

Submission Title:

A ground-based network for improved validation of satellite carbon dioxide and methane observations over the Eastern United States

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Abstract

Satellite observations of greenhouse gases (GHGs), notably carbon dioxide and methane, over the Eastern United States, are currently only validated indirectly and/or sporadically. There are only four existing routine, ground-based remote sensing locations in the United States suitable for validation of satellite GHG observations: Edwards and Pasadena, CA, Lamont, OK, and Park Falls, WI as part of the Total Carbon Column Observing Network (TCCON). Among other efforts, e.g. the Network for the Detection of Atmospheric Composition Change (NDACC) and EM27/SUN deployments led by the University of Toronto, the only sites west of the Mississippi River are Park Falls, WI and Toronto, ON. The only remaining validation tools, vicarious calibration and airborne campaigns, are sporadic in space and/or time and thus coincide with only a small subsample of available soundings and conditions. As a result, satellite GHG observations over the east coast of the United States, home to more than half of its population, lack a consistent, widespread means of validation. We describe an ongoing effort to position 8 EM27/SUN spectrometers along the Eastern Seaboard over the next two years. The goals of this effort are to improve both satellite validation and our understanding of human and natural influences on the carbon cycle of the Eastern US, the former enabling the latter. This work is intended to augment past, ongoing, and future inter-agency programs, e.g., the NIST Urban Testbed, routine aircraft and aircore sampling by NOAA, and NASA's Atmospheric Carbon and Transport (ACT)-America sub-orbital campaign, in particular by offering information on broader time and spatial scales than what is already available while maintaining the high-accuracy constraints of in situ data. We will present early analysis including siting considerations to capture local and/or background conditions and comparison to NASA's Goddard Earth Observing System (GEOS) modeling and assimilation systems. This includes a 40-day, 3-km horizontal resolution global simulation of early 2020 and a 50-km retrospective analysis of Orbiting Carbon Observatory 2 (OCO-2) observations over 2015-present. Both are valuable tools for analyzing expected and observed signals and are useful boundary conditions for yet higher-resolution studies.