Automatic Detection of the center of Sq current and their implication for magnetosphere-ionosphere coupling

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Sq currents flowing on the ionosphere which is in the altitude from 100 km to 1000 km from the ground have been studied by many investigators to understand an affection of neutral wind due to a tidal effect to the ionospheric current systems. In particular, the center of the Sq currents represents the ionospheric potential distribution, which is subsequent ionosphere-magnetosphere coupling through the Field Aligned Current (FAC) depending on the magnetospheric conditions. The north-south asymmetries of the center of Sq are considered as a cause of an Inter-hemispheric Field Aligned Currents (IHFAC).

In this study, the Sq currents pattern is estimated by the magnetic variation observed at 72 ground magnetic observatories from INTERMAGNET network stations. First, we calculate the Sq current during the solar quiet days, that is defined as sigma Kp < 13 at Kakioka observatory in Japan. In order to define a base line of the daily variations, the monthly average value of the intensity of the magnetic field during 23-02 MLT is calculated and subtracted from the daily variations. Then the equivalent current vectors just above the stations are estimated by using Ampere’ s law. The current vectors of each station are calculated in every one MLT bin and obtained 24 vectors for one day along MLT in the latitude where the station locates. The obvious Sq pattern is obtained that a strong vortex current is more clearly observed in the summer hemisphere and less in the winter hemispheres. The location of the center of the Sq current is automatically deduced by calculating the vorticities in the coordinated grid. We discussed the relationship between the location of the center of Sq current and various condition of the solarwind parameter during the magnetic disturbance.

