

Kashima and Koganei 11-m VLBI Stations

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Abstract Kashima and Koganei 11-m stations have been used for geodetic and astronomical monitoring observations and for R&D test bed of VLBI technology. Unfortunately Kashima 11-m station has stopped due to accidental cable break happened in Oct. 2013. This will be fixed in early March 2014. Koganei 11-m antenna has been constantly operated for VLBI and satellite down-link observations.

1 General Information

A pair of 11-m diameter antennas is operated by VLBI group of Space-Time Standard Laboratory (STSL) of the National Institute of Information and Communications Technology (NICT). Kashima 11-m antenna is located in Kashima Space Technology Center (KSTC), which is east coast of the Japanese main island. Koganei 11-m antenna is located in the headquarters of the NICT in Tokyo (Fig. 1). The 11-m VLBI antennas at Kashima and Koganei (Figure 2) were established and have been operated for the monitoring of crustal deformation of the Tokyo metropolitan area (Key Stone Project) since 1995 [1]. After the regular VLBI observations, the KSP VLBI Network terminated in 2001. Then the 11-m VLBI stations at Kashima and Koganei have mainly been used for research and technology developments. “The Tohoku earthquake” occurred in March 2011 affected to Kashima city and the KSTC by destruction of a part of buildings and by Tsunami.

NICT Space-Time Standards Laboratory/Kashima Space Technology Center

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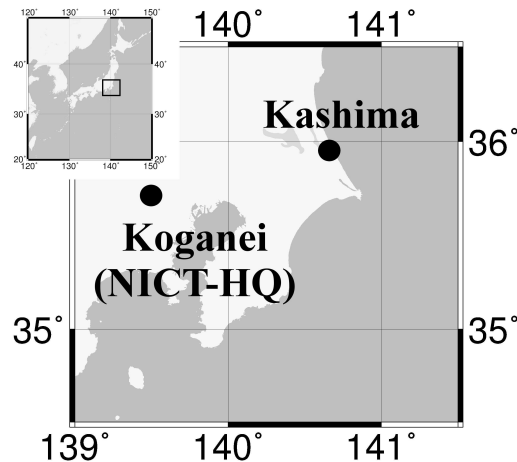


Fig. 1 Location of NICT-Koganei Headquarters, and Kashima

Fortunately the damage to the Kashima 11-m antenna was not as severe as that of Kashima 34-m antenna. Koganei 11-m antenna in Tokyo was also safe. Thus two antennas could be used for measurements of post-seismic crustal deformation of the Kashima-Koganei baseline. Kashima and Koganei 11-m stations participated to IVS-R1, T2, and APSG sessions from May 2011 and August, respectively.

2 Component Description

Antenna:

The antenna parameters of Kashima-11 and Koganei-11 are summarized in Table 1. The band-pass filters for S-band (2212-2360 MHz) have been installed since

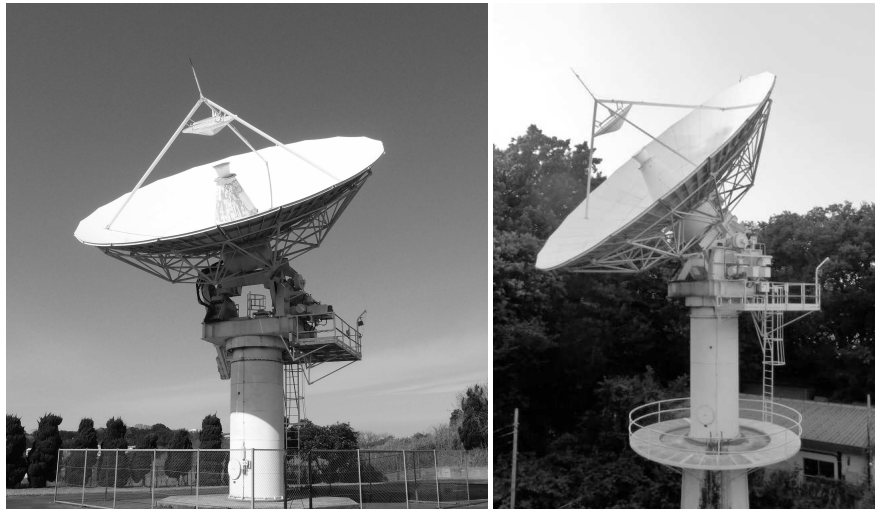


Fig. 2 11-m VLBI antennas at Kashima (left panel) and Koganei (right panel).

