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Middle atmosphere coupling during stratospheric warming events simulated with the HAMMONIA GCM

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Sudden stratospheric warmings (SSW) are an important manifestation of vertical dynamical coupling in the atmosphere and studied since many decades. It has become clear that SSWs are in general accompanied by mesospheric cooling. More recently other signals have been reported from observations of single events, among them a thermospheric warming, an increase of tidal amplitudes, and a mesospheric wind reversal several days in advance of the actual stratospheric warming event. It is unclear if these are general features of SSWs or if they occur under certain conditions only.
For this study we have analyzed 20 major warming events simulated with the entire atmosphere GCM HAMMONIA in order to search for common characteristics of the events and for mechanisms explaining the coupling. We will present results for composites and compare with single events. The thermospheric warming is a general feature of the simulated SSWs and also changes in tidal amplitudes occur in the composite. However, a pre-warming mesospheric wind reversal has only been simulated in few cases and only for selected longitudes. As similar mesospheric reversals may occur in the model also at non-warming times this feature can not be used as a precursor. In an attempt to further categorize SSWs they have been categorized into splits and displacements of the stratospheric polar vortex. Simulated split events show in general larger amplitudes in different signals than displacements but indicate no principally different coupling processes between stratosphere, mesosphere and lower thermosphere.