Steps Towards a Multi-year Continental Inversion: Comparing Simulated CO_2 Mixing Ratios in ABL to the North American Tower Network

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Continental scale inversions of carbon sources and sinks require the use of atmospheric transport models that are often the main contributors of inverse flux uncertainties. Multi-model comparisons and assessments of the simulated atmospheric transport have been performed at larger scales but our understanding of model error impact remains limited at higher resolutions. Our forward simulations, a preliminary step towards quantifying the impact of transport models on inverse fluxes, use initial conditions, lateral boundary conditions, and biogenic surface fluxes from the Carbon Tracker system, fossil fuel emissions from both Vulcan and CDIAC, and transport from WRF-Chem. We show measurements and simulations of the seasonal and weather-driven temporal and spatial patterns of the mole fraction of CO_2 in the atmospheric boundary layer (ABL) and the vertical column over the continent. The simulations capture many but not all characteristics of the observed spatial distributions and temporal patterns of atmospheric CO_2, indicating that errors in the surface flux fields and differences between WRF and Carbon Tracker (TM5) atmospheric transport may be possible explanations. Next steps include multi-year continental inversions that include reasonable variations in atmospheric transport and investigation of the possible benefits of column CO_2 observations from the Orbiting Carbon Observatory-2. This work is motivated by the need for improved land-atmospheric carbon exchange modeling over the North American continent.