



North-South differences in the Earth's high-latitude upper atmosphere dynamics: Influence of solar activity and seasonal variations

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Recent observations have shown that the upper thermospheric/ionospheric response to solar wind and IMF dependent drivers of the magnetosphere-ionosphere-thermosphere (M-I-T) system can be very dissimilar in the Northern and Southern Hemisphere. We present statistical studies of the high-latitude upper thermospheric neutral wind circulation patterns obtained from almost a decade of measurements with an accelerometer on board the CHAMP spacecraft. The influence of the solar activity and the dependence on seasonal variations is analysed with respect to average cross-polar wind velocities and high-latitude neutral wind vorticity values. Using the Coupled Magnetosphere-Ionosphere-Thermosphere (CMIT) model, on the other hand, we simulated representative equinox as well as solstice intervals for low and high solar activity conditions. For the simulations, we used on the one hand side symmetric dipole and on the other realistic (IGRF) geomagnetic field configurations. The comparative survey of both the numerical simulation and the statistical observation results show some prominent asymmetries between the two hemispheres, which are caused by the different geographic-geomagnetic offsets and/or the different patterns of geomagnetic flux densities. The average cross-polar neutral wind velocities show a distinct seasonal variation with minimum values during the respective hemispheric winter solstice. The neutral wind vorticity values are generally larger in the Northern than the Southern Hemisphere, except for northern winter solstice conditions. The hemispheric differences become larger for higher solar activity and show a semidiurnal variation. In contrast, the spatial variance of the upper thermospheric neutral wind is usually considerably larger in the polar region of the Southern Hemisphere compared with the Northern, and the hemispheric difference shows a strong semidiurnal variation.