

Munich, January 15, 2020

Responses to the comments of reviewer 1

We would like to thank reviewer 1 for thoroughly reading our paper and providing very helpful and insightful comments. Below, please find our responses to the reviewer's comments.

General comments:

This very original paper shows that methane emissions from large festivals such as the Munich Oktoberfest are measurable and non-negligible despite the time-limited event. In-situ methane measurements around the festival area are evaluated with plume modeling to assess the emissions and their uncertainties. The study about this somewhat amusing but also serious topic is comprehensive and robust. It is well written, concise, and contains informative figures. I therefore recommend publication after consideration of the following comments.

Response: *Thank you very much for appreciating our work and supporting its publication.*

Specific comments:

1. p. 5 line 4: explain what is a Kaiser window, or give a reference

Response: *We have included a reference to explain the Kaiser window:*

*Kaiser, James F.; Schafer, Ronald W. (1980). "On the use of the I_0 -sinh window for spectrum analysis". IEEE Transactions on Acoustics, Speech, and Signal Processing. **28**: 105–107. doi:10.1109/TASSP.1980.1163349.*

2. p. 5 line 7: explain why you chose 5 ppb as threshold, and how your results change when you choose another value

Response: *We introduced a new sentence in the paper to explain why we chose the 5 ppb: "We chose this threshold to be equal to the combined uncertainty of the instrument (3 ppb) and background (4 ppb)"*

3. Figure 8: by comparison with Fig 9 I would expect a third, certainly smaller yet distinct peak around 8.5 ug/(m2s) due to the weekend emissions. Why is this peak missing in

Fig. 8? If Fig. 8 shows all emission estimates, then could it be that you did less measurements on a weekend day such that these measurements/samples are under-represented? In this case your overall emissions would be biased low.

Response: *We appreciate your thoughts. However, in Fig. 8 we show the distribution of the averaged emission numbers over the whole Oktoberfest time period, including during the week and the weekend. The spread of the Gaussian curve results from the uncertainty of the input signals, i.e. wind, background, measurement error. We have changed the first sentence of section 3.2, to make it clearer. The question about the bias is answered in the next comment.*

4. Maybe I have overlooked it: have you indicated how evenly in time your measurements were spaced, both over the course of the week, and over the course of the day (important for Fig.11)? An additional figure could clarify this and eliminate doubts about a systematic bias due to possibly irregularly spaced measurement times. Also, in case of weekend under- representation, you could introduce weights to your measurements.

Response: *The daily distribution of the measurements has been included to Figure 11. Furthermore, we included the following sentence to make clear how many plumes were recorded on weekdays and weekends, respectively: "After grouping the emission numbers into the two categories, weekday (in total 59 valid plumes) and weekend (26 valid plumes), two separated distributions are visible in Figure 9."*
The ratio between measurements at weekend days and weekdays is about 2 to 5, which is similar to their respective occurrence in a 7-day week. Therefore, we don't think that weekend days are underrepresented and need additional weighting factors.

5. Figure 11: include the number of samples in the caption if it is constant, or as an additional line if not.

Response: *Figure 11 was changed. It contains now the number of valid plumes for each hour.*

6. p. 5 line 6: better "minima", not "valleys"

Response: *We changed it to "minima" according to your suggestion*

7. p. 10 line 16: better "run", not "round"

Response: *We changed it to "run" according to your suggestion*

With best regards,

Jia Chen, Florian Dietrich on behalf of all co-authors