A Reanalysis of Inter-laboratory Comparisons as the Stable Isotope Lab at INSTAAR Switches to the JRAS-06 Realization of the VPDB Scale

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The INSTAAR Stable Isotope Lab has a twenty-eight year record of measurements of stable isotopes of carbon dioxide (CO_2) from the ESRL/GMD Global Greenhouse Gas Reference Network. Until now we have been tied to the Vienna Pee Dee Belemnite (VPDB) scale by measurements of the primary reference material NBS19 done in the early 1990's and then carried forward by bootstrapping of working references. Following the recommendations of the Greenhouse Gas Measurement Techniques stable isotopes community, we are moving to the Jena Reference Air Set-06 (JRAS-06) tie to VPDB, produced by the Central Calibration Laboratory (CCL) for delta carbon-13 ($\delta^{13}C$) and delta oxygen-18 ($\delta^{18}O$) of CO_2 at The Max Planck Institute for Biogeochemistry (MPI-BGC), in Jena, Germany. We can now re-examine our suite of comparisons with other laboratories to see if our compatibility has improved.

Our offsets from the CCL decreased significantly: in a comparison of flasks filled with air and measured by both labs, the agreement in ambient delta carbon-13 dioxide ($\delta^{13}CO_2$) improves from -0.05 to -0.01 ‰ (Jena-INSTAAR). Our $\delta^{13}C$ agreement in the last round robin improved from -0.04 ‰ to -0.02 ‰. INSTAAR calibrates cylinders for many other laboratories, so our move to JRAS-06 will greatly improve inter-laboratory compatibility. However, many laboratories still use locally-produced realizations of JRAS-06, and discrepancies persist in correction algorithms, especially for oxygen-17 (^{17}O). INSTAAR is making a major step toward implementing WMO-GAW recommendations, and other laboratories will need to do the same in order to achieve the data quality objectives of 0.01 ‰ and 0.05 ‰ for $\delta^{13}C$ and $\delta^{18}O$ respectively.

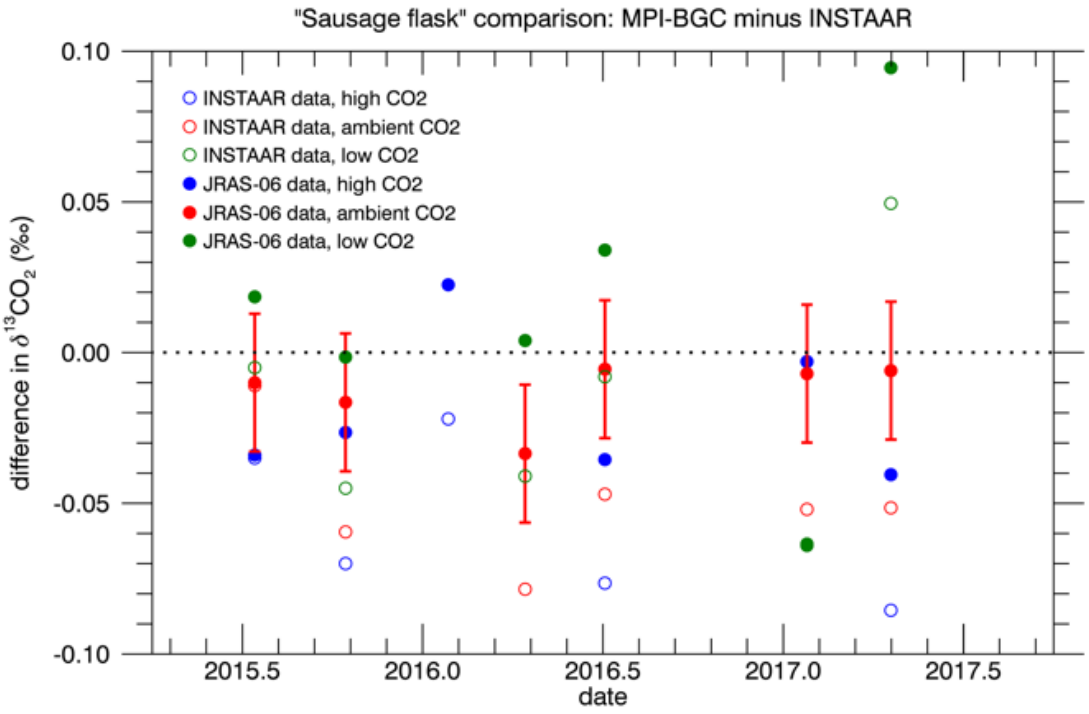

Figure 1. Offsets between MPI-BGC and INSTAAR measurements of flasks filled from high pressure cylinders. Open circles are on the old "INSTAAR" scale; closed circles are on the JRAS-06 scale. Colors represent low, ambient, and high CO_2 mole fraction of the fill gas.