Ionospheric dynamic and coupling processes during geomagnetic storms

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Geomagnetic storms cause the largest disturbances in the ionosphere-thermosphere system. We use measurements with satellites and ground based radars to study storm-induced variations in ionospheric plasma drift, ion density, and ion composition at low latitudes. It is found that the storm-time change of ion drift velocity in the equatorial ionosphere can reach 200-300 m/s, the change of ion density can be one or two orders of magnitude, and the change of ion composition can be 50-80%. These extremely large changes in the ionosphere can last for several hours or even a few days during the main and recovery phases of magnetic storms. The longitudinal, latitudinal and hemispheric differences of storm-time ionospheric disturbances are analyzed from measurements of multiple satellites or radar chain. Very long, continuous penetration of interplanetary electric fields to the equatorial ionosphere for 6 or even 14 hours are observed, and the time when disturbance dynamo electric fields become dominant is identified. The interplay of penetration, shielding, and disturbance dynamo electric fields in the storm-time ionosphere will be addressed. Mechanisms responsible for storm-time ionospheric dynamics will be discussed.