

Kashima and Koganei 11-m VLBI Stations

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Abstract

Two 11-m VLBI antennas at Kashima and Koganei are continuously operated and maintained by the National Institute of Information and Communications Technology (NICT). This report summarizes the status of these antennas, the staffs, and the activities in 2012.

1. General Information

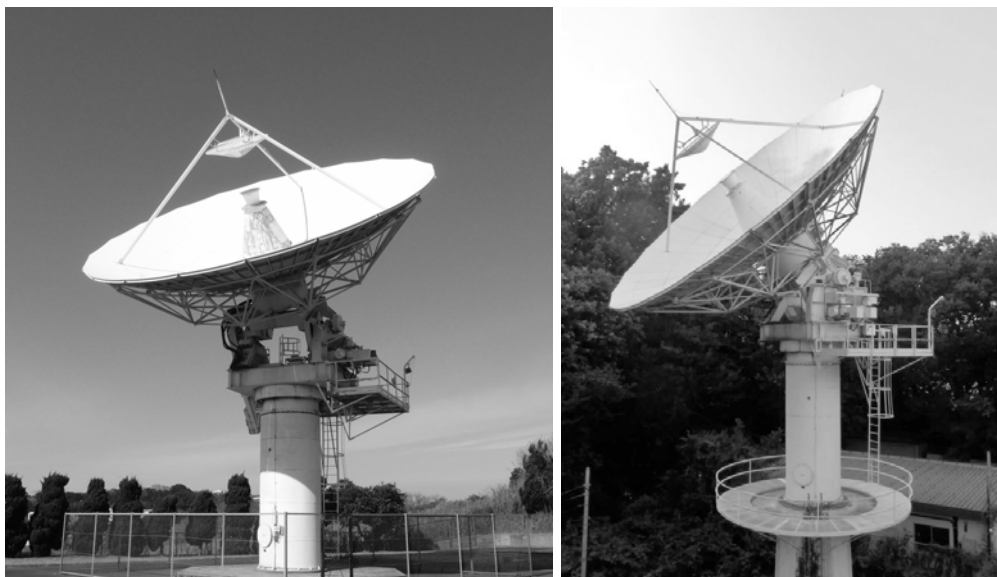


Figure 1. 11-m VLBI antennas at Kashima (left) and Koganei (right).

Two 11-m VLBI antennas at Kashima and Koganei (Figure 1) had been operated for monitoring of crustal deformation of the Tokyo metropolitan area (Key Stone Project) since 1995[1]. After the regular VLBI sessions with the KSP VLBI Network has terminated in 2001, the 11-m VLBI stations at Kashima and Koganei have mainly been used for research and of technical developments.

2. Component Description

The antenna parameters of Kashima-11 and Koganei-11 are summarized in Table 1. The band-pass filters for S-band (2215-2375MHz) have been installed since 2010 for RFI mitigation at both stations. Phase calibration signal (P-cal) of 5-MHz interval has been used instead of 1-MHz interval at these KSP stations.

Table 1. The Antenna Parameter of the 11-m antennas.

		Kashima	Koganei
Antenna Type		Cassegrain type	
Diameter of the Main Reflector		11 m	
Mount Style		Az El mount	
Latitude		N 35° 57' 19.46"	N 35° 42' 37.89"
Longitude		E 140° 39' 26.86"	E 139° 29' 17.06"
Height of Az/El intersection above sea level		62.4 m	125.4 m
Input Frequency [MHz]	S band	2212 ~ 2360	2212 ~ 2360
	X Low band	7700 ~ 8200	7700 ~ 8200
	X High band	8180 ~ 8680	8100 ~ 8600
Local Frequency [MHz]	S band	3000	3000
	X Low band	7200	7200
	X High band	7680	7600
SEFD [Jy]	X-band	5700	9500
	S-band	3300	5500

2.1. Kashima-11

The original design of these antennas was identical. However, the frequency of the first local oscillator of X-H band at the Kashima 11-m station was changed by 80 MHz since 2008, so that the observation frequency range became the same with that of the Kashima 34-m station. Compact hydrogen maser atomic time standard has been installed in November 2011. Since then reference signal of Kashima 11m station is provided from this frequency standard. Also precise temperature control box (PTCB: Fig. 2) has been used since 2010 to keep the environmental temperature of reference signal distribution unit being constant, which are sensitive to the temperature variation. The PTCB can keep the air temperature variation in the box within a few tenths of degrees, where the room temperature around the PTCB vary in the range of a few degrees under the control of standard air conditioner.



