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Atmospheric Measurement Techniques Discussions

**AMTD**

3, C1351–C1354, 2010

Interactive Comment

# *Interactive comment on* “Field intercomparison of two optical analyzers for CH<sub>4</sub> eddy covariance flux measurements” *by* B. Tuzson et al.

**Anonymous Referee #3**

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General Comments. This is a very good paper describing two rather new instruments and their use towards measuring eddy covariance fluxes of CH4. The authors are quite thorough in their analysis, from instrumental spectroscopic interferences to micrometeorological corrections. They present an especially good description on the effect of water vapor on absorption measurements. The authors also describe a novel system for generating an ecosystem-level flux (albeit, on a relatively small spatial scale), which allows them to produce CH4 fluxes with adequate signal to make robust comparisons between the two analyzers. Although their experimental design could be improved, it is adequate enough to provide a good comparison of these two analyzers and their use toward measuring ecosystem-level fluxes of CH4. Apart from a few minor changes, this manuscript merits publication.

Specific Comments:

Page 2964, line 14. Omit the word "particle" in "particle density". Just use "density" or "number density". (the word "particle" implies aerosol)

Page 2966. Lines 1-2. What happens when the mirrors become contaminated to some degree during field studies? Does the calibration of the FMA change? I would be quite skeptical that a manufacturer's calibration will be valid for any instrument during extended field operations.

Page 2968 – General description of both systems. Although not a critical aspect to this paper, it might be informative to readers to give the power requirements of both CH4 systems which could be reported in Table 1. Scientists interested in using these techniques may work at remote sites that are power-limited. Since both of these systems require fairly large flow rates (i.e., a fairly large pumps), this may preclude their use at some flux sites.

Page 2968, Line 3-4. How did the sonic anemometers compare in terms of measured turbulence parameters, momentum and heat flux?

Page 2968, Line24. What material is the "custom-made sampling tube" constructed of? Although wall losses of CH4 would not be expected to be a problem, were any tests performed to test this?

Page 2971, line 7. I do not know what "cross coupling effects" are?

Page 2971, line 16. The scale is set by the World Meteorological Organization (WMO), not NOAA/CMDL.

Page 2973, line 14 (and many other places in the manuscript). The authors do a very nice job of describing the water vapor effects on the absorption methods described here. However, the word "cross-talk" is colloquial and should not be used. It is not accurate of the process being described. Cross-sensitivity is a more accurate description – or, better, call it what it is: a "collisional broadening effect."



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Page 2973, line 14 again. Doesn't the "cross-talk" coefficient depend not only on the device, but of the interfering species. The discussion here concerns $H_2O$, but other molecules have the potential to also collisionally affect line widths.

Page 2974. Lines 20-26. If you were unable to repeat the dilution experiment in the field – how do you know that your laboratory-derived water corrections are valid towards your field measurements using the FMA? If the filters were a problem with this experiment, how do they affect the measured $CH_4$ fluctuations during flux measurements? Do these filters affect $CH_4$ fluctuations indirectly by adversely affecting $H_2O$ fluctuations within the system?

Page 2976., Lines 5-6. If the $H_2O$ collision l broadening effects were applied improperly, would not the $CH_4$ fluxes still show a correlation with the $H_2O$ flux? I am not sure that the correlation with $H_2O$ flux necessarily proves anything in this instance.

Page 2979. Lines 10-18. Although they seem to give similar results (within 6%), why use 2 different spectral corrections methods on the 2 separate instruments? How large are the spectral corrections relative to the total measured flux? What about corrections for sensor separation? These could be substantial at such a low measurement height.

Page 2980, 1st paragraph. Much of this section suddenly shifts to the present tense (whereas the majority of the paper is in the past tense).

Page 2980, Lines 5-6. The use of an emission grid to generate a known flux is quite interesting, but it does raise some issues. It is unfortunate that the authors chose to have 2 completely separate EC systems instead of a single sonic anemometer and co-located inlets. This would have eliminated 2 sources of uncertainty in their flux comparisons: (1) variability between the anemometers and (2) the need for footprint corrections, which, as the authors point out, can cause significant problems during periods with variable wind directions (the footprint corrections would, of course, still be needed to compare to the calculated emission rate of the grid). However, given the described experimental setup, one needs to know how large the footprint corrections



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are for each system on the measured fluxes, or how the magnitude of these corrections compare between the systems (at least – on an average basis)?

Page 2980. Lines 28-29. Again I would point out that the author's are applying a lab-derived correction that could not be duplicated with the field setup. This lessens one's confidence in their results.

Figure 1. What is the difference between "intensive grassland" and "extensive grassland"?

Figure 4. Remove the word "cross talk" in the legend – use cross sensitivity.

Figure 6. Why not present the power spectrum in the top panel in similar fashion to the cospectrum in the bottom panel? The cospectrum shows the y-axis normalized for frequency and total covariance. If the power spectrum is normalized similarly, one can see the expected fall-off region for the 2 analyzers more clearly.

Figure 7. The addition of the boxplots into the time series plot of the bottom panel is confusing. They should be moved to a separate panel below the time series of the measured fluxes. Furthermore, there is no description of what the boxes, error bars, etc. represent in the caption.

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Interactive comment on Atmos. Meas. Tech. Discuss., 3, 2961, 2010.