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Atmospheric Measurement Techniques Discussions

Interactive comment on "Nitrous oxide emissions from managed grassland: a comparison of eddy covariance and static chamber measurements" *by* S. K. Jones et al.

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The paper reports on a series of intercomparison of two fundamentally different approaches to assess N2O fluxes over an intensively grassland system in Scotland. Both approaches, static chamber measurements and EC approach are well establish and give technically reliable results in case they are properly done. The difference in the two approaches are twofold: EC measurements do integrate over a scale depending on stability and measuring height of several thousand square meters, chambers only over a surface smaller than one square meter. In addition the chambers do influence the soil conditions. Consequently an intercomparison of these two approaches over

a grazed system is comparing apples and oranges and is likely to give unsatisfactory results. In the abstract the authors say “Difference between N2O fluxes calculated from chamber measurements and EC over the same measurement period were never significant”. This is somewhat misleading, the variability of both measurement is so high, that it is of course unlikely that a significant difference will be found.

I would like to see more information on the setup in the field, especially on the chamber measurements: when they have been placed, how was the grass treated beforehand etc.. Grazing and chamber measurements are mutually exclusive as the chamber must be protected from the animals. Chamber also cannot operate in case the grass is getting too tall. There is likely to be a hidden systematic management difference between the area that the chamber are measuring and the average field conditions seen by the EC measurements. This is important because plant residuals are an important energy source for denitrifiers.

The presentation of the time series in Figure 2 and the corresponding scatter plot (Figure 3) seems to give two different messages: The presentation of the time series shows satisfactory correspondence of the EC and chamber data for March 2007, Mai and June 2008. May and July 2007 shows a clear difference in the timing of the peak as well as in most emission levels, whereas June 2003 has a too poor data coverage to give meaningful results. The regression analysis partially contradict the impression that I got looking at the time series. E.g. The regression for the series from May 2007 is quite good, but the timing is clearly different. Part of this discrepancy might come from the fact that for the scatter plot mean values of the chamber data has been used. As the chamber data most likely are log normal distributed eventually the second lowest chamber values could be used. In case this would clearly improve the correspondence this is a hint that the spatial distribution of the N2O emission is a key influence that is acting against a better correlation.

The authors discuss also the appearance of uptake fluxes measured with the EC setup. They claim that the high values exceeding 100 ng N2O-N m-2s-1 passed the applied

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quality criteria and thus seem to reflect true exchange fluxes. In our paper (Agricultural and Forest Meteorology 150 (2010) 775–785) we estimated that the physical limit of an uptake flux is around 10 ng N2O-N m-2s-1. This goes along with the values found with the chamber data presented in this paper, but contradict the measured EC uptake fluxes. As the EC measurements are integrating over a large area, I would expect that at least part of the chambers in the footprint would see similar uptake fluxes. I think that EC quality check procedure has to be improved: how stable is the lag determined from the absolute maximum of the covariance function?, how is looking the cumulative spectrum?. I also would assume that a real uptake of the soil has a certain persistence. In case large negative fluxes do occur isolated, they seems more a sign of an instability of the EC setup as a whole. Consequently the detection limit as well as the variability of the EC setup is well above the indicated 11 ng N2O-N m-2s-1. Clearly there is room for improvement of the EC analysis!

Interactive comment on Atmos. Meas. Tech. Discuss., 4, 1079, 2011.