Space Weather Induced Thermospheric Disturbances

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Increased high latitude convection electric fields and particle precipitation during magnetically active conditions result in global disturbances of the thermosphere that may have large impacts on satellite and debris orbitography. Because the empirical atmospheric models used to compute the drag force are not good enough during magnetic storms, the error induced along the predicted track of LEO satellites may reach several kilometres. We will show an example that occurred during the SOHO-MEDOC campaign at the end of may 2003.

Thermospheric temperatures measured by the Wind Imaging Interferometer (WINDII) onboard the Upper Atmosphere Research Satellite (UARS) between 1992 and 1995 have been used to assess the validity of two empirical models of the thermosphere: MSIS-90 and DTM-94. We have found that the modelled temperature variations represent very well the mean temperature variation observed by WINDII over 4 years, as well as the observed latitudinal/local time variation. However, we will show that the temperature variations during magnetically disturbed days are underestimated by almost a factor two.

The empirical models are based on the use of the planetary magnetic activity Ap or Kp indices which monitor the average level of the geomagnetic activity at the planetary scale, and therefore do not allow taking into account the LT dependence of geomagnetic activity. We will also show that the use of longitude sector activity indices allow to better characterize the temperature variations observed by WINDII at all latitudes during disturbed days.