(49-240329-C) **NOAA AirCore Program Development over the Past Decade: New Sampling Techniques, Analysis Methods and Observations**

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The AirCore -- a NOAA/GML-patented, balloon-borne air sampling system -- has brought about the unique capability of passively capturing a continuous sample of air from the lower stratosphere (~25 km MSL) to the Earth's surface, with measurements of these samples resulting in calibrated profiles of carbon dioxide (CO_2), methane (CH_4), carbon monoxide (CO) and, more recently, nitrous oxide (N_2O). Circa 2012, the NOAA/GML AirCore Program has collected over 170 profiles of trace gases from routine balloon flights in the western U.S., to campaign deployments in several European countries, Australia and New Zealand. Profiles have been used extensively to evaluate satellite retrievals and model output, to monitor and diagnose stratospheric composition and dynamical changes, and to assess the impacts of the Earth's radiation budget response to both natural and anthropogenic perturbations.

We present here an overview of AirCore design development and updates made to sampling techniques over the past decade to improve the assessment of data quality and reproducibility, to increase air collection efficiency at altitude and to improve the accuracy of sample measurement registration with altitude. Other developments to AirCore analytical systems will be discussed that have expanded the number of species measured in air samples to other, long-lived stratospheric tracers that include sulfur hexafluoride (SF_6), CFCs, and Halons. Looking to the future, new platforms for recovery of the AirCore will provide the capability of expanding trace gas vertical profiling efforts in data-poor, but climate-critical regions such as the tropics.

Figure 1. A dual-AirCore flight string launched by NOAA in California, USA.