Title: New approaches to quantifying transport model error in atmospheric CO2 simulations

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Abstract

In recent years, much progress has been made in observing CO_2 distributions from space. However, the use of these observations to infer source/sink distributions in inversion studies continues to be complicated by difficulty in quantifying atmospheric transport model errors. We will present results from several different experiments designed to quantify different aspects of transport error using the Goddard Earth Observing System, Version 5 (GEOS-5) Atmospheric General Circulation Model (AGCM). In the first set of experiments, an ensemble of simulations is constructed using perturbations to parameters in the model's moist physics and turbulence parameterizations that control sub-grid scale transport of trace gases. Analysis of the ensemble spread and scales of temporal and spatial variability among the simulations allows insight into how parameterized, small-scale transport processes influence simulated CO_2 distributions. In the second set of experiments, atmospheric tracers representing model error are constructed using 'observation minus analysis' statistics from NASA's Modern-Era Retrospective Analysis for Research and Applications (MERRA). The goal of these simulations is to understand how errors in large scale dynamics are distributed, and how they propagate in space and time, affecting trace gas distributions. These simulations will also be compared to results from NASA's Carbon Monitoring System Flux Pilot Project that quantified the impact of uncertainty in satellite constrained CO_2 flux estimates on atmospheric mixing ratios to assess the major factors governing uncertainty in global and regional trace gas distributions.