On the coupled interactions between Ring current intensity and high-latitude ionospheric electron density variations

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Investigations on the magnetospheric-ionospheric processes form an important element of research in the understanding of the solar-terrestrial interactions. In this work, we have investigated the linkage between the ring current intensity and the high-latitude ionospheric plasma density variations during different geomagnetic conditions. The Global Positioning System (GPS) derived Vertical Total Electron Content (VTEC) during 2011-2013 over high- and low-latitude stations in both the hemispheres and the symmetric ring current index (SYM-H) have been used in this study. A cross-correlation analysis performed between the variations of these two parameters during a wide range of geomagnetic conditions reveal that there is a seasonal, latitudinal and hemispherical dependence in the interrelationship between SYM-H and VTEC. The best cross-correlation between SYM-H and VTEC over both the hemispheres is obtained during equinoctial months which can be attributed to the semiannual variation of the solar wind-magnetospheric-ionospheric coupling. Summer time VTEC over southern hemisphere exhibits a better correlation with SYM-H index in comparison to that of the northern hemisphere. These results have been explained in the light of relative contributions from seasonal and hemispherical variation that exists in the ionospheric plasma. The results are striking as the correlation is found between the variation in two independent processes occurring at widely separated regions in space, namely, the ring current intensity and the behavior of ionospheric densities at high-latitudes. Season-dependent high- and low-latitude coupling of the ionospheric VTEC is observed during the disturbed geomagnetic conditions.