AirCore: An Innovative Atmospheric Sampling System

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This work describes the AirCore, a simple and innovative atmospheric sampling system. The AirCore used in this study is a 150m long stainless steel tube, open at one end and closed at the other, that relies on positive changes in ambient pressure for passive sampling of the atmosphere. The AirCore evacuates while ascending to a high altitude and collects a sample of the ambient air as it descends. It is sealed upon recovery and measured with a continuous analyzer for trace gas mole fraction. The AirCore tubing can be shaped into a variety of configurations to accommodate any sampling platform; for the testing done in this work it was shaped into a 0.75m diameter coil. Measurements of CO_2 and CH_4 mole fractions in laboratory tests indicate a repeatability and accuracy of better than 0.05ppm for CO_2 and 0.4ppb for CH_4 under a variety of conditions. Comparisons of AirCore data with continuous *in situ* and flask data in aircraft field tests indicate average absolute differences of 0.3ppm and 5ppb for CO_2 and CH_4, respectively, with no apparent bias. Accounting for molecular diffusion and flow-induced mixing, the expected measurement resolution for CO_2 and CH_4 is 110m at sea level and 260m at 8000m above sea level after three hours of storage, decreasing to 170m and 400m, respectively, after nine hours. Validation tests confirm that the AirCore is a robust sampling device for many species on a variety of platforms including balloons, unmanned aerial vehicles, and aircraft.

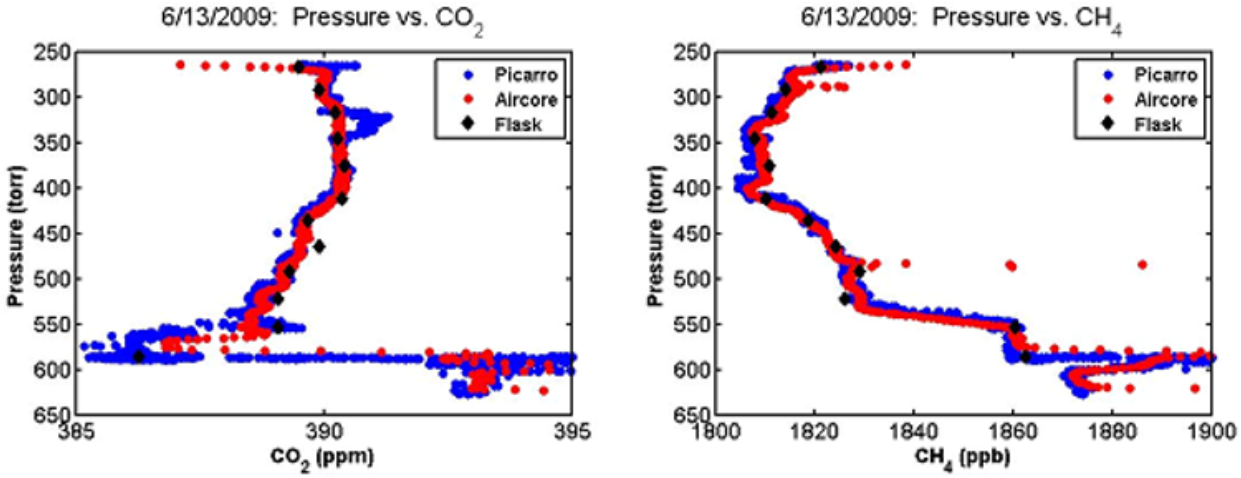

Figure 1. Pressure profiles for CO_2 (left) and CH_4 (right) by three different methods from a profile Cessna flight on 13 June 2009.