

## Air as Syrup – The Flow and Mixing of Air in the AirCore

P. Tans<sup>1</sup>, C. Sweeney<sup>2</sup>, A. Karion<sup>2</sup>, T. Newberger<sup>2</sup>, S. Wolter<sup>2</sup> and J. Higgs<sup>3</sup>

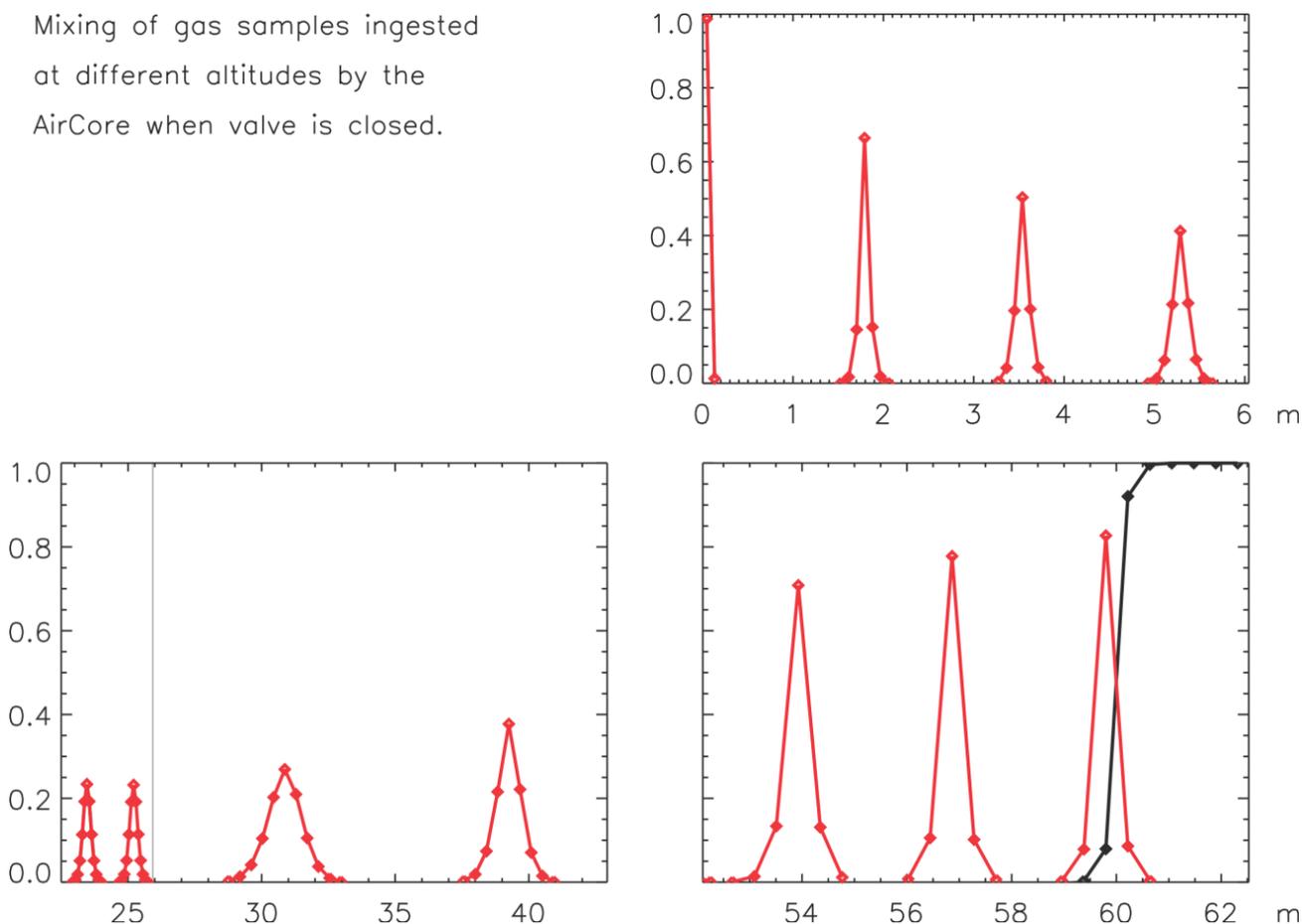
<sup>1</sup>NOAA Earth System Research Laboratory, 325 Broadway, Boulder, CO 80305; 303-497-6678, E-mail: pieter.tans@noaa.gov

<sup>2</sup>Cooperative Institute for Research in Environmental Sciences, University of Colorado, Boulder, CO 80309

<sup>3</sup>Science and Technology Corporation, Boulder, CO 80305

The AirCore is a long tube that collects a continuous vertical sample of the atmosphere. Initially filled with a well characterized dry reference gas mixture, it is carried by a balloon to altitudes of up to 30 km. During ascent, with one end open and the other closed, the initial fill air flows out as the atmospheric pressure drops. During descent atmospheric air flows back in, while the new air compresses the air already in the tube toward the back end. Surprisingly little mixing takes place so that a detailed vertical profile of atmospheric composition is obtained. “Read-out” takes place by using a known reference gas to push the sample slowly through an analyzer. The dynamics of filling the tube are modeled using measurements of atmospheric pressure and temperature as well as the temperature of the tube during the flight. Mixing of the sample is calculated due to molecular diffusion and the velocity shear inside the tube during laminar flow.

Mixing of gas samples ingested at different altitudes by the AirCore when valve is closed.



**Figure 1.** Mixing of equal-mass parcels of sample air as a function of position along the tube when the valve is closed. This AirCore consists of 26 m length of 1/4” diameter tubing at the open end and 37 m of 1/8” diameter at the closed end. Initial fill air (black) remaining at the closed end has not substantially mixed yet with sample air (red).