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Interactive comment on "System for δ^{13}C-CO_2 and $x$$CO_2$ analysis of discrete gas samples by cavity ring-down spectroscopy" *by* Dane Dickinson et al.

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Final author comments to peer review and manuscript revisions

We would like to once again thank the two anonymous referees and associate editor for reviewing our work and providing both encouraging and critical comments.

We have directly responded to each of the referee comments with author replies. From these and editor comments, we have subsequently revised our paper. Here below we list the relevant amendments and improvements. Supplement to this we have uploaded a copy of the revised manuscript with all changes tracked and marked.

Significant changes in revised manuscript:

- Clarified all discussion points about achieved precision of our method and eliminated the confusion stemming from comments about sample-throughput performance (sample turnover rate and measurement precision are entirely independent of each other).
- Added a new discussion section (Sect. 3.4) to outline the potential applications of the method (with particular regard to soil headspace studies). Made clear expected precision for sample measurements in headspace studies:
  - For natural abundance samples, precision in δ^{13}C-CO_2 of repeated measures (inter-sample) is ca. 0.15 ‰ .
  - The precision of a single sample measurement (intra-sample) will be ca. 0.2 to 0.5 ‰ (which reflects the noise of the CRDS analysis over the short 30s measurement period of the sample) and this also depends upon $x$$CO_2$ level (higher $x$$CO_2$ gives better precision; Fig. S1a).
- Have better explained the functionality of our software script that manages the measurement process:
  - The script's data analysis works in real-time.
  - The trigger and detrigger points are detected and the operator prompted accordingly.
  - The software directs the user when to introduce the samples.

Minor changes in revised manuscript:

- Incorporated comparisons of previous methods' sample throughputs in order to give context to performance of our system.

- Altered legends for Figs. 5, 6, and S1 to accord the "inter-sample" and "intra-sample" terminology used in the body text for describing measurement precision / data variance. We also have rectified the unintended omission of the caption to Fig. S1.
- We have adjusted our reports of precision so as to not give the impression that our measurement method provides better precision than previous / other methods. We have more explicitly explained that precision achieved in our method chiefly reflects the precision of the underlying CRDS analyser.
- Clarified and more thoroughly discussed the sources of variance in the long-term repeated measurements data (9-month period, 200 measures). More directly explained that the observed increase in variance in these data is likely due to instrument drift but could equally be due to transient inconsistencies in the syringe method.
- Removed the reference of CF-IRMS measurement performance (Prosser et al., 1991) to avoid a direct performance comparison.
- Various improvements in wording, grammar. Fixes of typos and formatting mistakes.

Other comments:

- One point raised during peer-review concerned our citation of a separate paper of ours that we recently submitted to *Rapid Communications in Mass Spectrometry* (RCM). That paper covered calibration of CRDS gas analyser under conditions of highly enriched ^{13}C abundance. We are pleased to report that the peer-review process of that paper is completed and publication in RCM is forthcoming. http://onlinelibrary.wiley.com/doi/10.1002/rcm.7969/full

- We have produced a short supplementary video showing our method in operation. This provides a demonstration of how to perform the syringe measurements as well as visual depiction of the physical measurement set-up. The video is currently available at (later to become formal video supplement): https://youtu.be/jqVFUO-EuCk

Please also note the supplement to this comment:
https://www.atmos-meas-tech-discuss.net/amt-2017-57/amt-2017-57-AC3-supplement.pdf

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