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MAGDAS/CPMN データから得られた科学的な成果
Scientific Results Obtained from MAGDAS/CPMN Data

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The Space Environment Research Center (SERC), Kyushu University has deployed the MAGnetic Data Acqusition System (MAGDAS) at 54 stations along the 210- and 96-degree magnetic meridians (MM) and the magnetic Dip equator, and three FM-CW radars along the 210o 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.

A new EE-index (EDst, EU, and EL) was proposed by SERC for real-time and long-term geospace 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. H-component magnetic variations observed at the MAGDAS/CPMN (Circum-pan Pacific Magnetometer Network) stations along the magnetic equator during each nighttime sector (LT = 18-06) were used as the baseline of EU and EL. The baseline value is defined as EDst and its variations are found to be similar to those of Dst. An empirical model of the quiet daily geomagnetic field variation has been constructed by Yamazaki et al.(2010), based on geomagnetic data obtained from 21 stations along the 210 Magnetic Meridian of the CPMN from 1996 to 2007 (Kp? 2+). Using the least-square fitting method, the quiet daily geomagnetic field variation at each station was described as functions of (1) solar activity SA, (2) day of year DOY, (3) lunar age LA and (4) local time LT. After interpolation in latitude, the model can describe solar-cycle and seasonal variations of both solar (S) and lunar (L) fields.

By using the MAGDAS/CPMN system 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 3-4 amplitudes along 96o MM and Pi 2 along 210o 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 the several scientific results obtained by the MAGDAS project.

Keywords: MAGnetic Data Acqusition System (MAGDAS), FM-CW radar, he International Heliophysical Year, the International Space Weather Initiative, MAGDAS/CPMN system