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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Simulating atmospheric composition over a South-East Asian tropical rainforest: Performance of a chemistry box model" *by* T. A. M. Pugh et al.

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This paper investigates the understanding of chemistry in tropical regions by comparing results from an optimized box model to measurements obtained during the Oxidant and particle photochemical processes field campaign in Borneo. The paper concludes that inadequate representation of physical and micrometeorological effects are more important than errors in chemistry.

In the discussion of these issues, the paper proceeds as if the tropics are on a different planet than mid-latitudes. Many of these issues have been discussed in detail in analyses of measurements at mid-latitudes and at conditions with under nearly identical

NOx. We highlight some of our own work in this area but these are by no means the only literature ignored in the current manuscript. In our opinion these ideas provide an important context for the interpretation of the measurements described in this paper, a context that might lead to a different interpretation of the results and that is at least deserving of acknowledgment in the references.

Previous studies that inform the issue of coupled chemistry and micrometerology within canopies include (Holzinger et al. 2005, Fuentes et al. 2007, Farmer and Cohen 2008, Wolfe et al. 2009). In the case of this study, the NO emissions imply strong gradients in the partitioning of HOx with height (NO itself is the major control over the HO2+RO2 to OH ratio). Modeling at a single level will not capture the effects of such gradients properly since the average of OH and the species it is oxidizing will by definition not be the same as the average of the product <[OH][R]>.

A more explicit comparison of the VOC measurements made at 5 m and at 75 m should be able to provide some constraints on the gradients. If gradients do exist, then comparing the above canopy modeled concentrations to the in-canopy measurements is invalid because they represent different chemical environments. We believe a more thorough treatment and discussion of within canopy chemistry is necessary before conclusions about our understanding of tropical VOC chemistry vs. micromet can be made.

We also note the discussion of HOx chemistry is confounded by the multiple couplings that are misrepresented by the model. For example, correcting the model underestimate of NO would enhance OH. Also, any claim the HO2 + RO2 is correctly modeled without constraining OH to observations is at best misleading. We point the authors to Thornton et al. 2002 who present an alternative approach to assessing HOx chemistry and who to our knowledge were the first to point out the need for recycling in isoprene peroxy radical chemistry.

Specific comments

Section 2 (Measurement site description): A more detailed description of the forest canopy should be given here including the canopy height and a description of the canopy density. A table summarizing the different species measured, their measurement location, and measurement technique should also be included.

Figure 1: Assuming that the units used throughout the paper for NO emission are correct, the units for NO emission in this figure should be ng(N)/m2/hr.

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