Ionospheric effects near the EIA crest under extreme space weather conditions

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Ionospheric responses to geomagnetic storms are manifested by drastic modifications of dynamics, electrodynamics and neutral composition of the earth's atmosphere-ionosphere system on a global scale. The resulting disturbances in the ionospheric parameters are the mixture of several solar terrestrial processes. Since no two ionospheric storms are quite the same, it is desirable to make a comprehensive study on the evolution of ionospheric effects under several geomagnetic storm conditions. Under present investigation an extensive study on the variability of occurrences of ionospheric scintillation at Raja Peary Mohan College (22.65°N, 88.36°E) located near the EIA crest and GNSS total electron content (TEC) during the periods of 13 intense (Dst < -100 nT) geomagnetic storm distributed over the 5 years period of 2011-2015 has been made. The study is augmented with electrojet data collected from wdc, IIG Mumbai and neutral composition data obtained from GUVI satellite images. IGS TEC data at Port Blair (11.3^{O}N, 92.4^{O}E), IISC Bangalore (13.0^{O}N, 77.3^{O}E), Lucknow (26.5^{O}N, 80.5^{O}E), Cocos (12.1^{O}S, 96.5^{O}E) and Diego Garcia Island (7.1^{O}S, 72.2^{O}E) available with www.igs.org are also investigated for the study. Out of total 13 storm events 8 storms occurs in equinoctial months, 3 in summer and 2 in winter months respectively. The main phase occurrence times are distributed on pre-noon, around sunset and post-midnight periods respectively. Both the positive and negative storm effects are reflected in TEC variability and in few cases opposite features are prominent in small longitude separation (~5°). Occurrence of scintillation seems to deviate from the climatological pattern reported till date. The observation may be explained in terms of electric field modulation under different stages of the particular space weather event. The contribution of neutral composition changes are found to be important to explain the variability patterns of ambient ionization. The variation of interplanetary parameters as well as subsequent magnetosphere ionosphere coupling process may be attributed to the variability of ionospheric parameters. Observations reveals that dominating mechanisms are changing in different phases of storm and importance of the respective process changes from storm to storm.