

Interactive comment on “Greenhouse gas observations from Cabauw Tall Tower (1992–2010)” by A. T. Vermeulen et al.

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- Reply text from the authors is indicated by a hyphen "-" at the start of a paragraph. All other paragraphs stem from the reviewer text

- First of all we would like to thank also anonymous reviewer #3 for his/her efforts and useful corrections and suggestions. We agree with the general remarks and changed the texts and figures in the revised manuscript where appropriate, according to the remarks in the review.

General:

1. The order of Tables and Figs. is not optional and their order of appearance does not

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follow their numbers. I refer to another review (Lowry); follow his suggestions.

- In the revised version of the article we have corrected all the figure and table numbering issues by using the automatic numbering mechanisms of (La)TeX. We understand that this numbering issue must have caused a negative overall impression of the article and a lot of confusion for the reviewers and readers. We therefore appreciate the efforts of the reviewers to still produce a consistent review despite this major hurdle.

2. This is mainly a question, which does not necessarily needs any revision for MS, but I use this opportunity to ask the following. I am a bit confused with the footprint estimates for 20 m level and the interpretation of that data. I have been told several times that to have a representative concentration data set (in tall tower sense), the tower must be so high that most of the time the measurement level is above the surface (constant flux) layer. The thumb rule is that the tower must be over 100 m. If not, then your measurement represents the areas which are nearby your tower, similar to direct flux measurements, only difference that the typical concentration footprints are order of 10 times larger than those for fluxes. This means that concentration footprints are the order of 1 – 10 km. However, now the 20 m level footprints are much larger. Can you explain why and what is possibly wrong in my thinking above?

- The height of the surface layer is varying over time and space due to factors such as atmospheric stability and local roughness. The 200m level at Cabauw is always above the local surface layer, but the 20m level is usually also above it during mid-day and afternoon. If we also measure at lower levels we obtain measurements that are representative for smaller scales, especially during night time and other stable conditions. The footprint model allows us to determine the extent of the area for which each level is representative. If we only use afternoon data the concentrations are usually well mixed and all levels receive more or less the same concentration signal, so then picking one level over the other won't make a big difference, unless we go to levels much lower than 20 meter in the case of Cabauw or in general to say much less than 100 times the local roughness length; as the local signal will then become more

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significant. Relative size of the local fluxes to the mean concentrations play also an important role here. The footprints shown here are a weighted average for continuous hourly observations and thus for the 20m footprint the day time observations make that the extent of the overall footprint is much larger than the footprint that can be expected from only more locally influenced observations during the other periods of day. This locally influenced concentrations, especially when measured at multiple levels, contain very useful information on local and regional fluxes that would be missed when only the measurements well above the mixed layer are performed. The observations at multiple levels below the boundary layer height can be mixed into a surface/mixed layer bulk concentration for regional model inversion studies in order to be less sensitive to errors in the modelled vertical mixing in the surface layer.

Minor:

p. 4172, lines 6-7: “..that is and will be used....”, there is some problems with the language.

- this has been corrected in the revised text

p. 4198, eq. 2.: omit “dots” indicating multiplication between some symbols

- the dots have been removed from eq. 2

Table 3: it would be good to explain shortly Mean method in the table caption.

- We renamed the term to Trimming method and refer to section 4.5 for the explanation, that is now close to the actual table position.

Interactive comment on Atmos. Meas. Tech. Discuss., 3, 4169, 2010.