



Evaluation of empirical thermosphere density models using accelerometer observations during the recent solar minimum

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Empirical models of thermosphere density, such as NRLMSISE-00 and JB-2008, are evaluated during the recent solar minimum, making use of accelerometer-derived density observations from CHAMP and GRACE.

During the declining part of the previous solar cycle, in the years 2005-2007, the comparison of models and observations is characterised by a slowly increasing offset, reaching a plateau during the deep minimum years 2008-2009. The NRLMSISE-00 model density compared to CHAMP accelerometer measurements is 22% higher during these years than during the high solar activity years 2001-2003. Interestingly, this additional offset in ratio between data and model disappeared in just two months, in early 2010, not long after new solar cycle sunspots had started to appear regularly. Similar observations have been made as well for other density models (e.g. JB-2008), using data from satellites in other orbits, and with other measurement techniques. These discrepancies of empirical density models with observations will be useful for formulating a required improvement of the parameterisation of these models.

The low solar activity data is also useful for investigations of shortcomings of the diurnal and seasonal variations in these models. At high activity, such variations are nearly impossible to distinguish from temporal changes, due to the slow precession of the satellite's orbit. At deep solar minimum, due to the limited time-variability of the solar input, seasonally varying patterns in the local time/latitude space emerge much more clearly. These show variations in the data/model density ratio of up to about 30%, exhibiting both long wavelength features and shorter wavelength signatures of solar terminator waves.