Diurnal and Seasonal Variations in Mid-Latitude Geomagnetic Field During International Quiet Days: BOH Magnetometer

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Korea Astronomy and Space Science Institute researchers have installed and operated magnetometers at Bohyunsan Observatory to measure the Earth’s magnetic field variations in South Korea. In 2007, we installed a fluxgate magnetometer (RFP-523C) to measure H, D, and Z components of the geomagnetic field. In addition, in 2009, we installed a Overhauser proton sensor to measure the absolute total magnetic field F and a three-axis magneto-impedance sensor for spectrum analysis. Currently three types of magnetometer data have been accumulated. In this paper, we use the H, D, Z components of fluxgate magnetometer data to investigate the characteristics of mid-latitude geomagnetic field variation. To remove the temporary changes in Earth’s geomagnetic filed by space weather, we use the international quiet days’ data only. In other words, we performed a superposed epoch analysis using five days per each month during 2008-2011. We find that daily variations of H, D, and Z shows similar tendency compared to previous results using all days. That is, H, D, Z all three components’ quiet intervals terminate near the sunrise and shows maximum 2-3 hours after the culmination and the quiet interval start from near the sunset. Seasonal variations show similar dependences to the Sun. As it becomes hot season, the geomagnetic field variation’s amplitude becomes large and the quiet interval becomes shortened. It is well-known that these variations are effects of Sq current system in the Earth’s atmosphere. We confirm that the typical mid-latitude geomagnetic field variations due to the Sq current system by excluding all possible association with the space weather.

Keywords: BOH magnetometer, mid-latitude geomagnetic field, Sq current

1. INTRODUCTION

The three magnetometers (Fluxgate, Overhauser Proton sensor, and magneto-impedance (Ml) sensor) for measuring the geomagnetic field were installed in 2008 at Bohyunsan Optical Astronomy Observatory in Yeongcheon, Gyeongbuk and have been operated by the Korea Astronomy and Space Science Institute. Among the three magnetometers installed at Bohyunsan Optical Astronomy Observatory, the fluxgate magnetometer (RFP-523C) measures the 3-axis component values (H, D, and Z) of the geomagnetic field with an interval of a second. This study investigates the general characteristics of the geomagnetic field in the mid-latitudes through the statistical analysis of the data obtained from the fluxgate magnetometer. The latitude, longitude, L and altitude for the geological location of the magnetometer

at Bohyunsan Optical Astronomy Observatory (BOH magnetometer) are N36.2°, E128.9°, L = 1.3, and 1,224 m, respectively. The measured geomagnetic field data are recorded on the basis of universal time, and it is operated on a 24 hours a day basis (Hwang et al. 2011).

This paper extends the results of Hwang et al. (2011) which performed the first statistical analysis of the data obtained during 2008 and 2009 from the magnetometer installed at Bohyunsan. The diurnal, seasonal, and annual variations of the mid-latitude geomagnetic field were examined for the international quiet days (IQDs) using the data obtained from the fluxgate magnetometer during 2008-2011. This is intended to minimize the effects from the transient variations of the space environment because the geomagnetic field variation is both directly and indirectly influenced by the solar activity. The BOH magnetometer

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