

## ***Interactive comment on “Eddy covariance measurements of the net turbulent methane flux in the city centre – results of 2 years campaign in Łódź, Poland” by W. Pawlak and K. Fortuniak***

**Anonymous Referee #2**

Received and published: 15 March 2016

Pawlak and Fortuniak present CH<sub>4</sub> flux measurements that were collected over Lodz, Poland for a two year period. Long term measurements of urban CH<sub>4</sub> fluxes are still rare; therefore this dataset is of great use to the community. However, I do have some concerns that need to be addressed before this paper is published.

### Major comments

1) The quality of the writing needs to be dramatically improved throughout the paper. I've tried to point out specific areas where improvement is needed; however this list is not exhaustive. I suggest this paper should be thoroughly proofread. Removing repetition and shortening paragraphs will make the paper more readable.

C1

2) Source apportionment could be improved, currently it is limited and quite qualitative. Statements such as page 12 line 3 and page 13, line 10 suggest specific sources, but these are not justified. To improve this I suggest you further examine FCO<sub>2</sub> : FCH<sub>4</sub> ratios. Currently, these are dismissed due to a lack of strong correlation over daily and monthly averaged timescales. However, strong correlation might not always be expected, CO<sub>2</sub> and CH<sub>4</sub> have a mixture of common and unique sources. The ratio FCO<sub>2</sub> : FCH<sub>4</sub> will still give information about the relative abundance of different source types. Whenever a particular source type is suggested you should examine the FCO<sub>2</sub> : FCH<sub>4</sub> ratio and compare it to literature values for the source.

### Specific comments

Abstract Page 1, line 11 to 12- Reword e.g. “Long-term continuous measurements of CH<sub>4</sub> fluxes from cities are still relatively rare.” Page 1, lines 11- replace “turbulent exchange” with “flux” here and throughout. Page 1, lines 17 to 20 contain too much detail for an abstract. You don't need to give manufacturers and part numbers. Saying you used the eddy covariance technique should be sufficient. Page 1, line 24 to 27- These two sentences should be simplified and merged. It is sufficient to say that the centre of Lodz is found to be a net source of methane to the atmosphere. Page 1, line 26- give summer mean flux.

Introduction The introduction is too long and incoherent. This section could do with a complete re-write, focusing on 1) what sources of methane are important in urban areas, 2) what are the challenges with determining urban emissions (e.g. spatiotemporal variability, lack of long term measurements), 3) what techniques can be used to determine fluxes (EC, inverse models, etc) and 4) how do your measurements help address these issues. Page 2, line 11- “The temporal and spatial exchangeability of the concentration of greenhouse gases” is confusing- simplify e.g. “The temporal and spatial variability of greenhouse gas fluxes...”. Page 2, lines 12-20- This section should be made more concise, much of the information given is very general. Page 2, line 20 to Page 3 line 12- I would only focus on the sources important in urban areas and

C2

then give an estimate of their proportion of total global emissions. Page 3 line 13-15- This sentence is very confusing, please reword. Page 3 line 17-18- Reword “The classical measurements. . .” Page 3 line 20-25- Reword/simplify this sentence is currently very confusing. Page 3 line 25 Change “suitable instruments” to “precise fast response instruments” Page 3 line 13- “poorly widespread” please reword.

Measurement site and instrumentation This section needs to include an assessment of the measurement uncertainty. You need to give precisions for the CH<sub>4</sub> and meteorological variables. Page 6, line 4 to 5- “which definitely facilitates investigating the climate of the city”. This is vague. Are you trying to say that there are suitable conditions to apply the eddy covariance technique. Page 7, line 20-21- “using a standard measurement kit”. This is vague. Reword/Remove. Page 8, line 2- “slightly lower”- Give the distance. Page 8, line 8- The word “fluctuations” is vague, change to “mole fractions”/ “concentrations” whichever is appropriate. There are several other occasions where this is used and should be changed. Page 8, line 9- How much did the zero and span change? Did you do any calibrations? Page 9, line 2- This sentence is not necessary. Page 9, line 12- Are you able to show a power spectrum/cospectrum to support this? Page 9 – please use shorter paragraphs.

Results Page 11, line 23- “was a definite domination”- please reword. Page 11, line 24- What is the reason for the negative fluxes for 6-7% of the time? Is it a measurement artefact or a sink in the flux footprint? Page 14, line 2-3- This is confusing please clarify. Page 14, line 6- “twice lower”. Reword e.g. “During the summer CH<sub>4</sub> fluxes decreased by greater than a factor 2 to . . .”. Page 14, line 20-22- This is not necessarily correct, the seasonal cycle of background CH<sub>4</sub> is largely due to changes in OH. Page 14, line 32- I am not sure how you did this could you be more precise? Page 17, line 28-30- In the previous section you suggested there was a weak relationship between CO<sub>2</sub> and CH<sub>4</sub>.

Summary Page 18, line 4-5- I don't think this is necessary to say. Page 18 line 21- The flux given by O'shea et al. is just for 1 day for comparison with their aircraft measure-

C3

ments. Page 18 line 14- You should mention studies on urban CH<sub>4</sub> emissions using techniques other than eddy covariance, e.g. Peischl, J., et al. (2013), Quantifying sources of methane using light alkanes in the Los Angeles basin, California, *J. Geophys. Res. Atmos.*, 118, 4974–4990, doi:10.1002/jgrd.50413. Mays, K. L., Shepson, P. B., Stirr, B. H., Karion, A., Sweeney, C., and Gurney, K. R.: Aircraft based measurements of the carbon footprint of Indianapolis, *Environmental Science and Technology*, 43, 7816-7823, doi:10.1021/es901326b, 2009 Wunch, D., P. O. Wennberg, G. C. Toon, G. Keppel-Aleks, and Y. G. Yavin (2009), Emissions of greenhouse gases from a North American megacity, *Geophys. Res. Lett.*, 36, L15810, doi:10.1029/2009GL039825 Page 19 line 1-3- This is very vague, either expand or remove.

Table 1 – Based on page 10, line 9, I assume these are percentages. Please clarify? Figure 9. For the daily mean plot I would've expected over 700 data points for a two year period. There appears to be much less, have I missed something?

---

Interactive comment on Atmos. Chem. Phys. Discuss., doi:10.5194/acp-2015-979, 2016.