

Geomagnetic Sq equivalent currents variation characters in the 210° mm meridian region

*Xiaocan Liu¹, Katsumi Hattori^{2,3}, Huaran Chen¹, Peng Han⁴, Chie Yoshino², Xudong Zhao¹

1. Institute of geophysics China Earthquake Administration, 2. Graduate School of Science, Chiba University, Chiba, Japan, 3. Center for Environmental Remote Sensing, Chiba University, Chiba, Japan, 4. Department of Earth and Space Sciences, Southern University of Science and Technology, Shenzhen, China

Abstract When solar-terrestrial disturbances are absent, daily variations of the geomagnetic field are called Sq (solar quiet) [Campbell, 1989; Yamazaki, 2009]. It is well known that the amplitude of Sq variation shows annual changes [Chapman and Bartels, 1940; Chapman, 1951, Kane, 1976], well as the intensity and morphology of the equivalent Sq current system, and the position of the vortex centers of the current system have an annual variation in the local time and latitude [Matsushita and Maeda, 1965; Takeda, 1999,2002; Olsen, 1997; Yamashita and Iyemori,2002; Xu W.Y., 1992, 1993,2003,2004; Zhao X.D. et.al, 2008, 2010,2014]. Most of these studies are based on global geomagnetic observations, so there is lack of researches on regional Sq variation changes, Yamazaki (2009) analyzed the spatial distribution of the annual and semiannual Sq variations by using 19 stations along 210° mm during 1996 to 2007, but the external and inner parts of Sq equivalent current system were not be separated in his work. So, in present work, we use different stations along 210° mm to investigate the variation characteristics of the external and inner two parts of Sq equivalent current systems respectively during 2009 to 2013 in Japan- Australia region.

We use 20 geomagnetic observatories distributing at both the Northern hemisphere and the Southern hemisphere along with the 210° magnetic meridian(mm) from 2009 to 2013, which include 10 observatories in Japan, and investigate the variation characters of Sq equivalent external and inner currents in D season(January, February, October, December, namely winter season) E season(March, April, September, November namely equinox season) and J season (May, June, July, August, namely summer season), here we use three currents parameters to analyze, as the local time (LT), latitude (Lat) and current intensity(J) of current vortexes center, as the result, both external and inner current parameters demonstrate significant seasonal variation respectively. There are also special case, as each hemisphere have one vortex in northern and southern, we find Lat parameter in northern vortex of external current and southern vortex of inner current almost have non-seasonal variations. Then, we analysis more detail variation characters in each season, like J parameter in D season is lowest, have values about 50kA to 100kA, however the values are about 100kA to 150kA in other seasons of external currents. And we also get some asymmetric variation characters for northern and southern hemisphere, for example, in J season, LT of Southern hemisphere vortex center is about 1400LT, but in northern hemisphere vortex center is about 1030LT at the same time, here, obvious LT time shift and asymmetric activity between two hemispheres appear.

Keywords: Sq equivalent current, variation characters, external current, inner current, seasonal variation, asymmetric variation