Upper Atmospheric Storms

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During geospheric storms a large amount of energy is dissipated in the polar region, leading to profound charges in the global morphology of the upper atmosphere. Since such perturbations degrade satellite ephemeris predictions, shorten the life times of satellite (even disabling them at times) and disturb the sub- and transionospheric radio communication, they constitute an important element of space weather. The present review attempts to summarize what is presently known about the properties and about the physics of such thermospheric and ionosperic storms. First the dissipation of electrical energy and the resulting basic atmosperic disturbance effects at higher latitudes are described. These include large plasma and neutral wind velocities, high plasma and neutral gas temperatures, and changes in the neutral gas composition. Parts of these perturbations are transportet toward lower latitudes by traveling atmospheric disturbances and by large - scale wind circulation. Traveling atmospheric disturbances, for example, are thought to be responsible for the transient density perturbations observed at equatorial latitudes; large - scale winds are made responsible for the transport of composition perturbations toward middle latitudes. Local time and seasonal variations are attributet to the interaction of magnetospheric storm and solar radiation driven winds. Since charged particles are firmly embedded in their neutral gas environment, any perturbation of the neutral atmosphere will cause ionosheric disturbance effects. These include short - duration positive storms due to traveling atmospheric disturbances, long - duration positiv storms due to changes in the large - scale wind circulation, and negative storm effects due to neutral composition changes. Even though significant progress has been made in understanding upper atmospheric storms, many open questions remain, and some of these are summarized at the end of this review