3.6.2 Institut National de l'Information Geógraphique et Forestière (IGN)

This report summarizes the activities of the ITRS Combination Centre at IGN during the year 2019.

Research and development activities

The members of the IGN CC, often in cooperation with other scientists, conduct research and developments activities relating to the ITRF in particular and reference frames in general. R&D activities include ITRF accuracy evaluation, mean sea level, loading effects, combination strategies, and maintenance and update of CATREF software. Scientific results of specific data analysis and combination are published in peer-reviewed journals, as listed in the publications section, but also presented at international scientific meetings.

Investigation of the scale discrepancy between SLR and VLBI

The scale of ITRF2014 was defined in such away that it has zero scale and zero scale rate with respect to the arithmetic average of the implicit scales of SLR and VLBI solutions as obtained by the stacking of their respective time series. The resulting scale and scale rate differences between the two solutions (SLR and VLBI) are 1.37 ($\pm$0.10) ppb at epoch 2010.0 and 0.02 ($\pm$0.02) ppb/yr. The level of the scale agreement between SLR and VLBI confirms the ITRF2008 finding and is an indication of the persistent scale offset between the two technique solutions. These results suggest that there is still an urgent need for investigation on the causes of the scale discrepancy, e.g., range biases in case of SLR [Appleby et al., 2016] and possible effects due to VLBI antenna gravity deformations [Sarti et al. 2009, 2010]. The ILRS has initiated a pilot project on systematic errors including the range baises which will be estimated in the ILRS solution to ITRF2020. A preliminary SLR test solution was made available to the ITRS center by Cinzia Luceri from the Italian Space Agency (ASI) where estimated range biases were taken into account. Analyzing the time series of this SLR test solution showed a clear scale offset of about 1 ppb with respect to the ILRS solution which was used in the ITRF2014 as illustrated by Figure 1. We expect that this scale offset will greatly minimize the scale discrepancy between SLR and VLBI in the coming ITRF2020 solution.

Contribution to the IERS Technical Note 40

As reported in the ITRS Centre Report, this issue, an IERS Technical Note (# 40) was published in order to, primarily, acknowledge the activities of the ITRS Combination Centres at DGFI and JPL, beside the ITRS Combination Centre at IGN which is part of the ITRS Centre (Altamimi and Dick, 2020). The Technical Note includes in particular a specific article by the ITRS Centre which evaluates the two solutions DTRF2014 and JTRF2014 with respect to the ITRF2014 (Altamimi et

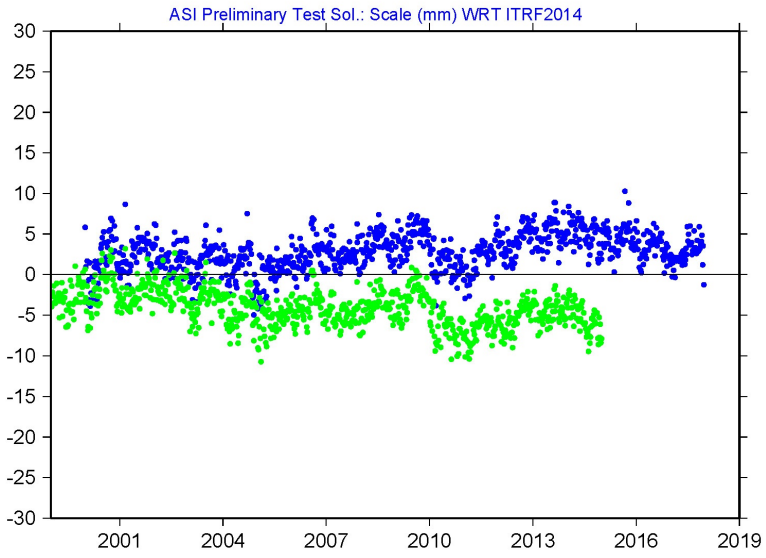

Fig. 1: Scale discrepancy between ASI preliminary solution (blue) where range biases are estimated and ILRS solution (green) used in the ITRF2014 computation

al., 2020). The article concludes in particular that (1) SLR and VLBI intrinsic and discrepant scales coexist in the DTRF and JTRF 2014 solutions, and (2) with respect to ITRF2014 and assuming that its scale is homogeneous, the scale offsets and rates between SLR and VLBI solutions embedded in DTRF2014 and JTRF2014 are respectively 1.32 and 1.21 ppb at epoch 2010.0 and 0.04 and 0.01 ppb/yr. These results are in almost perfect agreement with the results of ITRF2014 analysis.

Publications

Altamimi, Z. and W. R. Dick (Eds.) (2020), Description and evaluation of DTRF2014, JTRF2014 and ITRF2014, IERS Technical Note 40, Frankfurt am Main: Verlag des Bundesamts für Kartographie und Geodäsie. 167 p., ISBN 978-3-86482-137-0, online: https://www.iers.org/IERS/TN40

Altamimi, Z., P. Rebischung, X. Collilieux, and L. Métivier (2020), ITRS Center evaluation of DTRF2014 and JTRF2014 with respect to ITRF2014, in: Altamimi, Z. and W. R. Dick (Eds.), IERS Technical Note 40, Frankfurt am Main: Verlag des Bundesamts für Kartographie und Geodäsie, 2020, pp. 71–78

Benoist, C., X. Collilieux, P. Rebischung, Z. Altamimi, O. Jamet, L. Métivier, K. Chanard, and L. Bel (2019), Accounting for spatiotemporal correlations of GNSS coordinate time series to estimate station velocities, J. Geodyn., 135, 101693, doi: 10.1016/j.jog.2020.101693

Li, Z., W. Chen, T.M. van Dam, P. Rebischung and Z. Altamimi (2019), Comparative analysis of different atmospheric surface pressure models and their impacts on daily ITRF2014 GNSS residual time series,

Journal of Geodesy, vol. 94, n. 42, doi: 10.1007/s00190-020-01370-y

Ma, Y., P. Rebischung, Z. Altamimi, W. Jiang (2019), Assessment of geocenter motion estimates from the IGS second reprocessing, GPS solutions, vol. 24, n. 55, doi: 10.1007/s10291-020-0968-2

Mertikas, S.P., Donlon, C., Matsakis, D., Mavrocordatos, C., Altamimi, Z., Kokolakis,C., Tripolitsiotis, A. (2019), Fiducial Reference Systems for Time and Coordinates in Satellite Altimetry, Advances in Space Research, doi: 10.1016/j.asr.2020.05.014

Métivier, L., Altamimi, Z., and Rouby, H. (2019), Past and present ITRF solutions from geophysical perspectives, Advances in Space Research, Vol. 65, Issue 12, 15 June 2020, pp. 2711–2722, doi: 10.1016/j.asr.2020.03.031

Métivier, L., H. Rouby, P. Rebischung, and Z. Altamimi (2019), ITRF2014, Earth figure changes and geocenter velocity: implications for GIA and recent ice melting, J. Geophys. Res., 125, e2019JB018333, doi: 10.1029/2019JB018333.

Zuheir Altamimi, Paul Rebischung, Laurent Métivier,
Xavier Collilieux, Kristel Chanard