Double frequency long baseline interferometer observation for Jovian decametric radiations using Iitate-Yoneyama baseline

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For understanding of generation mechanism of the Jovian decametric radiations (DAMs), identification of the propagation mode by clarifying the source location as well as the polarization character is one of the most important key parameters. Although a long baseline interferometry is only possible method to identify the source location directly, the method is significantly suffered from the effect of Total Electron Contents (TEC) of the earth's ionosphere. To solve this difficulty, we have developed the double frequency long baseline interferometer system.

The new observation system has been developed in Iitate and Yoneyama station, which are involved in the interferometer network in Tohoku university. Iitate-Yoneyama baseline has the advantages as follows :(1) solution of inverse problem is more stable because of the longest baseline length (116km) in the interferometer network. (2) baseline direction has easily allowed us to identify whether the DAM source is located in northern or southern ionosphere of Jupiter.

The receiving system consists of three parts, i.e. the front-end, the main receiver and the data recording system. The front-end consists of a log-periodic antenna, a band pass filter whose passband is 20-30MHz, and a low noise wide-band preamplifer. The main receiver is a double super-heterodyne receiver and the received RF signal is further converted to the frequency range from 5 to 15kHz. In each station, two independent main receivers are set to carry out the double frequency observation and the output waveforms from the main receivers are digitized directly by the data recording system. The phase stability of the observation system is almost decided by the stability of main receiver . The stability is achived as 1.0 (degree/degrees Celsius) by using Direct Digital Synthesizer (DDS) whose operation temperature is controlled as to keep 35 +/- 0.3 (degrees Celsius), and whose referense signal is fed by the cesium frequency standard (the phase stability of band pass filter and preamplifer is about 0.1degree/degrees Celsius). In order to evaluate the quality of data, temperature and man-made radio noise in each station is monitored and the phase calibration is carried out from end to end of main receiver by the calibration signal generator.

From the results of simulation study, it has been evaluated that this observation system will allow us to decide the source location of DAMs with the accuracy of 25 arcsec (about 0.5 Jovian radii) under the condition of temperature fluctuation less than 5.0 degree during the typical observation time interval of DAMs (within a few ten minutes).