

Japanese VLBI network observations of 6.7-GHz methanol masers I. Array

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Abstract. The Japanese VLBI network (JVN) has begun observations of 6.7-GHz methanol masers associated with massive star-forming regions. The JVN is a newly-established VLBI array with baselines ranging from 50 to 2560 km spread across the Japanese islands. Three observing bands of 6.7, 8.4, and 22 GHz are now available. The array consists of ten antennas: VERA Mizusawa 20 m, VERA Ishigaki 20 m, VERA Iriki 20 m, Usuda 64 m, Yamaguchi 32 m, Tomakomai 11 m, Tsukuba 32 m, Kashima 34 m, VERA Ogasawara 20 m, and Gifu 11 m, the first five of which have 6.7-GHz receiving systems. In summer 2005, we obtained the first fringes at 6.7 GHz, and VLBI images of 12 methanol maser sites including seven that had not previously been imaged with VLBI at this band. In 2006 summer, we obtained phase-reference observations toward several methanol maser sites.

Keywords. masers, instrumentation: interferometers, radio lines: ISM

1. The Japanese VLBI network

The Japanese VLBI network (JVN) obtained the first fringes at 8.4 GHz in November 2004, at 22 GHz in May 2005, and at 6.7 GHz in September 2005. The array consists of ten antennas: VERA Mizusawa 20 m, VERA Ishigaki 20 m, VERA Iriki 20 m, VERA Ogasawara 20 m (Kobayashi et al. 2003), Usuda 64 m, Yamaguchi 32 m, Tomakomai 11 m, Tsukuba 32 m, Kashima 34 m, and Gifu 11 m, with baselines ranging from 50 to 2560 km. The VSOP-terminal system is currently used as a digital back-end; digitized data in 2-bit quantization are recorded onto magnetic tapes at a data rate of 128 Mbps. Correlation processing is performed with the Mitaka FX correlator (Shibata et al. 1998) at the National Astronomical Observatory of Japan.

2. The 6.7 GHz array

The receiving systems at 6.7 GHz are currently installed in five antennas: Mizusawa, Iriki, Ishigaki, Usuda, and Yamaguchi, with baselines of 293–2270 km, resulting in synthesized beam sizes of ~ 5 milli-arcsecond. The individual baseline sensitivities are $2.4\text{--}28 \text{ Jy beam}^{-1}$ for a 180-sec integration and 2.0-kHz bandwidth, and the resulting image sensitivity is $\sim 0.4 \text{ Jy beam}^{-1}$ for a 1-hour integration.

Currently, the 6.7 GHz JVN array is in an experimental phase and: (1) the receivers on Yamaguchi 32 m and VERA 20 m antennas are not cooled, (2) there is only a single

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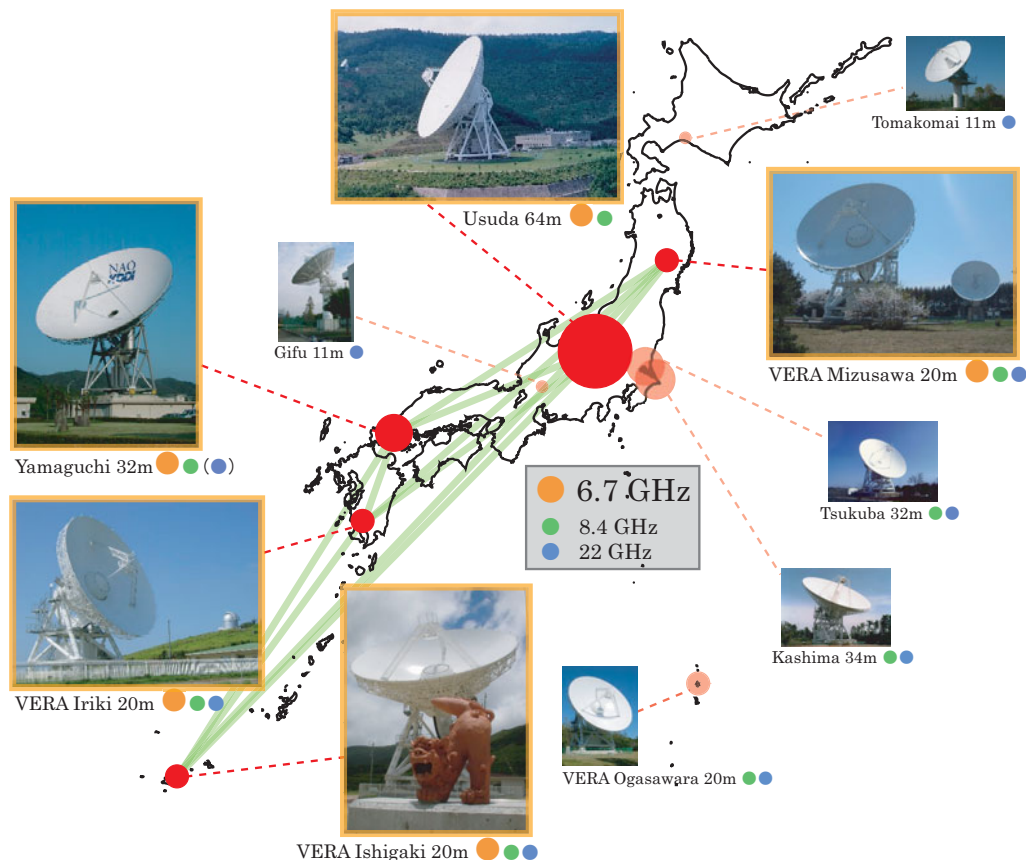


Figure 1. Japanese VLBI network and its 6.7 GHz array, which currently consists of Usuda 64 m, Yamaguchi 32 m, VERA Mizusawa 20 m, VERA Ishigaki 20 m, and VERA Iriki 20 m telescopes.

polarization receiving system on each antenna, and (3) the polarization is mismatched between antennas, with linear polarization for the VERA Mizusawa 20m and VERA Ishigaki 20m antennas and circular polarization for the other antennas. The corresponding loss of correlated amplitude is corrected in a data reduction process. Because of these factors, *at present*, observations at 6.7 GHz are not open to general users.

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