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Atmospheric Chemistry and Physics Discussions

Interactive comment on "CityFlux perfluorocarbon tracer experiments" *by* F. K. Petersson et al.

Anonymous Referee #2

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The paper describes two short range tracer dispersion experiments carried out in central Manchester in June, 2006. Sources were at street level and concentrations measured both at street and roof level, and on a 80 m tower, all within about 600 m of the source. Wind speeds and directions were different on the days of the experiments. The results make a useful, though modest contribution to the collection of such information in UK cities, particularly so as they are not from London.

The concentration measurements are either 8 or 10 minute averages and the consequences of this have not been addressed in the analysis. For example, the dispersion pattern observed on the first day (one 10 minute release) is analysed in an attempt to reveal generic aspects of urban dispersion. Had the experiment been repeated in the subsequent 10 minutes a quite different pattern would almost certainly emerge; e.g. results in London show that high values in one sample may be low in the next. The data must be regarded as a single realisation from an ensemble with high variability.

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This means that it isn't altogether useful to draw firm generic conclusions from a single, or even a few experiments – a large number is required. I think it best that the results are interpreted in terms of what is already known about short range urban dispersion, rather than to infer new aspects of the phenomena.

There's a second important aspect of the measurements in Manchester. In the first case the release and sampling ran simultaneously over 10 minutes. Let's say that the street level wind speed is about 2 m/s, then tracer is advancing (very roughly) at 120 m per minute. Have I got this wrong? If not, then no sampler has sampled the whole plume and the fraction sampled decreases with distance from the source. This can be seen in the data from the second experiment. The street level wind is now probably of order 1 m/s or less and tracer only reaches receptors in any quantity in the third measurement period, 20 mins after start of the emission. Whether plume material is sampled over the whole of the third period at all detectors is uncertain, so again caution is needed in drawing conclusions. Some discussion of this feature of the experiments is needed.

With the foregoing in mind, I see no reason to assume that the information is sufficient to conclude that the variations with height are linked to convective motion - or that the Gaussian and street network models can be tested against the data.

Some page by page comments.

Page 29. There's a large body of wind tunnel data and some small scale field work in which vertical profiles have been analysed. This is not a neglected area, at least as far as neutral conditions are concerned.

Page 30. (1) and (2) can be reconciled with a Gaussian model if linear spread is assumed and U taken as a constant. The constant, K, is not universal because there are many choices for U. There's a better chance that it may if a consistent measure of wind speed is used. That isn't the case in this work as in one experiment the local 80 m wind is used and in the other the airport (10 m?) wind; the K = 12 value from DAPPLE

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was based on roof level wind speeds and K would have been about 4 time greater had the BT Tower speeds been used.

Page 31. Section 2 – spell out in one sequence ADS-GC-NICI-MS. Is 01:30 BST the afternoon, or should pm be added? Fig 1 needs to be slightly revised so that it's absolutely clear where samplers 1, 2 and 3 are.

Page 32. Section 3.1 – a few measurements at street and roof level and one at 80 m don't really constitute a vertical profile, particularly when some pairs analysed (e.g. 1 and 3) are not at the same location.

Page 33. I don't know the area, but there appears to be a large open space adjacent to source X and also off Portland St, between Princess St and sites1 and 2. This makes application of the network model somewhat debatable. In any case, more detail is required about this model – and some references. I don't follow why R should be related to the distribution of wind directions seen at the tower. Would there be no division of the plume if the wind direction were steady?

Page 34. Say why there were no local wind data and discuss the implications of using the airport measurement instead.

Page 35. I don't believe that REPARTEE proved that normal profiles were inadequate. In fact, I feel sure that a reasonably good fit could have been obtained.

Page 36. The best use of the data is as a pooled set but the lack of consistent wind speeds is a problem. K depends on the choice of U. Can they all be plotted with the airport wind speed, or that used to estimate the tower speed on the second day? Bottom of page – a reference is needed to the DAPPLE conclusion.

Page 37. Conclusions need to be revised.

Table 1 – the final column doesn't mean very much without the full specification of the Gaussian model and assumptions. Add to the caption that these at 10 min averages.

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Table 2 – add that these are 8 minute averages.

Figs 1 and 2. Make X and Y and the wind vector clearer. Add on 2 where the wind vector was measured and note that this is the third measurement period.

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 27, 2010.