Geoscience Australia Analysis Center

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Abstract

This report gives an overview of the activities of the Geoscience Australia IVS Analysis Center during 2011.

1. General Information

The Geoscience Australia (GA) IVS Analysis Center is located in Canberra. The Geodesy group operates as a part of the Mineral and Natural Hazard Division (MNHD).

2. Component Description

Currently the GA IVS Analysis Center contributes nutation offsets, EOP, and EOP rates on a regular basis for IVS-R1 and IVS-R4 networks and their predecessors (IRIS-A and NEOS-A). The EOP time series are available for 1983 to 2011. The CRF catalogs using a global set of VLBI data since 1979 are regularly submitted to the IVS archives.

3. Staff

- Dr. Oleg Titov - project manager
- Dr. Laura Stanford - VLBI scientist

4. Current Status and Activities

Several CRF solutions have been prepared using the OCCAM 6.2 software. The last solution was uploaded in January 2011. VLBI data comprising 4,109 daily sessions from 25-Nov-1979 to 10-Oct-2011 have been used to compute several global solutions with different sets of reference radio sources. This includes 5,257,804 observational delays from 2,881 radio sources observed by 60 VLBI stations [1].

Station coordinates were also estimated using NNR and NNT constraints. The long-term time series of the station coordinates have been established 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 [2]. The tectonic motion of the Tigoconc (2010 year) and Tsukub32 (2011 year) VLBI sites after the strong earthquakes is currently under study.

The adjustment was made by least squares collocation [3], which considers the clock offsets, wet troposphere delays, and tropospheric gradients as stochastic parameters with apriori covariance functions. The gradient covariance functions were estimated from GPS hourly values [4].

A paper on the secular aberration drift has been prepared in collaboration with colleagues from the IVS Analysis Center of Paris Observatory [5]. A dipole systematic effect, with magnitude 6.4 ± 1.5 μas/yr, was found using the individual proper motions of the 555 reference radio sources with the CALC/SOLVE software. This corresponds to the Galactocentric acceleration of $(3.2 \pm 0.7) \times 10^{-13}$ km/s^2, in good agreement with the theoretical predictions.

5. Geodetic Activity of the Australian Radio Telescopes

During 2011, three Australian radio telescopes – Hobart26, Hobart12 operated by the University of Tasmania (UTAS) and Parkes, operated by the Australia Telescope National Facility (ATNF) – started regular geodetic VLBI observations for different IVS programs.

The Parkes 64-meter telescope participated in six geodetic VLBI sessions in 2011 for improvement of the ITRF and the ICRF in the Southern Hemisphere. This program is undertaken in cooperation with ATNF and UTAS.

6. Optical Spectroscopic Observations of the Reference Radio Sources

A program for optical identification and spectroscopy of the reference radio sources has continued [6]. During 2011, five large optical facilities were used for observing optical spectra of the reference radio sources to determine their red shifts. This list comprises two 8-meter Gemini telescopes in Chile (projects GS-2011A-Q-89 and GS-2011B-Q-94) and Hawaii (project GN-2011B-Q-109), a 6-meter telescope in Russia operated by the Special Astrophysical Observatory, a 3.58-meter New Technology Telescope (NTT) in Chile, operated by the European Space Observatory (project 088.A-0021(A)), and a 2-meter Nordic Optical Telescope (NOT). The goal of this work is to identify the radio sources regularly observed for the geodetic and astrometric VLBI programs. An international team of scientists participated in this program. A paper describing the new set of red shifts is in preparation.

During the new five-night observing run, several faint quasars were completely resolved from the obscuring bright star due to a more stable atmosphere (0905-202, 1123-356, 2300-307). Figures 1 and 2 show a sky field around the 2300-307 source observed at NTT in August 2010 and December 2011. The bright star in the image center in Figure 1 has a size of 4 arcseconds obscuring the quasar separated by 4 arcseconds from the star. Under better sky conditions the visible disk of the bright star in the image center has a smaller size in Figure 2 (about 2 arcseconds). Therefore, the faint quasar in Figure 2 is becoming clearly visible.

7. New Staff Member

Dr Laura Stanford joined the geodetic group of Geoscience Australia in October 2011.

