Japan Geoscience Union Meeting 2010
(May 23-28 2010 at Makuhari, Chiba, Japan)

PEM025-06 Room: Function Room A Time: May 27 12:00-12:15

Relationship between global Sq current system and equatorial electrojet (EEJ) in the east Asian region

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This is a study of Sq-EEJ relationship based on these extended magnetometer networks in the east Asian region: (1) the Circum-pan Pacific Magnetometer Network (CPMN), (2) the International Real-time Magnetic Observatory Network (INTERMAGNET) and (3) the World Data Center for Geomagnetism, Kyoto (WDC). We estimated noon-time eastward Sq current intensities by latitudinally integrating north-south component of the Sq field. The corresponding EEJ intensities were estimated from the daily geomagnetic field variations at Davao station (DipLat = -0.84 deg.). These daily intensities of Sq and EEJ were derived for each geomagnetically quiet day (Kp is less than or equal to 2+) from 1996 to 2005. It was found that these Sq and EEJ intensities are well correlated (r=0.80).
The dependences on the solar activity and season (the day number) of Sq and EEJ intensities were examined. It was shown that both Sq and EEJ intensities are correlated to solar activity with similar sensitivities. Also, it was shown that both Sq and EEJ intensities semi-annually change with similar spring-fall asymmetry. Our results indicate that the daily values of Sq and EEJ intensities react, in the same manner, to temporal changes in solar ionization and heating of the ionosphere caused by changes in solar surface radio activity and changes in geometric relationship between the sun and earth.
Furthermore, spherical harmonic geomagnetic data analysis was performed for the cases of including and excluding dip-equatorial stations. The power spectral study showed that the spherical harmonic analysis of Sq-EEJ field should be extended to order m = 6 and degree n = m+4 1. Meanwhile, Sq field excluding dip-equatorial stations can be represented only with order m = 6 and degree n = m+6. It was found that inclusion of dip-equatorial stations increases the total current intensity of the equivalent current system by 8% in the external current system and by 15 % in the internal current system.

Keywords: Sq, EEJ, ionosphere