relationship. The independent analysis of their temporal behaviour is of great importance for guiding the choice of the origin and scale of the ITRFs. So the stacking procedure is regularly conducted for each geodetic technique by extending the input frame time series with the most recent data. This procedure also ensures a constant assessment of the geodetic product using a limited number of parameters of interest that are meaningful for reference frame analyses.

The station position residual time series from VLBI, SLR and GPS that are by-products of the ITRF2005 stacking analyzes have been also extensively studied in Ray et al., 2008 and Collilieux et al., 2007.

Helmert parameter analysis

A particular attention has been paid to the understanding of the SLR scale and translation variations over time. The influence of the SLR range bias handling strategy on the SLR scale has been carefully studied and has been shown to significantly impact the SLR scale behaviour. A temporal de-correlation method has been developed to optimally estimate SLR station range biases from SLR data (Coulot et al., 2008). Supplementary analyses have been led to study SLR translation and scale variations related to the network effect. The use of additional constraints on station displacements may reduce the aliasing effect occurring between global bias parameters and station individual motions (Collilieux et al., 2008), see Figure 1.

ITRF and EOPs consistency

The availability of frame time series makes possible a rigorous combination of the station positions and EOPs from the space geodetic techniques (Altamimi et al., 2007). This joint combination enforces the mutual consistency between the estimated secular frame and its consistent set of EOPs. ITRF2005 combination strategy is applied regularly to all available data sets from IERS technique services including the most recent data, in cooperation with the IERS Earth orientation centre. This procedure can be used to assess the consistency between the EOP series 05C04 and the ITRF2005 (Altamimi et al., 2008).

Multi-technique combination at the observation level

IGN, being part of the Groupe de Recherche en Géodésie Spatiale (GRGS), has been involved in the IERS Combination Pilot Project (CPP). Research on the combination of station positions and Earth

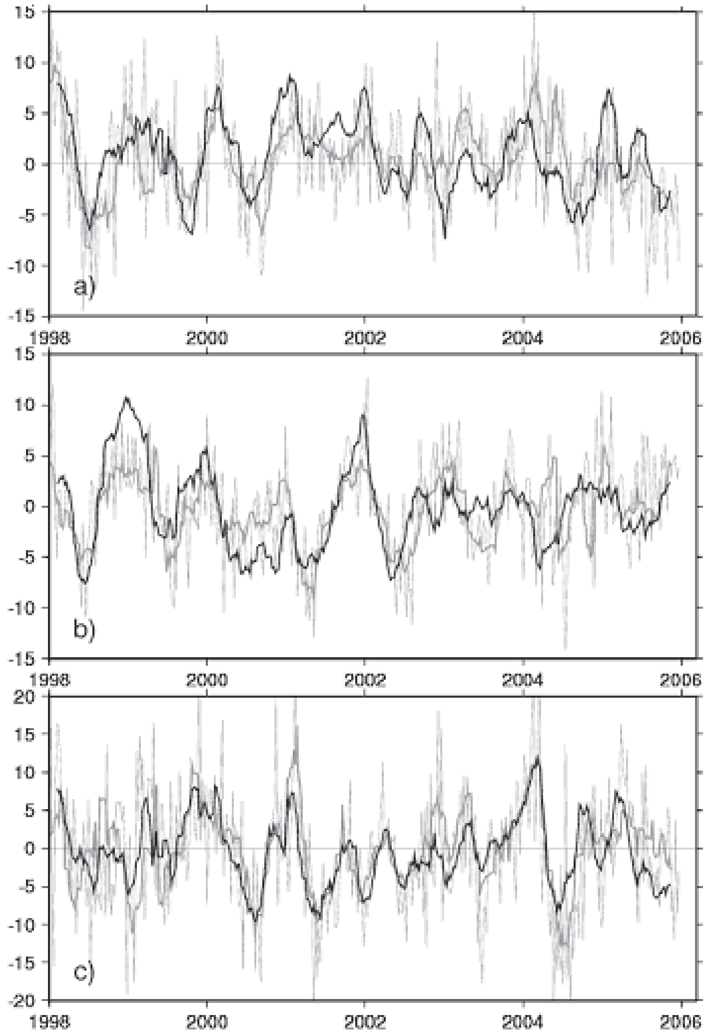

Fig. 1: ILRS solution Helmert parameters from ITRF2005 analysis, in light gray. Estimated parameters constrained with GPS results according to Collilieux et al., 2008, in black. Solid lines correspond to 10 weeks average values. a) X component, b) Y component, c) Z component.

Orientation Parameters (EOPs) at the observation level has been carried out (Coulot et al., 2007) and is still underway. A new modeling of the station position parameters, which involves Helmert parameters directly in the observation equations, is being implemented to ensure that the combined reference frame is well defined and self-consistent. Eight months of data from SLR (LAGEOS I and II), VLBI, DORIS (SPOT2, SPOT4, SPOT5, ENVISAT, JASON), and GPS have been stacked using this model. First results demonstrate its benefit for estimating time series of multi-technique reference frames. Currently, the impact of the introduction of local ties on the combined frame is studied as well as the proper way to use them. To ensure a better consistency of this combined reference frame, the use of other common parameters like zenithal tropospheric delays or multi-technique satellite orbital parameters will be investigated.

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