

The AirCore atmospheric profiler: methods, challenges, applications, and updates

Jonathan Bent^{1,2}, Colm Sweeney^{1,2}, Pieter Tans², Tim Newberger^{1,2}, Jack Higgs², Sonja Wolter^{1,2}

¹ Cooperative Institute for Research and Environmental Sciences, University of CO, Boulder; Boulder, CO

² National Oceanic and Atmospheric Administration, Global Monitoring Division; Boulder, CO

The AirCore atmospheric profiler is currently the only platform capable of delivering near-complete, finely resolved vertical profiles of atmospheric gases (currently of CO₂, CH₄, and CO). The 100m-long passivated stainless steel tubing coil works as a sort of atmospheric “tape recorder”—it is launched on a balloon with one end open, allowing the tube to empty as it ascends, and fill back up with an atmospheric profile as it descends.

For CO₂, CH₄, and CO, the sampled air is analyzed on a Picarro cavity ring down spectrometer in a temperature controlled setting after recovery, and provides dry mole fraction of the three gases from 30 km (~12 mbar) to the surface or >98% of the atmospheric column. Ambient meteorological data and a fluid dynamics model map the resulting core to the pressure altitude at which a given parcel of air was sampled. Here, we present the current NOAA GMD sampling and analysis methodology, discuss challenges relating to repeatability of profiles, and demonstrate the utility of a software package in Python intended to standardize the analysis of AirCore profiles coming from different laboratories.