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Forecasting the weather
- ensemble techniques
in probabilistic weather prediction

The roles of planetary and gravity waves during a major stratospheric sudden warming characterized by an elevated stratopause in WACCM

Y. Orsolini (1), V. Limpasuvan (2), J. Richter (3), O. Kvissel (4), and F. Stordal (5)

(1) Norwegian Institute for Air Research (NILU), Kjeller, Norway (orsolini@nilu.no), (2) Coastal Carolina University, Conway,USA, (3) NCAR, Boulder, USA, (4) University of Oslo, Norway, (5) University of Oslo, Norway

Stratospheric sudden warmings (SSWs) contribute significantly to the inter-annual variability of the polar middle atmosphere, and couple the stratospheric and mesospheric circulations. It has long been recognized that gravity waves play a role during the mesospheric coupling observed during SSWs. While it had also long been observed that the polar stratopause plunges down during the onset of SSWs, recent satellite observations have further revealed that SSWs can be accompanied by an abrupt "jump", or reformation, of the stratopause near 75km, at what are normally mesospheric altitudes. The stratopause then returns to its climatological altitude over a period of 1-2 months.

We analyze cases of SSWs simulations of the National Center for Atmospheric Research (NCAR) Whole Atmosphere Community Climate Model (WACCM3.5). The planetary and gravity wave forcings are examined in detail using the Transform Eulerian Mean diagnostic.

We investigate the respective roles of parametrized, orographic and non-stationary (frontal or convective) gravity waves, during the development of the SSW and of the zonal wind reversal, and find that both upper-mesospheric planetary waves and gravity waves of frontal origin play a key role during the stratopause reformation at high altitudes.