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Atmospheric Measurement Techniques Discussions

Interactive comment on "On-farm beef cattle methane emissions measured with tracer-ratio and inverse-dispersion modelling techniques" *by* Mei Bai et al.

Anonymous Referee #2

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The authors describe results from a measurement campaign, measuring methane emissions from cattle, comparing two techniques (based on either a tracer gas or inverse dispersion modelling). They find similar results from both techniques, which give higher estimates than the IPCC default. The paper is generally well-written and nicely succinct. However, it requires some more detail in a few areas, and there is considerable room for improvement.

General points:

1. Two different laser instruments were used, as well as the comparison of two different measurement techniques. The rationale for this is not very well explained, and needs

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expanded upon.

2. The IDM method is barely explained, and really only by reference to previous papers and the software web site. This needs at least a brief description and some key details.

3. How were the uncertainties calculated? This is important, and values needs to be included in Table 1. Statistical testing is not relevant, and reference to p values should be removed.

4. The advantage of the IDM method versus the tracer method is not very clear. The latter is simple enough to be explained in one equation. It seems to be the logistic problem of releasing the tracer versus the computational task and assumptions of running WindTrax. Scope for discussion at least.

5. Discussion - the agreement of the two method seems to depend on the spatial distribution of the animals, which comes down to the vagaries of the pen size and animal density. So a single 7-day experiment is not grounds to say that the agreement will generally be good. Does the spatial distribution of the animals affect both methods similarly? If not, why not? This needs expanding.

Specific points:

l 72: the tracer-ratio technique is indeed simple, but cannot be considered "true". The uncertainty associated with its estimates needs to be quantified. The point is presumably that these uncertainties are smaller than the IDM method, but this needs to be demonstrated. E.g. how predictable is the N2O release rate? The authors say this has to be corrected for temperature dependency, but presumably this is established in lab tests?

l 78:define exactly what Q_{ch4} is, with units.

l 110: could the data collected while the animals were absent be shown, to demonstrate the noise/sensitivity? This provides a neat control period with zero emission.

l 131: how big is the sensor drift? Is this a large uncertainty?

l 144: touchdowns - the whole Lagrangian particle idea needs to be explained.

l 146: spec.max?

l 149: why was the diel cycle used? What is driving the diel cycle in methane emission? Production rate should be constant, but emission will be affected by feeding behaviour, Or is this cycle a measurement artefact? This needs explaining. Other gap-filling methods might be better e.g. smoothers such as GAMs.

l 171: Yield needs to be explained.

l 216: This question is not answered very clearly. The authors seem to find no reason, except the IPCC value should perhaps have wider uncertainty bounds on it.

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