

**Date:** Tuesday, November 12, 2024

To,

Russel Dickerson  
Handling Editor  
**Atmospheric Measurement Techniques**

Sub.:- Submission revision RC2 of research paper to the atmospheric measurement techniques

Dear Sir,

Greetings of the day, I hope you are doing well! With reference to the above-cited subject, we are resubmitting herewith the revised version of research paper on **“A simplified system to quantify carbon dioxide, water vapor and heat within a maize canopy (egosphere-2024-2041)”** to your esteemed journal **“atmospheric measurement techniques”**. Authors are grateful to the reviewer for a careful and helpful analysis of our manuscript. Undoubtedly, due to the Reviewer`s comments, the manuscript has been significantly improved. All the reviewer`s comments are reasonable, and we have corrected the MS in accordance with the comments and suggestions

Thank you for receiving our manuscript and considering it for further processing. Authors appreciate your valuable time and look forward to your response.

Sincerely yours,

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## **Major comments**

the presentation of Fig. 2, especially regarding the transit/sampling time, needs further clarification. The first question is: should we expect the same pattern for intake 2 as shown for intake 1? I do see the first few seconds data of intake 1 should be discarded while the remaining data are stable and good for analysis. But where are the stable, equilibrium regions for intakes #2 and #4? I presume that a similar stable region and the same amount of data points are desired for each height/intake.

- ✓ Yes, not only 1 and 2 but all intake tubes have the same sampling time. After careful consideration, we decided to remove Table 1 (IRGA output for the multipoint air sampling system, for CO<sub>2</sub> conc. (430 ppm) fed through the sampling lines at ambient pressure) and Figure 2 (The time-dependent relationship between the infrared gas analyzer (IRGA) in the multipoint air sampling apparatus for a gas concentration of 430 ppm CO<sub>2</sub> flowing at <1 L/min) from the manuscript, as it raised additional questions and complexities not central to the primary objectives of our study. The initial purpose of this figure was to demonstrate that the instrument was accurately measuring a known CO<sub>2</sub> concentration (430 ppm) using different intake tubes, which was a verification step supporting the field trial described in the text that follows. In the revised manuscript, we have clarified that both N<sub>2</sub> (0 ppm CO<sub>2</sub>) and CO<sub>2</sub> (430 ppm) were used to test the stability of the system and confirm that the analyzer and switching mechanism were functioning correctly. We believe that the removal of this figure enhances the clarity and focus of the manuscript.

The second question is: at line 181, the authors mentioned that the 4.9 s delay time was improved to 3.2s but did not tell how this was achieved. Did the authors either increase the flow rate or change the tube length? Also, why not show a figure with 3.2 seconds delay since it's the most recent and reasonable result? Using 4.9 seconds delay is confusing here.

- ✓ Thank you for bringing this to our attention. We made a mistake. In fact, actual timing for measurement was 3.1 seconds and 4.4 seconds were ignored during the CO<sub>2</sub> reading by the analyzer. This has been briefly explained in the revised manuscript.

2) This concern is about section 3.1 Experimental Site. First, the authors started this section with introducing their field instruments and setup, then move to a subsection talking about the basics about the field site. Would it be logically better to introduce the experimental site first, then describe the field measurement setup?

- ✓ This is the valid question of the reviewer, and we agree that logically experiment site should first and then the field measurement setup. In the revised manuscript we have incorporated the reviewer's suggestion

Second, should subsection 3.2 belong to Methodology? It's odd to put it under the section Field Measurement Setup.

- ✓ Thank you for bringing this to our attention. We have moved subsection 3.2 under the result section.

3) Another concern is about section 4. First, starting at line 247, this paragraph delivers almost the same message as the paragraph above and adds nothing new. Second, starting at line 295, Fig.7b and 7c are mixed up in the figure and in the text, making it hard for readers to follow. The rest of this section lacks further discussion on the results, such as the advantages/limitations of this system compared to other similar studies/systems, a more comprehensive description on what aspects this system can be useful for in future micromet studies.

✓ Thank you for your feedback. We have addressed the concerns you raised in the revised manuscript. We have removed the reputation you mentioned in the revised manuscript. We have also fixed the figure 7 a, b & c in the revised manuscript. We have given a complete paragraph describing how this study can be useful for future micromet studies at the end of the result section. Similarly, the limitation of the study has been given in the conclusion and summary. See the revised manuscript.

**Minor comments are also listed below:**

Highlights: the second and third bullet points convey the same meaning: neglecting the storage terms leads to inaccuracies (point 2) while considering it leads to an improved accuracy (point 3). In addition, how this consideration of storage fluxes improved the accuracy of energy closure was not shown in the study. Full budget calculations with/without the storage terms are needed to prove that.

✓ Yes, we agree with that highlight 2 & 3 conveying same message. We have removed point 2 and added new highlights. We agree with the reviewer that how this consideration of storage fluxes improved the accuracy of energy closure was not shown in the study. Actually, this paper focuses on the development of the system to measure the storage terms for considering them in the energy balance closure. How this instrument can advance science involve in modeling etc. Our 2<sup>nd</sup> study focused on calculations of full budget with/without the storage terms.

2) Line 53, the previous two references (Lamas Galdo et al., 2021 and Wang et al., 2023) are very recent, can you find a more recent one to replace this 2004 paper?

✓ Recent references have been added in the revised manuscript (e.g., Hoeltgebaum and Nelson, 2023).

3) Line 56, same as above. Replace this one with a more recent paper if possible.

✓ Recent reference (Varmaghani et al., 2016) have been added in the revised manuscript

4) Line 67, is there a newer paper discussing how many sites are measuring storage? This number must have increased since 2006.

