Impact Assessment of Adverse Near Space Earth Environment System to the Polar Ionosphere

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The present work is an attempt to examine the impact of changing near-earth space environment systems on the polar ionosphere. The work addresses the scientific interest in high latitudinal ionospheric consequences caused by the modulation of near-earth space environmental conditions. In connection to this, a case study has been performed using ground (Ionosonde) and satellite (GPS) based ionospheric observations during a moderate type of geomagnetic storm that occurred on October 25th 2011 when the maximum negative excursion of -147 nT was observed in Dst index. The observations reveal an abrupt enhancement in auroral electrojet that crossed the 1000 nT mark. The consequences were observed in the ionospheric parameters i.e., the virtual height of F-layer increased with an increase in AE index beyond 500 km, due to which no traces were observed in the recorded ionograms during the event day. However, the GPS-based Ionospheric Vertical Total Electron Content (I-VTEC) showed negative ionospheric responses. This might be due to the fact that the excessive amount of energy deposition over the high latitude region causes the phenomenon known as Joule's heating which causes uplift of the molecular-rich air to the higher altitudes and changes the thermospheric compositions which are responsible to change the direction of the neutral wind from pole-ward to equator-ward. The enhancement in auroral electrojet is also responsible for the equator-ward expansion of the oval hence the lifted F-layer ionization drifted towards the low-mid latitude region along with magnetic field lines. Therefore, the combination of equator-ward plasma transportation and change in ionospheric composition causes a negative ionospheric impact over a high latitude region.

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