Geophysical Research Abstracts,
Vol. 11, EGU2009-6312, 2009
EGU General Assembly 2009

Stratospheric temperature response to dynamically-consistent zonal asymmetries in ozone

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Stratospheric ozone exhibits significant departures from zonal symmetry, largest in both polar regions in November-December, and these zonal asymmetries are not usually accounted for in model simulations with prescribed ozone. Previous investigations into the effect of zonal asymmetries in ozone on climate have compared simulations with prescribed 3-D ozone, in which the ozone is not necessarily consistent with the model dynamics, to simulations with prescribed zonal mean ozone. We assess the impact of zonal asymmetries in ozone by comparing a control simulation of a coupled chemistry version of the Canadian Middle Atmosphere Model (CMAM) in which the ozone and model dynamics are consistent, with a simulation in which only the zonal mean of the ozone is passed to the radiative transfer scheme. These simulations reveal a robust stratospheric zonal-mean temperature and geopotential height response to zonal asymmetries in ozone that is consistent with that identified in previous studies and of a magnitude comparable to observed trends. These results suggest that the inclusion of zonal asymmetries in ozone may be essential for the accurate simulation of past and future stratospheric temperature trends.