Solar cycle variation of Equatorial Electrojet based on the EE-index

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Equatorial Electrojet (EEJ) is an extremely interesting phenomenon from the view of connecting the ionosphere to the atmosphere, which have different physical backgrounds caused by the sun and the magnetosphere. In 2008, International Center for Space Weather Science and Education, Kyushu University (ICSWSE) proposed the EE-index, which is an index to evaluate quantitatively EEJ variations. EE-index indicates the total intensity of EEJ variation of the dip-equator magnetometer stations. EE-index has improved with the development of the MAGnetic Data Acquisition System and the Circum-pan Pacific Magnetometer Network (MAGDAS/CPMN) and the enormous archive of MAGDAS/CPMN data over 10 years. The latest EE-index is produced by using 29 MAGDAS/CPMN stations located from dip-equator to low-latitude.

Using the improved EE-index, the time series analysis is executed for EUEL (this is one index of EE-index and represents the localized variations in the magnetic field at each individual station) at ANC (Ancon, Peru) and the solar activity from September 18, 1998 to March 31, 2015, in order to reveal influences of the solar activity on the EEJ intensity throughout one solar cycle. The result shows that the long-term variation of daily EEJ peak intensity has a trend similar to that of F10.7 (the solar activity). The dominant spectrum powers of daily EEJ peak occur at 14.5 days and 180 days throughout two solar cycles. In contrast, F10.7 has no dominant spectrum peaks throughout the analyzed interval. The solar cycle variation of daily EEJ peak correlates well with that of F10.7 (the correlation coefficient 0.99). We conclude that the daily EEJ peak intensity is roughly determined as the summation of the long-period trend of the solar activity resulting from the solar cycle and day-to-day variations caused by various sources such as lunar tides, geometric effects, magnetospheric phenomena and atmospheric phenomena. We discuss possible mechanisms to cause the day-to-day EEJ variations.