104 -- 2017-03-08 02:46:15
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Longitudinal Variability of Nightside Equatorial Electrodynamics

The longitudinal variability of equatorial electrodynamics or scintillations has not been thoroughly investigated due to the lack of ground-based instruments that track the temporal variation of electrodynamics at different longitudes. Thus, study of longitudinal variability of electrodynamics has been possible only using in situ observations.

In this paper, for the first time, we present the longitudinal variability of the nightside equatorial electrodynamics signatures that may be responsible for the formation of bubbles and scintillation activities. It is well known that the H-component geomagnetic field at low latitudes shows clear signatures for external currents during dayside and nightside. Thus, by removing Sq and ring currents contribution, it is possible to eliminate the gradual drift of the background field. Conspicuously, the residual geomagnetic field signature shows interestingly well-defined increase in ΔH during nightside, indicating the existence of eastward electric field at night.

Because the eastward ionospheric electric field enhancement may be responsible for the positive bay in ΔH during night side through eastward Pedersen current. It is also well known that the Pedersen conductivity exhibits a large gradient across the sunset terminator due to large E-region conductivity on dayside and negligible conductivity on nightside. This causes the positive charges to be accumulated at the terminator followed by the formation of divergent electric field at the terminator, which is eastward and maps along the equipotential field lines to F-region. This additional electric field causes the upward drift of equatorial F layer that may cause for Rayleigh–Taylor (RT) instability growth rate.

In this paper, we present the longitudinal variability of the nightside divergent eastward electric field using the longitudinal chain of AMBER magnetometer network.