Different Behaviors of TEC and NmF2 During Magnetic Storms and Their Implications

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The F-region plasma density is strongly disturbed during magnetic storms due to various processes such as electric field penetrations from the magnetosphere to the ionosphere, and effects of disturbed thermospheric composition and wind distributions. The dominant processes differ from storm to storm depending on the energy input to the magnetosphere from the disturbed solar wind and on the changes in the interplanetary magnetic field direction. They can even change during a storm event depending on the storm phase, location (local time and latitude), and season. Therefore, it is important to analyze each storm event in detail and derive common features for understanding the magnetosphere-ionosphere and thermosphere- ionosphere coupling processes and predicting storm disturbances.

In this study, we use ionosonde and TEC observations. Ionosonde observations give information on the vertical profile of electron density from the bottom of the ionosphere to the F2 peak, while TEC can be obtained from propagation delay between GPS satellites and receivers on the ground, giving information on the vertically integrated electron density including the ionosphere and plasmasphere. During magnetically quiet time, TEC and the F2 peak electron density (NmF2) behave in similar ways, since the F-region electron density most contributes to the integration in the derivation of TEC. On the other hand, TEC and NmF2 sometimes behave in different way during storm times. We investigate these behaviors of the two quantities and their implications for storm-time plasma dynamics in the ionosphere and plasmasphere, and potential storm drivers.

In this report, we first discuss morphology of the quiet-time TEC and NmF2 behaviors. Then, we discuss different TEC and NmF2 behaviors observed during some large ionospheric storms, by showing both observation and simulation results

Reference:
Jin and Maruyama, Temporary Decrease in Daytime F-region Peak Electron Density due to Eastward Electric Field Penetration during Magnetic Storm, J. Geophys. Res, 2008