Geophysical Research Abstracts
Vol. 17, EGU2015-1533, 2015
EGU General Assembly 2015

Statistical results for the thermospheric and geomagnetic response to interplanetary coronal mass ejections

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During the time range August 2003 – August 2010, we find for 35 disturbances from interplanetary coronal mass ejections (ICMEs) a clear density enhancement in the thermosphere (derived from GRACE and CHAMP accelerometer measurements) by more than 150 percent compared to the pre-event level. For this sample of ICME-thermosphere events, we extract geomagnetic parameters and from the ICME, separately for the sheath and magnetic cloud component, characteristic parameters such as the impact speed, magnetic field orientation as well as strength and disturbance duration.

We present a statistical analysis of various ICME parameters and their relation to geomagnetic (Dst, AE, ap, Kp, ...) as well as thermospheric response. We show, among high correlations between geomagnetic and thermospheric quantities, that the strength of the Bz component of the ICME gives the strongest relation to the neutral density enhancement. For most of the events, the strongest negative Bz component is found in the magnetic cloud of the disturbance. Furthermore, the results indicate a shock related intensification of geomagnetic storms and neutral density enhancement due to a larger Bz caused by shock compression.