

3.6.2.7 Groupe de Recherches de Géodésie Spatiale (GRGS)

In the framework of the IERS Combination Research Centres, the “Groupe de Recherches de Géodésie Spatiale” (GRGS) has organized the different tasks in order to participate in the IERS Combination Pilot Project (CPP) and to deliver routinely from beginning of 2005 weekly SINEX files from combination of five space techniques.

GRGS' organisation

Groups of the Paris Observatory (N. Capitaine, D. Gambis, A.-M. Gontier, J. Chapront, G. Francou, T. Carlucci), of the Observatory of the “Côte d'Azur” (P. Exertier, D. Coulot, Ph. Bério), of CNES (R. Biancale, J.-M. Lemoine, J.-C. Marty), of the Noveltis (S. Loyer) and CLS (L. Soudarin) companies and with the expertise of P. Charlot (Bordeaux Observatory) and Z. Altamimi (IGN) have worked together in the framework of GRGS to succeed in combining at the observation level SLR, LLR, GPS, DORIS and VLBI observations for providing consistent Earth Rotation Parameters and station network coordinates on a weekly basis.

All processing are made with the GINS software and using the same up-to-date standards. In the test phase which took place in 2004, we have chosen for validating our combination approach to process data from the five techniques over the whole year 2002: SLR has been processed in OCA, VLBI and LLR in Paris Observatory and CNES, DORIS in CLS, GPS in Noveltis. The combination have been performed in OCA with the DYNAMO software package and in IGN. In the routine phase from 2005 onward, roles will be somewhat different, VLBI amounting to the Bordeaux Observatory and the combination process to the Paris Observatory.

Processing of individual techniques

At first some improvement has been achieved and orbit standards have been fixed before processing individual techniques. We took care particularly of GPS processing in order to approach the IGS level of quality. Produced GPS orbits obtained with the GRGS' GINS software compare now globally at 10 cm in 3D rms.

Moreover the LLR technique has been introduced in the GINS software, based on Moon 6-h ephemeris and libration parameter series derived from the CAROLL software of the Paris Observatory. Results over the year 2002 have shown residuals around 13 cm rms from measurements of both stations, Grasse and Mac Donald.

SLR residuals on Lageos-1 and -2 reach 1 cm in average. It is to notice that D. Coulot and Ph. Bério have even detected in their computation a sudden change in the orbit of Lageos on April 5th which is probably due to a space particle impact.

Classical DORIS residuals on the SPOT satellites are around .4 mm/s. ENVISAT measurement residuals are a little bit higher, due to a small bug on the attitude detected later on. Routinely Jason

should replace TOPEX (because of the definitive failure of the on-board DORIS receiver end of 2004 after having worked more than 12 years) when the oscillator anomaly in the SAA will be corrected by modelling.

At last, four VLBI sessions (A, F, E and U) were processed over 2002: they give residuals of the order of 30 ps (~ 1 cm).

Combination of techniques

The combination process of weekly normal equations has been intensively studied and assessed by D. Coulot and Ph. B  rio in OCA over the test year 2002. The optimal relative weights between each technique were obtained weekly by using the Helmert's optimal variance-covariance method for combining normals of x- and y-pole parameters and UT1 every 6 hours, nutation corrections in obliquity and longitude every 12 hours and weekly stations coordinates from all techniques. Solutions were stabilized applying minimal constraints per technique and per week through the classical Helmert's transformation on station coordinates in order the whole network stays close to the ITRF2000 reference system. This strategy applied for combination in the 2002 test year has been slightly modified for the CPP.

Results

Comparisons of the adjusted Earth Rotation Parameters have shown rms differences to the official EOPC04 series of .07 mas for the pole and of .01 ms for UT1. All station coordinates have been adjusted weekly and we have particularly looked at collocated stations which present a fair homogeneous behaviour.

These results for instance in the polar motion and UT1 have shown sufficient quality with respect to results of individual techniques that we decided to pursue the experiment in participating to the CRC's CPP from beginning of 2005. For that purpose we have developed an interface software for converting the DYNAMO format into SINEX files which are then delivered to the IERS server beside the SINEX files of the international services (ILRS, IGS, IVS, ...).

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