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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Atmospheric chemistry and physics in the atmosphere of a developed megacity (London): an overview of the REPARTEE experiment and its conclusions" *by* R. M. Harrison et al.

Anonymous Referee #2

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The study gives an overview and conclusions of the REPARTEE experiment carried out in London, UK. The two measurement campaigns have been comprehensive and have brought new information about the behaviour of urban climate in a mid-latitude city. Particularly comprehensive turbulent flux measurements have been carried out above a city and for the first time ozone and carbon monoxide fluxes above a city have been reported. However, there are some issues that the authors need to address before the paper can be published in Atmospheric Chemistry and Physics.

First of all, the manuscript does not address the downsides of the experiments, which

are the very short measurement periods only in autumn time in 2006 and 2007. How general conclusions can be drawn from such a short measurement period and how representative the results are for London itself and can the results be applied in other cities?

The paper is an overview, but lacks to utilize the comprehensive dataset. For example, the authors have shown a case study for LIDAR data but no other variables were simultaneously analyzed with respect to the observed mixing and aerosol layers. Though, LIDAR data was successfully combined with the measured CO2 flux. Also reasons to the observed differences between the campaigns were not properly studied.

The manuscript is very long and there are too many figures (34). The length of the paper should be shortened, particularly Introduction is too long. The long historic overview on P30148 – 30149 between lines 21 – 26 could be shorter. Also there is too detailed information about the past PM10 measurements on lines 27 (30149) - 22 (30150). PM measurements are systematically measured in various cities so less focus could be given to them. The rareness of flux measurements of aerosol particles and gaseous compounds were not addressed in introduction at all. Some results presented in the paper have been published in previous papers so text related to these could be shortened (e.g. in Sections 4.4 and 4.5). Also the number of figures should be reduced: some of them could be removed or moved to Appendixes. Many of the figures have poor quality and reading them was difficult (See detailed comments below).

Section 2 should be made more consistent. Now for some measurements lot of details are given under “Section 2.1 Sampling sites” while these would be better under instrumentation. Either the authors should give minimal information and refer to previous publications or give more information. For example, on P30155, L18 – P30156, L3 tube details and flow rates are given, but important information including: did all instruments use the same inlet, was there a filter, what was the distance between the anemometer and the inlet, how long measurement tube was and what are particle losses in the tube, is missing. Authors mention that they made 2-dimensional rotation to fluxes but

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do not give other information about the flux analysis (wpl-correction, spectral corrections, etc.). It is also unclear that was same procedures used for all fluxes?

Specific comments

In Section 3 there should be some information given what is the typical climatology of autumn period in London to get some idea how representative the measurement periods are.

The text related to turbulent transport scales on P30190, L13-20 is unclear. Could the authors explain more in detail what do they mean by "The normalization had little effect on the pattern observed, indicating that z/U is not appropriate. . .". What pattern do the authors mean and how does this indicate improper scaling? Also from Figure 28a, it is not clear that in stagnant conditions the peak maxima would shift to higher frequencies. To me it looks like opposite.

P30192, L20 – 24: The authors say that a slight curvature is observed in midday and early morning hours in CO vs. CO2 plot, but looking Figure 30 there seem to be only few data points "curving" in midday and in early morning the curvature is not clear at all. Is there any statistical proof for this reported behaviour? If not, the conclusions drawn out of this seem to be over interpretation.

P30165, L1 – 5: It is concluded that during REPARTEE I there was less exceedances than during REPARTEEII but no discussions for the reasons are given.

P30198, L25 – 29: This bimodal behaviour was observed on 26th October with low wind speed conditions. How representative the fluxes are for the surface in this case? In general, how often this bimodal pattern was observed as in Figure 34 we see only four days.

P 30212, L5 – 9. Aerosol particle fluxes were not compared with emission inventories.

Specific minor comments

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P30145: In title atmosphere is mentioned two times. Maybe leave “atmospheric” out?

P30155, L12: In what coordinate system the coordinates are given. Why there is two times BT Tower?

Section 2.3: There is no need for this section. These dates could be given under Section 2 after the first sentence.

Section 2.4: Are the details related to tracer experiments explained in Martin et al. 2011a? If yes, text in this Section should be shortened.

P30159, L14: Are the limits standard deviations or something else?

P30161, L23 – 24: Urban heat island is not only caused by this delayed cooling. It is also observed in daytime but is just typically stronger in night-time. Anthropogenic heat emissions play an important role.

P30163, L16 – 21: Are these values calculated from the daily data or directly from high resolution data? Also is it necessary to list minima and maxima here as they are also visible from Figure 10. Or have them in a table rather than scattered in the text.

P30170, L5: Looking Figure 15 the peak at the Park seems to be also in the nucleation mode rather than accumulation mode despite the shift of the mode.

P30171, L16 – 28. This text would be more suitable under Methods.

P30177, L20 – 23. This text could be removed to Methods.

P30178, L1 – 3. I think there is some over interpretation of the differences between the Park and NK as in error limits the concentrations are nearly equal.

P30182, L19 - P30183, L14. This text would be more suitable in methods section.

P30184, L6 – 8. What were the correlation equations and statistics (rmse, r) and were the correlations significant. Looking only Figure 25 the stated correlations are not clear.

P30189, L13: What does “$\zeta < ws$” stand for?

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P20190, L5 – 6: Why weaker correlation for particles and CO2 are expected?

P30194, L11 – 14. This information is not relevant here and should be given in the Introduction.

Related to the text in P30196, L14 – 20, how wide the footprint of the flux measurements typically is?

P30199, L5 – 8: From figure 34 it is not clear that the times when deposition fluxes were observed, the air was more polluted than on other times.

P30220, L16: Helfter et al. has already been published in ACP so maybe use rather that reference

P30205, L9 – 10 and L21 – 22: Do these sentences refer to the same "remarkable change"?

Tables and figures

Table 1: Used abbreviations should be explained (e.g. KCL). Turbulence and heat flux have a temporal resolution of 10 Hz here while in the text is said to be 20 Hz (P30155, L25). Why the measurement uncertainties are left out in the case of turbulent fluxes? These can be calculated (both systematic and unsystematic)

Figure 1: The area marked in the larger map is not clear. Using another colour for the box would help.

Figure 2. Is this figure necessary?

Figure 4: This figure is not giving any extra information and should be left out.

Figure 3 and 5: The quality of these figures is poor. The x-axis labels should be improved. Also the labels should explain the used abbreviations and what are the plotted resolutions (10-min, 30-min etc.).

Figure 7: x-axis label is missing from the lowest panel

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Figures 10, 11: What are the black vertical lines in the figures. Labels should be with bigger font.

Figures 12, 13: Are poor quality. Labels are not clear and reading the figures is difficult.

Figure 14: Could be removed. The strong morning peak between 6 and 10 can be described in the text only.

Figure 17: The different x-axis is subplots should be emphasized in the figure label.

Figure 18: This was published already in Allan et al. (2010) paper. Is this necessary here as there are quite many figures anyway? If yes, please, add the reference to the figure label.

Figure 26: What are the black circles in the figure?

Figure 27: The quality of this figure needs to be improved: different text's are not readable.

Figure 29. Could be removed (or added to appendixes if needed) and explained in the text.

Figure 32. Again, is this necessary figure in the main text?

Figure 34. The figure needs to be bigger. In its current form it is not possible to see in size A4.

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 30145, 2011.

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