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Evaluation of co-operational observation strategy for formation-flying satellites using a magnetosphere model

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Recently multi-satellite mission is a mainstream of in-situ measurement method of the Earth's magnetosphere, because it is quite difficult to distinguish between spatial and temporal variation of plasma environment in the magnetosphere by single satellite. So far four Cluster satellites launched in 2000 and five THEMIS probes launched in 2007 are in operation, and MMS mission is in the planning stage.

The SCOPE is a Japanese future mission to investigate the multi-scale plasma physics using multiple satellites. In the SCOPE mission, formation flying will be made up of a mother satellite, a daughter satellite in the near distance, and two or three daughter satellites in the long distance from the mother.

Because it is obviously impossible to transmit all raw data measured by onboard instruments because of limitation of down-link capacity, we need to make an operation plan predicting a forthcoming observation region in order to optimize observation parameters for the purpose of data reduction.

To achieve a co-operational observation efficiently with formation-flying satellites, we developed a system using LAN-connected PCs in order to simulate inter-communication among satellites and onboard data processing functions. On the simulator, we assume that each satellite has a function of event detection such as boundary crossing in the magnetosphere, and the mother satellite makes an autonomous decision as a multi-satellite federation to grasp temporal and spatial variation of the target region.

In the present study, we introduced a magnetosphere model in the simulator and studied appropriate parameters to select the best observation mode. In the presentation, we show some experimental results under some conditions of observation configuration and discuss the performance of co-operational observation.

Keywords: Formation-flying satellite, Inter-satellite communication, Co-operational observation, Magnetosphere, Simultaneous multi-point observation