10m Radio Telescope of Mizusawa Astrogeodynamics Observatory

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Abstract

The Mizusawa 10m radio telescope was constructed in 1993 and has been in use for both geodetic and astronomical researches. In June, 2002 the antenna was hit by a thunderbolt and its control unit was broken. Therefore, there were only a few real observational activities in the year 2002. In this report, general features, observations and future plans of the telescope are described.

1. General Information

The Mizusawa 10m radio telescope was constructed in 1993 and is located in the campus of Mizusawa Astrogeodynamics Observatory which was established as one of the International Latitude Service stations in 1899. It is a dedicated antenna for VLBI. However, it is also operated in a single dish mode mainly for monitoring water maser sources.

Besides dedicated use by NAOJ researchers the Mizusawa 10m radio telescope is open to cooperative use by researchers at universities and governmental institutes. It acts as a component station of the Japanese VLBI network (J-Net) consisting of Mizusawa 10m, Nobeyam 45m, and Kagoshima 6m, and eventually, Gifu 10m and Kashima 34m antennas. Main observational targets of this network are positions and velocities of Galactic water maser sources. The frequency band is 22 GHz. This type of observation is usually performed a few times a year. Geodetic observations are also made with Tsukuba 32m.

Figure 1 shows the 10m antenna and the VERA 20m antenna at Mizusawa.

2. Component Description

Tables 1 and 2 summarize technical parameters of the Mizusawa 10m radio telescope.

A K4 terminal with 128 Mbps is used for data aquisition and recording.

3. Observational Activities in 2002

Before June 1, 2002, when a thunderbolt hit the 10m radio telescope and other facilities in the Mizusawa campus and the control unit of the antenna was broken, it was mainly used to help complete the VERA system. It is used as a reference antenna in VLBI observations with the VERA stations. However, a geodetic observation with Tsukuba 32m radio telescope of the Geographic Survey Institute was made. The repair of the antenna control unit finished in the end of November. Therefore, there was no scientific activity in the latter half of 2002.

4. Staff

Operators at observations are assigned among VLBI operater team consisting of about 10 persons in observation by observation basis. The core members are listed below.

5. Future Plans

From 2003 on regular geodetic observations are planned by using 4 radio telescopes at the VERA stations, that is, Mizusawa, Iriki, Ogasawara and Ishigakijima, where S and X band facilities are being installed. However, Mizusawa is the only station that is equipped with a K4 system. Therefore, the VERA network will be tied to the international network by joining with GSI's domestic observation campaign. The 10m and 20m antennas will observe simultaneously in order to tie the 20m's position to the 10m's position and determine the 20m's velocity.

Another scheduled usage of the 10m radio telescope is to calibrate the phase calibration system of the dual beam receiving system of the VERA 20m antenna. The 10m antenna is quickly switched between target and reference radio sources while the VERA antenna tracks the two souces simultaneously.

Figure 1. The Mizusawa 10m antenna(right) and the VERA 20m antenna(left) viewed from north

Table 1. Antenna parameters

Position	φ = 39°8′0".1412N λ = 141°7′56".4518E H = 111.048m in WGS84		
Diameter	10m		
Mount	Azimuth-Elevation		
Surface accuracy	0.34mm(rms)		
	S	X	K
HPBW	54'	13'	5'.2
Aperture efficiency	38%	63%	36%
Beam efficiency	55%	73%	
Slew	Azimuth	Elevation	
range	180° ± 267°	3° − −90°	
speed	3°.14/sec	3°.06/sec	
acceleration	3°.78/sec^2	3°.71/sec^2	
Pointing accuracy	$< 1'$(rms)	$< 1'$(rms)	

Table 2. Receiver parameters

Frequency band	Frequency range(GHz)	Receiver temperature(K)	T$_sys$(K)	Polarization	Receiver type
S	2.15—2.35	50	340	RHC/LHC	FET
X	8.13—8.60	55	130	RHC	cooled HEMT
K	19.5—25.0	80	150	RHC/LHC, Linear	cooled HEMT

Table 3. Staff members

Chief	Osamu Kameya
Scientist	Yoshiaki Tamura, Takaaki Jike
Chief engineering technician	Kenzaburo Iwadate
Engineering technician	Seisuke Kuji, Katsuhisa Sato