Exploring the Use of Compressed Gas Mixtures as Water Vapor Transfer Standards

B. Hall[1], F. Moore[2], D. Hurst[2], and A. Jordan[2]

[1]NOAA Earth System Research Laboratory, 325 Broadway, Boulder, CO 80305; 303-497-7011, Fax: 303-497-6290, Email: Bradley.Hall@noaa.gov
[2]Cooperative Institute for Research in Environmental Sciences, University of Colorado, Boulder, CO 80309

Understanding the distribution of water vapor in the upper troposphere and lower stratosphere has long been a goal in the atmospheric science community. Measurements of water vapor mixing ratios have been carried out using several different methods aboard aircraft and balloons. Some hygrometers are based on first principles (e.g. frost point or spectroscopy), while others are based on the change in capacitance of a thin polymer film with changing humidity. In either case, calibrations are generally reserved for the laboratory. This is due, in part, to the fact that humidity generators, typically cryogenic frost point generators or bubbler/dilution systems, can be cumbersome to operate in the field. We have explored the use of humidified air in electropolished stainless steel cylinders as transfer standards. Cylinders of compressed air containing known, stable water vapor concentrations would be very convenient for checking the calibration of airborne hygrometers before and after flights. They might also be useful for field-based comparisons. Preliminary tests were performed using ultra-pure zero air containing 10-500 ppm water vapor in 34-L electropolished stainless steel cylinders. Several mixtures were used to compare the responses of a tunable-diode laser hygrometer and a cryogenic frost-point hygrometer. The stability and reproducibility of water vapor mixtures will be discussed.

Figure 1. Electropolished 34-L stainless steel cylinder used to develop water vapor standards.