

Kashima 11-m and Koganei 11-m VLBI Stations

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Abstract The Kashima and Koganei 11-m stations have been used for participating in T2, CRF, and APSG sessions conducted by the IVS and AOV sessions organized in the Asia-Oceania region.

1 General Information

A pair of 11-m diameter antennas have been operated by the VLBI group of the Space-Time Standard Laboratory (STSL) of the National Institute of Information and Communications Technology (NICT). The Kashima 11-m antenna is located at Kashima Space Technology Center (KSTC), on the east coast of the Japanese main island. The Koganei 11-m antenna is located at the headquarters of the NICT in Tokyo (Figure 1). The 11-m VLBI antennas at Kashima and Koganei (Figure 2) have been regularly operated with two other stations for the monitoring of crustal deformation of the Tokyo metropolitan area (Key Stone Project) since 1995 [1]. After the KSP project terminated in 2001, two 11-m diameter antennas were transferred to Gifu University and Hokkaido University. The Kashima and Koganei 11-m stations remained and have been used for research and technology development by NICT.

These two stations had not participated in international geodetic observing until 2011. After the “Tohoku earthquake” occurred in March 2011, the Kashima and Koganei stations have been participating in international IVS-R1, T2, APSG, and AOV sessions.

NICT Space-Time Standards Laboratory/Kashima Space Technology Center

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IVS 2015+2016 Biennial Report

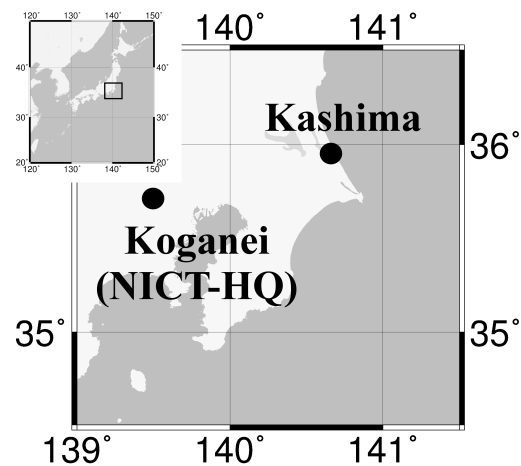


Fig. 1 Location of NICT-Koganei Headquarters and Kashima.

2 Component Description

2.1 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) were installed in 2010 at both stations for mitigation of radio frequency interference from cell phone stations. The local oscillator frequency of XH-band at the Kashima 11-m station has been changed from 7600 MHz to 7680 MHz since 2008, and since then, the observation bands of the Kashima and Koganei stations have been different by 80 MHz.



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

Table 1 The antenna parameters 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

2.2 Data Acquisition Systems

Two kinds of samplers 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 constitute one geodetic VLBI terminal with 16 video channels. This system is constantly used for geodetic VLBI observations including IVS sessions. This K5/VSSP32 sampler has digital filter functionality inside. The input video signal is digitized with 8-bit quantization with 64 MHz sampling. Then the frequency bandwidth is shaped by digital filter and output by specified data rate. The output data is

written to a standard Linux file system in K5/VSSP32 format¹. Data format conversion from K5/VSSP32 to Mark IV, VLBA, and Mark 5B are available with conversion tools².

Another sampler, ADS3000+ [3, 4], and a data recording system, PC-VSI, are available at both stations. The ADS3000+ sampler has the digital base-band conversion (DBBC) function, which enables flexible selection of 16 video frequency channels with any of the 4/8/16/32 MHz bandwidths. Thus, this is compatible with the conventional 16 channels of geodetic VLBI. Geodetic VLBI observing has been done by using K5/VSSP32, and ADS3000+ DAS is not used at the 11-m stations yet.

2.3 Network for e-Transfer

All of the data observed by the NICT VLBI stations are provided to the correlator by e-transfer. The acquired VLBI data format is converted to Mark 5B if necessary, and the data are put on external servers for e-transfer to the correlator. The speed of the local area network (LAN) connections among the Kashima 34-m, the Kashima 11-m, and the Koganei 11-m stations has

¹ Please see http://www2.nict.go.jp/sts/stmg/K5/VSSP/vssp32_format.pdf

² Observation and data conversion software for K5/VSSP are freely available from <http://www2.nict.go.jp/sts/stmg/K5/VSSP/index-e.html>

Table 2 VLBI data sampler/DAS systems equipped at the Kashima 11-m and Koganei 11-m 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

