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Atmospheric Measurement Techniques Discussions
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Interactive comment on "CH_4 emission estimates from an active landfill site inferred from a combined approach of CFD modelling and in situ FTIR measurements" *by* Hannah Sonderfeld et al.

Anonymous Referee #2

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GENERAL COMMENTS

The authors propose a study to infer methane emissions from sub-areas of a landfill site by using a computational fluid dynamics model, and they present a short field campaign as a dataset for the model validation.

The paper is well written, the introduction addresses the background issue satisfactorily, but the paper objectives (not the project ones) could be better clarified; similarly, the novel character of the work presented does not get through within the paper.

My main concern with this paper is that the observations presented are very few: the data are generally well described, but I think they are not sufficient for a full char-

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Discussion paper

acterisation and validation of the proposed model: for example, there is no data for describing meteorology-driven variations, and so on. However, this may not necessarily be the main focus of this paper, and besides, the presented work is of clear interest to the scientific community.

Measurements over three sampling days in the year can be considered a spot- measure, useful to verify rather than characterise an emission source: chemical reactions in the substrate and subsequent emissions can be driven by changing atmospheric pressure and temperature, for example, not only by the daily development of turbulence.

I see the presented work as mainly a modelling work: I think more emphasis should be put on the main advantages of the CFD models compared for example to backward Lagrangian models. I think this issue is touched upon in the abstract, but not in the conclusion, where it could be expanded. Also, the usage of LIDAR data and people surveying the site could be expanded in the method section (or in the conclusion). From what emerges from the results, the model seems fit for representing emissions in conditions of well-developed turbulence regime: however common this could be, it is a big limitation, and should be addressed in the conclusions, perhaps including criteria for good functioning of the model vs bad.

Overall, I think this work is well done and useful, but I recommend major revisions to be made.

SPECIFIC COMMENTS:

The description of the experimental site and of the FTIR and CFD methods, including the setup, is clear and well detailed; I think adding information on the dump age (the different sections of it) would be a benefit. The section with the background measurements would benefit from a better explanation on how the measurements were used, or explain it better in the results section.

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P6 L6: wind is not a fluid, air is.

P7 L10-15. I agree with the authors that the emissions from the hot spot areas are not representative of the landfill site, however I believe omitting those measurements does introduce a bias as well, in that they will be taken into account as much lower emission areas. For a model validation they may not be suitable, but under an observational point of view they should not be ignored. Perhaps you could expand on this point.

P8 L10-13. I think that here it is not clear why you need an enhancement factor rather than an emission ratio: what are the advantages of the technique you're using? Adding explanations would help the reader in understanding the value of your work.

P8 L10-15. It is not clear here when you did use the background measurements and when not: is it only for CO2? Is it only for some calculations? Explain better.

P8 L20. "wind field" instead of "wind".

P8 L28-30. Can you really conclude this from your data? Perhaps change the wording highlighting this is a possible interpretation.

P10 Table 1. The slope is an outcome of a regression, not a correlation.

P11 L8. Substitute "emissions" with "emitted gases".

The section on "methane distribution" is not very conclusive: what is the message here?

P12 L9. Molar mass density, not mass concentration.

P13 L17. Delete "are" after fluxes.

P13 L20. Any suggestions on what these extra sources could be?

P13 L27. Why do you think night fluxes should be higher? How is the production (emission of methane) connected to day/night pattern?

P13 L31-32. It is good to show all data for completeness, but it would be very useful to

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have possible explanations for peculiar data, or just further discussion.

P18 Figure8. Specify that concentration refer to the portakabin location as well.

P18 L14-18 This really would be sorted with a longer period of measurements. . .

P20 L5-10. This is not fully clear: are you suggesting that a larger area is wrong for there are e.g. roads in between, or non-emitting areas that are considered emitting? What would the suggestion be, if this is the case, and spell it out.

P20 L17-19. Specify the meteorological measurements are easy and can be maintained over long periods.

P20 L20. “stable” has a definite meaning when talking about atmospheric processes (I refer to stability parameters), and I am not sure you mean this here.

P21 L1-3. This last sentence seems to be there without having any evidence to support it.

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