Elimination of terrestrial ionospheric effect on VLBI observation for Jovian decametric radiation

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VLBI technique has been unique method to determine a location of radio source from ground. However, in decameter range, it has been considered that determination of source location is difficult because of the refraction effect in terrestrial ionosphere. In Tohoku University, the 100km-class long baseline interferometer observations have been carried out for purpose of detecting a motion of Jovian decametric radiation (JDR) source position from northern to southern hemispheres since 1980's. Especially, dual-frequency observation has started to eliminate the ionospheric effect from 1994. Now, 400km-class long baseline interferometer observations with dual-frequency method have been carried out by collaboration Fukui University of Technology and Tohoku University. In recent years, moon-earth baseline VLBI observation for JDR sources has been suggested, which is expected to enable extremely high resolution of 20km on Jovian surface. Based on the calculation and the data analysis, we evaluated the validity of such long baseline interferometer with the dual-frequency method for purpose of determine the location of JDR sources.

We carried out a calculation of the effect of terrestrial ionosphere on a delay time in VLBI observation. We set up two observation sites, one is the ground-based station, and the other is space-based station. The radio source is assumed to be a point source and the electron density is zero on the ray path from the point source to the space-based station. On the other hand, a single-layer ionosphere is set up on the ray path to the ground-based station. We calculated the excess delay time in the ionosphere and the shift of source position generated by the excess delay time. In the calculation, the elevation of JDR source from the ground-based station changes from 30 to 70 degrees. As a result, it is possible to determine the source location with the accuracy of 20 arcsec at 380,000 km baseline length (moon-earth baseline) in the case of the elevation more than 30 degrees. In addition, VLBI observation more than 50,000 km baseline length with dual-frequency method will enable us to determine the source location of JDR under the accuracy of 10 arcsec (The observation frequency is 25 MHz and 25.5 MHz).In the future study, it is important to consider the calibration system of the excess delay time caused by the observation system. It will enable us to determine the absolute position of JDR sources.