Effects of the most severe magnetic storms on the equatorial and low latitude F-region Ionosphere over India.

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The effect of magnetic disturbances on the equatorial and low latitude F-region ionosphere is examined using ionosonde data for the periods of three most severe magnetic storm events of the current solar cycle 23, occurred in October and November 2003 and November 2004. The F-layer base height (h 'F), peak height (hmF2) and critical frequency (foF2) data, from Trivandrum an equatorial station and Delhi a low latitude location, are examined during the periods of above events. The results of the analysis clearly shows that the height of F-region (both h'F and hmF2), at equator and low latitude, simultaneously increases by 200 to 300 km, in association with maximum negative excursion of Dst values around mid night hours with large depletion of ionization over the equator which is followed by an ionization enhancement at low latitude during recovery phase of the storm. At Delhi, fast variations up to 200 m/s is also observed in the F-layer vertical upward/downward velocity, calculated using Doppler shifts, associated with the maximum negative excursion of Dst. This shows that during magnetic disturbances, equatorial ionization anomaly (EIA) expands to much wider latitude than the normal fountain driven by the E/F-layer dynamo electric fields. It is also observed that during the main phase of the storm, at low latitude there is generally, an enhancement of F-region ionization with increase in h'F/hmF2 but in equatorial region, ionization collapses with decrease in h'F/hmF2 especially after sunset hours. In addition, at the equator the normal pre-sunset hours enhancement in h'F is considerably suppressed during storm periods. This might be due to changes in magnitude and direction of electric field affecting the upward ExB drift and hence the plasma distribution in the form of decrease of electron density in equatorial region and an increase in low latitude region. In association with disturbance electric fields, the enhanced storm induced equator ward meridional winds in the thermosphere, can also further amplify the F-layer height rise at low latitude during the post midnight hours as observed in two of the storm periods.