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Traveling Atmospheric Disturbances (TADs) in the thermosphere inferred from accelerometer data at three altitudes

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Densities derived from accelerometer measurements on the GRACE, CHAMP and Air Force/SETA satellites near 490, 390, and 220 km, respectively, are used to elucidate global-scale characteristics of traveling atmospheric disturbances.

The accelerometers on the CHAMP and GRACE satellites have made it possible to accumulate near-continuous records of thermosphere density between about 320 and 490 km since May 2001, and July 2002, respectively. They have recorded the response to virtually every significant geomagnetic storm during this period. CHAMP and GRACE are in (near) polar and quasi-circular orbits, sampling 24 hr local time approximately every 4 and 5 months, respectively. These capabilities offer unique opportunities to study the temporal and latitudinal responses of the thermosphere to geomagnetic disturbances. The Air Force/SETA accelerometer data have also been processed, but the analysis is more complicated due to data gaps.

Significant and unambiguous TAD activity in the observed response of the thermosphere was detected for about 25 events with CHAMP and GRACE, and less than 10 with SETA. The atmospheric variability is evaluated by de-trending the data, allowing the extraction of specific ranges in horizontal scale, and analyzing density "residuals". The scale of the perturbation is decisive for its lifetime and relative amplitude. Sometimes the disturbances represent wave-like structures propagating far from the source, and these so-called 'TADs' were detected and described for the May 2003 storm for the first time. Some TADs traveled over the pole into the opposite hemisphere; this was found in both CHAMP and GRACE data. Most TADs propagate equatorward, but poleward propagating TADs have on occasion been detected too. The estimated speeds and amplitudes of the observed TADs, and their dependence on altitude and solar and geomagnetic activity in particular, will be presented in this poster.