Acknowledgements

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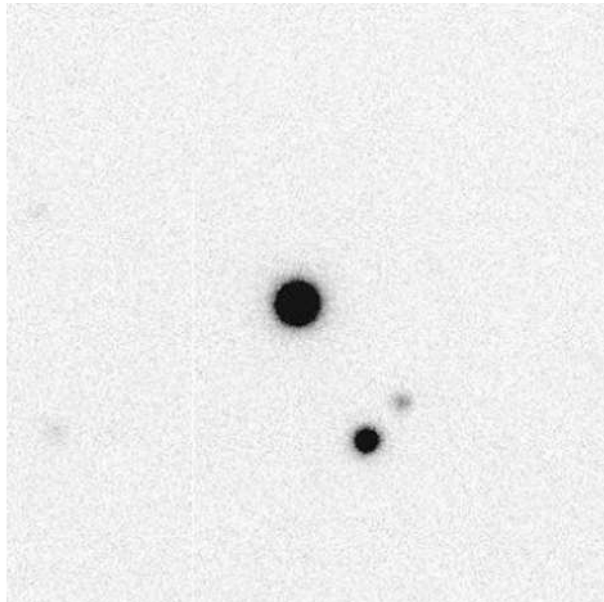

Figure 1. NTT image of the sky field around the quasar 2300-307 made in August 2010 at a visual field of about 2 arcseconds. The bright star in the image center completely obscures the quasar due to the large size of the visible disk (4 arcseconds).

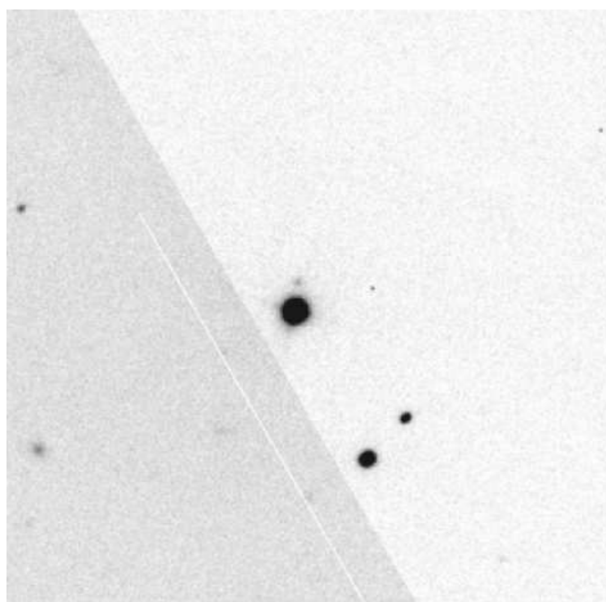

Figure 2. NTT image of the sky field around the quasar 2300-307 made in December 2011 at a visual field of about 0.5 arcseconds. The bright star in the image center has a visible disk two times smaller than in Figure 1, disclosing the faint quasar (22nd magnitude) separated by 4 arcseconds from the star.

References

[1] Titov, O., Systematic effects in the radio source proper motion, in: Proceedings of the 19th European VLBI for Geodesy and Astrometry Meeting, Bordeaux, G. Bourda, P. Charlot, and A. Collioud (eds.), 14–18, 2009.

[2] Titov, O., P. Tregoning, Post-seismic motion of the Gilcreek geodetic sites following the November, 2002 Denali Earthquake, in: International VLBI Service for Geodesy and Astrometry 2004 General Meeting Proceedings, NASA/CP–2004-212255, N. R. Vandenberg and K. D. Baver (eds.), 496–500, 2004.

[3] Titov, O., Estimation of subdiurnal tidal terms in UT1-UTC from VLBI data analysis, in: IERS Technical Notes 28, B. Kolaczek, H. Schuh, and D. Gambis (eds.), 11–14, 2000.

[4] Haas, R., private communication.

[5] Titov, O, S. Lambert, A.-M. Gontier, VLBI measurement of secular aberration drift. AA, 529, A91, 2011.

[6] Titov, O., D. Jauncey, H. Johnston, R. Hunstead and L. Christensen, Optical Spectra of the southern hemisphere flat-spectrum ICRF radio sources, AJ, 142, 165, 2011.