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Evaluation of Convective Transport in the GEOS-5 Chemistry and Climate Model

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The NASA Goddard Earth Observing System (GEOS-5) Chemistry and Climate Model (CCM) consists of a global atmospheric general circulation model and the combined stratospheric and tropospheric chemistry package from the NASA Global Modeling Initiative (GMI) chemical transport model. The subgrid process of convective tracer transport is represented through the Relaxed Arakawa-Schubert parameterization in the GEOS-5 CCM. However, substantial uncertainty for tracer transport is associated with this parameterization, as is the case with all global and regional models. We have designed a project to comprehensively evaluate this parameterization from the point of view of tracer transport, and determine the most appropriate improvements that can be made to the GEOS-5 convection algorithm, allowing improvement in our understanding of the role of convective processes in determining atmospheric composition. We first simulate tracer transport in individual observed convective events with a cloud-resolving model (WRF). Initial condition tracer profiles (CO, CO2, O3) are constructed from aircraft data collected in undisturbed air, and the simulations are evaluated using aircraft data taken in the convective anvils. A single-column (SCM) version of the GEOS-5 GCM with online tracers is then run for the same convective events. SCM output is evaluated based on averaged tracer fields from the cloud-resolving model. Sensitivity simulations with adjusted parameters will be run in the SCM to determine improvements in the representation of convective transport. The focus of the work to date is on tropical continental convective events from the African Monsoon Multidisciplinary Analyses (AMMA) field mission in August 2006 that were extensively sampled by multiple research aircraft.