Study of Sun-Earth Couplings using MAGDAS/CPMN Data

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The Space Environment Research Center (SERC), Kyushu University has deployed the MAGnetic Data Acqusition System (MAGDAS) at 57 stations along the 210- and 96-degree magnetic meridians (MM) and the magnetic Dip equator, and three FM-CW radars along the 210^{o} MM during the International Heliophysical Year (IHY; 2005-2009) and the International Space Weather Initiative (ISWI; 2010-2012) (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 Litho-space Weather. By analyzing these new MAGDAS data, we can perform a real-time monitoring and modeling of the ambient plasma mass density and the global current system (e.g. Sq, EEJ) for understanding the plasma and electromagnetic environment changes in geospace and lithosphere 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 also investigated by analyzing the Doppler data of our FM-CW ionospheric radar and the MAGDAS magnetic data.

By using the MAGDAS/CPMN network and FM-CW radar array, we could obtain the following results; (1) Imaging of global 3-D current system, (2) Annual and semi-annual Sq and EEJ current variations, (3) A new EE-index and its long-term variation, (4) Estimation of plasma mass density, (5) Latitudinal dependence of Pc 3-5 amplitudes along 96^{o} MM and Pi 2 along 210^{o} MM, (6) Ionospheric electric fields of DP-2, sc, Pi2, and Pc 5 observations by FM-CW radar, and (7) anomalous magnetic daily and ULF variations associated with the great earthquakes observed near the MGDAS/CPMN stations. In this paper, we will present several scientific results based on data from the MAGDAS project -- especially results that reveal a better understanding of Sun-Earth couplings.