

In “Locating and quantifying CH₄ sources within a wastewater treatment plant based on mobile measurements” by Junyue Yang, et al., the authors describe an approach to quantify methane emissions from a wastewater treatment plant using a multi-point Gaussian plume model optimized by a genetic inversion algorithm. Atmospheric emissions from WWTPs come from a variety of source types and can be quite variable. This work makes a notable effort to combine previously tested methods to generate plant-level estimates. Overall, this manuscript offers a clear and comprehensive description of the experiment and attempts to position the work in context of the current literature in a compelling manner.

Comments (general):

1. Mobile measurements are described as “circling the functional area 1-2 times” for a given experiment. Was one experiment performed per day during the two campaign periods? Is this a sufficient amount of data to generate statistically-based conclusions distinguishing the different sources or seasonal effects? Given the nature and size of the sources, it seems feasible that numerous passes could be necessary to capture any variability in the operations. Some evidence of this is noted in the text (L365) where “the substantial variation in the emissions [...] suggests a degree of emission instability” for the aeration tank emission estimates. Based on Figure 5, all of the experiments are within the uncertainty of each other.
2. The characterization of the different sources (i.e., line and point) could be further detailed. Specifically, it would be helpful to see more about how the line source was determined beyond the note in the text (“substantiated by through model validation”, L221), perhaps in the Supplement? Also, it seems like the primary clarifiers resemble area sources more than line or point sources. How were they characterized in this work? As multiple point sources?
3. There appears to be no discussion on the possible effect of interferences from surrounding areas. Is there another WWTP neighboring the site? The satellite images show similar equipment or process areas in the adjacent lot outside of the “exterior road”. Also, the wind direction in Figures S5, S6, and S7 comes from an area on land with fields and some buildings, also outside of the subject area, which seem worth identifying. If the model or optimization algorithm address these interferences, then it should be explained in text.
4. In Table 1, wind speed on “0711” was listed as 0.9 m s⁻¹. Presumably, this is an average value. Was there a trend in the emission estimates relative to wind speed, specifically low-speed winds? Are there datapoints collected when wind speeds were below 0.7 m s⁻¹?
5. Discussion on how uncertainty was calculated is brief and non-specific. Further detail on the contributing factors and how the uncertainty was calculated is needed in the text (see L424 for context).
6. Consider emphasizing discussion of tracer flux ratio, also known as “tracer release”, as another top-down method that employs mobile measurements. This method was mentioned specifically in text as an example, but it is noted throughout other publications (Delre et al., 2017; Moore et al. 2023; Yacovitch, et al. 2015; von Fischer et al. 2017), including use for validation or comparison with other modelling techniques for similar applications.
7. Using units of t a⁻¹ could be useful for comparison-sake (e.g., with the IPCC inventory method), but given the limited number of measurement days, it seems like a significant extrapolation. Other studies present findings in kg h⁻¹ (as noted in the introduction) or also

otherwise normalized by other factors. Perhaps consider presenting the results in kg h^{-1} (or similar) with mention of the extrapolation (t a^{-1}) to offer the reader a quick comparison to other relevant figures.

Comments (line-by-line):

1. L23: replace “emission” with “emissions”.
2. L29: consider changing the verb tense of “are” to “is”.
3. L57: remove “ ’s” from “(IEA) ’s” or change sentence.
4. L63: clarify the meaning of “actual emission factors activity data” depending on the intent of the sentence. For example, “activity data used for actual emission factors”. Or if that’s not the intention, then perhaps, “activity-based emission factors”.
5. L137: change “Spectroscopy” to “Spectrometer” or add “monitoring system” as done in the Instrumentation section and elsewhere.
6. L147: is this “1-2 times” *per day*? Does each day comprise of one experiment? This should be addressed in the text.
7. L148: is a “set” equivalent to an experiment?
8. L148: what deems these datasets “valid” in this context?
9. L148: what happened to the other two days/experiments?
10. L157: were the less abundant isotopologues of CH_4 or CO_2 used in the data analysis? If not, it should be stated.
11. L163: how was the probe mounted “on” the roof and how did that position “mitigate the effect of vehicular emissions”? This should be addressed in the text.
12. L166: similar to the previous question, how was the meteorological unit mounted to the roof? Given the additional on-site wind stations, this may not be a critical point, but positioning of the wind unit close to the vehicle body will affect the measurement accuracy.
13. L169: specific the manufacturer of the SWS-500.
14. L242: make mg/s into mg s^{-1} for consistency.
15. L308: what does “the similarity of concentration measurement methods” mean? Wasn’t the same method applied to the whole dataset? Or is this a reference to the roads driven? The wind direction is clearly different. This should be addressed in the text.
16. L414: are these average values? Or is there only one estimate determined per day? This should be addressed in the text.
17. L414: while it’s relatively clear from context what the labels in this table mean (i.e., Q , W_s , W_d , γ , α) some more detail in the caption would be helpful.
18. L424: need more detail on the uncertainty estimates in the text. Is this a confidence interval?
19. L509-511: it is an excellent point that collaborative monitoring offers significant advantages.