



Studying the dynamics in the ionosphere-thermosphere system during 20th November 2003 storm with CTIPe

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Geomagnetic storms often go along with ionospheric disturbances which may threaten radio systems used for communication and navigation. During the super storm on 20 November 2003 for example, plenty of strong and unusual perturbations were reported. This paper analyses the dynamics of the high-latitude ionosphere over Europe during this storm. Here, Total Electron Content (TEC) measurements derived from ground-based Global Navigation Satellite System (GNSS) observations are used to monitor large scale traveling ionospheric disturbances (LSTIDs). The source region of these LSTIDs is characterized by enhanced spatial gradients, TEC depletion, strong electron density uplifting, the proximity of the eastward auroral electrojet and strong Aurora E-layers. In the course of the storm, the TEC observations show a southward shift of the source region of the TIDs. These meridional dislocation effects are obviously related to a strong compression of the plasmasphere. The Coupled Thermosphere Ionosphere Plasmasphere electrodynamics (CTIPe) clearly reproduces intensive Joule heating in the source region of the LSTIDs. The sudden heating of the thermosphere leads to strong vertical winds in the heating region and the development of so-called storm wind cells. The sudden changes in wind and pressure generate thermospheric wind surges, which are observed as LSTID signatures in the TEC. The surges are also reproduced by CTIPe in the vertical winds. As potential source mechanisms for the Joule heating the dissipation of the eastward auroral electrojet and/or particle precipitation are considered. The presented results demonstrate the complex interaction processes in the thermosphere-ionosphere-magnetosphere system during the extreme storm on 20 November 2003.