The CVN Experiments and Data Analysis

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Abstract

Since 2006, the geodetic experiments has been carried out by the Chinese VLBI Network (CVN). These experiments are used to determine and monitor the crustal movements of the Chinese Mainland. In this report we will introduce the Status of the CVN and present some results of CVN experiments.

1. Background of the CVN

Since the year of 2009, China began to carry out the Project of Crustal Monitoring Network of the Chinese Mainland Geological Environment (CMNOC). In the end of the year of 2011, CMNOC begins to operate. CMNOC is a large scale network for crustal movement observation of high accuracy and spatial and temporal resolution, with GPS as its main observation technique and combined with other space techniques, such as VLBI and SLR, precise leveling and precise gravimetry. It is a comprehensive, open and unified network of continuous observation for various applications with data shared by many institutions. Its main scientific aim is to monitor the crustal movement for earthquake prediction. It also serves for the geodetic survey and national construction. In this project, the CVN will carry out more than eight 24-hour experiments. SHAO undertake the operations of CVN and data analysis.

The CVN is now consisted of four antennas, Seshan 25m, Urumq 25m, Kunming 30m and Miyun 50m (see Fig. 1). A new antenna with aperture 65m in Shanghai are building and will involve in observations of the CVN in the end of this year. Moreover, the program to construct another antenna with a huger aperture (110m) in Urumqi is already on the schedule.

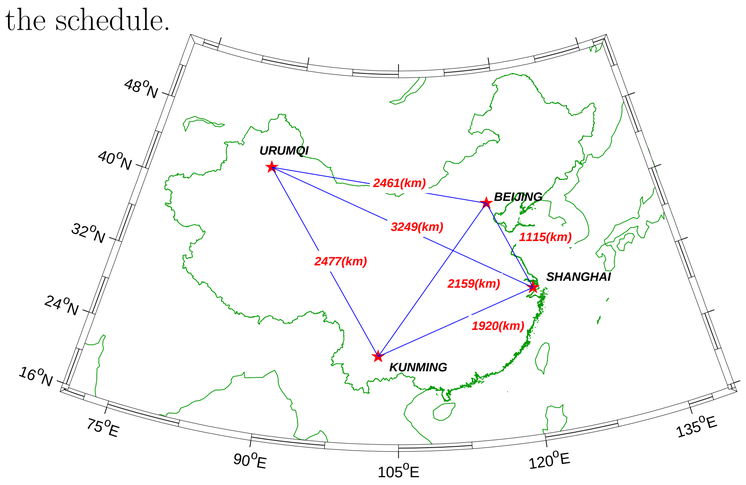

Figure 1: the map of the CVN

2. Geodetic experiments of the CVN

The CVN started to conduct the astrometric and geodetic VLBI experiments in 2006 to monitor the movement of the network of the Chinese Mainland. But the regular observations were taken place until the last year. Table 1 shows the statistic information of the CVN experiments. And the CVN plans to operate routine experiments for geodetic applications about ten times every year in the future.

Table 1: the statistic 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	–	–

3. Data process and analysis

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

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

4. Results of the CVN observations

The data we used here are totally 14 sessions of the CVN observations from Jun. 2006 to Nov. 2011, the results of which are shown as follows. We estimate the parameters such as coordinates of the stations, two nutation parameters, offsets and rates of clock function, and zenith wet delay. The values of the UT1 directly take from the IERS C04 time-series.

Table 2: The baseline lengths and their rates

Baseline	Length (mm)	Rate (mm/yr)	epoch
BEIJING - KUNMING	2158739970.7 ± 18.2	10.2 ± 16.9	2010.0
BEIJING - URUMQI	2460848839.0 ± 2.9	-9.9 ± 1.8	2010.0
KUNMING - URUMQI	2476626883.8 ± 5.6	12.0 ± 4.4	2010.0
SESHAN - BEIJING	1114949639.8 ± 1.5	-1.1 ± 1.0	2010.0
SESHAN - KUNMING	1920129542.1 ± 9.9	4.4 ± 8.1	2010.0
SESHAN - URUMQI	3249214246.0 ± 4.6	-6.2 ± 2.7	2010.0

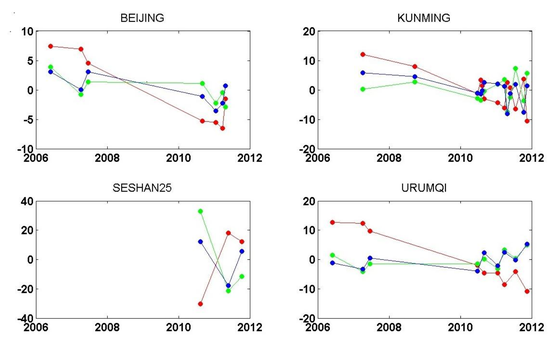

Figure 2: Coordinate Time-series of the CVN stations. The red, green and blue lines represent the X, Y, Z coordinates, respectively. (Units: cm.)

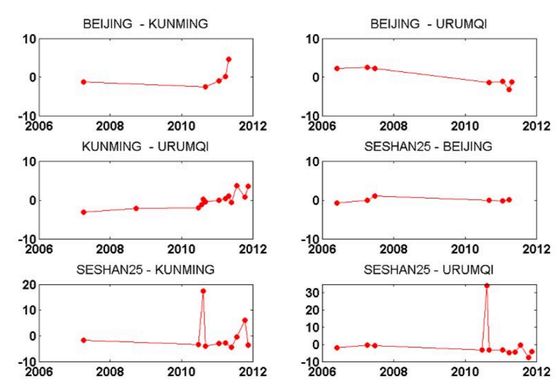

Figure 3: time-series of the baseline lengths. (Units: cm.)

4. Future plans

This report shows the preliminary results of the CVN observations. There are some experiments with a large uncertainty in the post-fit rms of the delay mainly because of the station instability, which need to be settled in the future. And much further work also may be needed to make the CVN data analysis more conveniently and effectively, such as developing a new VLBI data analysis software. Moreover, we are investigating the possibility of the EOP service by using the CVN and several experiments have been conducted.

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