(26-220414-C) **A Novel, Low-cost Analytical Method for Measuring High-resolution Vertical Profiles of Stratospheric Trace Gases**

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The radiative balance of the upper atmosphere is dependent on the magnitude and distribution of greenhouse gases and aerosols in that region of the atmosphere. Climate models predict that with increasing surface temperature, the primary mechanism for transporting tropospheric air into the stratosphere (known as the Brewer-Dobson Circulation) will strengthen, leading to changes in the abundance of water vapor, other greenhouse gases and aerosols. Robust stratospheric relationships between greenhouse gases and other long-lived trace gases with various photochemical properties provide a strong constraint for tracking changes in the stratospheric dynamics. Therefore, a cost-effective approach to monitor these trace gases in the stratosphere is urgently needed. In the past decade, the balloon borne AirCore sampler developed at NOAA/GML have been routinely used to monitor the mole fractions of CO_2, CH_4 and CO from ground to ~25 km. Our recent development work has allowed us to measure a suite of long-lived trace gases (N_2O, SF_6, CFC-11, CFC-12, H-1211, and CFC-113) from the tropopause to mid-stratosphere. We adapted a GC-ECD for high vertical resolution (~4 hPa) measurements in the NOAA/GML AirCore, then analyzed the vertical profile of trace gases in the stratospheric portion of two AirCore samples from two different flights. The results from the two flights showed consistent and expected tracer-tracer relationships and good agreement with recent aircraft campaign measurements, suggesting that the AirCore technology provides a low-cost, robust, and accurate approach to retrieving vertical profiles of key stratospheric trace gases. To this end, we have designed and developed NOAA's next-generation balloon-borne AirCore sampler (called the StratoCore) to increase the volume of air sampled in the stratosphere and extend vertical profile measurements to 31 km altitude.

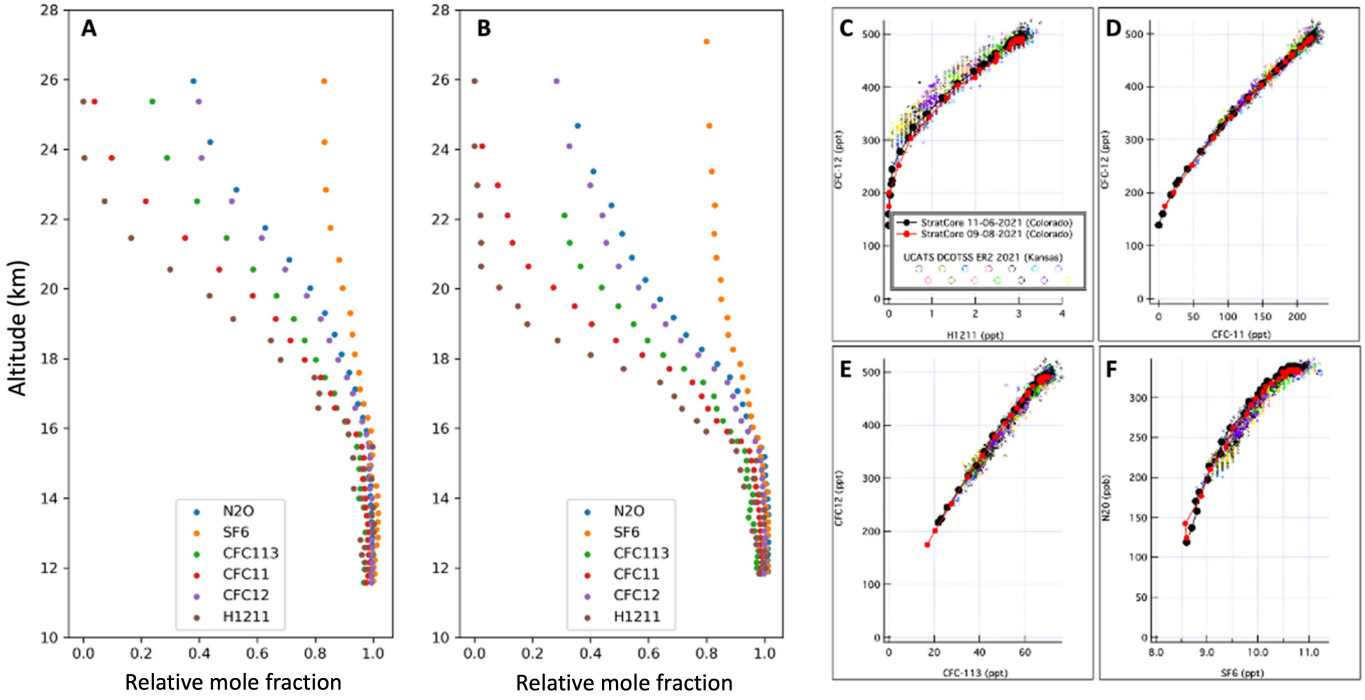

Figure 1. A, B: Relative mole fraction (normalized to tropospheric value) profiles of SF_6, N_2O, CFC-12, CFC-113, CFC-11, and H-1211 measured in two AirCores launched from Boulder, CO on Sept. 8, 2021 (A) and Nov. 16, 2021 (B). C-F: tracer-tracer relationships of trace gases measured in two AirCores (black and red points) compared with in-situ measurement data collected over the continental U.S during the NASA DCOTSS campaign in summer 2021.