New aspects of thermospheric and ionospheric storms revealed by CHAMP

The neutral mass density \( N \) and electron density \( N_e \) at 400 km height measured by CHAMP during intense geomagnetic storms bring out some new aspects of the thermospheric and ionospheric storms. The thermospheric storms (increase of \( N \)) develop with the onset of the geomagnetic storms and reach their peak phases by the end of the main phases (MP) of the storms. The ionospheric storms (change of \( N_e \)) in general undergo an initial negative phase (with the EIA crests shifting poleward) before turning positive and the positive storms reach their peak phases centered at \( +/-25-30 \) degree magnetic latitudes; in some other (4) cases the positive storms develop without an initial negative phase and with the EIA crests shifting equatorward; in all cases the positive storms reach their peak phases before the end of the MPs and turn to conventional negative storms by the end of the MPs. The observations agree with the different aspects of a physical mechanism of the positive storms. The observations also reveal that the Halloween storms of 30 October 2003 with a short MP without fluctuations produced the strongest positive ionospheric storms through impulsive response, and there is strong equinoctial asymmetry in the ionosphere and thermosphere during geomagnetic storms.