Measurement of Uncertainty

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A measurement without an uncertainty is hard to use. Before one can use it, one has to do a lot of work to estimate the missing uncertainty. Manufacturers provide limited assistance by supplying detailed reports on their stability tests of a few 'typical' instruments. They understand their instruments better than users, but their work usually stops once the instrument leaves the manufacturing facility. This talk will discuss the Earth Networks design for continually measuring four sources of uncertainty at each site: instrument drift, tank drift, line contamination, and water vapor correction uncertainties. One measures uncertainty by measuring a known quantity and comparing the measurement to the known true result, or by measuring the same unknown quantity two ways and comparing the measurements to each other. For instrument drift we, like all others, compare to a calibration tank with known mixing ratios. For tank drift we continually compare two tanks at each site. For line contamination we continually compare two lines at each site. We were unable to measure water vapor two ways or compare to a standard. Since we cannot measure this uncertainty in the field, we instead try to make its contribution negligibly small by drying the gas before measuring the water vapor content. Details will be provided about how the Earth Networks calibration system allows us to measure each of these uncertainties.

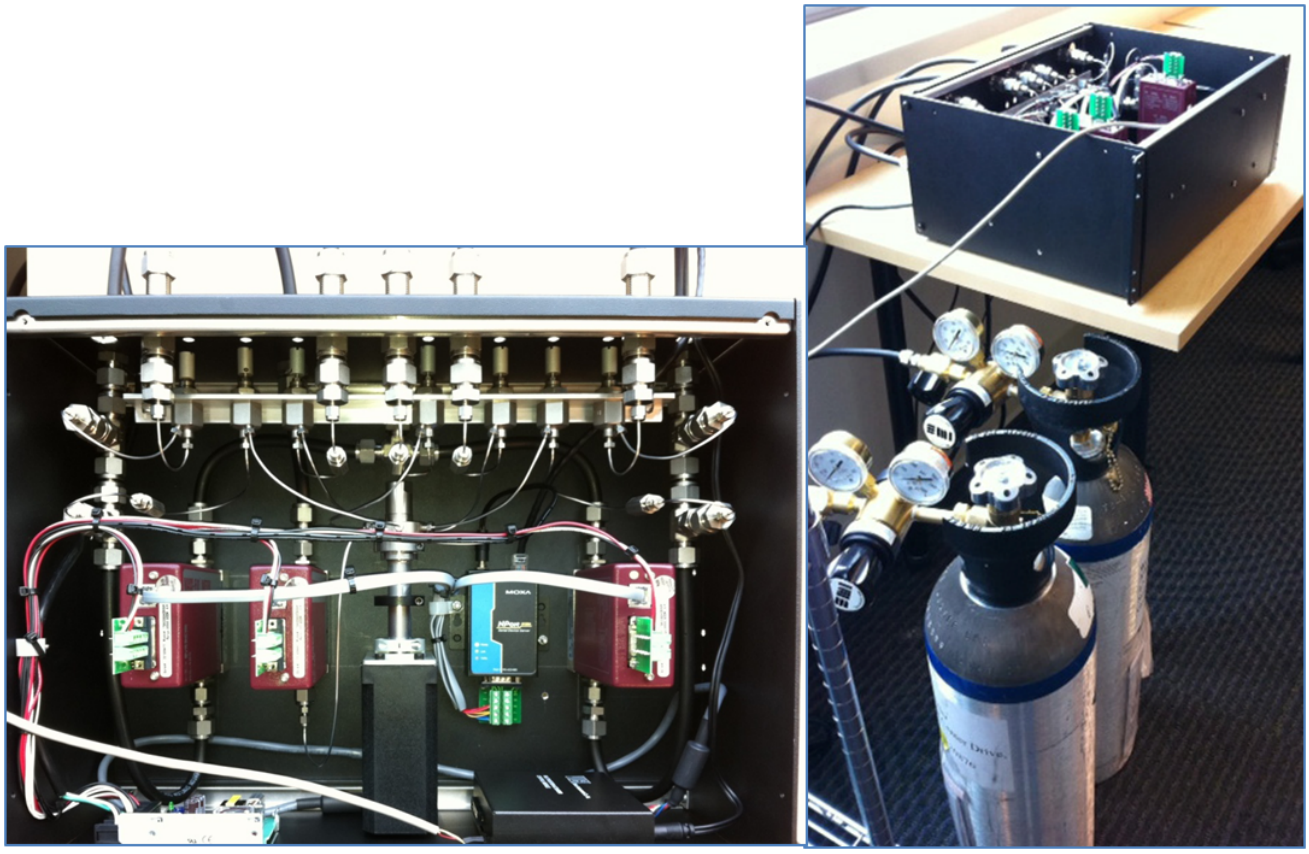

Figure 1. Earth Networks, in collaboration with Scripps Institution of Oceanography, have developed a system for calibrating gas analyzes and monitoring their ongoing well-being. The system includes a calibration box and two air tanks filled with air containing known levels of gases.