Choosing meteorological variables to be assimilated into CTM driven by GCM for ozone reanalysis

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Brief Abstract:

We investigate the impact of changing meteorological variables obtained from the objective analysis to be nudged into the General Circulation Model (GCM), in order to provide realistic ozone simulation with the Chemical Transport Model (CTM) driven by the nudged GCM. Two experiments have been performed; one nudges only horizontal wind (mechanical nudging), and the other does temperature (thermal nudging) additionally. The mechanical nudging alone reproduces much better zonal mean ozone field than the mechanical and thermal nudging, since the former simulates more realistic meridional circulation than the latter. The thermal nudging term is found to work substantially as spurious heat source in the upper troposphere and lower stratosphere owing to much colder GCM tropopause. As a result, the thermal nudging makes meridional circulation stronger in the lower stratosphere and weaker in the troposphere, bringing about the degradation of the ozone field. On the other hand, the inclusion of the thermal nudging becomes indispensable when the chemical process outweighs the transport process such as Antarctic ozone hole period. The polar stratospheric cloud occurrence responsible for the depth of Antarctic ozone hole is very sensitive to temperature.