

Feasibility Study of Space Weather Observation by CubeSat in LEO

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Recently the concept of “Lean Satellite” has been proposed to emphasize that the essential advantages of the nano-satellites are a short-period development and an affordability, rather than their size and weight themselves.

Conducting the science observations, especially lean satellites enable us to implement the experimental test in orbit and preliminary observations prior to conventional satellite missions. The EU conducted the QB50 program which is an international network of CubeSat for multi-point, in-situ observation in the lower ionosphere (Thoemel et al., 2014). Total 36 CubeSats have been launched into orbit in 2017 by QB50 program.

Kyushu Institute of Technology (Kyutech) has developed and launched 19 satellites since 2006, including several science missions such as the observation of the plasma density in the ionosphere by Double Langmuir Probe, the observation of Total Electron Content (TEC) by using Chip Scale Atomic Clock (CSAC), and experimental test of store and forward of the data observed on the ground stations. Moreover, the bus system developed for the series of CubeSat (Birds Satellites) has been disclosed as open-source protocol from Kyutech in 2021.

Based on these achievements, we newly start the ionospheric observation project by 2U size CubeSat under collaboration with Kyushu University as part of human resource development program from 2021. The program will be conducted by mainly under-graduate students to focus on the nature of Interhemispheric Field Aligned Current (IHFAC) (Fukushima 1979, Tomas et al., 2009). We propose the CubeSat which make in-situ observation of the Sq current system including IHFAC at the LEO in the altitude of ~400km. The feasibility of CubeSat with 2U-size structure is considered for the electric power budget, communication capability, and specification of the magnetometer.

In this paper, we discuss the science of the hemispheric asymmetry of potential associated with Sq current system and resultant IHFAC from the concept of lean satellites applications, and implications of the program for the future observation of space weather sciences.