Geoscience Australia Analysis Center

Oleg Titov, Ramesh Govind

Abstract

This report gives an overview about the activities of the Geoscience Australia IVS Analysis Center during the 2004 year.

1. General Information

The Geoscience Australia (GA) IVS Analysis Center is located in Canberra. After some organizational changes the Space Geodesy Analysis Center became a part of the Geohazard Division.

2. Component Description

Currently the GA IVS Analysis Center contributes nutation offsets, three EOPs and their rates on regular basis for IVS-R1 and IVS-R4 networks and their predecessors (IRIS-A, NEOS-A). The EOP time series from 1983 to 2004 are available. Also the CRF catalogues using a global set of VLBI data since 1980 are regularly submitted.

3. Staff

- Dr. Ramesh Govind - Director of the Space Geodesy Analysis Center
- Dr. Oleg Titov - project officer of the Space Geodesy Analysis Center

4. Current Status and Activities

The last global solution has been done using the new features of the OCCAM 6.1 software. VLBI data comprising 3177 daily sessions from 25-Nov-1979 till 21-Oct-2004 have been used to compute the global solution aus2005a. This includes 3,170,447 observational delays from 746 radiosources observed by 57 VLBI stations. Weighted root-mean-square of the solution is about 0.62 cm (about 21 picosec).

The aus2005a solution strategy used radiosources as close as possible to the ICRF-Ext.2 [1]. The radiosource catalogue included 639 sources. Coordinates of 207 of the 212 defining sources [2] were treated as global and imposed by the NNR constraints. 107 "other" sources were treated as local and their positions were estimated for each VLBI session. The rest of the 432 sources were treated as global parameters without NNR constraints.

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. Due to a limited amount of observations the velocities have been estimated for 52 stations only. The tectonic motion of the Gilcreek VLBI site after the Denali earthquake is modelled using an exponential function [3].

The adjustment has been done by least squares collocation method, which considers the clock offsets, wet troposphere delays and troposphere gradients as stochastic parameters with apriori

covariance functions. The gradient covariance functions were estimated from the GPS hourly values [4].

The relative orientation and deformation parameters to transform aus2005a to ICRF-Ext.2 were calculated using the approach by Feissel and Essaifi [5]. Table 1 shows estimates of the rotation angle between the aus2005a catalogue and ICRF-Ext.2. Solution 1 includes all sources (of the 207 imposed by NNR constraints) having more than 1 observation. Solution 2 includes sources having more than 20 observations. Both solutions demonstrate that only shift around pole (A3) and declination bias Bδ estimates are significant. Other parameters look negligible.

Table 1. Num - the number of sources; A1,A2,A3 - the rotation angles between axes of aus2005a and ICRF-Ext.2 frames; Dα, Dδ - the linear trends as function of declination; Bδ - the declination bias parameter; r(α), r(δ) - the weighted rms. All units in μas.

Solution	Num	A1	A2	A3	Dα	Dδ	Bδ	r(α)	r(δ)
Solution 1	202	-7 +/- 6	1 +/- 8	51 +/- 19	0.6 +/- 0.4	1.2 +/- 0.4	-70 +/- 20	184	190
Solution 2	194	-8 +/- 6	1 +/- 8	44 +/- 18	0.5 +/- 0.4	1.2 +/- 0.4	-68 +/- 19	174	165

Also the GA Analysis Center continues the regular submission of EOPs to the IVS/IERS and works on the development of long-term time series for the EOP, station coordinates and comparison of techniques (VLBI, SLR, GPS) for EOP and ITRF adjustment.

5. Geodetic Activity of the Australian Radiotelescopes

During 2004 two Australian radiotelescopes (Hobart and Parkes) were involved in geodetic VLBI observations. GA geodetic group promoted the observations in different ways.

In August 2004 the Hobart radiotelescope was surveyed by conventional survey techniques so as to enable the recomputation of the local tie between the radio telescope, used for VLBI, and the IGS geodetic GPS antenna located nearby. In addition to these observations, further conventional survey observations and a precision terrestrial photogrammetry survey were undertaken in an attempt to quantify the gravitational sag of the radio telescope. It was determined that, as a function of the telescope's pointing elevation and azimuth, the distance between the telescope receiver and the reference point varied by approximately 2 mm. A gravitational sag model for the Hobart telescope is developed and an assessment of its impact on geodetic VLBI is being made.

The operations of the Hobart telscope for geodetic VLBI is supported through an Australian Research Council (ARC) grant awarded jointly to the University of Tasmania (UTAS) and GA. A consortium which includes among others the UTAS and GA, was awarded an ARC grant to put optical fiber links from the Mount Pleasant VLBI site to the UTAS building: eVLBI in Hobart is getting close to being a reality.

6. Future Plans

- update OCCAM software
- combined estimation of the EOPs using VLBI, SLR and GPS data
- cooperation with the Australian National University (ANU), Australian National Telescope

Facility (ANTF) and University of Tasmania on development of VLBI for the southern hemisphere

References

[1] Fey, A., C. Ma, E. Arias, P. Charlot, M. Feissel-Vernier, A.-M. Gontier, C. Jacobs, D. MacMillan, The second extension of the International Celestial Reference Frame: ICRF-Ext.2, In: AJ, 127, 3587–3608, 2004.

[2] Ma, C., E. Arias, T. Eubanks, A. Fey, A.-M. Gontier, C. Jacobs, O. Sovers, B. Archinal, P. Charlot, The International Celestial Reference Frame as realized by Very Long Baseline Interferometry, In: AJ, 116, 516–546, 1998.

[3] 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.

[4] Haas, R., private communication.

[5] Feissel, M., N. Essaifi, 1993 IERS Annual Report, Paris observatory, Paris, 1994.