Tsukuba 32-m VLBI Station

Ryoji Kawabata, Shinobu Kurihara, Yoshihiro Fukuzaki, Jiro Kuroda, Tadashi Tanabe, Yasuko Mukai, Takashi Nishikawa

Abstract

The Tsukuba 32-m VLBI station is operated by the Geospatial Information Authority of Japan. This report summarizes activities of the Tsukuba 32-m VLBI station in 2012. More than 200 sessions were observed with the Tsukuba 32-m and other GSI antennas in accordance with the IVS Master Schedule of 2012. We have started installing the observing facilities that will be fully compliant with VLBI2010 for the first time in Japan.

1. General Information

The Tsukuba 32-m VLBI station (TSUKUB32, Figure 1) is located at the Geospatial Information Authority of Japan (hereafter GSI) in Tsukuba Science City, which is about 50 km to the northeast of the capital of Japan, Tokyo. GSI has three regional stations besides TSUKUB32: SINTOTU3, CHICHI10, and AIRA, which form a geodetic VLBI network in Japan covering the whole country (Figure 2).

GSI carried out the domestic VLBI session series called "JADE (JApanese Dynamic Earth observation by VLBI)". The main purposes of the JADE series are to maintain the reference frame of Japan and to monitor the plate motions for the advanced study of crustal deformations around Japan. Additionally, Mizusawa (VERAMZSW) and Ishigakijima (VERAISGK), which are part of the VERA network of the National Astronomical Observatory of Japan (NAOJ), and Kashima (KASHIM11) and Koganei (KOGANEI) 11-m stations, which belong to the National Institute of Information and Communications Technology (NICT), have also participated in some JADE sessions.

Figure 1. Tsukuba 32-m VLBI station.

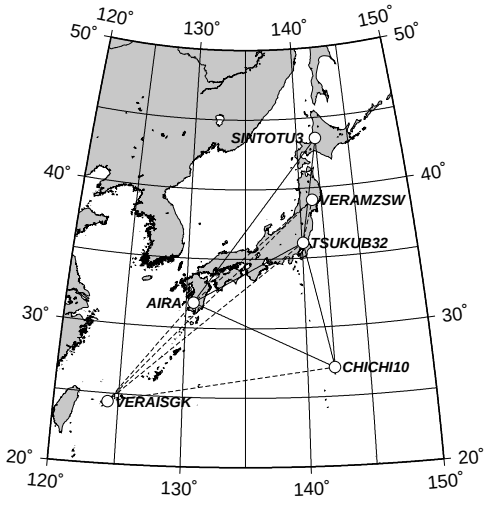

Figure 2. Geodetic VLBI network in Japan.

2. Component Description

The specifications of the Tsukuba 32-m antenna are summarized in Table 1.

Table 1. Tsukuba 32-m antenna specifications.

Owner and operating agency	Geospatial Information Authority of Japan
Year of construction	1998
Radio telescope mount type	Az-El
Antenna optics	Cassegrain
Diameter of main reflector	32 m
Azimuth range	10 – 710°
Elevation range	5 – 88°
Az/El drive velocity	3°/sec
Tsys at zenith (X/S)	50 K / 65 K
SEFD (X/S)	320 Jy / 360 Jy
RF range (X1)	7780 – 8280 MHz
RF range (X2)	8180 – 8680 MHz
RF range (X3)	8580 – 8980 MHz
RF range (S with BPF)	2215 – 2369 MHz
Recording terminal	K5/VSSP32, ADS3000+ with DDC

3. Members

Table 2 lists the regular members belonging to the GSI VLBI observation group. Misao Ishihara and Kensuke Kokado moved to another division at the beginning of April. Therefore, Tadashi Tanabe has become the director of our division. Routine operations were mainly performed under contract with Advanced Engineering Service Co., Ltd. (AES).

Table 2. Member list of the GSI VLBI group.

