Seasonal dependence of semidiurnal equatorial magnetic variations

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The fundamental structure and features of EEJ are well known from the many studies involving the ground-based magnetometer, rocket observations, radars and simulation. These results are based on the data during the geomagnetic quiet time. We believe that the continuous observation of EEJ is most important on the study of space weather and space climates. In 2008, International Center for Space Weather Science and Education, Kyushu University (ICSWSE) proposed the EE-index (Uozumi et al., 2008; Fujimoto et al., 2016), which is an index to monitor quantitatively various equatorial geomagnetic phenomena in real time. EE-index separates the magnetic disturbances in the equatorial region into the global (EDst) and local (EUEL) magnetic variations. Especially, the detail analysis of EUEL index provides the quantitative and visible information in order to reveal the electromagnetic phenomena affecting the fundamental structure of Equatorial Electrojet (EEJ).

We have already demonstrated some examples applying EE-index to the equatorial magnetic variation by using EUEL data: solar cycle variation of EEJ peak, semiannual EEJ variation. In this presentation, we will show the result from the time series analysis of the semidiurnal EUEL variation by using the data from Huancayo in Peru and Davao in Philippine during 2005-2009. We found the 5-year average of semidiurnal EUEL variation is strongly related to the lunar phase. The strong semidiurnal EUEL variation appears around full and new moons. The monthly average of 5-year semidiurnal EUEL variations show the remarkable seasonal dependence. The semidiurnal variation is stronger around January solstice and weaker around July solstice. This feature is confirmed on the data from Huancayo and Davao. The seasonal dependence of semidiurnal variation agrees with the seasonal profile of atmospheric neutral wind (2.2) mode. The quiet EEJ is well known to be associated with lunar tides. The unquiet EEJ, however, has not well examined the relationship with the lunar tides. In this paper, we will present comprehensively that the quiet and unquiet semidiurnal EUEL variations result from the lunar tide effect.