Atmospheric
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Discussions

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Interactive comment on "Optimization of a gas sampling system for measuring eddy-covariance fluxes of H₂O and CO₂" *by* S. Metzger et al.

Anonymous Referee #2

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1   General comment

This paper describes the effect of the system components of enclosed IRGA (LI-7200, LI-COR) including rain cap, particulate filter, intake tube (with/without heater), flow modules on the measurements via various laboratory tests and field experiments. In this study, the Neon requirements were adopted as the criteria to be established. Laboratory tests were focused on the effect of the size and design of rain cap, selection of particulate filter and tube on the high-frequency attenuation, and on the effect of the selection of particulate filter and flow rate on the pressure drop. On the other hand, field experiments were focused on the effect of the heating of filter and tube on the

spectral attenuation, with the special emphasize on the H_2O response issue.

I think this paper is generally well written and informative, but it is somewhat wordy and not easy-to-follow. Subject to addressing the comments below, the paper would be appropriate for publication in AMT.

2   Specific comments

2.1   Major points

1. I think the citation of "NEON requirements" throughout this MS reduces readability. Though the list of NEON design requirements are provided in the supplementary, I recommend to create a table to show some part of these requirements (criteria) needed in this MS, or to add them to Table 4. Also, I'm curious about how such NEON requirements (criteria) were determined, which is not provided in the supplementary and should be noted (e.g., citations of the original studies).

2. Authors cited the presentation results by De Ligne et al.(2014), but it has been published as a discussion paper (Aubinet et al., 2015AMTD).

3. To improve the readability of this MS, I encourage the authors to separate the theoretical part and the experimental design part in Section 2.

4. Authors finally recommended to use the 70 cm stainless steel tube with 4.8 mm ID, but they compared two kinds of tubes only, and it is not objectively confirmed which length is a good compromise or how long is acceptable. Also, the 4-W heating of filter and tube is the lowest setting of their experimental design, and it is not clear whether the lower setting (e.g., 3 W or lower) is acceptable. Therefore, they just found the "best combination" within their experimental design, which can fit the requirement by NEON.

2.2 Minor points

Title As pointed out by Referee #4, I also recommend to add the term "enclosed gas analyzer".

P10993P17–P10994L3 Readers cannot see the design and results of this CFD experiment. And the related descriptions were found in P11000L10–11 and P1103L20–25 only. Is it really needed?

P10988L11 I could not find the part number of LO (9972-054) in the LI-COR website, and I just found 9972-043 as the old-design cap. Is this number (9972-054) correct?

P10991L1 Provide the unit of Q_v (it will be cm^3 s^{-1})

Section 2.2 I think the Figure 2 in the supplementary (study-summary.docx) is important. Please include it in the main manuscript, which is a good visual information of the field experiment.

P10999L5 "LPM Hz^{-1}" is the unit of the coefficient 2.167; thus this form of writing looks strange.

P11001L23 "2.0 μm particular filtering" is it correct? Or is it a typo of "particulate"?

P11002L2–3,L4 Pall open-face 2μm filter is not shown in Tables 1 and 3, and Figure 3.

P11002L8–9 Though De Ligne et al.(2014) did not show the half-power frequency, Aubinet et al.(2015AMTD) shows. Please check their discussion paper.

P11006L2 Add (T_{in}) to read "the sampling cell inlet temperature (T_{in})"

P11006L2 Add (T_a) to read "above ambient (T_a)"

P11006L3–4 Add ($T_{in} - T_a$) and delete "above ambient" to read "this difference ($T_{in} - T_a$) decreased to 0–3 $^\circ$C."

P11006L4 Add ($T_{in} - T_{out}$) to read "the temperature gradient in the sampling cell ($T_{in} - T_{out}$)"

P11006L6 Add ($T_{in} - T_{block}$) to read "the temperature difference between the sampling cell inlet and block ($T_{in} - T_{block}$)"

P11005L9–10 Add ($T_{in} - T_a$) to read "the increase in sampling cell inlet temperature above ambient ($T_{in} - T_a$)"

P11006L10–13 Can you provide the scatter plot of these experiments, i.e., $T_{in} - T_a$ against T_a (ΔT_a?) with/without the sampling cell heating?

P11008L12 According to the lower panel of Figure 6, the performance (high-frequency response) of LN (4W) is similar to LO (4W) when RH < 60%, but much worse than LO (4W) when RH > 60%. Why? Does it mean the LN rain cap is not recommended for the wet condition such as tropical rain forest?

P11011L20–12 No, De Ligne et al.(2014) as well as Aubinet et al.(2015AMTD) also pointed it out.

P11011L25–27 De Ligne et al.(2014) and Aubinet et al.(2015AMTD) also described the same conclusion about the filter.

Figure 4 Line graph is good to show the continuous variation such as temporal variation. In these cases, bar graph or point graph with error bars is preferable.

Figure 5 Please specify that the gap (missing data) in this figure correspond to the water ingress occurred on 14 July 2013 in the figure caption or on the graph.

Figure 6 Legends of these plots are confusing. The description "LO (non-heated)" and "LO (heated)" are required also in the upper and middle panels.