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IV. RELATED RESULTS AND ACTIVITIES IN WESTERN PACIFIC VLBI NETWORK

IV.2 SHORT REPORT OF THE EXPERIMENTS WITH THE URUMQI VLBI STATION, WESTERN CHINA

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ABSTRACT

Very Long Baseline Interferometry (VLBI) experiments were carried out between Japan and China using a newly constructed VLBI station at Urumqi in western China which was equipped with the data acquisition system transported from Communications Research Laboratory (CRL). The first VLBI fringe of the Urumqi station was detected, and the position of the 25 m antenna at Urumqi was derived within an error of several centimeters, which indicates that the Urumqi station is established as a unique VLBI station on the central part of the Eurasian Plate.

1. Introduction

Urumqi in western China is located on the central part of the Eurasian Plate which is conjectured to be a stable part against the plate deformation provoked by the conflict between the Indian Plate and the Eurasian Plate at the Himalayas(1). On the other hand, Shanghai is thought to be on the South China block of the Eurasian Plate(1), where the east-southeastward displacement caused by the deformation of the plate had been detected by the experiments with the Western Pacific VLBI Network(2). Consequently, Urumqi is a candidate remarkable point as a geodetic standard of the stable interior of the Eurasian Plate which is effective for the elucidation of the plate deformation.

A 25 m antenna for geodetic VLBI and radio astronomy observations was constructed at Urumqi Astronomical Observatory of the Chinese Academy of Sciences (CAS) in 1992(3). We executed the first international geodetic VLBI experiments with the Urumqi station for the purposes of the establishment of the VLBI system and the precise positioning of the station in 1994. Because the VLBI data acquisition system had not been equipped by the Chinese side yet, it was transported from CRL for temporary use.

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Table 1 Properties for the experiments

Properties in common with each station			
Receiving frequency band		S/X band	
Mode of data acquisition		2 MHz × 14 ch	
Frequency standard		Hydrogen maser	
Specific properties for each station			
Station	**Kashima**	**Urumqi**	**Shanghai**
Antenna diameter	34 m	25 m	25 m
T_{sys} (S band)	71 K	160 K	140 K
T_{sys} (X band)	52 K	100 K	120 K
Efficiency (S band)	65%	46%	50%
Efficiency (X band)	68%	50%	60%
Data acquisition system	K-4	K-4	MK-III

2. Experiments

Geodetic VLBI experiments were executed using the 34 m antenna of Kashima Space Research Center of CRL, the 25 m antenna of Urumqi Astronomical Observatory of CAS, and the 25 m antenna of Shanghai Observatory of CAS. The K-4 type VLBI data acquisition system[(4)(5)], including the video convertor, the local oscillator, the input interface, and the data recorder, was transported from CRL to the Urumqi station before the experiments. A phase calibrator was also transported from CRL and equipped to the antenna at Urumqi.

Two sessions of a 24-hour observation were made from 7:00 UT on February 28 and 7:00 UT on March 2, 1994. 23 radio continuum sources toward extragalactic quasars were observed in S band at 2 GHz and X band at 8 GHz simultaneously. The VLBI data were recorded with 14 channels of 2 MHz by the K-4 type VLBI data acquisition systems at Kashima and Urumqi, and Mk-III type system at Shanghai, respectively. Frequency standard signals were generated by hydrogen masers at each station. These observational properties are summarized in Table 1. The signal of the phase calibrator at Urumqi, however, could not be optimized to the antenna system, and the hydrogen maser at Shanghai were unstable during the experiments. The correlation processing using the K-3 type VLBI correlator[(6)] and the baseline analysis were performed at Kashima from March to April 1994.

