

Upper atmosphere response to stratosphere sudden warming: local time and height dependence simulated by GAIA model

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The whole atmosphere model GAIA is employed to shed light on atmospheric response to the 2009 major stratosphere sudden warming (SSW) from the ground to exobase. Distinct features are revealed about SSW impacts on thermospheric temperature and density above 100 km altitude. 1. The effect is primarily quasi-semidiurnal in tropical regions, with warming in the noon and pre-midnight sectors and cooling in the dawn and dusk sectors. 2. This pattern exists at all altitudes above 100 km, with its phase being almost constant above 200 km, but propagates downward in the lower thermosphere between 100–200 km. 3. The northern polar region experiences warming in a narrow layer between 100 – 130 km, while the southern polar region experiences cooling throughout 100 – 400 km altitudes. 4. The global net thermal effect on the atmosphere above 100 km is a cooling of about -12 K. These characteristics provide us with an urgently needed global context to better connect and understand the increasing upper atmosphere observations during SSW events.

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