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Simulations of dynamics and isentropic transport during the February 2001 Arctic major warming. Role of planetary waves.

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The Stratospheric Sudden Warming (SSW) is the most dramatic meteorological phenomenon to take place in the stratosphere, causing effects on the dynamical and chemical state of the stratosphere. During a SSW event, polar stratospheric temperatures may rise by up to 50 K in a few days, the stratospheric polar vortex may break down, and air is transported over large distances and mixed at midlatitudes. Another issue is the tropospheric response to SSW events. While SSWs are commonly believed to be caused by breaking planetary waves originating from the troposphere, there is increasing evidence that the anomalous state of the stratosphere during sudden warmings affects surface weather. Hence the importance of understanding and successfully modelling SSWs for the stratosphere-troposphere system. Here we use the COupled Mimosa Msdol Interactive Dynamics (COMMID) model to simulate the February 2001 stratospheric major warming in the Northern Hemisphere. The COMMID model, which comprises the MSDOL global 3-D mechanistic model coupled with the MIMOSA high-resolution advection contour model of potential vorticity on isentropic surfaces, has been developped by Morel et al. (2005) to investigate the impact of the tropospheric circulation on the isentropic transport in the stratosphere. MSDOL, which is forced toward NCEP reanalyses below 100 hPa, provides a consistent picture of the stratospheric large-scale circulation from which MIMOSA simulates the fine-scale filaments generated by breaking planetary waves in the stratosphere. Having obtained a realistic simulation of the warming event, we use simulations of the model with changes in the lower-boundary planetary-wave forcing to examine aspects of the dynamics and the isentropic transport during the warming.