Variabilities of the Ionosphere Near the Anomaly Crest During Geomagnetic Disturbances

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Geomagnetic storm is one of the important space weather events to create perturbations in the earth's ionosphere-magnetosphere system. With the increasing reliance of space based communication and navigation systems studies of ionosphere during geomagnetic disturbances have become the important aspect of present space research activities. The disturbance effects are investigated by observing variabilities produced in the various ionospheric parameters among which total electron content (TEC) may be considered one important component. The state of ionosphere is normally dictated by TEC. Under present investigation TEC during a large number (>150) of geomagnetic storms, distributed over a period (1979-1990) more than one solar cycle, are studied from a location (Calcutta (geographic: longitude, 88.380 E; latitude, 22.580 N; dip: 320 N)) near the northern crest of equatorial ionization anomaly (EIA) in the context of developing a climatological pattern of variation of the ionosphere. The storms of moderate and severe intensities as dictated by the maximum values of Dst index (≤-50 nT) are considered for the present study. These are further classified on the basis of local times of main phase onset (MPO) and end of main phase (EMP). Both enhancements and decreases from the quiet days' mean of TEC are observed during geomagnetic disturbances. The variability is found to depend largely on the local times of MPO and EMP. A good correlation of the magnitudes of TEC deviations with geomagnetic activity index Ap is reflected. In the main phase TEC deviations are significantly correlated with the solar flux but the same is not true for the recovery phase. The regular sunrise effects in the diurnal TEC profile are found to be severely perturbed. At the sunrise sector both positive and negative deviations from the quiet days' averages are reflected which are modulated by the local times of MPO as well as intensity of storms. Depending on the local times of MPO and EMP a prominent seasonal pattern in the variation of ambient ionization is also revealed. The results of observations may be discussed in terms of various solar wind parameters like plasma flow pressure (Psw), solar wind speed (Vsw), interplanetary electric field (IEF) Esw, interplanetary magnetic field component (IMF Bz), several magnetic activity indices such as AE, Dst (SYM-H) and other ionospheric parameters (h/F, foF2) near the magnetic equator and equatorial electrojet.