Atmos. Meas. Tech. Discuss., 7, C2885–C2887, 2014
www.atmos-meas-tech-discuss.net/7/C2885/2014/

Atmospheric Measurement Techniques Discussions

Interactive comment on "Development and field testing of a rapid and ultra-stable atmospheric carbon dioxide spectrometer" *by* B. Xiang et al.

Anonymous Referee #1

Received and published: 24 September 2014

Overview

This manuscript describes field testing of a second generation spectrometer designed for measurement of atmospheric CO2. Improvements over the first generation instrument are presented, along with data from an 8-month deployment at a typical field site. The performance of the instrument in its current form is impressive. While the authors suggest that this instrument could be operated as an "absolute device", the use of minimal calibration gas seems like a relatively easy way to improve the performance and provide quality control.

General Comments

Overall, the manuscript is well-written and should be of general interest. Publication is

recommended with minor corrections.

Specific Comments

P8102, L3: Suggest to use the SI unit "μmol/mol" on first use of "ppm". Also applies to p8013, L20.

P8102, L14: delete "another". "Field measurements agree well with those of a commercially available ...."

P8103, L9: Suggest re-phrasing as " ... deployed in situ, and variations in the composition of gas delivered to the sensors may limit the accuracy of the measurement."

P8103, L29: While the performance of the ABC is certainly impressive, it may be comparable to that of an un-calibrated Picarro (see fig 12a in Andrews et al., 2014, Atmos. Meas. Tech., 7, 647–687, 2014).

P8104, L19: check McManus et al citations. McManus et al (2010) not found in reference list.

P8015, L21: What is the isotopic composition of the 4% CO2 in the reference cell. Does this matter?

P8017, L27: Possibly mention the set-point for temperature control here. From Fig. 3 it appears to be 298K, but could also mention in text.

P8111, L6. It is not explicitly stated if the air samples analyzed by ABC were dried. I assume they were with reference to Xiang et al 2013, but a statement specifying the drying procedure should be added. P8112, L11: Check spelling of "Scot-Marrin".

P8112, L26: I object to the term "tank science". Knowledge and experience related to the stability of trace gases in cylinders is no different to that related to any other critical component or experimental design. We, as scientists, must simply discover what works best. In that sense is "tank science", really any different from "pressure transducer science", "optics science" (e.g. fringes), etc.? Confirmation of the benefits

AMTD

7, C2885–C2887, 2014

of aluminium over steel is worth mentioning. Why not leave it at that?

P8113, L11: Comment on accuracy: To be used as an absolute device (i.e without calibration), a traceability chain would need to be established. I can see that, in principal, the ABC could do this, but it would require periodic re-calibration of the quartz reference cell, and temperature and pressure sensors to establish traceability to national standards, or periodic comparison to a “reference ABC”. The expense and work required to do this would not be trivial.

P8113, L19: Overall I agree that this system has the potential to offer very stable CO2 measurements, but I would change “without costly reference gas transport and consumption” to “with minimal reference gas consumption”. Fig 4a: Results of the high and low surveillance tanks (moving in opposite directions) suggests a linearity change during the period. For practical deployment, the use of reference gases, even sparingly, would likely improve the results.

Fig.6: Since steel tanks are known to be poor choices as reference materials for long-term CO2 measurement, does including them in Fig. 6 add any information? It just seems to complicate the issue. Either the steel tanks were not properly calibrated in the first place, or out-gassing of water vapor o

---

Interactive comment on Atmos. Meas. Tech. Discuss., 7, 8101, 2014.