Modification of Nighttime Equatorial Ionospheric Electric Fields due to Magnetic Storms

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An important aspect of the effect of magnetic storms on the equatorial ionosphere is the interaction between promptly penetrated electric fields (PPEFs) and disturbance dynamo electric fields (DDEFs) when both are present. Model calculations have shown that in the nighttime equatorial ionosphere, PPEF may have a large impact on the DDEF when the disturbance dynamo sets in after a couple of hours of magnetic activity since the PPEF alters the F region plasma distribution and Pedersen conductivity (Maruyama et al., 2005). Changes in the pattern of temporal variation of the zonal electric field in the post sunset equatorial ionosphere due to magnetic storms have been extensively studied using ionosonde data, which is more widely available than incoherent scatter radar data. In this context, nighttime ionospheric scintillation data can also make a contribution, although indirectly, by first of all yielding information about the state of the zonal electric field in that a westward electric field would inhibit fresh development of equatorial plasma bubbles (EPBs). In particular, spaced receiver observations of scintillations not only help in identifying nascent EPBs, but also allow estimation of the zonal drift of the background plasma once the perturbation electric field associated with the Rayleigh-Taylor instability becomes insignificant. Some results obtained in a study of the changes in zonal and vertical plasma drifts due to magnetic storms under varying conditions based on ionosonde and ionospheric scintillation data are discussed here.

Keywords: Equatorial ionosphere; Magnetic storms; Disturbance dynamo; Prompt penetration; Electric fields.

References

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