Detection of Jovian decametric radiation by using a short baseline interferometer system

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1. Introduction

Observation of Jovian decametric radiation (DAM) is one of important tools to investigate the activity of Jovian magnetosphere. In a lot of previous studies, the detection of DAM has been carried out based on information of wideband dynamic spectrum or intensity measurement at some fixed observing frequencies. These conventional detection techniques are reliable in the case of strong DAM emissions. However, they tend to be less reliable in the case of weak DAM emissions because the judgment on occurrence of DAM may be affected by subjective view of observer. Then, we tried to establish a more objective detection technique in the case of weak DAM emissions based on a short baseline interferometer observation.

2. Observation and Data analyses

We performed the observation of DAM from 2007 to 2010 by using a short baseline interferometer system in Fukui University of Technology. The interferometer system consists of 3 baselines with the baseline length of about 150 m and records 6 fringe waveforms for RH and LH components continuously. In order to detect weak DAM emissions objectively, we calculated the correlation coefficients between observational and theoretical fringe waveforms and judged the detected signals were emitted from Jupiter when the correlation coefficients exceeded a threshold value which was set based on a probability distribution of observed correlation coefficients.

3. Results

In the data analysis, we were forced to set the integration time 2 hours, which seems to be too long compared to typical duration of DAM, because the minimum of fringe period is about 30 minutes in our interferometer system. Therefore, it should be noted that we may fail to detect short duration DAM. However, the results show (i) CML-Io phase diagram obtained in this study tend to correspond to the previous results, (ii) the detection day of DAM in this study have a positive correlation with the day that shock structure in solar wind was expected to reach Jupiter, and (iii) in 2009 and 2010, detection period in this study was complementarily in agreement with that in Nancay observatory.

4. Conclusion and future study

Based on the above 3 results, we concluded that the new detection technique applied in this study is very useful for objective detection of weak DAM emissions. In order to improve the detection accuracy of this technique, we need to develop a new interferometer network of which baseline lengths are a few km. The new interferometer network will succeed to detect short duration DAM and reveal the occurrence characteristics of DAM in detail.