Geoscience Australia Analysis Center Report 2019–2020

Oleg Titov

Abstract This report gives an overview of the activities of the Geoscience Australia IVS Analysis Center for the period 2019–2020.

1 General Information

The Geoscience Australia (GA) IVS Analysis Center is located in Canberra within the National Geodesy Section; National Positioning Infrastructure Branch; Place, Space and Community Division (PSCD).

2 Activities during the Years 2019–2020

Several celestial reference frame (CRF) solutions have been prepared using the OCCAM 6.3 software. The latest solution (aus2020b.crf) was released in November 2020. VLBI data consisting of approximately 4,000 daily sessions from May 1993 to September 2020 have been used to compute this solution. This includes 10,796,358 observational delays from 4,817 radio sources having three or more observations. Earlier VLBI data between 1980 and 1993 were not used for this solution due to poor quality of astrometric parameters.

Station coordinates were also estimated using No-Net-Rotation (NNR) and No-Net-Translation (NNT) constraints. The long-term time series of the station coordinates have been used to estimate the corresponding velocities for each station. The tectonic motion for the Gilcreek VLBI site after the Denali earthquake was modelled using an exponential function typical of post-seismic deformation.

The adjustment was made by least squares collocation, which considers the clock offsets, wet troposphere delays, and tropospheric gradients as stochastic parameters with a priori covariance functions. The gradient covariance functions were estimated from GPS hourly values.

Observations of several radio stars were undertaken within the Asia-Oceania VLBI (AOV) observational program. Four radio stars were observed (HR1099, UX Ari, HD132742, and LSI+61 303), and the new results were used with the previous astrometric data to improve positions and proper motions of these objects. The preliminary results were reported during the "Journées 2019" meeting in Paris [Titov et al. (2020a)].

A special investigation was made to solve a problem of the transformation of the relativistic group delay model due to the transition from the XF-type correlators to the FX-type correlators. While the legacy baseline-based XF-type correlators calculate the observable values referring to the epoch of reference station, the modern station-based FX-correlators refer the observable to the epoch of the geocenter. This transition from XF- to FX-correlator was not followed by any changes in the IERS Conventions model that still refers to the epoch of the wavefront passage at the reference station. Therefore, the alternative equation of the relativistic group delay model was suggested for application [Titov et al. (2020b)].

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References

[Titov et al. (2020a)] Titov, O., Shu, F., & Chen, W. 2020, "Observations of radio stars in geodetic VLBI experiments." Proceedings of the Journées 2019 "Astrometry, Earth Rotation, and Reference Systems in the GAIA era", Observatoire de Paris, Paris, France, 7–9 October 2019, Ed. C. Bizouard, pp. 173–178.

[Titov et al. (2020b)] Titov, O., Melnikov, A., & Lopez, Y. 2020, "Resolving VLBI correlator ambiguity in the time delay model improves precision of geodetic measurements." Publications of the Astronomical Society of Australia, 37, e050. doi:10.1017/pasa.2020.43