

Application of Observations from the Summer 2016 ACT-America Campaign to Constrain Modeled Regional CO₂ Concentrations and Fluxes

B. Gaudet¹, K.J. Davis¹, T. Lauvaux¹, S. Feng¹, S. Pal¹, A. Jacobson^{2,3} and J. DiGangi⁴

¹The Pennsylvania State University, Department of Meteorology, University Park, PA 16802; 814-867-2110, E-mail: bjg20@psu.edu

²Cooperative Institute for Research in Environmental Sciences (CIRES), University of Colorado, Boulder, CO 80309

³NOAA Earth System Research Laboratory, Global Monitoring Division (GMD), Boulder, CO 80305

⁴NASA Langley Research Center, Hampton, VA 23681

While observational constraints on greenhouse gas (GHG) fluxes exist on the local scale (via eddy-covariance flux towers) and the global scale (via remote-site concentration measurements and the conservation of mass), regional-scale observational constraints are relatively deficient. One of the primary goals of the Atmospheric Carbon and Transport – America (ACT-America) project is to increase the understanding of regional-scale GHG fluxes through the use of aircraft, tower and satellite-based measurements over three focus regions (Mid-Atlantic, Midwest and Gulf Coast) during all four seasons. Two airborne platforms, a C-130 Hercules and a B-200 King Air, are equipped with various instruments that sample GHGs as well as other trace gases and meteorological variables. Flight patterns sample the atmosphere at multiple levels (from a few hundred to 8000 meters AGL) that encompass significant portions of weather systems. One flight pattern type focuses on fair-weather conditions with the intent of improving our understanding of seasonal-scale GHG fluxes over spatial scales of order 10⁵ km². A second pattern type samples gradients associated with mid-latitude storm systems.

Here we will compare carbon dioxide (CO₂) concentration observations from the summer 2016 ACT-America campaign to those produced by the CarbonTracker (CT) atmospheric CO₂ inversion system in order to: 1) evaluate the accuracy of the modeled concentrations at various spatial scales; and 2) where practical from the meteorology, infer the accuracy of regional-scale CO₂ flux estimates. We make use of the CarbonTracker Near-Realtime (CT-NRT) product, which uses priors derived from the optimized fluxes of regular CT along with provisional observations to reduce the time required to produce an analysis.

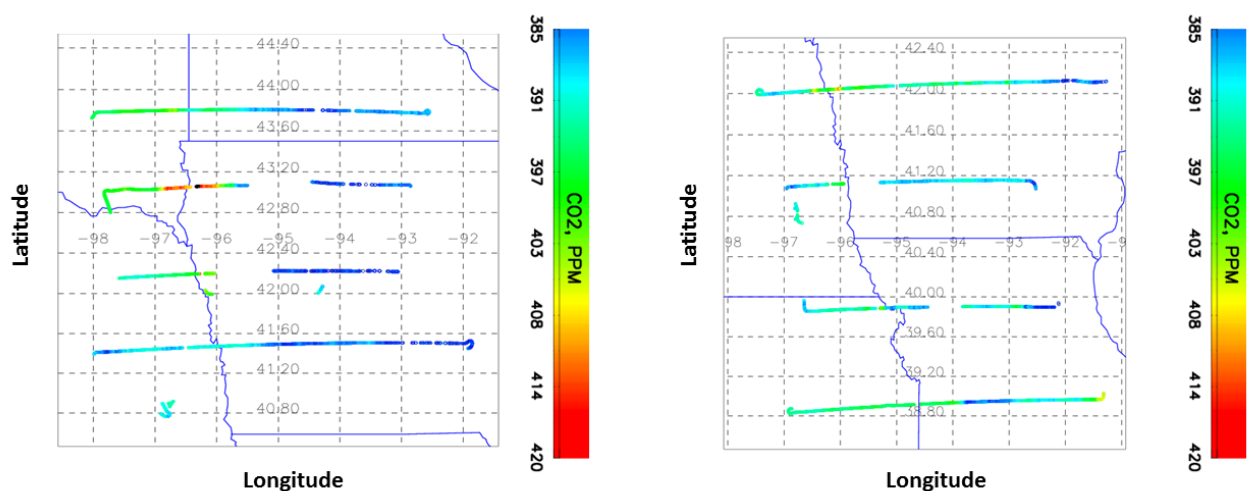


Figure 1. Observed atmospheric boundary layer CO₂ concentrations for both the C-130 and B-200 aircraft for the fair weather cases of 13 Aug 2016 (left panel), and 14 Aug 2016 (right panel).