Observation of Jovian decametric radiation by using a new 400km-class long baseline interferometer system

Tomoyuki Nakajo[1]; Takayuki Ono[2]; Masahide Iizima[3]; Hiroshi Oya[4]

[1] Space Commu. Fukui Univ.; [2] Department of Astronomy and Geophysics, Tohoku Univ.; [3] Geophysical Inst., Tohoku Univ.; [4] Space Commu. Fukui Univ. Tech.

It has been thought that the positions of Jovian decametric radiation sources cannot be determined with the accuracy of a few 10 arc seconds because of the enormous influence of the terrestrial ionospheric plasma. However, since 1995, the dual frequency interferometer observation has been started in Tohoku University in order to expand the opportunities where the long baseline interferometer observation works. The results seem to support that the sources are located in the both polar region. The detailed pictures of source location of Jovian decametric radiation will be clarified by the observations carried out in the years to come.

The dual frequency interferometer method has been established in the field of VLBI. The information of source location can be obtained by solving simultaneous equations. However, in the case of Jovian decametric radiation, the difference of two observation frequencies must be set to a few hundred kHz, which makes the equations unstable. Consequently, the high accurate measurement of fringe phase is required to obtain the information of source location stably. In order to realize the required accuracy, we had broadened the frequency bandwidth of main receiver up to 10 kHz. As the result, the time variation of source location of Jovian decametric radiation could be estimated with the accuracy of 10 arcsec in the observations carried out in 2002 and 2003. On the other hand, to expand the baseline length is a powerful method to constitute the stable equations. We have developed a new long baseline interferometer system by the collaboration between Tohoku University and Fukui University of Technology (F.U.T.). This new interferometer system has been formed by the participation of Awara observatory, which belongs to F.U.T., in the long baseline interferometer network of Tohoku University. As the result, the maximum baseline length becomes from 116km to 530km. It is expected that the detailed structures of Jovian decametric radiation sources are clarified by using the new long baseline interferometer system. Especially, we are interested in the relationship between the auroral region and source location of the decametric radiation.

The new interferometer network consists of five stations, i.e., Kawatabi, Zao, Yoneyama Iitate, and Awara. At present stage, the receiving system has been developed in Yoneyama, Iitate and Awara stations. We plan to develop the receiving system at Kawatabi and Zao station in the next couple of years. The receiving system consists of five parts, i.e., the front-end, the main receiver, the data recording system, the communication system and the calibration system. The front-end consists of a 9 elements log-periodic antenna, a band pass filter whose passband is 20-30MHz and a low noise wide-band pre-amplifier. The main receiver is a triple stage super-heterodyne receiver and the received RF signal is converted into a frequency range from 5 to 15kHz. The output waveforms from the main receivers are, then, digitized directly by the data recording system. The time synchronization in the observation at the different stations is achieved by the 1PPS signal supplied by GPS. The cesium frequency standard is installed at each station. The phase calibration of main receiver can be carried out at any time by using the calibration signal generator installed in each station. The observation system in each station is controlled and monitored from the Sendai station through the computer network by using the communication line.

The development of receiving system for the long baseline interferometer observation in Awara station was started in September 2003. The initial observation has been started from March to April 2004 for detecting the fringe pattern of Jovian decametric radiation. In 2005, we plan to carry out the observation continuously for detecting the fringe pattern of Jovian and Solar decametric radiation.