

Full-column Greenhouse Gas Profiles Measured at ARM SGP

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The vertical distributions of CO₂, CH₄, and other gases provide important constraints for the determination of terrestrial and ocean sources and sinks of carbon and other biogeochemical processes in the Earth system. Remote sensing from ground-based and satellite-borne platforms require in-situ validation. We report results from a collaborative measurement campaign between the DOE Biological and Environmental Research Program (DOE-BER) and the NOAA Earth System Research Laboratory (NOAA-ESRL) to quantify the vertically resolved distribution of atmospheric carbon-cycle gases (CO₂, CH₄, and CO) throughout 99% of the atmospheric column. To accomplish these measurements, a long coiled tube (or AirCore) is lofted to the stratosphere (~ 30km) on a weather balloon, and then collects a vertically resolved sample of air on descent. From 2012-present, we have conducted more than a dozen AirCore flights from the DOE ARM Southern Great Plains Facility in Oklahoma. Comparisons with collocated ARM aircraft measurements show good agreement for the lower half of the atmospheric column. AirCore profiles are also be integrated to evaluate the ground based (TCCON) column-mean CO₂ and CH₄ mixing ratios. In the past year we have also started development of a automated guidance system that is expected to expedite AirCore recovery of the Aircore packages. The expected outcome of this project will be an operational capability providing data that supports key DOE science objectives.