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Atmospheric Measurement Techniques Discussions

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Interactive comment

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

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The only major addition I would like to propose is a broader discussion of the technique in the context of other techniques used to estimate gas exchange between land and atmosphere. In particular, I would like to see a comparison with the eddy covariance and the radon mass balance techniques (e.g. Biraud et al., 2002, Tellus, 54B, 41-60) in terms of their precision and the scale of the observed 'footprint'. As indicated below, an eddy covariance component to the project was not possible but would be helpful in future efforts to evaluate the method. The fetch indicated study (Biraud et al, 2002) cannot be used in the current study since: 1) they assumed wind flowing in a constant direction while the flow during the night events presented here clearly changed direction commonly, 2) the mean wind used in their study were on the order of 5 m/s while our study worked in a BL with mean wind speeds of 1 m/s, 3) their study is based on the entire atmospheric boundary layer (ABL) not the surface boundary layer (SBL) and as such accumulation near the surface in teir study was assumed equivalent for all gases while we observed different accumulations for N2O and CO2, 4) because of the depth of the BL,the rate concentration increase at the surface and the averaging period (and lag periods) are much longer than 1.5 hours, 5) the study is based on synoptic scale events and turbulence scales not local surface boundary layer turbulence scales, 6) as a result of the ABL framework and selection of daytime and nighttime events based on synoptic conditions, the events include both unstable and stale conditions within the entire ABL, 5) as a consequence of the time scales and dominance of daytime instability, the 'footprint' is much larger than the present study timescales, winds, and stability conditions, and 6) the depth of the ABL and the footprint dimension will result in a precision that is not relevant to nocturnal SBL emissions estimates. In agreement: Increased time duration from 2 to 12 h was found by Biraud et al. to decrease estimated flux. We also found that increasing the period from 1.5 h to 3 h decreased the flux estimate.

Minor issues âĂć Title: instead ". . .using changes. . ." perhaps ". . .from changes. . ."? Ok âĂć Page 2, line 12: ". . .mass accumulations are reported for CO2, CH4, N2O, and H2. . ." Since H2 is consumed by soil microorganisms, I would expect H2 concentrations to decrease in the nocturnal boundary layer, not to accumulate. True, it was a depletion rather than accumulation for that gas. Omitted. âĂć Methods: Please show coordinates of the experimental field, or at least tell the reader in which country, near which town, it is located. Coordinates added. âĂć Page 3, line 30: "measured", not "measure" corrected âĂć Precision of reported fluxes, e.g., page 7, line 15, and Table 4: How meaningful is it to report the value of a mean flux to the second digit after the decimal point, when the standard deviation is larger than the mean itself? This does not factor in to any of the rules of significant digits I know of. However, I have reduced the significant digits at Page 7 and on gradients and N2O accumulations in Table 4 in careful accordance with the rules: Since the data has 1 significant digit after the decimal point (N2O measurement error of 0.5 ug/m3, height measurement error of 0.1 m) and 1 significant digits after the decimal point (CO2 measurement error of 0.009 mg/m3, height measurement error of 0.1 m) significant digits, the flux could likewise have the same number of significant digits and the least accurate measure. The rest of the text uses fewer significant digits than possible (as described above). âĂć Mass accumulations, first paragraph: Were the comparable fluxes cited here done in a similar climatic region, with similar land management (e.g. N fertilisation)? I cannot determine where/what you are referring to. âĂć Page 8, line 29: The first sentence in this line states a trivial fact and can be deleted.OK âĂć Page 9, Discussion of lower N2O accumulation compared to chamber fluxes: Another possible explanation is that chamber fluxes were measured during the day, when soils tend to be warmer than during the night. Other parameters being equal, N2O flux from soil increases substantially with soil temperature. Diurnal chamber flux measurements were made during this part of the season with measurements showing very little difference. I have added the results of the short study.

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