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 2016. These research activities are mainly related to the computation and publication of the ITRF2014.

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 references' section, but also presented at international scientific meetings.

Finalization and publication of the ITRF2014

Specific new developments were achieved and validated for the ITRF2014 computation and analysis: CATREF software was enhanced and upgraded to include periodic terms of the station position time series, such as in particular annual, semi-annual terms for all techniques and draconitic signals for satellite techniques, especially GNSS. These new developments were applied to the technique solutions which were submitted to the ITRF2014.

The ITRF2014 involved two main modelling innovations to enhance the robustness of the frame, mainly (1) the estimation of the annual and semi-annual signals embedded in the time series of station coordinates provided by the four space geodesy techniques, and (2) the incorporation of Post-Seismic Deformation (PSD) models for sites subject to major earthquakes.

In summary, the ITRF2014 was the occasion to construct an ITRF solution with an improved accuracy and robustness, by adequately modelling nonlinear station motions: annual and semi-annual signals, as well as the post-seismic deformations for sites that were subject to major earthquakes.

We showed in Altamimi et al. (2016) that estimating the annual and semi-annual signals has statistically no impact on the horizontal station velocities, while the vertical station velocities may change by up to 1 mm/yr for sites with large seasonal signals, multiple number of discontinuities, or/and data gaps in their time series. Estimating these periodic terms helps the identification and detection of discontinuities in the times series and performs better than applying an atmospheric loading model, especially in the horizontal components.

Modelling the post-seismic deformations for sites impacted by major earthquakes allows the user to have access to the effective site trajectory during the relaxation period. The GNSS-derived parametric models were shown to precisely fit the time series of the co-located DORIS, SLR or VLBI instruments.

The full development, description and results of the ITRF2014 are published in an Open access article, freely available here: http://onlinelibrary.wiley.com/doi/10.1002/2016JB013098/full.

The full results and documentation of the ITRF2014 are available at its dedicated website: http://itrf.ign.fr/ITRF_solutions/2014/. In addition, the preparation for a dedicated IERS Technical Note on ITRF2014 analysis and results was initiated in 2016 to be published in 2017.

Publications

Altamimi, Z., P. Rebischung, L. Métivier, and X. Collilieux (2016), ITRF2014: A new release of the International Terrestrial Reference Frame modeling nonlinear station motions, Journal of Geophysical Research: Solid Earth, doi:10.1002/2016JB013098

Appleby, G., R. Rodriguez, and Z. Altamimi (2016), Assessment of the accuracy of global geodetic satellite laser ranging observations and estimated impact on ITRF scale: estimation of systematic errors in LAGEOS observations 1993-2014, Journal of Geodesy, doi:10.1007/s00190-016-0929-2

Rebischung, P., Z. Altamimi, J. Ray, and B. Garayt (2016), The IGS contribution to ITRF2014, Journal of Geodesy, doi:10.1007/s00190-016-0897-6

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