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Interactive comment on "Versatile soil gas concentration and isotope monitoring: optimization and integration of novel soil gas probes with online trace gas detection" *by* Juliana Gil-Loaiza et al.

Anonymous Referee #2

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I would like to congratulate the authors on what I found to be a very interesting and informative paper on a very important topic. The prospect of deciphering the source of gas emissions based on isotope ratios, in-situ and with minimal soil disturbance is very exciting, and I look forward to seeing where this research goes next. I have no major comments, and my minor comments are mostly related to making this more accessible to people less-well versed in these kinds of analyses (like me!).

Minor comments:

Is there still control air coming through the bottom of the column when the probe is incubated in soil, or only for flushing the column for rapid redox state shifts?

Can the authors add in a sentence about the response/equilibrium time (if it can be deduced from the flow rates) for the gasses in the system in the setups shown, and how does that compare to other published probe setups? This would be especially important for highly temporally dynamic and depth-stratified systems.

Why did the authors choose to sample destructively in the soil setup rather than recirculating the air through the column after going through the TILDAS? It doesn't seem like TILDAS is a destructive method so a closed system should be possible (and possibly more desirable) for the soil experiment and more amenable to translating the setup to controlled in-situ studies. I would assume that an open system with fresh ultra zero air would just generate a concentration gradient and accelerate influx, such that the relative difference between actual and perceived gas concentration would be greater at high flow rates compared to low flow rates after accounting for dilution. But that there is also a counteracting equilibration time effect at fast flow rates (which is what is shown in figure 4 and 6, without necessarily parsing out the magnitude of concentration gradient and time to equilibrium effects).

Maybe something to speculate on whether it would be possible to make the detector volumes even smaller so that the probe volumes could be smaller and perhaps depth-resolved, or whether the whole system would need to be re-developed. This would be a really useful for any system where the soil is strongly depth resolved in terms of chemistry and/or temperature (ex thawing tundra or forest floor)

Typographical comments:

Soil texture for S1: if the clay+silt = 66%, then the sand cannot be > 34%. L600 with rather than without?

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