Atmos. Meas. Tech. Discuss., 8, C1346–C1349, 2015
www.atmos-meas-tech-discuss.net/8/C1346/2015/

Atmospheric Measurement Techniques Discussions

Interactive comment on "Comprehensive laboratory and field testing of cavity ring-down spectroscopy analyzers measuring H_2O, CO_2, CH_4 and CO" *by* C. Yver Kwok et al.

Anonymous Referee #1

Received and published: 2 June 2015

General comments:

This study is impressively comprehensive in the breadth of its testing of Picarro model cavity ring-down spectroscopy (CRDS) analyzers. Further, due to the scope of the ICOS infrastructure, the sheer number of units tested by the MLab (47) means that this data set is likely to be representative of the performance of these instruments in general and therefore of considerable interest to many users of this new generation of instruments for atmospheric measurements. The authors present a clear account of a large range of tests across different models, different chemical species and in both laboratory and field conditions. This elucidates a range of issues relevant to the

CRDS technique including the water vapor correction, and pressure and temperature effects. They eventually formulate a series of practical recommendations for obtaining high quality data from these instruments. Such recommendations are likely to be of practical use for many new (and existing) users of these instruments as the number of relatively inexpensive units proliferates. Section 4.4 'Calibration and linearity', is a clear illustration of the ability of this new technique to shed light on the accuracy of the assigned calibration scales. The referee recommends publication in AMT and looks forward to the forthcoming publication focusing further on water vapor effect in these instruments.

Specific comments:

The definition of the short-term drift has altered between generations of instruments. Could the authors comment on why this change has occurred, noting that one of the authors is based with the manufacturer? Also, since the raw data must exist, is it possible to standardize this measure by recomputing the short-term drift of the older generation of instruments with the new definition?

On page 4225, lines 24 & 25: "The isotopic composition of these last cylinders is controlled to correct for any bias compared to natural air." Do the authors mean 'controlled to correct for' or do they mean that the isotopic composition is matched to natural air to avoid bias? I would like clarity on this and think many readers could benefit from a sentence or two as to why this is necessary. I.e. that the CRDS instruments are sensitive only to the major isotopologue and therefore the measurement of 'CO2' or 'CH4' is actually a measurement of 12C16O2 or 12CH4 that is scaled to total CO2 or CH4 based on the isotopic composition of the calibration standards.

There are a lot of figures in this paper and many of them are currently of insufficient size or resolution for a reader to easily make sense of them. They are detailed and busy, but small. I recommend moving some of this detail to the Appendices. For instance, Figures 3, 4 and 5 could be moved to an Appendix and Figure 6 (essentially a summary

of the preceding three figures) enlarged so as to be more legible. Table 1 could also be moved to an Appendix.

Technical corrections:

p. 4220, l. 16, insert ‘project’ after ‘infrastructure’. l. 24, add ‘s’ to budget

p. 4221. l. 4, delete ‘order of magnitude’ l. 21, delete ‘s’ from end of requires

p. 4222, l. 10, delete second instance of the word ‘first’ l. 20, add ‘s’ to the end of follow

p. 4224, l. 16, add ‘s’ to the end of ‘follow’

p. 4226, l. 7, insert ‘to’ after ‘referred’

p. 4228, l. 18, replace ‘answer’ with ‘response’

p. 4229, l. 8, replace ‘during’ with ‘for’ and delete the instance of ‘for’ after ‘min’ l. 17 ff, This sentence is unclear to me. I suggest it becomes, ... “evaluated through the same calibration cylinders for the first instruments (4 calibration plus a lower and higher concentrated cylinder”. . . if this is indeed what the authors mean.

p. 4230, l. 12, insert ‘to’ between ‘and’ and ‘estimate’ l. 24, replace ‘than’ with ‘as’

p. 4232, l. 3, insert ‘us’ after ‘allow’

p. 4234, l. 8, replace ‘in’ with ‘on’

p. 4238, l. 29, replace ‘in’ with ‘on’

p. 4239, l. 13, replace ‘that’ with ‘than’

p. 4240, l. 16, insert ‘us’ after ‘allows’ and replace ‘of’ with ‘for’

p. 4241, l. 1, insert ‘us’ after ‘allow’ l. 6, replace ‘to note’ with ‘notable’ l. 18, insert ‘in’ before MHD41 and replace ‘is’ with ‘are’

p. 4242, l. 17, insert ‘for CH4’ after ‘fractional change’

p. 4248, Table 1 caption. Suggest, “The 47 analyzers considered in this study. Their serial number, model, ICOS number and date of purchase. . .”

Interactive comment on Atmos. Meas. Tech. Discuss., 8, 4219, 2015.