Atmos. Chem. Phys. Discuss., 15, C1879–C1883, 2015
www.atmos-chem-phys-discuss.net/15/C1879/2015/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Seasonal trends in concentrations and fluxes of volatile organic compounds above central London" *by* A. C. Valach et al.

Anonymous Referee #1

Received and published: 24 April 2015

The manuscript 'Seasonal trends in concentrations and fluxes of volatile organic compounds above central London' by Valach et al. describes measurements of fluxes and concentrations of several anthropogenic and biogenic VOCs at a site in central London. Measurements are carried out and discussed carefully. Fluxes and concentrations are related to meteorological variables and fluxes and concentrations of other compounds. Comparisons are made between observed fluxes and an emission model and emission inventories. Although not presenting surprising new insights, the research is of high quality and the paper fits well in the scope of ACP. Therefore, I recommend publication after minor revisions.

General comments:

My main comment concerns the discussion on the influence of boundary layer dynamics: the possible role of atmospheric boundary layer (ABL) dynamics in shaping the diurnal profiles of species concentrations and their difference between summer and winter is mentioned briefly several times throughout the MS (e.g. in section 3.3.1), but not shown. Only in section 3.1.2 it is mentioned that the ABL was on average 1700 m in summer and 900 m in winter. I think you can discuss much more exactly how ABL dynamics have influenced your observations, and show it using the available data. Just some thoughts on the influence of the ABL from looking at the data: In Fig. 1 several concentrations (acetaldehyde, benzene, toluene, C2-benzenes) show a peak just around 8 a.m., which could be due to the emission into a shallow nocturnal ABL. After 8, the ABL quickly grows, clean air is entrained and emissions are diluted, leading to lower concentrations. The second peak in concentrations of aromatics (around 5 p.m.) could be the result of continuing emissions into a collapsing ABL. Finally, during night time, the ABL is shallow, but also the emissions are low, leading to low concentrations. For a good introduction on the ways in which ABL dynamics influence the relation between fluxes and concentrations of chemical species, see for instance Vilà-Guerau de Arellano et al. (2009). It would be very interesting to see correlations between species mixing ratios and ABL height (which is apparently available from LIDAR observations), in addition to the correlations with temperature, PAR and traffic density in Fig 3. This information could also help to strengthen your argument in Sect. 3.1.2 for the role of ABL dynamics in the seasonal variability and your conclusion (p.6625, l. 2-4) that 'many of the spatio-temporal differences in the observed mixing ratios were attributable to emissions and boundary layer dynamics'.

Throughout the MS, the term 'diurnal averages' of VOC fluxes/concentrations are used, which I think is very confusing. To me, a diurnal average flux/concentration means the flux/concentration, as averaged over all observations during one day, so a single value for each day. I think what you mean is the 'average diurnal cycle' (or 'aver-

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age diurnal profile' as you write in the caption of Fig. 2), so the diurnal cycle of the flux/concentration, averaged over multiple days. Please check throughout the MS and use the latter term consistently.

Specific comments:

Title: since large parts of the results section discuss (3.1, 3.1.1) and figures 2 and 4 show diurnal cycles, I would add to the title that you have also looked at diurnal trends. Therefore I would recommend 'Seasonal and diurnal trends in . . .'.

p. 6603, l. 17-20: the lines about satellite retrievals of VOCs are not necessary for the discussion and could be left out

p. 6604, l. 1: Seasonal, diurnal and spatial differences?

p. 6604, l. 1: I would mention both VOC fluxes and concentrations here, since you discuss both.

p. 6612, l. 22: Is Mexico City the only other city for which flux measurements are available for comparison? You also mentioned papers by Park et al. with flux measurements in Houston, TX. Why not compare those with yours too?

p. 6613, l. 10: If the moments of the peak fluxes coincide with those of a low ABL it is difficult to tell the effects of emissions and ABL dynamics on the concentration apart. Can you check with data on ABL height how exact this coincidence is?

p. 6624, l. 26-27: 'There were observable spatial and temporal variations in relative source impacts at different resolutions such as hour to month.' I find this a too general statement for a conclusion. Can you be more specific?

Technical comments:

p. 6602, l. 5: after 'proton transfer reaction-mass spectrometer', add '(PTR-MS)', since this acronym is used throughout the text

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p. 6602, l. 15: accounted for → explained

p. 6602, l. 17: change into 'Modelled biogenic isoprene fluxes from urban vegetation, using the G95. . .. ' and remove: ', due to urban vegetation.'

p. 6602, l. 25: live → lives

p. 6603, l. 9: additionally act as a source → act as an additional source

p. 6603, l. 11: introduce the acronyms NAEI and LAEI here, where they are first used

p. 6604, l. 12: m.s.l. → m.a.s.l.

p. 6612, l. 3: diurnal averages → average diurnal cycles

p. 6613, l. 8: concentrations for aromatics → concentrations of aromatics

p. 6615, l. 3-4: were seen with → were seen between, positive correlations with → positive correlations between

p. 6615, l. 5: pls add a comma between 'temperature' and 'likely'

p. 6615, l. 27: Bohnenstengel et al., 2014 → Bohnenstengel et al., 2015

p. 6616, l. 4: the equation from Langford et al: which equation?

p. 6617, l. 16: add 'from those' between 'than' and 'areas'

p. 6617, l. 21: add 'that' before 'compounds'

p. 6617, l. 21-22: Higher correlations than what? Than compounds with traffic sources?

p. 6618, l. 1: tended → tend

p. 6618, l. 20: delete 'observed', since it is mentioned twice in this sentence

p. 6624, l. 6: What does SNAP stand for?

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p. 6625, l. 14: however → but

p. 6625, l. 15: Where does 'this' refer to? This study? The previous line?

p. 6625, l. 22: there is a typo in the name of the 1st author

Fig. 1: Can you increase the size of the green dot, so it is easier to find?

Fig. 2: Some use of colours would be very helpful to distinguish between the different lines, like in figure 4. Besides, the axis labels are too small to read without zooming in.

Fig. 5: In the caption, first describe the left and then the right panel. Also here, it would be helpful to increase the font size of the axis labels.

Supplementary material: A caption for the figure would be useful. Besides, since the supplement consists of only 1 figure, it would perhaps be more convenient to include it in an appendix to the main paper.

References

Vilà-Guerau de Arellano, J.; van den Dries, K. & Pino, D. On inferring isoprene emission surface flux from atmospheric boundary layer concentration measurements. Atmos. Chem. Phys., 2009, 9, 3629-3640

Interactive comment on Atmos. Chem. Phys. Discuss., 15, 6601, 2015.