Geophysical Research Abstracts
Vol. 13, EGU2011-8131-1, 2011
EGU General Assembly 2011

Influence of Stratosphere-troposphere exchange on local budgets of ozone, studies with the Whole Atmosphere Community Climate Model (WACCM)

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The goal of this study is to investigate the influence of stratosphere to troposphere transport on the regional budget of ozone in the Mediterranean and Middle East/North Africa region. In this region, high tropospheric ozone has been observed during summer. The region is of particular interest because in the middle and upper troposphere the region is strongly influenced by transport of Asian pollution associated with the extended Asian monsoon system. Furthermore, European and African pollution is transported into the region at low altitudes in summer. This has important implications for both air quality and climate in the region.

In this work, the NCAR Whole Atmosphere Community Climate Models (WACCM) is used to derive the ozone abundance in the region described above. This model, extending from the Earth's surface to $\sim$135 km, has a detailed representation of tropospheric and stratospheric chemical and dynamical processes. This includes a base mechanism that contains over 125 species, >220 gas-phase reactions, 71 photolytic processes, and 18 heterogeneous reactions on multiple aerosol types. WACCM is a fully interactive model, where the radiatively active gases affect heating and cooling rates and therefore dynamics. WACCM can also be driven with specified (external) meteorological fields. In this study, these meteorological fields come from the NASA GMAO data assimilation center. This approach essentially turns the WACCM into a chemical transport model, which is useful for studies that involve synoptic scale comparisons to satellite and aircraft data. For this work an ozone "tagging" approach will be used to help define the regional budget.
To examine the sensitivity of stratosphere to troposphere transport to the regional budget, the model will be run with both dynamical approaches (fully interactive and specified dynamics).