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Modelling the high-latitude magnetosphere-ionosphere-thermosphere system for various solar wind/IMF conditions using the UAM model

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The upper atmosphere responds strongly to the highly variable solar wind conditions, in particular to changes of the orientation and strength of the interplanetary magnetic field (IMF). Electromagnetic stresses transferred by field-aligned currents (FACs) from outer magnetospheric regions to the high-latitude ionosphere/thermosphere together with energy deposition via Joule heating and particle precipitations drive the thermospheric winds and variations in neutral density and composition. In this study, we employ the Upper Atmosphere Model (UAM), a time-dependent, fully self-consistent global model of the neutral and plasma components in the Earth's environment to calculate upper ionosphere convection and 3-D neutral wind circulation patterns for various IMF conditions. The high-latitude modelling needs an accurate and consistent knowledge about the magnetospheric energy and momentum inputs via FACs and particle precipitations and their configurations in dependence of various solar wind and IMF conditions. It constitutes a highly complex, mutual dependent system that needs numerical treatment for understanding the driver and feedback processes. We compare the model results with various observations, in particular with CHAMP accelerometer measurements of neutral wind and density for some stable solar wind/IMF conditions.