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Statistical analyses on low latitude thermospheric mass density measured by CHAMP in relation to solar and magnetospheric influences

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In our study we have performed statistical analyses on thermospheric mass density data at equatorial latitudes in order to identify its response to various drivers. It is based on four years (2002 - 2005) of CHAMP accelerometer measurements.

To isolate the influence of the different contributions we perform a dedicated data selection and/or removal of other effects. First we normalise all readings to an altitude of 400 km. For the investigation of the solar influences only magnetically quiet days ($A_p < 15$) are considered. The air density exhibits clear annual and semi-annual variations with maxima at the equinoxes and a pronounced minimum around June solstice. The thermosphere maintains a day/night density ration very close to 2 during quiet days. This ratio is independent of solar flux level and season. The magnetospheric forcing causes an additive contribution to the quiet-time density, which is linearly correlated with the a_m index.

Thus we can delineate the influences of the contributions of solar flux level ($P10.7$-index), magnetic activity (a_p and a_m indices), local time and seasonal influences. The forcing terms can be treated as linear combinations of the respective components.