Name	Main Function
Tadashi TANABE	Supervisor
Jiro KURODA	Management, Co-location
Yoshihiro FUKUZAKI	Installation of VLBI2010 system
Shinobu KURIHARA	Correlation, Analysis, IVS Directing Board member
Ryoji KAWABATA	Observation, Co-location
Kazuhiro TAKASHIMA	Research
Yasuko MUKAI	Operation (AES, Co., Ltd)
Takashi NISHIKAWA	Operation (AES, Co., Ltd)
Toshio NAKAJIMA	System engineer (I-JUSE)

4. Current Status and Activities

4.1. Geodetic VLBI Observations

The regular sessions in the IVS Master Schedule which were observed by using GSI antennas are shown in Table 3. TSUKUB32 participated in 87 domestic and international 24-hr VLBI sessions, and in 131 Intensive 1-hr sessions for dUT1 measurement in 2012. TSUKUB32 could not participate in the IVS sessions from the end of February to March due to the repair of some cracks in the supporting structures of the subreflector as mentioned in Section 4.2. Some IVS-CRF sessions were observed by TSUKUB32 this year. The other GSI antennas, SINTOTU3, CHICHI10, and AIRA, participated not only in domestic sessions but also in some international sessions.

Table 3. The number of regular sessions observed by using GSI antennas in 2012. The numbers in parentheses show those of canceled sessions listed in the IVS Master Schedule.

Sessions	TSUKUB32	SINTOTU3	CHICHI10	AIRA
IVS-R1	44(4)	–	–	–
IVS-R4	9(3)	–	–	–
IVS-T2	6(1)	–	7	7
APSG	2	2	2	2
VLBA	5	–	–	–
IVS-R&D	9(1)	–	–	–
IVS-CRF	3	–	–	–
JADE	8	7	4	4
JAXA	1	–	1	1
IVS-INT2	88	–	–	–
IVS-INT3	43	–	–	–
Total	218	9	14	14

4.2. Repair of Tsukuba 32-m Antenna

At the end of February, we investigated the TSUKUB32 antenna in order to find the cause of a reduction of main beam efficiency in K-band especially at low elevation angles, which was reported by our research collaborator, Tsukuba University. After the investigation, some cracks were found on the joint parts of the subreflector supporting structure, which could cause the change of the subreflector position depending on the elevation angle. TSUKUB32 could not participate in the IVS sessions for just over one month, until we repaired these cracks and reinforced the joint parts by using iron covers at the end of March.

4.3. Fringe Tests with Sejong 22-m Antenna

The Sejong 22-m antenna, which is the first geodetic VLBI antenna in Korea, was constructed and became an IVS network station in 2012. TSUKUB32 had some fringe tests with the Sejong antenna in order to check the Sejong antenna system before participating in the IVS sessions. After some tests, we managed to detect fringes in both S and X-band (Figure 3).

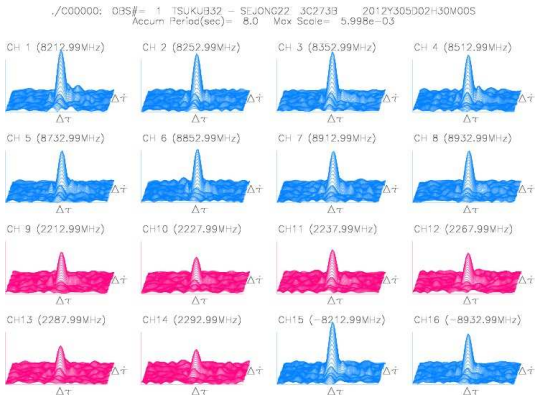

Figure 3. Fringes in X-band (blue) and S-band (red) found in the experiment on October 31.

5. VLBI2010 Project in GSI

We have entered into contracts with some manufacturers for a new antenna and necessary components for GSI VLBI2010 observing facilities. The GSI VLBI2010 station is now planned to be installed at a candidate site in Ishioka city located about 17 km northeast from Tsukuba (Figure 4), and it will be compliant with all requirements for VLBI2010 specification. The site has stable foundation ground and is in a relatively RFI-quiet environment. We considered special features of the antenna structure and the location of the survey pillars so that we can efficiently perform a local-tie survey with a GNSS observation point, which is also planned to be installed at the same site.

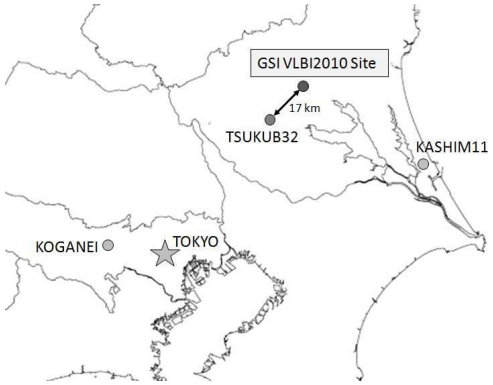

Figure 4. Location of the candidate site for the GSI VLBI2010 station.