

F3 LAYER AS AN INDICATOR OF PROMPT PENETRATION ELECTRIC FIELD

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The observations and modeling of an additional layer, called F3 layer, over the equator during the main phases of five super geomagnetic storms are presented. The observations show the occurrence, re-occurrence (in some cases) and quick drift to the topside ionosphere of unusually strong F3 layer during the main phases of all the five super storms. The unusual F3 layers, with large reductions in peak electron density, occurred in the longitudes that were in daytime sector during the main phases of the super storms; IMF Bz was also strongly southward. These observations indicate that the unusual F3 layers are produced by strong daytime eastward prompt penetration electric field (PPEF) events. The PPEF events are identified in the equatorial electrojet strength in all five cases; the PPEF events are also measured in some cases. By using a measured PPEF event, the SUPIM model qualitatively reproduces the observed F3 layer. The observations and modeling suggest that the sudden appearance of strong F3 layer that quickly drifts to the topside ionosphere can be used as an indicator of daytime eastward PPEF event. The suggestion can be confirmed by a statistical study of the F3 layer during major and super geomagnetic storms.

Penetration, electric field

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