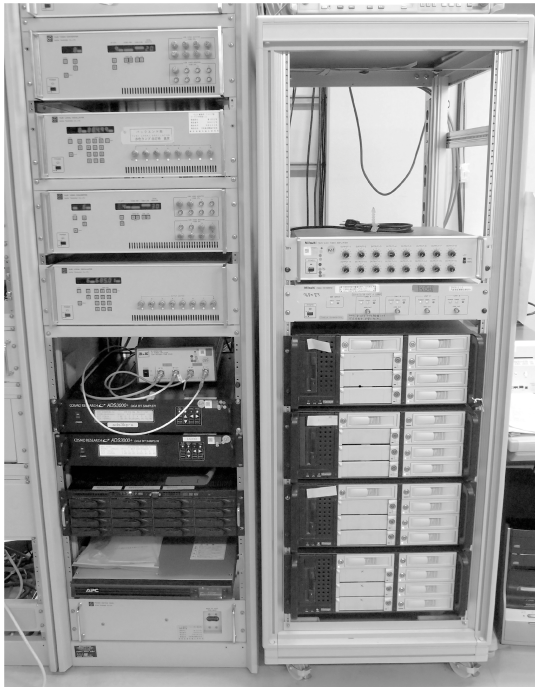


Fig. 3 Data acquisition terminal (K5/VSSP and K5/VSI) at the Kashima 11-m station.

been upgraded to 10 Gbps in 2014. The high speed network connection is provided by collaboration with the Research Network Testbed JGN. Figure 4 shows the schematic diagram of the local network connections and the outbound network.

2.4 GNSS Site

Both Kashima 11-m and Koganei 11-m have GNSS observation sites—named KSMV and KGNI, respec-

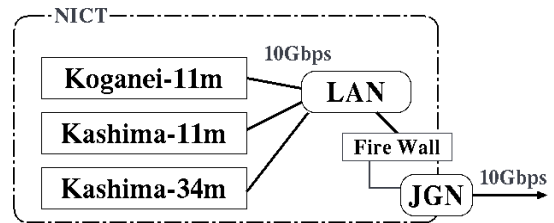


Fig. 4 The network environment of the NICT VLBI stations (Kashima 11-m, Kashima 34-m, and Koganei 11-m). A network speed of 10 Gbps is available internally and for e-transfer of VLBI data to the correlator.

tively. Their data is regularly uploaded to the International GNSS Service (IGS) Data Center. Figure 5 shows the KSMV station at the Kashima 11-m antenna site. A local survey was performed in 2014 at Koganei.



Fig. 5 The Kashima 11-m antenna and the GNSS receiver pillar of the IGS tracking station KSMV.

3 Staff

The following staff members (in alphabetical order) are contributing to running the Kashima 11-m and Koganei 11-m stations.

Hasegawa Shingo: Supporting staff for IVS observing, operation of data conversion, and maintenance of file servers for e-transfer.

Ichikawa Ryuichi: In charge of GNSS station care and GNSS observations.

Kawai Eiji: In charge of station maintenance.

Kondo Tetsuro: Contributes to the implementation of ADS3000+ control by FS9. Maintains the K5/VSSP software package, which is used for data acquisition and conversion.

Miyauchi Yuka: In charge of data acquisition software with PC-VSI and VDIF data stream.

Sekido Mamoru: In charge of observing operations and overall activities of the Kashima and Koganei VLBI stations.

Tsutsumi Masanori: In charge of network security and maintenance of data acquisition computers.

4 Current Status and Activities during the Past Two Years

The Kashima and Koganei 11-m stations are participating in geodetic VLBI IVS-T2, APSG, CRF, and AOV sessions. Because of a system crash of the antenna control computer at the Kashima 11-m in 2016, some IVS sessions partially failed once. Except for that problem, the two stations have been working stably.

The Koganei 11-m antenna has been operated under time sharing with the Space Environment Laboratory (SPEL). Our group has higher priority to use the antenna for VLBI observing. When the antenna is free from VLBI observing, it is used for receiving a downlink signal from the STEREO satellite³ by the SPEL.

The last pointing observation for upgrading the antenna axis parameter was made in January 2015.

Acknowledgements

We thank the research testbed network JGN and the Information System Section of NICT for supporting the high speed network environment.

References

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³ http://www.nasa.gov/mission_pages/stereo/main/index.html