Multiple equatorial ionospheric observation project based on FMCW radar combining MAGDAS/SDR-based scintillation detector

*Akiko Fujimoto[1], Shuji Abe[2], Toru Mikura[1], Akihiro Ikeda[3], Akimasa Yoshikawa[2]

1. Kyushu Institute of Technology, 2. Kyushu University, 3. National Institute of Technology, Kagoshima College

In recent years, numerical experiments have advanced the understanding of the local generation mechanism of equatorial plasma bubbles (EPBs) that cause radio wave propagation abnormalities, but the relationship with the environmental field that controls the generation and suppression of EPBs has not yet been clarified. We focus on the global formation process of equatorial jet currents (EEJ), which is the electromagnetic drive sources of the environmental field that trigger the local generation mechanism of EPBs. This study aims to reveal the structure and generation mechanism of environmental fields in inner-magnetosphere and ionosphere that is linked to the development of EPBs.

We propose a three-dimensional coupling system of ionospheric E-F regions controlling EEJ as a model that connects the pre-sunset EEJ, PRE at near sunset, and EPBs after sunset. In order to detect this coupling system, we have planned a multi-ionospheric observation project with FM-CW (Frequency Modulated Continuous Wave) radar, MAGDAS (MAGnetic Data Acquisition System) magnetometer network and SDR-based scintillation detector. The FM-CW radar has two kinds of observation modes: one is Ionosonde mode and the other is Doppler mode. FM-CW radar enables continuous multi-mode ionospheric observation by switching between the detection of time evolution from PRE to plasma bubble by Ionosonde mode and the observation of F region electric field by Doppler mode. We have developed a new "autonomous FM-CW control system" without the manual concrete operation schedule. The new FM-CW system consists the supervised machine learning and reinforcement learning by using several ionospheric disturbance triggers. In the presentation, we will introduce the overview of the observation project and explain the new FM-CW control system.

