

## ***Interactive comment on* “Controls of carbon dioxide concentrations and fluxes above central London” by C. Helfter et al.**

### **Anonymous Referee #2**

Received and published: 7 December 2010

#### General Comments

The paper presents eddy-covariance (EC) measurements of atmospheric CO<sub>2</sub> concentration and CO<sub>2</sub> fluxes from a tall tower in the centre of London, UK. The EC instruments were mounted at around 22-times the mean building height and are thus regarded as representative for large parts of the city. The EC measurements are compared with bottom-up estimates of CO<sub>2</sub> emissions using the National Atmospheric Emissions Inventory on the scale of emissions per boroughs. Diurnal and seasonal patterns of the measurements and calculations are studied.

The paper is well written, the data analysis in most parts carefully done, and the subject is appropriate for the journal. It is an important contribution to relatively scarce publications using data from EC measurements within an urban environment. On the

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basis of below listed concerns and specific comments, I believe that the paper can be accepted after minor revisions.

### Main Concerns

(1) Please provide more information on how traffic emissions were derived. As traffic counts were available, emissions per vehicle class should be distinguished (passenger cars, vans, etc.).

(2) The authors find evidence for an inversion layer during which 'the tower height is above the layer connected to the urban surface below'. Please state more clearly whether CO<sub>2</sub> measurements observed under such conditions were included in the analysis – clearly the footprint model is not able to properly account for these situations.

(3) Sections 3.3 and 3.4 contain a lot of important findings. However, these findings are somewhat difficult to distil from the bulky text. The manuscript could gain a lot from a better organisation of these sections. Maybe it would help to shorten the sections slightly.

(4) The results from the bottom-up study, i.e. the comparison of EC data with emissions from NAEI should be illustrated and highlighted more clearly.

(5) Table 2 shows almost constant traffic counts for Marylebone road, while at three other locations, traffic decreased very significantly from June to October 2007. It should be stated whether this observation was specific to the selected year (road closure nearby?) or whether it was a re-occurring pattern. In either case, it does not seem justified to select only one dataset (traffic counts of a single road) for the analysis. This may raise some concern on the analysis.

### Specific Comments

(1) Page 3, line 7: The authors state that CO<sub>2</sub> concentration and CO<sub>2</sub> fluxes were measured 'semi-continuously' from October 2006 to May 2008. Please state more clearly what data was available from when exactly. How many flux data points were

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used for the present study?

(2) Page 3, line 30: Canary Wharf seems to have a substantially different roughness length than other sites surrounding the tower. How was this accounted for? Furthermore, the surface of Canary Wharf seems difficult to model – with a few buildings around 200 m tall. Again, how did the authors deal with possibly induced turbulence and eddies in this area?

(3) Page 9, line 9: Only the extent of footprints for unstable stratification is listed. Please mention the according figures for neutral and stable stratification.

(4) Page 11, line 12: The authors suggest that traffic emissions contributed to ‘background CO<sub>2</sub> concentration rather than dominating its seasonal fluctuations’. This is somewhat counterintuitive. If possible, refer to literature with similar findings.

(5) Page 12, line 6ff: Not clear, please re-formulate.

(6) Page 12, line 17ff: Please explain – possible reason for findings?

(7) Page 13, line 27: Please give examples for ‘other activities’.

(8) Page 14, line 16ff: Is this possibly due to decoupling from the surface layer? Do typical wind directions differ for mornings and afternoons?

(9) Page 23, Table 2: Please add figures for each month during the EC survey.

(10) Page 26, Table 5: On page 16 it is stated that the emissions from natural gas usage etc. were estimated rather than observed. Please state this clearly in the Table captions.

(11) Page 31, Figure 5: Plot traffic counts of all sites.

(12) Page 32, Figure 6: Please annotate color bars with measures/units.

(13) Page 32, Figure 6: Is there possibly a shadowing effect of the tower?

(14) Page 33, Figure 7: Would results look similar for mean traffic emissions rather

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than traffic counts?

(15) Page 34, Figure 34: Please state the period selected for winter, spring, summer and autumn.

(16) Page 35, Figure 35: Data should be plotted separately for winter, spring, summer and autumn.

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Interactive comment on Atmos. Chem. Phys. Discuss., 10, 23739, 2010.

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