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Atmospheric Chemistry and Physics Discussions

Interactive comment on "The influence of small-scale variations in isoprene concentrations on atmospheric chemistry over a tropical rainforest" *by* T. A. M. Pugh et al.

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In this paper the authors test their approach to estimate the influence of segregation by making use of results presented by Dlugi et al. (2010) from measurements 37m above a mixed forest of canopy height $h_c = 30m$. Therefore the relation $z_R/h_c = 1.23$ holds and the measurements were performed in the surface layer above the rough surface of the canopy. Also the modeling by Patton et al. (2001) was done in the same flow regime.

In the following we refer to some further aspects not explicitly discussed by the reviewers. The data for the case study by Pugh et al. are taken from the OP3 campaign on

30 April 2008 at the Bukit Atur tower 75 m above its base and situated in a 50m*150m large clearing surrounded by trees of about 10 m height as described in the cited literature and the paper itself. The station is situated on top of a hill 260m above valley floor. Note that under such conditions the determined covariances are only related to the emission in the surrounding area by strongly nonlinear relations (e.g. J. Finnigan (2004), Agr.For.Met. 127, pp 117-129; A. Sogachev et al, (2004), Agr.For.Met., 127, pp 143-158) also influenced by mesoscale motion (Stull, 1988).

But we refer now to the relation z_R/h_c during the OP3 campaign. The boundary layer height z_i is on average 800 m. On page 18205 a displacement height d=20m is given for a canopy. Compared to the canopy of the surrounding trees d is larger than h_c by a factor of 2. This, by the definition of d, is not possible. If one instead takes d=20m for the trees in the footprint area, where most of the isoprene is emitted, and which is given to be about 1400m away, one can estimate h_c from relations given by Raupach et al. (1991, 1996) or Kaimal and Finnigan (1994) as cited by Dlugi et al. (2010). One find $d = a * h_c$ with $0.6 <= a <= 0.9$ for $2 < LAI < 10$. This leads to $22m < h_c < 33m$ for this forest in the footprint area. From the cited reference by Helfter et al. an effective measuring height of 125m is given but it remains unclear, if this is considered to be above valley floor or canopy top in the source area or another reference height. With this height we get a relation $z_R/h_c > 5$ which is above the surface roughness layer and with $z_R/z_i => 0.16$ in the CBL. Therefore surface layer scaling to estimate a time scale should not be applied. The loss of high frequency contributions in turbulence, as cited in the text, also points to towards measurements in the CBL where spectra of all quantities are shifted to lower frequencies compared to surface near measurements (H.A. Panovsky, J.A. Dutton (1984), Atmospheric Turbulence, Wiley, N.Y.)

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