3. Results and Discussion

VLBI fringes including the first fringe by the Urumqi station was successfully detected for all the baselines in conjunction with Kashima, Urumqi and Shanghai on both S band and X band in the correlation processing. Because of the inferior quality of the phase calibrator signal at Urumqi, we assumed, in the bandwidth synthesis processing, that the phases for each scan and the relative phases for each channel at Urumqi have constant values as those obtained from the scans with large signal to noise ratio during the observations. Results of the obtained position for the Urumqi station are summarized in Table 2 with ITRF92 coordinates[(7)]. The distance between Kashima and Urumqi antenna is estimated to be 4,484,257.466 ± 0.026 m. Figure 1 also shows the obtained baseline length between Kashima and Urumqi and the distribution of the VLBI stations. Thick solid lines and broken

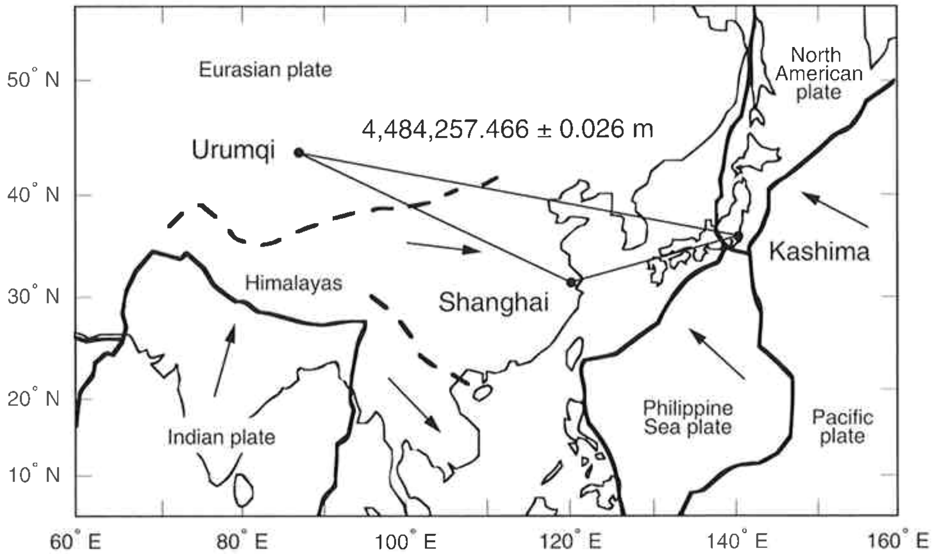

Fig. 1 The distribution of the VLBI stations and the baseline length between Kashima and Urumqi obtained by the VLBI experiment. Thick solid lines and broken lines denote the boundaries of the plates and the South China block, respectively, and arrows denote the directions of the plate motion.

Table 2 Results for Urumqi Station

Position of Urumqi by ITRF92 coordinates
X = 228,310.845 ± 0.038 m
Y = 4,631,922.768 ± 0.065 m
Z = 4,367,063.951 ± 0.037 m
Base line length between Kashima and Urumqi
L = 4,484,257.466 ± 0.026 m

lines in Fig. 1 denote the boundaries of the plates and the South China block, respectively, and arrows denote the directions of the plate motion, which indicate that Urumqi is located on the stable interior of the Eurasian Plate.

The error on the order of several centimeters derived from our VLBI experiments is smaller by about four figures than that of several hundred meters measured by GPS at Urumqi. It is, however, larger than those of typical geodetic VLBI measurements, which is thought to be due to the inferior quality of the phase calibrator signal at Urumqi. The averaged loss of correlated amplitudes caused by phase synthesis processing is about 5% for the baseline between Kashima and Urumqi, which indicates that the frequency standard signal at Urumqi had enough stability. These results show that though the optimization of the phase calibrator signal is necessary for the improvement of the system, the Urumqi station is established as a geodetic VLBI station.

4. Conclusion

The first international geodetic VLBI experiments were executed between Urumqi, Kashima, and Shanghai, using the K-4 VLBI data acquisition system transported from CRL to Urumqi. The first VLBI fringe of the Urumqi station has been detected, and the position of the 25 m antenna at Urumqi was estimated within an error of several centimeters. Though the error of the derived position at Urumqi is larger than those in conventional geodetic VLBI experiments, we can conclude that the Urumqi VLBI station is established to be of a unique one on the central part of the Eurasian Plate.

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