AirCore: The Gold Standard for Satellite Evaluation

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Satellite retrievals of CO_2 offer an unprecedented opportunity to measure the column mean CO_2 dry mole fractions globally. By monitoring changes in gradients of the column mean over time and space, contributions to atmospheric CO_2 from land and ocean can be estimated to better understand and quantify both anthropogenic and natural sources of CO_2. However, it is critical to modeling and interpreting the column mean that: 1) the CO_2 column mean measured by satellites be directly tied to the World Meteorological Organization (WMO) dry mole fraction scale and 2) the vertical gradients of the column be accurately modeled.

The NOAA/ESRL Carbon Cycle Aircraft Program continues to collect data and develop new instrumentation to directly tie satellite measurements to WMO column mean and better resolve the vertical gradients from the boundary layer through the stratosphere. The most recent advance is the AirCore sampling system which enables profiles from 0 to 30 km, or 99% of the total CO_2 column, to provide a primary standard directly tied to the WMO with an accuracy of better than 0.1 ppm (~ 0.025%), a significant improvement when compared to an uncertainty of 0.4-0.5 ppm of column mean CO_2 from aircraft extrapolated to the full column. The column mean derived from these profiles can be directly compared to Fourier transform spectrometers that make up the Total Carbon Column Observing Network and will serve as transfer standards for satellite retrievals.

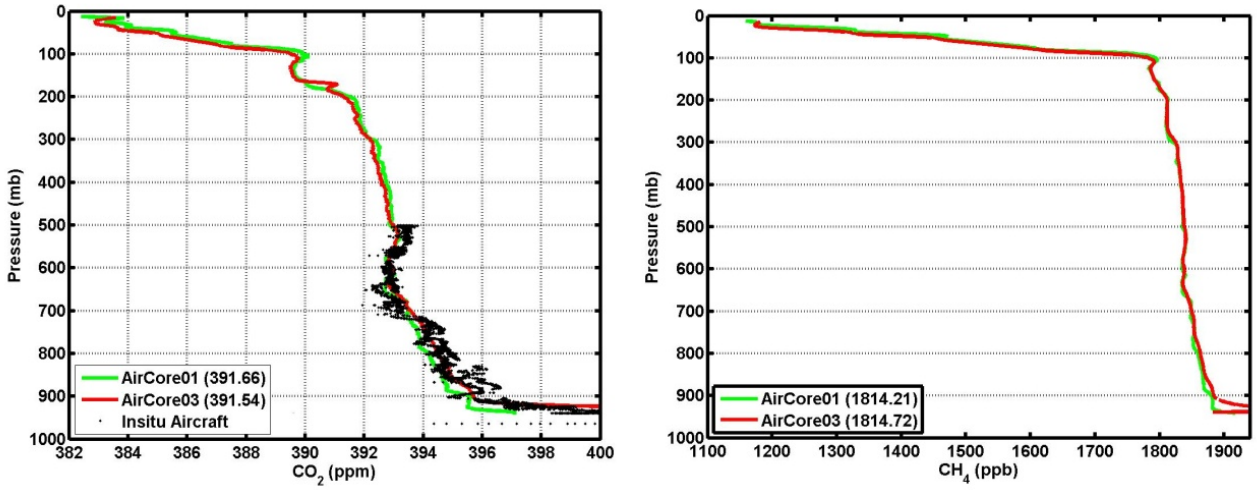

Figure 1. Side by side launches of AirCore at Lamont, OK, on January 15, 2012. This launch shows the replicate profiles demonstrating the reproducibility of the AirCore. Red line shows results from the lightweight AirCore that can be launched without a Federal Aviation Administration certificate of authorization. The column mean for CO_2 between large and small AirCores differed by 0.12 ppm and for CH_4 the column mean differed by 0.5 ppb.