AirCore: The Gold Standard for Comparing Remote Sensing Observations to the Ground Network and the Capturing Changes in Stratospheric Circulation Changes

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After a decade of development at the ESRL/GMD, the balloon-borne AirCore sampling system is now being used by several groups around the world as a relatively cost-efficient way to capture and subsequently measure more than 95% of the atmospheric column. The AirCore, which is essentially a long tube with one end open and one end closed that is lifted by balloon to altitudes as high as 30 km and returned to the ground by parachute. It takes advantage of the fact that molecular diffusion length scales in a few hours to a day are small relative to its length (>50 m). By analyzing the air captured on descent with a high precision calibrated analyzer it is possible to get a detailed profile of the atmospheric carbon dioxide (CO_2), methane (CH_4), and carbon monoxide (CO). The resulting dataset of measurements has provided us with critical constraints for remote measurements of the total column and upper free troposphere/stratospheric CO_2, CH_4, and CO.

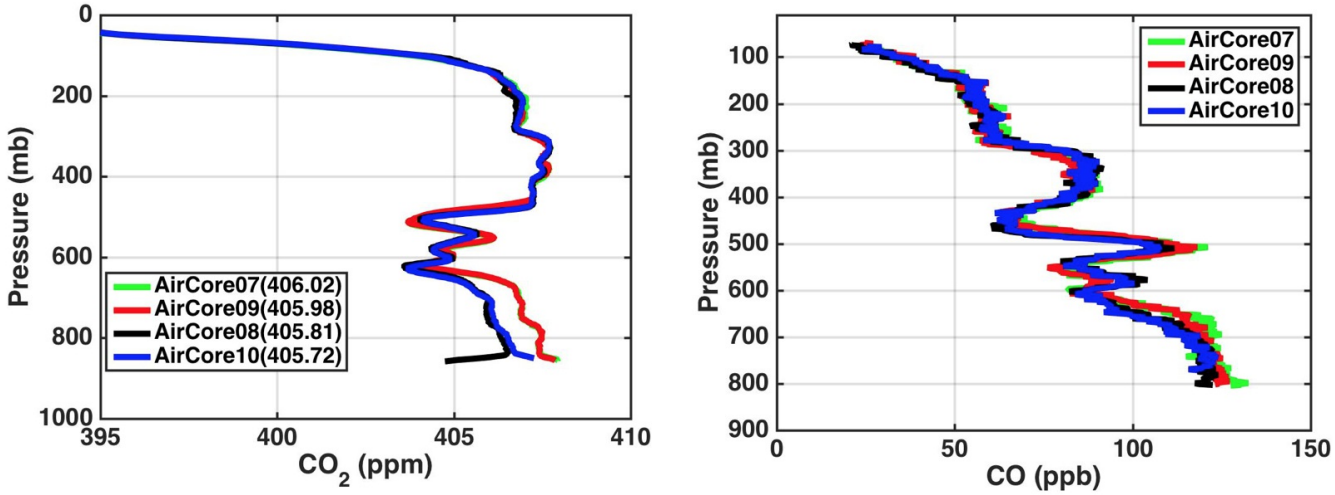

Figure 1. AirCore flight up to 27 km on July 14, 2017 showing CO_2 and CO profiles of 4 different AirCores. For each balloon launch two AirCores were flown together (AirCore 07 together with AirCore 09, and AirCore 08 together with AirCore 10). Balloon launches were 15 minutes apart. The comparability of the AirCores flown in pairs indicates only small differences in the profiles (<0.03 ppm for CO_2 and <5 ppb for CO) while larger difference are shown between the two balloon launch indicating large spatial variability in the free troposphere CO_2 profile in particular.