3.7.2 Working Group on Combination at the Observation Level

Introduction

The IERS "Combination at the Observation Level" (COL) Working Group was created in 2009. Its main objective is to bring together groups able to perform combinations of space geodetic techniques (DORIS, GNSS, SLR and VLBI) at the level of observations searching for an optimal strategy to simultaneously solve for geodetic parameters, in particular Earth Orientation Parameters, terrestrial and celestial reference frames. This implies to improve the accuracy, the time resolution and the overall consistency of the geodetic products derived.

Progress of the project

A Working Group meeting took place at the DGFI in Munich in May 2012. Its objective was first to review the Analysis and Combination Centres activity (AIUB, ASI, DGFI, ESOC, GRGS, GSFC) concerning the two inter-comparison benchmarking campaigns corresponding to the VLBI CONT08 and CONT11 intensive projects.

Discussions developed about the following points:

Use of the defined standards and a priori recommended models over both test periods, on the data sets to be used (list of stations, number of data rejected per technique and per week), number of satellites to be processed (for instance Etalon, Starlette, Stella, Jason, ...). This can be particularly of interest for multisatellite processing as it is done at ESOC. The way Pole and UT1 parameters had to be parameterized was as well discussed.

SINEX file compatibility. Most of discrepancies which were still present are now solved.

Supply by the combination center OP of variance factors obtained by the Helmert's variance component estimation method for all normal equation, this in the objective of weighting.

Minutes of the meeting and presentations from ACs and CCs are available on the following site:

<http://www.iers.org/WGCOL> (see "Activities" section).

Combination processing at the GRGS Combination Center

Implementation of the No Net Rotation (NNR) condition for the Celestial Reference frame

In order to align positions of radio sources to the a priori catalog (ICRF2) we introduce a constraint so that the global transformation, i.e. three rotations, between the a priori and the estimated catalogue is zero. This no net rotation condition for the celestial frame was developed and introduced in the combination package DYNAMO. The variations of the three angular parameters which were estimated with respect to the ICRF2 are shown for each period CONT08 and CONT11 on Figure 1. As expected, values are small.

Handling systematic effects before combination

Combining reference frames of various geodetic techniques requires expressing them in a unique homogeneous frame. However, this is not perfectly realized. Due to inaccuracies in coordinates,

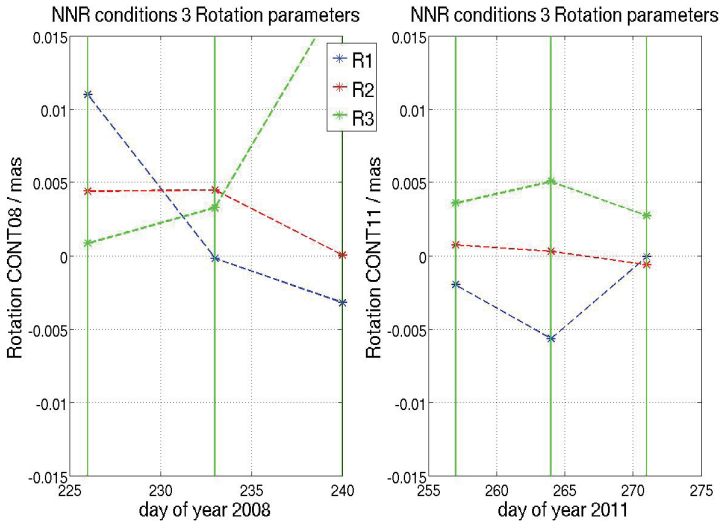

Fig. 1: NNR parameters variations over CONT08 and CONT11 periods

individual reference frames are affected by systematic effects. Consequently, before their combination, it is necessary for each technique to identify, calculate and remove these effects with respect to a standard reference frame such as ITRF2008.

For each technique, the a priori station coordinates expressed in the ITRF reference frame are transformed into a common reference frame by the introduction of the Helmert parameters. Systematic effects estimated over CONT08 and CONT11 periods are shown on Figure 2. Table 1 summarizes the rank deficiency of the geodetic techniques used and the Helmert parameters added.

