Atmospheric
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Discussions

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Interactive comment on "Estimation of nocturnal CO_2 and N_2O soil emissions using changes in surface boundary layer mass storage" *by* Richard H. Grant and Rex A. Omonode

Anonymous Referee #2

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General Comments

This manuscript describes measurements on carbon dioxide and nitrous oxide concentration increases in the nocturnal stable surface layer to arrive at fluxes. The technique is not new, but the manuscript provides additional data to the scientific community.

Overall, the methods are sound and the structure of the paper is appropriate. The study covers a period of low N2O fluxes, which creates some additional challenges for the measurements. Below are several specific comments that the author should address.

Specific Comments:

1. Page 1, line 24. The use of the concentration change within the stable surface layer is also a "micrometeorological" technique. Your method is one of the micromet tools available.

2. Page 1, line 26. The community usually uses "eddy covariance" instead of "eddy correlation".

3. Page 2, line 21. I couldn't find that SBL was defined.

4. Page 2, line 22. Molecular diffusion rates are closer to 10^-5.

5. Page 2, line 22. Qualify that you mean typical turbulent diffusion coefficients during daytime. We can argue a wide range before we get to molecular diffusivity at night.

6. Page 3, line 26. I think you mean that the N2O MDL is 0.3 nL/L, not ul/L?

7. Page 3, line 28. The manual for this instrument suggests better than 1 uL/L; is your value related to precision or accuracy?

8. Page 4, line 5. The van de Wiel reference is quite recent, whereas similarity theory has been developed much earlier. Please give original references.

9. Check typographical (spelling) errors: e.g., Page 4 line 19 and line 26.

10. Page 4, line 27. Why were the chamber measurements made during the day? Can you give the audience an indication about how the chamber measurements would cycle diurnally? Recall that your comparison is with the night.

11. Page 5, line 6. You use 30-minute chamber measurements for a relatively short period on each day. It would seem more reasonable to report the measurements on a reasonable time unit; typically umol/m2/s is used. It is misleading to scale this to units of "per day" with such a small, biased sample.

12. Page 6, line 1. Be consistent; use friction velocity instead of shear velocity here. Also, in several places, variance is used when you define standard deviation (sigma

w). Be specific.

13. Page 6, line 2. The term "z-less" tends to be a very specific term used with stable atmospheres. Please define this if you think the word is needed. Same issue on Page 8, line 8.

14. Page 6, line 9. It would help the audience to use consistent units. In this paper, most readers would really prefer that you use units such as umol/m2/s throughout. The fertilizer community often uses mass of N, but mass units really don't help this paper (and you use mass of N2O, not N). In this particular line, we are given a concentration in uL/L and then you switch to gradient of mg mˆ-4.

15. Page 6, line 24. Should not say w'; this would mean the variance of the deviation.

16. Page 8, line 26. The literature reported in Table 1 is quite selective. Please tell us why you chose these specific papers.

17. Page 9, line 11. You say "generally lower". Please quantify that it was about a factor of 2 to 5 less. Given this magnitude, what can you say about the possibilities of the technique? Also, most researchers gap-fill night periods using various techniques. Is your stable atmosphere measurement better than gapfilling these periods?

18. Page 9, line 30. I am confused why you think that advection of N2O from soybean would necessarily have a lower concentration at this time of year. The fertilizer applied to the corn field was much prior to your measurement period. This actually resulted in very low N2O fluxes through your measurement period, typically about 10% of the peak measurements that most researchers measure following fertilizer application.

19. Page 10, line 9 and 12. It looks like the accumulation method was a factor of 2 to 5 less than the chambers. These statements appear to mislead that they were close.

20. Table 2. The superscripts on the column labels look like powers; please just label the columns to avoid this. Also note that sigma w is standard deviation, not variance.

21. Table 3. Same issue with superscripts. The gradients are written as differential equations. In fact, you do not know this information; you have estimated this from finite difference measurements between heights. Please label appropriately.

22. Figure 3 (a). Is this the absolute value of the difference in wind direction? It is always positive.

23. Figure 3 (b) and (c). In other parts of the paper, you plot sigma w. But here you show variance; why?

24. Figure 4 (a). Variance is indicated on the right axis, but the units don't match.

25. Figure 6. If this is an accumulation starting at 1900, why don't the accumulations start at zero?

26. Figure 8. "h" is used for hour in most places, but now rainfall uses "hr".

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