

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.

Anonymous Referee #1

Received and published: 11 October 2009

Pugh et al. have performed a large suite of chemical box model runs in which they simulate the chemistry and mixing in the boundary layer over the tropical rainforest in Borneo. This suite of model runs includes sensitivity studies in which model parameters such as the emissions and deposition of reactive species, the amount of recycling of OH in the isoprene oxidation mechanism, and the intensity of segregation between isoprene and OH are varied over large ranges. Cost functions are calculated for each model run based on the deviation from measurements made during the recent OP3 field measurement campaign. In this way the model run with the most optimal fit to the measurements is identified, and conclusions can be made about the likely values of the model parameters which were not measured.

C5824

Resulting from this optimisation, Pugh et al. determine that deposition of isoprene oxidation intermediates is likely more important than previously thought, that some modest degree of as-yet-unexplained OH recycling is necessary in the isoprene oxidation mechanism, and that a 50% intensity of segregation between isoprene and OH must be present in the boundary layer in order to explain the OP3 measurements. The emissions of isoprene and monoterpenes, which were also a component of this optimisation analysis, are comparable to independent flux measurements made during the campaign, lending strength to the other conclusions.

The atmospheric chemistry of the remote tropical rainforest has received much attention of late, and it is becoming clear that our understanding of this important part of the atmosphere is severely lacking. This paper by Pugh et al. makes an important contribution to this emerging topic, and I recommend that it be published in ACP subject to the following minor revisions.

Page 19246, line 3, Global emissions

Page 19249, line 22, “and” should be “an”

Page 19249, line 22, “concentration” should be “mixing ratio”. Please check the rest of the manuscript for other places where you mix these two terms up. For example, page 19253, line 21.

Page 19249, line 23, when referring to the chemical conditions as they were actually measured, “regime” or “conditions” are better words than “scenario”. The word “scenario” is best used to describe a particular model run. Please check for this in the rest of the manuscript.

Equation 1, you have not defined \hat{x}_i .

Reaction R1 (page 19258), I do not think that Lelieveld et al. (2008) actually proposed this reaction as an OH recycling mechanism occurring in reality, but rather they used this reaction as a method of assuming a tunable degree of OH recycling in their iso-

C5825

prene oxidation mechanism, much as your “generic reaction” R2 (page 19259) seems to be intended. Butler et al. (2008) used the same approach as Lelieveld et al. (2008), and they go into more detail about this “artificial OH recycling”.

Page 19258, line 13, “24” is a typo. The correct quotation from Lelieveld et al. (2008) is 2–4 (ie. between two and four).

Page 19261, line 9, “Damkhler” should be “Damköhler”.

Page 19261, line 12, there should be a condition between “If” and “then”.

Page 19265, line 13, it is worth mentioning here that the 200 ppt of NO_x observed during OP3 (page 19249, line 22) is an order of magnitude more than was observed in the GABRIEL campaign (Lelieveld et al. 2008). This will tend to recycle more OH from HO₂ via reaction with NO, and require less OH recycling within the isoprene oxidation mechanism itself.

Interactive comment on Atmos. Chem. Phys. Discuss., 9, 19243, 2009.