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Atmospheric Measurement Techniques Discussions

Interactive comment on "Evaluating calibration strategies for isotope ratio infrared spectroscopy for atmospheric $^{13}CO_2/^{12}CO_2$ measurement" *by* X.-F. Wen et al.

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General comment. This is a very practical and very handy paper. It is well written, with a clear structure and a well identified goal: the quantitative inter-comparison of two major commercially-available CO2-isotope analyzers (one from Picarro, the other from Los Gatos Research). Many research groups recently invested in such instruments, which have a high potential for long-term and high-resolution isotope monitoring. Isotopes are powerful tools in the identifications of sources and processes, but isotope analyses by classical methods require costly instruments, skilled people and time-consuming processes. Since the emergence of these instruments, which are apparently easy to

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use, many scientists started to include isotope measurements in their research. However, some are not trained in isotope chemistry, nor backed by trained analysts. This may end up in poor-quality data and even cast doubt on the performance of this new generation of instruments. Comprehensive short courses such as some given during international conferences or such as this paper by Wen et al. are thus welcome to provide the community with the necessary background. It is well known in spectrometry analysis that the dependence of the d13C on the CO2 concentration must be measured and corrected. It took long for some commercial dealers of IRIS instruments to admit it. This may even take longer for end users not trained in isotope chemistry. However this is of crucial importance, especially when these measurements are used for Keeling plots. Incidentally, it is also shown that the calibration methods recommended by the manufacturers for their instruments are not good and lead to much larger d13C errors than what the pure (and practically meaningless) Allan deviation is giving. It is puzzling why manufacturers are not conducting such types of evaluation before selling their instruments (or before writing user's manuals when such documents are available).

Specific comment. The dependence of the d13C on the CO2 concentration of each instrument taken separately, for each calibration method, deserves a complete analysis. I wander why the authors only discussed the difference between 2 instruments or between 2 calibration methods. In Fig. 5 for example, why using the difference Picarro – Los Gatos? Also I think that Fig. 4 might be misleading for some people: it must not be confused with the dependence of the d13C on the CO2 concentration for a given instrument. There is no practical reality to use the difference Picarro – Los Gatos as nobody will run the two instruments at the same time. The difference has little meaning: one instrument may depend on the CO2 concentration, not the other. Trying to quantify the dependence of the d13C on the CO2 concentration for each instrument would be of more interest. This may help to understand why different calibration methods may yield similar results for one instrument and not for the other. Indeed, not knowing the mixing ratio seems to be of increasing importance with increasing CO2 concentration for the Los Gatos instrument (see Table 1). Also, Fig. 7 only shows data for the Picarro

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instrument while the label on the Y axis refers to some d13C difference (with very high values). There must be an error in the Y label and the data for the Los Gatos instrument should be shown equally, as in the other figures, so that the authors are easier to follow.

Technical corrections. P 799, line 9. Air is flowing through a Nafion tubing then through a Drierite-filled cavity. I would recommend using a Nafion tubing embedded in Drierite. This would prevent for potential memory effects and reduce air residence time. What is the dead volume of air in Drierite? Any effect of CO2 interaction with sorbed moisture? P 800, line 15. I= 1, 2. It is not clear that it also means that i=a. Please rephrase. P. 803, line 19. What is the pore size of the Swagelok filter? P. 807, Line 6. "Loa" must be replaced by "Los" P. 807, Line 7. "The Nafion dryer... should yield an outlet dew point...". It seems that the moisture has not been measured. Please explain why "should yield". P. 808, Line 26. Add "Table 2" to (2.00‰ Method 1). P. 809, Line 3. "by the regression shown in Fig. 6a". Please add ", in the case of the Picarro analyzer." P. 809, Line 9. "In Eq. (15), the delta error (d) is ..." P. 809, Line 11. Remove "that". P. 809, Line 15. It is not clear where E=0.15‰ comes from. Please explain. P. 809, Line 20. Add "As given in Table 2" in the sentence beginning with "For the Picarro analyzer". P. 812, Line 11. Typo error: "Agrinie" should read "Agrinier". P. 817. Fig. 1. Any clue for the bump in the Allan deviation of the CO2 concentration from the Los Gatos analyzer?

Interactive comment on Atmos. Meas. Tech. Discuss., 6, 795, 2013.