✓ We have updated the number of sites in the revised manuscript and also provided recent references (Fluxnet; Pastorello et al., 2020).

Line 108, a period is missing before 'These'.

- ✓ Thank you for your attention. A period has been added before “these” in the revised manuscript.

Line 115, the first 'and' changes to 'as'.

- ✓ Thank you for your attention. “as” has been replaced with “and” in the revised manuscript.

Line 115, 'To minimize consequences of individual sensor offsets'. My comment: Actually you avoided the consequence of inconsistency in sensor offsets because you were using a single sensor rather than multiple, so I think you could just say "avoid" instead of "minimize" because it was no longer an issue.

- ✓ Thank you for your comments. “minimize” has been replaced with “avoid” in the revised manuscript.

Line 162, '3.2 seconds were ignored' changes to 'The first 3.2 seconds of data were discarded, and the remaining ...'

- ✓ Thank you for bringing this to our attention. We made a mistake. In fact, actual timing for measurement was 3.1 seconds and 4.4 seconds were ignored during the CO<sub>2</sub> reading by the analyzer. This has been briefly explained in the revised manuscript. These time was monitored during the laboratory evaluation of the system for our understanding.

9) Line 162, maybe I missed that but I don't think you have mentioned the frequency of your data so far. Is it 10Hz, 20Hz or else? Since you start to talk about data here, readers may wonder how many data points are there in 4.3 seconds.

- ✓ The frequency of data was 10Hz which is mentioned in 2.1 Apparatus design and operation. After careful consideration, we decided to remove Table 1 (IRGA output for the multipoint air sampling system, for CO<sub>2</sub> conc. (430 ppm) fed through the sampling lines at ambient pressure) and Figure 2 (The time-dependent relationship between the infrared gas analyzer (IRGA) in the multipoint air sampling apparatus for a gas concentration of 430 ppm CO<sub>2</sub> flowing at <1 L/min) from the manuscript, as it raised additional questions and complexities not central to the primary objectives of our study. The initial purpose of this figure was to demonstrate that the instrument was accurately measuring a known CO<sub>2</sub> concentration (430 ppm) using different intake tubes, which was a verification step supporting the field trial described in the text that follows. In the revised manuscript, we have clarified that both N<sub>2</sub> (0 ppm CO<sub>2</sub>) and CO<sub>2</sub> (430 ppm) were used to test the stability of the system and confirm that the analyzer and switching mechanism were functioning

correctly. We believe that the removal of this figure enhances the clarity and focus of the manuscript.

10) Line 164, I don't get this 1.8 seconds. You just said 3.2 seconds is the delay time but now you have another delay time. Is the 3.2 seconds delay for the entire switching system and the 1.8 s delay for the IRGA separately? If you did not use this 1.8s delay time for your flux data calculation, I think it would be better to not mention it to avoid confusion.

✓ 1.8 seconds mean system takes 1.8 second to produce steady or continuous reading of CO<sub>2</sub>, and H<sub>2</sub>O. After 1.8 seconds there is no gap (missing data points) recorded. Yes, we did not use this data recorded during this delay period for flux calculation. The 1.8 second is out of 3.2 seconds. The timing was just for our record to check the response time.

11) I don't see any results about the environmental data such as precipitation, temperature, wind, etc. Such data could provide useful information or at least context about this specific location.

✓ A new table 1 is added where precipitation, temperature and storage terms data are provided along the cop height and growth stage. For wind speed see the figure 4. Both table 1 and figure 4 are added into the revised manuscript.

12) Line 211, 'A)' for what?

✓ Thank you for pointing out the mistake. "A)" has been deleted in the revised manuscript.

13) Line 213, font size changed.

✓ The front size has been fixed in the revised manuscript.

14) Line 260, times of sunrise and sunset are NOT shown.

✓ We have deleted "times of sunrise and sunset are shown" from the description of figure 5 and described the time of sunrise and sunset in section 3 experimental site in the revised manuscript.

15) Line 262, '15-minute'. My comment: this is the only place you mentioned the average time for flux calculation. You should do this earlier in the method section.

✓ Thank you for bringing your attention. "constructed from 15-minute" has been deleted as It was already described in the methodology section (2.1 Apparatus design and operation).

16) Fig. 5 and Fig. 6: Need to provide a separate table/graph showing how the heights of the intakes were adjusted during the two-month study period (at least in the supplementary materials). Moreover, the sampling heights in these figures are not consistent with what the authors described earlier. For instance, in the figures, the maximum height for the

second level is 1.4 m (0.5h), which means max canopy height  $h$  is 2.8 m. Then the max height for the third level ( $1+h$ ) should be 3.8 m and the max for the top level ( $2+h$ ) should be 4.8 m. However, in either figure the maximum heights are only 3 m for the third level and 4.4 m for the fourth level. This inconsistency needs explanation.

- ✓ The instrument evaluation study was conducted for six weeks from May to end of June 2023 (for your clearance, results are provided for only 6 weeks measurement). The maximum height for H1, H2, H3, and H4 was 0.11m, 1.27m, 3m and 4.36m respectively. In the revised manuscript the measurements along the height and growth stage are provided in table 1.

17) Line 303, there were both positive and negative storage before 2000LT.

- ✓ Latent heat storage (Fig. 7c) fluctuated about zero for most of the daylight hours, after exhibiting a major positive excursion ( $> 4 \text{ W m}^{-2}$ ) during the few hours after sunrise. After about 2100 LT, similar fluctuations occurred until sunrise, with an average of about  $-0.5 \text{ W m}^{-2}$ . We have explained it clearly in the revised manuscript.

18) Fig.7: figure letters a-c need to be placed at the same corner.

- ✓ We apologize for misplaced letter a-c in fig 7 but placed correctly in the same corner in the revised manuscript