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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Megacity and local contributions to regional air pollution: An aircraft case study over London" *by* Kirsti Ashworth et al.

Anonymous Referee #3

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This manuscript describes measurements around the city of London with an aircraft equipped with various instruments measuring both gases and particles. The data is clearly of excellent quality, and the measurements were well done. The paper has some utility to the measurement and possibly the regional modelling community. The topic is certainly relevant to ACP, as urban outflow and regional impacts of urban outflow is an important issue in atmospheric science. However, ultimately, the entire manuscript relies upon only three flights and limited data. While many publications have used a limited number of flights (sometimes even just 1 flight), this manuscript is severely lacking focus. As such, as currently written, I cannot recommend this be published in ACP, for the reasons noted below. Substantial reorganization and rewriting would be required, although perhaps is possible.

Generally, the manuscript lacks focus. The introduction should clearly set out what is unique or novel about this study, but it does not do so. It is imperative that ones describes in the introduction, how this study is any different than others, and what additional information is gained here. This is especially important here, since there have in fact been other similar studies aboard aircraft around the London area. Without this introductory information, this paper seems like a simple reporting of obtained data without a clear motivation or scientific objective. Determining the relative importance of London outflow is not a sufficient objective and lacks detail, neither is the sampling of an urban plume, as that has been done many times. I suspect the paper would be more coherent if the objectives were clearly stated from the outset.

In the methods section, more information regarding where the flight took place relative to the urban city is needed. How far from the city were you? How far downwind from London were the flights? Were multiple altitudes flown for each flight? A sense of the photochemical age for the air masses should be provide up front, as should a description of the purpose of fling the type of flight conducted.

Only a single flight is not sufficient to say anything meaningful regarding the flux of CO, CO2, CH4. In addition, the method by which the flux was determined was very poorly described. Nothing is mentioned about how the flux below the lowest flight track is determined. This can be a substantial amount but is unclear how this is treated here. Was an extrapolation performed to the ground? This is in fact critical for ground based sources, as the highest concentration of pollutants is often below the lowest flight track, and without this information it is unclear how accurate the estimate would be. Significantly more description of the flux approach is needed.

Regardless, it is unclear how the flux from one flight is illustrative of anything. Nor is it possible to make a meaningful comparison to anything else, due to hourly/daily variability of emissions. Furthermore, some effort into determining the impact of the background subtraction on the flux is required. Finally, this is not technically a "mass balance" approach as stated, as the authors have not gone through the task of de-

termining if a mass balance is actually achieved, particularly through the top of the cylinder.

The paper is generally poorly organized, which makes it very difficult to read. The sections should more likely be organized by scientific objective rather than by flight. However, without clearly stated objectives in this paper, that is a difficult task. Clearly stating the objectives at the beginning of the paper would help to determine how to better organize the rest of the paper.

What is the point of having a section on marine emissions? This section seems to come out of nowhere, and is of minimal value. How did this suddenly become a marine vessel paper? I suggest removing this section unless it fits with the objectives of this paper as a whole. As written it currently does not.

There are far too many figures in this paper to be readable. It reads as a set of observations associated with these figure with no clear outcome. Many of these figures can be in the SI, keeping only the ones that provide evidence of the objective.

Specific items:

Line 82: “These observations match those of the EM25 campaign”. If this statement is true, then what is the purpose of this paper?

Line 121: “Local” vs London outflow need to be put in context and properly defined. Since at this point the reader has no idea how far from London the flights were conducted, local and London could be the same thing. If you were flying around London, then presumably everything is “local” to London.

Line 181: it is not clear what is meant by “temporal stability of total aerosol”

Line 529: what is the importance of this statement? It is not clear how this is a “conclusion”.

Line 557-559: There is nothing new about this statement. It is quite obvious that “the

factors that control the air pollution buildup in the London area are various and multiple: local emissions, transport from distant sources, terrestrial and marine emissions”. This is not a significantly new conclusion here.

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