

Activities of the Ishioka VLBI Station as a VGOS station

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The International VLBI Service for Geodesy and Astrometry (IVS) promotes the transition from the legacy VLBI system with S/X frequency bands to the next-generation VLBI system called VGOS (VLBI Global Observing System), which is part of Global Geodetic Observing System (GGOS). The goals of VGOS are to achieve: 1-mm position accuracy on global scales, continuous measurements for time series of station positions as well as Earth Orientation Parameters, and turnaround time to initial geodetic results of less than 24 hours. To achieve these goals, the VGOS stations should be equipped with antennas with high slewing rate, receivers for broadband observations (2-14 GHz) and high speed recording systems up to 32 Gbps. Currently, because the number of VGOS stations is not sufficient, legacy S/X observations are mainly conducted at IVS while VGOS observations are also regularly conducted.

The Geospatial Information Authority of Japan (GSI) constructed a new VLBI facility in Ishioka in 2014 which meets the VGOS requirements and began its operation in May 2016. The Ishioka Station uses two different types of receiver depending on a type of an observation: tri-band feed for S/X observations and QRFH for broadband observations, and it is necessary to replace receivers when switching types of observations, which takes about one week. Hence, the Ishioka Station mainly participates in legacy S/X international observation, and participates in broadband observation for several months every year. In the latest broadband observation term from December 2019 to February 2020, the Ishioka Station participated in VGOS Test observations organized by IVS (once every two weeks, 24 hours observation. Since January 2020, these have been operated as official observations.), and also participated in test observations organized by the European VLBI Group and VGOS-intensive test observations (once a week, 1 hour) for the first time. The Ishioka Station also participated in experiments for the inter-continental frequency comparison project conducted by National Institute of Information and Communications Technology (NICT).

To avoid the replacement of receivers when switching types of observations, we are promoting investigations and improvement for “Mixed Mode” observations in which S/X and broadband signals are received simultaneously without replacing receivers. In the Mixed Mode observations, S/X and broadband signals are received at the same time by QRFH. With the Mixed Mode Observations, the Ishioka Station may participate in broadband observations as one of VGOS stations while regularly participating in S/X observations for stable position products until IVS moves to full VGOS.

For achieving the Mixed Mode observations, it is necessary to mitigate the effect of strong RFI around S-band (2-3 GHz). Currently, a high pass filter which cuts off signals lower than 3GHz is inserted in the circuit of QRFH. To receive S-band signals by QRFH, it is necessary to design the band pass filter to allow the reception of S-band signal while avoiding signal saturation caused by RFI. The GSI is currently developing a superconductor band pass filter whose design reflects the investigation of RFI around the Ishioka Station (Hayashi et al., 2019), which will replace the current high pass filter.

This talk will summarize activities of the Ishioka station as one of VGOS stations and progress of improvement of QRFH for Mixed Mode observations.

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