Table 1: Rank deficiency and Helmert parameters of geodetic techniques

	Satellite techniques DORIS, GNSS, SLR	**VLBI**
Rank deficiency	Orientation imperceptible Rx, Ry, Rz	Frame orientation undefined Rx, Ry, Rz & Origin imperceptible Tx, Ty, Tz
Helmert parameters	Tx, Ty, Tz, Scale	Scale

Retrograde diurnal oscillation cancelled for sub-diurnal EOP

There is some ambiguity in the respective definition of nutation and polar motion in the diurnal band. These parameters are separated in the conventional parameterization. Thus theoretically, there is no retrograde diurnal component to polar motion; however, when estimating the polar motion in the diurnal/sub-diurnal band, an oscillation appears. This oscillation should not exist, and consequently has to be put to zero by adding constraints. The corresponding procedure was implemented in the DYNAMO package.

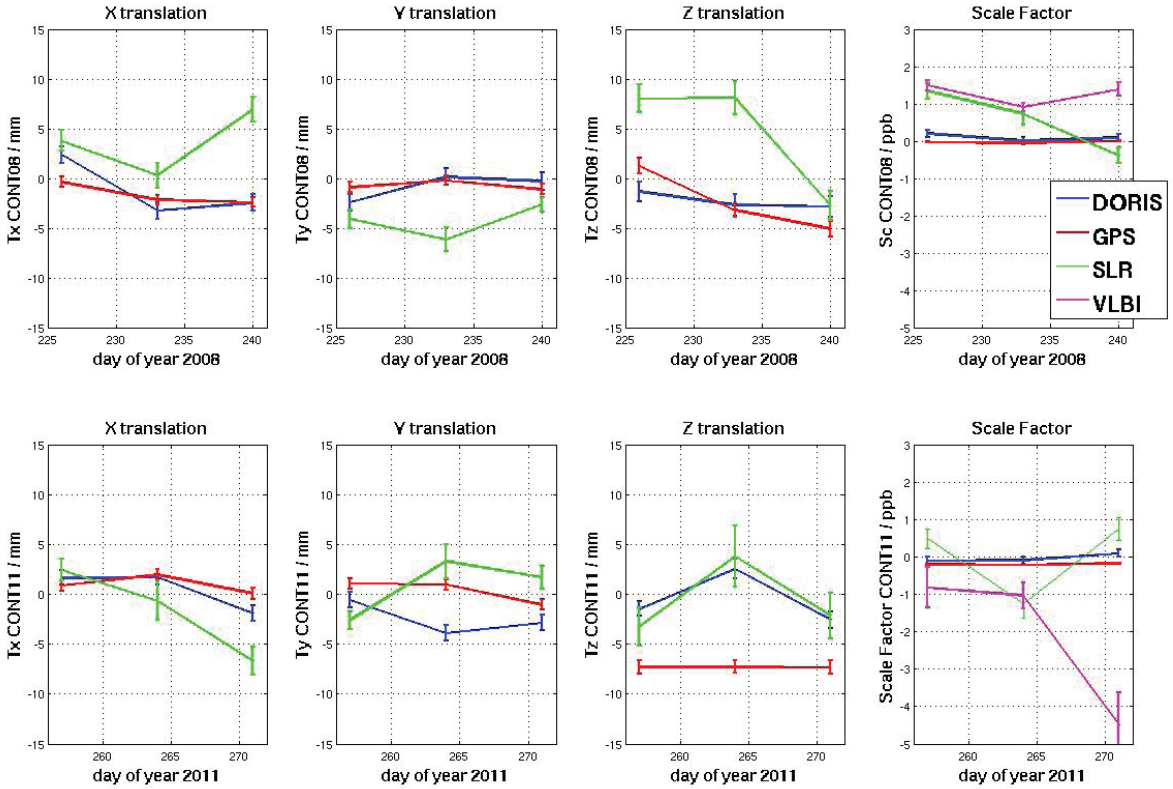

Fig. 2: Systematic effects over CONT08 and CONT11

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