SHAO Analysis Center 2011 Annual Report

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Abstract

This report presents the activities of the Shanghai Astronomical Observatory (SHAO) Analysis Center in 2011. The SHAO Analysis Center performs data processing and analysis of the geodetic experiments of the Chinese VLBI Network (CVN), analyzes all of the IVS 24h sessions, and submits the analysis products (EOP, TRF, and CRF) to the IVS regularly. We have carried out research work on estimation of Solar acceleration and the consistency analysis of the UT1 time series from IVS Intensive sessions.

1. General Information

We are in charge of the data processing and analysis of the CVN experiments and analyzing the IVS data using the CALC/SOLVE software. The members involved in the IVS analysis activities are Guangli Wang, Jinling Li, Minghui Xu, Li Guo, Liang Li, Fengchun Shu, and Zhihan Qian.

2. Activities in 2011

2.1. Data Processing and Analysis of the CVN Geodetic Experiments

Since the year 2009, China has carried out the Project of Crustal Monitoring Network of the Chinese Mainland Geological Environment (CMNOC). In this project, the CVN carries out more than eight 24-hour experiments per year. SHAO undertakes the operations of CVN and data analysis.

The CVN started to conduct astrometric and geodetic VLBI experiments in 2006. But regular observations did not take place before 2010. Table 1 shows the statistical information about the CVN experiments.

The SHAO Analysis Center is in charge of the routine analysis of the CVN data, including:

- Calculation of the delay and delay rate of the CVN observations at each band, resolving group delay ambiguities, and computation of ionosphere calibrations utilizing the post-correlator software *pps*, which is developed based on software made especially for the post-correlation in the Chang'E Program.
- Generation of the VLBI group delay in the NGS format using the software *gngs*.
- Analysis of all CVN sessions using software *shops*, which is developed based on the software $OCCAM6.1E(Linux)$ with modifications mainly in VLBI data processing models.

2.2. Regular Data Analysis of the IVS 24h Sessions and Product Submission

We restarted routinely analyzing all IVS 24h sessions using the CALC/SOLVE software, and in this year we also regularly submitted our analysis products (EOP, TRF, and CRF) to the IVS Data Centers.

Table 1. The statistical information of the CVN experiments.

Experiment Code	Date	Duration (hr)	Stations	Obs. Number	Delay wrms (ps)
s6602	20060601	10	ShBjKmUr	171	30.3
r7404a	20070404	24	ShBjKmUr	1561	57.3
r7620a	20070620	24	ShBjKmUr	479	32.7
r8919a	20080901	24	ShBjKmUr	282	36.1
g1003d	20100602	24	ShKmUr	545	65.8
g1004a	20100720	24	ShKmUr	368	48.5
g1005a	20100810	24	ShKmUr	414	64.5
r0902a	20100902	24	ShBjKmUr	1590	46.0
r1117a	20110117	24	ShBjKmUr	2534	34.3
r1325a	20110325	24	ShBjKmUr	1598	54.0
r1425a	20110425	23	ShBjKmUr	902	55.7
r1524a	20110524	24	ShKmUr	1136	44.4
t2078	20110720	24	ShKmUr	641	112
r1b14a	20111114	24	ShKmUr	1302	100.1
r1b28a	20111128	24	ShBjKmUr	–	–

Table 2. Statistical information of the results from the different INT1 types.

Year	1984 - 1994	1994 - 2000	2000 - 2011
Stations	Wettzell Westford	Wettzell Green Bank	Wettzell Kokee Park
Number of sessions	1854	1359	2374
Length of baseline (km)	5998	6724	10357
East-West-dimension (km)	5977	6669	10072
Avg. number of scans per session	9.6	17.2	20.9
Avg. normal error of ΔUT1 (μs)	124.6	26.2	11.7
Avg. offset w.r.t. C04/precision (μs)	-14.1 / 2.4	14.0 / 1.7	10.4 / 0.5
Standard derivation w.r.t. C04 (μs)	101.8	61.8	25.6

Table 3. Comparison of the results from the different Intensive types.

	Avg. number of scans per session	Avg. normal error (μs)	Avg. offset / precision w.r.t. C04 (μs)	Standard deviation w.r.t. C04 (μs)
INT1	20.9	11.7	10.4 / 0.5	25.6
INT2	29.7	10.3	10.3 / 0.9	21.4
INT3	70.2	8.6	31.0 / 2.8	28.3

2.3. Analysis of UT1 Determined from IVS Intensive Observations

We carried out an analysis of the IVS Intensive data from 1984.02 to 2011.08 with different observation networks, INT1, INT2 and INT3, and we discussed the progress of the UT1 accuracy. By comparing UT1 results from different networks, we have found a difference on the order of dozens of microseconds between the networks. The results from the IVS Intensive observations in which the Seshan station observed showed a similar performance to that of other stations. From the comparison and analysis of different UT1 series, there exists a level of 10 μs uncertainty between UT1 estimations obtained from the IVS Intensive observations and from the IERS C04. The results are presented in Table 2 and Table 3.

2.4. Estimation of Solar Acceleration

The secular aberration drift observed as the apparent proper motion of extragalactic radio sources is caused by the acceleration of the coordinate origin, the Solar system barycenter. For 30 years, this effect will accumulate up to about 200 μas, which is far beyond the declared several tens of μas-level of the ICRF2 accuracy. We estimated the acceleration as a global parameter by using the 30 years of global geodetic/astrometric VLBI data. This estimation is independent of any kinematic or dynamic model of the Milky Way or statistics hypothesis. The estimated acceleration in the direction of the Galactic center is 0.75 ± 0.05 cm$\cdot s^{-1} \cdot yr^{-1}$, while the other two components are -0.02 $\pm$ 0.06 and 0.40 $\pm$ 0.05 cm$\cdot s^{-1} \cdot yr^{-1}$ in the direction along the Solar motion in the Galactic plane and in the direction normal to the Galactic plane, respectively.

3. Plans for 2012

We will continue to submit our analysis products to the IVS Data Centers regularly. In order to submit the CVN observations to the IVS, we will conduct the work of transferring the data format of CVN observations from NGS to netcdf. The research activities will focus on the ICRF with the consideration of the secular aberration and the study of the high frequency variations of EOP.