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MAGDAS Project at SERC for Litho-space Weather during IHY/ISWI(2007-2012)

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The Space Environment Research Center (SERC), Kyushu University deployed the MAGnetic Data Acqusition System (MAGDAS) at 50 stations along the 210- and 96-degree magnetic meridians (MM) and the magnetic Dip equator, and several FM-CW radars along the 210-degree MM during the International Heliophysical Year (IHY) period of 2005-2009 (see http://magdas.serc.kyushu-u.ac.jp/ and http://magdas2.serc.kyushu-u.ac.jp/). The goal of MAGDAS project is to become the most comprehensive ground-based monitoring system of the earth's magnetic field. It does not compete with space-based observation. Rather, this ground-based network complements observation from space. To properly study solar-terrestrial events, data from both are required.

This project intends to get the MAGDAS network fully operational and provide data for studies on space weather. By analyzing these new MAGDAS data, we can perform a real-time monitoring and modeling of the global (e.g. Sq, EEJ) current system and the ambient plasma mass density for understanding the electromagnetic and plasma environment changes in geospace during helio-magnetospheric storms. In order to examine the propagation mechanisms of transient disturbances, i.e., sc/si, Pi 2, and DP2, relations of ionospheric electric and magnetic fields are investigated by analyzing the MAGDAS magnetic data and the Doppler data of our FM-CW ionospheric radar.

A new EE-index (EDst, EU, and EL) was also proposed by SERC for real-time and long-term geo-space monitoring. The basic algorithm to obtain EE-index was constructed by Uozumi et al. (2008). EU and EL mainly represent the range of the EEJ (equatorial electrojet) and CEJ (equatorial counter electrojet) components, respectively. The baseline levels of EU and EL are obtained by averaging the H-component magnetic variations observed at the nightside (LT=18-06) MAGDAS/CPMN (Circum-pan Pacific Magnetometer Network) stations along the magnetic equator. The baseline value is defined as EDst and its variations are found to be similar to those of Dst. We examined relationships among the EEJ amplitude, the F10.7 solar radiation flux, the solar wind parameter, Ap-index and the ionospheric conductivity. We found that the intensity of the EEJ depends on the 11-years solar activity. The semi-annual EEJ oscillation is caused by changes in the ionosphere dynamo and not by changes in the ionospheric conductivity. The 14.5-day EEJ oscillation may be caused by semi-monthly lunar tidal waves. The short-term EEJ variations are also controlled by the interplanetary electric field (Ey = -Vsw x BIMF).

In this paper, we will present the several scientific results obtained by MAGDAS project, and introduce a coordinated near-earth JAXA satellite (ETS-VIII, QZS) and MAGDAS observations in Siberia, where 10 new MAGDAS magnetometers will be installed near the foot points of the Quasi-Zenith Satellite (QZS) for space weather, and an international collaboration (Asian network) to establish the short-term EQ prediction in southern Sumatra, Indonesia, where 10 ULF-EM(MT) sites will be constructed in 2010 with inter-sensor distance of 100-200 km, during the International Space Weather Initiative (ISWI) period of 2010-2012.