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

		Kashima	Koganei
Antenna Type		Cassegrain type	
Diameter		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
Altitude		62.4 m	125.4 m
Rx Freq. [MHz]	S band	2212 ~ 2360	2212 ~ 2360
	X Low band	7700 ~ 8200	7700 ~ 8200
	X High band	8180 ~ 8680	8100 ~ 8600
Local Freq. [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

2010 for radio frequency interference mitigation at both stations.

Data Acquisition System: Sampler

Two sorts of sampler are available at both stations as summarized in Table 2. The K5/VSSP32[2] has four channels of video band signal input per unit. Four units of K5/VSSP32 constitutes one geodetic VLBI terminal with 16 inputs. This system is constantly used for geodetic VLBI observations. This sampler has digital filter function realized by FPGA in it. Input video sig-

nal is digitized with 8 bit quantization with 64 MHz sampling, then frequency bandwidth is restricted and output by reduced data rate for requested sampling mode. The output data is written in standard Linux file system in K5/VSSP32 format. Data format conversion from K5/VSSP32 to Mark4, VLBA, and Mark5b are possible with conversion tools¹.

The ADS3000+[3] is a sampler with digital base-band conversion (DBBC) function. Several kinds of data acquisition modes (personalities) are switchable by loading FPGA program. The DBBC mode enables flexible selection of 16 video frequency channels with any of 4/8/16/32 MHz bandwidth. Therefore this can be compatible with conventional 16 channels of geodetic VLBI observations. One channel of 8 bit with 128 MHz sampling mode has been used for astronomical observation with higher dynamic range, such as pulsar observation. Another one channel of 1/2bit 1024 MHz sampling is used for wide-band single channel VLBI observation. This mode is going to be used in the Galax-V project[4].

Network Connection:

Local are network connection from Kashima 34-m antenna site to Kashima 11-m and Koganei 11-m are 10

¹ Observation and data conversion software for K5/VSSP are freely available from <http://www2.nict.go.jp/aeri/sts/stmg/K5/VSSP/index-e.html>

Table 2 VLBI data sampler/DAS system available at Kashima and Koganei 11m stations.

System	K5/VSSP32(4 units)	ADS3000+(K5/VSI)
Video Converter	K4/KSP 16ch	not necessary
# of Input Channels	4 /unit x 4 units	1 or 2
# of Output Channels	16	1,2, 16
Input Freq. Range	0 - 300 MHz	0 - 2 GHz
Sampling Rate [Msps]	0.04,0.1,0.2,0.5,1, 2,4,8,16,32,64	128, 256, 1024, 2048,4096
Quantization bit	1,2,4,8 bit	
Max. data rate [Mbps]	256 /unit x 4	4096
Output Interface	USB 2.0	VSI-H

Gbps and 1 Gbps, respectively. Observation data of IVS sessions are gathered to e-VLBI data server at Kashima 34-m site, and then those data are provided to correlation center thorough 1 Gbps network link of the Japanese research network JGN-X.

3 Staff

Kawai Eiji: In charge of station keeping /maintenance, and IVS observations.

Hasegawa Shingo is supporting staff for IVS observation preparation, operation, and maintenance of file servers for e-VLBI data transfer.

Ichikawa Ryuichi: In charge of keeping GNSS stations and GNSS observations.

Sekido Mamoru: In charge of overall activities of Kashima Koganei VLBI stations.

4 Current Status and Activities

Kashima and Koganei 11-m stations are participating geodetic VLBI sessions: IVS-T2, APSG, and JADE, about once in a month. These two stations are used as a test bed of R&D experiments including feasibility study of frequency comparison with VLBI. In addition, flux monitoring of Sgr-A* with Kashima - Koganei baseline has been performed under collaboration with S. Takekawa and T. Oka of Keio University [5].

However a tear of cables (coaxial cables and status-control lines) happened at Kashima 11m antenna in October 2013 by accident. It was caused by aging and

break of strings for cable binding. Loosed cables have caught on antenna structure during observation. Then they were stretched and torn by antenna motion. Replacing work for fixing cables was contracted and to be finished by early March 2014.

Koganei 11-m antenna is jointly operated by two groups in the NICT; the STSL and Space Weather and Environment Informatics Laboratory (SWEIL). When the antenna is not used for VLBI observations, it is used for down link observation from Stereo satellite² by the SWEIL.

5 Future Plans

As a medium size radio telescope, Kashima - Koganei 11-m antennas have good slew speed (3 degrees/sec) and stable observation performance. This interferometer will be continuously used for good R&D VLBI experiments.

Acknowledgments

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² http://www.nasa.gov/mission_pages/stereo/main/index.html