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Atmospheric Measurement Techniques Discussions

Interactive comment on "Using the tracer flux ratio method with flight measurements to estimate dairy farm CH_4 emissions in central California" *by* Conner Daube et al.

Anonymous Referee #1

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general comments

Daube et al. compare three methods of estimating methane emissions from a dairy farm. Two are well-established in the scientific literature: tracer release using a mobile laboratory and mass balance using an aircraft. The third is tracer release using an aircraft. They find generally good agreement between emissions determined using the tracer release/aircraft combination and the other two methods.

This paper extends the work of tracer release using mobile laboratories into the realm of airborne measurements. As such, it is a relatively straightforward analysis comparing the two methods. The only thing I find lacking is a more in-depth discussion of the

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Discussion paper

added complexity of the additional dimension, the vertical, that the aircraft can probe compared to the mobile laboratory. I think a plot of altitude vs. the CH4/ethane ratio might be informative. The authors briefly described this in the first paragraph of page 7, but I think a visual presentation might be better.

I also question the usage of a linear regression because of the need to align the two plumes. The tracer is presumably a point source, but a manure lagoon might be meters or tens of meters wide. I would expect sources such as this to have much broader plumes than the tracer release. Or worse yet, there could be two separate methane plumes, but only one ethane plume. The only way to properly account for this is by taking the integral. For example, what is the ratio of the integrals for the transect shown in Figure 2?

In Table 2, why do the emissions from Animal Housing and Liquid Manure add up to more than the Whole-site emission?

specific comments

The authors should be consistent with their use of the term “sub-source”. First, they should probably define it, because I’m not sure it’s a word. Second, I would prefer they simply use the word “source”, and remind the readers that a dairy farm is actually a combination of many different sources: cows, manure, settling cells, etc.

For Figures 2 and 3, I would clearly label (or title) these as Dairy 1 and Dairy 2, instead of burying this information in the caption.

p. 1, line 25: is that 60% of anthropogenic CH4 emissions?

p. 2, line 27: how “low and close” did the aircraft fly?

p. 6, line 8: what altitude was the aircraft at for the transect described here?

p. 6, line 28: I think this section needs a little introduction, instead of immediately delving into the ethane background. Which dairy is this? Introduce whatever Figure 4

is before referring us to it.

Figure 4 and p. 6, line 31: Based on horizontal wind speed, how long would you expect it to take to see the signal from the aircraft after the tracer had been released?

technical corrections

p. 2, line 12: should that reference be for “Grainger”?

p. 3, line 1: since ethane isn’t emitted from dairy farms, I suggest saying “. . . emitted from within dairy . . .”

p. 4, line 15: add “its” to read “. . . and its long atmospheric lifetime.”

p. 4, line 21: change to “molar enhancement ratio” and add comma after “The molar ratio,” p. 5, line 16: replace “generally” with “with speeds”

p. 5, line 26: why say “appear to represent”? I would assert that they do represent an entire site.

p. 5, line 32: “plumes” isn’t really the noun you should use in this sentence. You are talking about emission estimates here.

p. 6, line 4: instead of “recording data”, perhaps say “sampling the same plume”

p. 6, line 6: add comma after “22”

p. 7, line 30: I suggest “sparse number” instead of “sparse amounts”

p. 8, line 16: I suggest “circling at a particular radius”

p. 9, line 13: I suggest “independent” instead of “stand-alone”

p. 9, line 19: remove “of”

p. 13, line 3: I suggest “the wind is carrying the plume across the site. . .”

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