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NOAA’s balloon-borne AirCore sampling system has the unique capability of capturing a continuous sample of air for over 95% of the total atmospheric column, allowing for high-resolution, multi-species trace gas profiles that extend from ~27 km above mean sea level to the ground. An important application for this technology over the past decade has included the use of these profiles for evaluation of total-column CO2 (XCO2) retrievals from NASA’s OCO-2 and OCO-3 satellites due to the potential for greater error reduction in total column retrievals relative to lower-altitude in situ profiling. The use of calibrated airborne profile measurements such as those from AirCore or aircraft is a critical procedure in satellite calibration and validation programs for not only providing higher vertical resolution throughout the atmospheric column and the capability for integrating trace gas observations across different spatial scales, but also for scaling retrievals to World Meteorological Organization (WMO) trace gas standard scales and maintaining compatibility between surface and space observing networks.

Here, we discuss several AirCore applications for satellite evaluation that include multi-year efforts within the NOAA AirCore Program to evaluate OCO-2 satellite retrievals directly, in addition to the evaluation of models that assimilate these retrievals. We will also outline relatively new methods that involve airborne scaling of continuous, portable ground-based Fourier Transform Spectrometers at ground-based “supersites”, which can utilize a variety of measurement methods to increase the efficacy of satellite calibration and evaluation programs beyond direct comparisons. Because of its low cost, small balloon platform, the AirCore provides one avenue for total-column retrieval evaluation in remote, data-poor regions and we will touch upon future opportunities that take advantage of new, UxS-based airborne platforms for such work.
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