Figure 2. Precise temperature control box located at Kashima 11m Station.

2.2. Koganei-11

Reference signal (5MHz) has been provided from H-maser standard, which is synchronized to the UTC (NICT), through the optical loop-back controlled reference signal transmission system since 2009[2]. Therefore the clock of Koganei 11m station is highly stable and its rate is maintained

to be close to zero with respect to the UTC.

3. Staff

The 11-m antenna stations at Kashima and Koganei are operated and maintained by the members of the Space-Time Standards Laboratory. The staff members contributing the operation and maintenance of the 11m antennas are as follows:

- AMAGAI Jun (Okinawa): has supported Antenna System and Timing Systems at Koganei 11-m station. He moved to Okinawa Electromagnetic Technology Center in July 2012.
- HASEGAWA Shingo (Kashima): Maintenance of computer system.
- ICHIKAWA Ryuichi (Koganei,Tokyo): Maintenance of meteorological sensors and IGS Receivers.
- KAWAI Eiji (Kashima): Overall antenna system.
- SEKIDO Mamoru (Kashima): Operation and maintenance of overall of the VLBI systems.
- TAKEFUJI Kazuhiro (Kashima): Operation and Maintenance of data acquisition system.

The operation and maintenance of the 11-m VLBI station at Koganei have been also supported by the Space Weather and Environment Informatics Laboratory and the Space Communication Systems Laboratory at the Koganei Headquarters of NICT.

4. Current Status and Activities

The two 11m antennas have been used variety of VLBI observations and single dish observations as follows:

International and Domestic VLBI Observation for Geodesy: The Kashima region was widely affected by the big earthquake that occurred on 11 March 2011 in the north east area of Japan. Fortunately the Kashima 11-m and Koganei 11-m stations were not seriously damaged. These two antennas have been participating IVS-T2, APSG, and JADE sessions since 2011. These participation's are important for monitoring the change of global positions of the Kashima and Koganei stations after the earthquake.

Data transport of international and domestic VLBI observations are made via e-transfer, rather than physical shipping of recorded data disks. Depending on the request, Mark5 data or K5 data are stored and provided to the correlation center from our data server, which is accessible from the Internet with 1 Gbps connection.

VLBI Experiments for Frequency Comparison: The Space-Time Standards Laboratory is in charge of keeping the national standard time of Japan, and is developing optical frequency standards for the primary frequency standards of the next generation. The main mission of the VLBI group of NICT is development of VLBI system used for frequency comparison between optical frequency standards at intercontinental distances. For this purpose, a new VLBI system with small diameter antenna pairs and wide-band observation system are under the development[3]. Before the new VLBI system become available, test experiments with 11m antenna pair have been conducted several times for feasibility study of frequency comparison.

Astronomical Observation: Flare up of the galactic center Sgr-A* of our galaxy is predicted to occur in the summer of 2013 by Glissen et al.[4]. Based on the proposal by Miyoshi et al.[5] and Tsuboi et al.[5], monitoring observation of the flux variation of Sgr-A* in S/X-band were conducted in June, October, December in 2012. The observation will be continued until fall in 2013 at least.

Receiving the Down-link Signal from STEREO Spacecraft: Koganei 11m antenna has been used to download data from the STEREO spacecrafts¹ by cooperation with the Space Weather and Environment Informatics Laboratory of NICT. When VLBI sessions or maintenance work are not scheduled, the Koganei 11-m antenna has been mostly used for tracking the STEREO.

5. Future Plan

The antenna performance of the Koganei 11m antenna is about 60 % with respect to that of Kashima 11m antenna. The reason of this degradation is not known yet. We are going to investigate the reason and to recover the performance of the Koganei 11m antenna to the same level with that of Kashima 11m.

References

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- [2] Fujieda, M., M. Kumagai, S. Nagano, and T. Gotoh, UTC(NICT) signal transfer system using optical fibers, IVS NICT-TDC News, No. 31, 17-20, 2010.
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- [6] Tsuboi, M., et al., Short baseline VLBI Observation of 2013 Event of Sagittarius A*, Astronomical Society Japan Spring Meeting in 2013, B08a, 2012.

¹Two STEREO spacecrafts were launched by NASA in October 2006 to investigate the solar terrestrial environment and to provide 3D images of the Sun and solar storms.