



Development of a Compact VLBI System for Providing over 10-km Baseline Calibration and Its Implications to Geodesy and Precise Time Transfer

R. ICHIKAWA (1), A. ISHII (1), H. TAKIGUCHI (1), Y. KOYAMA (2), T. KONDO (1,4), S. KURIHARA (3), K. KOKADO (3), and S. MATSUZAKA (3)

(1) National Institute of Information and Communication Technology, Kashima Space Research Center, Kashima, Japan (richi@nict.go.jp), (2) National Institute of Information and Communication Technology, Koganei, Japan, (4) Ajou University, Suwon, Korea, (3) Geographical Survey Institute, Tsukuba, Japan

We are developing a compact VLBI system with 1.6 m diameter aperture dish in order to provide reference baseline lengths for calibration. The reference baselines are used to validate surveying instruments such as GPS and EDM and maintained by the Geographical Survey Institute (GSI) of Japan. The compact VLBI system will be installed at both ends of the reference baseline. However, it is too insensitive to detect fringe between both stations using such compact dish. Thus, we have designed a new observation concept including one large dish station into the baseline observation. We can detect two group delays between each compact VLBI system and the large dish station based on conventional VLBI measurement. A group delay between the two compact dishes can be indirectly calculated using a simple equation. We named the idea 'Multiple Antenna Radio-interferometry of Baseline Length Evaluation (MARBLE)' system. The compact VLBI system is designed to be assembled with muscle power simply in order to perform short-term (about one week) measurements at several reference baselines in Japan islands. The compact VLBI system is also capable to be used as a fiducial station of a local geodetic observation network at remote locations.

We have evaluated a front-end system with a wide-band quad-ridged horn antenna (QRHA) by installing it on the 2.4 m diameter dish at Kashima. The 2.4 m VLBI station is operated in order to test equipments which will be planed to install on the compact VLBI system. On December 5 of 2007, we have successfully detected first fringes of the 3C84 signal for S/X band using the new front-end system. Moreover, we have succeeded to perform two geodetic VLBI experiments on 54 km baseline between the 2.4 m dish equipped with the QRHA and the Tsukuba 32 m station of GSI. The results of determined baseline length between the 2.4 m station and Tsukuba 32 m station are almost identical with the previous results which are used by X-band feed only on the 2.4 m dish. On the other hand, the formal error of recent results are slightly worse due to low signal-to-noise ratio (SNR) of signal fringes caused by low aperture efficiency of the antenna. Since the new 1.6 m dish is optimized for the new front-end, we expect SNR of the new system will improve. We are now preparing to perform first fringe detection experiment using the compact VLBI system with 1.6 m dish in March of 2009. In addition, we are also planning to use the system into the accurate time and frequency comparison between a separated locations and we will present its outlook.