Global Lunar Current System during Sudden Stratospheric Warming in December 2002

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Recently, Fejer et al. [2010] found that the equatorial electrojet shows a significant increase in the morning hours and decrease in the afternoon hours with onsets near new and full moons during sudden stratospheric warming (SSW) events. They considered these variations of the equatorial electrojet are due to strongly enhanced semidiurnal lunar currents. However, since their observations were limited in the equatorial region, it was not possible for them to determine the global ionospheric current system that is necessary to verify their ideas.

Using ground magnetometer data mainly from the Circum-pan Pacific Magnetometer Network (CPMN), we derived the global ionospheric current system during a SSW event in December, 2002. We first removed the seasonally averaged Sq from the data and then performed the spherical harmonic analysis on the residual data. The global current system is obtained, which is characterized by two oppositely directed vortices in the morning and afternoon sectors of the Southern Hemisphere. The vortex foci are located about 30 degrees away from the dip equator and move to later local times about by seven hours per 10 days, which is explained by the difference in the length of the solar and lunar days. The current intensity is observed to increase during the SSWs. Our results suggest that the observed global current system during SSW is lunar current system and its intensity is affected by SSW.

Reference:
Fejer, B. G., M. E. Olson, J. L. Chau, C. Stolle, H. Luhr, L. P. Goncharenko, K. Yumoto, and T. Nagatsuma (2010), Lunar dependent equatorial ionospheric electrodynamic effects during sudden stratospheric warmings, J. Geophys. Res., 115, A00G03, doi:10.1029/2010JA015273