Hydrol. Earth Syst. Sci. Discuss.,
https://doi.org/10.5194/hess-2017-453-AC2, 2017

Hydrology and Earth System Sciences
Discussions
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Interactive comment on "Non-destructive estimates of soil carbonic anhydrase activity and soil water oxygen isotope composition" *by* Sam P. Jones et al.

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Received and published: 3 October 2017

We would like to thank the reviewer for their time in reviewing this manuscript. Please see the uploaded supplementary material for our responses to their comments.

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Discussion paper

Response to Anonymous Referee #2

We would like to thank Referee #2 for taking the time to review the manuscript. We have reproduced their comments, in blue, along with our responses in below.

To start with, the statistical analysis of the data should be improved, and that part of the Methods description should be elaborated and improved. As statistical method to assess the treatment effects in this study I recommend linear mixed effects models, see e.g. [Gueorguieva and Krystal, 2004; Crawley, 2009]. Crawley, M. J. (2009), The R book, 942 pp., John Wiley & Sons Ltd, Chichester. Gueorguieva, R., and J. H. Krystal (2004), Move over ANOVA: progress in analyzing repeated-measures data and its reflection in papers published in the archives of general psychiatry., Archives of General Psychiatry, 61, 310-317.Anon: Wiley: The R Book, 2nd Edition - Michael J. Crawley, [online] Available from: http://www.wiley.com/WileyCDA/WileyTitle/productCd-0470973927.html (Accessed 14 September 2017), n.d.
Thanks, we agree that a proper description of the statistics used was lacking and now have added a full description of our approach to the method section as suggested. We are not sure a mixed effect modelling approach is the best way forward for our data. We conducted a total of 18 incubations, with 6 incubations for each of the three levels (i.e. addition of $\delta_{iw,lam}$, $\delta_{iw,med.}$ $\delta_{iw,high}$ water) of water treatment. Whilst repeated measurements were made (i.e. the gas fluxes at different inlet conditions) on each incubation these are reduced to single parameters when regression coefficients are calculated. We test whether there are significant differences between soil properties or model parameters (determined from these coefficients) among water treatments. As such, we consider the 18 incubations to be independent for these tests. For this reason and as we are testing for differences between three population means (of the same factor / categorical independent variable i.e. δ_{iw} treatment), we used one-way analysis of variance. We chose not report statistical test of treatment effects for the gas flux data shown in Table 2 (and section 3.3), however, the reviewer is correct that a mixed effect modeling approach would be appropriate here. Hopefully the suggested improvements to the methods clarify this point.

P10 L23: *"Treatment summaries are reported as mean and standard deviation unless stated otherwise. A total of 18 incubations were conducted on sub-samples of same homogenised bulk soil. Six independently replicated incubations were conducted for each of the three δ_{iw} water treatments. Soil properties and model parameters were determined individually for each incubation as described above. Differences in soil properties and model parameters among δ_{iw} treatments, with statistical significance reported at $p < 0.01$, were tested through one-way analysis of variance with post-hoc comparison by Tukey's HSD (Crawley, 2007; Mendiburu, 2016). To do so, a given property or parameter was taken as the dependent variable and δ_{iw} treatment as the categorical independent variable."*

I noted that the reference that is currently used in the Statistics part is missing on the reference list (Mendiburu, 2016).
The reference for Mendiburu was present but the new-line after the previous reference (Massman, 1998) was missing making it hard to see. We have corrected this, thanks.

Moreover, the Results section should be improved. In long parts many values are listed, e.g. means and error estimates for several parameters and treatments are spelled out in the text. I suggest to check which values are already given in the Tables, and to consider moving more of the values currently given in the text into Tables to refer to.
Following this advice we have removed duplicated numbers from the text and expanded Table 1.

Also, the authors are using many acronyms throughout the text. I find they are too many and this makes the text in parts hard to read. I suggest to reconsider which acronyms are central and to keep these, but consider to spell out certain variables (i.e. avoid too many acronyms). Alternatively, you might add a list of acronyms to the manuscript and refer to it repeatedly, to facilitate for the reader to look up the meaning of all acronyms during reading.
We agree that the manuscript makes use of several symbols that may need to be re-defined regularly to help the reader and, at the same time, we feel that the symbols used are vital to clearly relate to the methods without lengthening the text. For this reason we were careful to select consistent and logical symbols e.g. $\delta_{iw,ce}$ for soil water isotope composition determined following cryogenic extraction or $\delta_{iw,eq}$ for soil water isotope composition determined to be in equilibrium with CO_2 from gas flux measurements. However, we understand that following multiple symbols through a text can be difficult for the reader. In acknowledgement of this point, we have removed a number of less central symbols (e.g. δ_{atm}, $k_{air,uncat}$, PTFE, GWC) and refer back to the meaning of important symbols at key points in the hope that this prevents the reader from having to search back through the text for first usage.

Please check as well that all acronyms are actually defined upon first use, and consider to even define acronyms that are common in your field but may not be obvious to all readers of the article (e.g. VPDBg and VSMOW-SLAP).
Done, thanks.

The same applies to the Tables and Figures, please include in footnotes or legend the meaning of the used acronyms (if you decide to keep them), with the goal that Figures and Tables can be understood independent of the text. As example I refer to the legend of Fig. 6, which contains four acronyms and is difficult to understand in its current form.

Fig. 1.

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