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Interactive comment on “Isoprene suppression of new particle formation in mixed deciduous forest” by V. P. Kanawade et al.

Anonymous Referee #2

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New particle formation in forests is an important atmospheric process and likely linked to biosphere – atmosphere – climate feedbacks. Despite intensive research on the physical and chemical processes involved in atmospheric new particle formation many aspects such as the identity of nucleating vapours, exact nucleation process, and conditions favouring new particle formation are still under debate. This paper adds valuable information for the so far less characterized deciduous forests. The authors present field observations of particle number concentration and size distributions measured at the University of Michigan Biological Station in summer 2009. From observed particle number concentrations and measurements of H₂SO₄, NH₃, SO₂, NO_x, OH and various VOCs the conclusion is drawn, that the prevailing high isoprene concentration in the mixed deciduous forest suppresses new particle formation as previously found in a plant chamber. Only two nucleation events were observed in early evening

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episodes characterised by high SO₂ and NO_x concentrations, indicative of an anthropogenic plume. The nucleation events are simulated with a box model incorporated with ion-induced nucleation to investigate the nucleation mechanism. The paper is well written, within the scope of ACP, and recommended for publication after the following comments have been considered.

Specific comments: While a mechanistic explanation of why isoprene suppresses the formation of new particles is beyond the scope of this paper and possibly even unachievable from field observations alone, it is interesting to see that the OH concentrations found here are comparable to OH concentrations in the boreal forest, where nucleation events are frequently observed. For a full picture of trace gas concentrations it would be desirable that the authors add NH₃, NO and NO₂ time series to figure 2 together with temperature and RH information. This information might be valuable for future comparisons and according to the list of measured parameters is available.

In view of recent observations of an OH recycling mechanism effective in the presence of low NO_x and isoprene (Lelieveld et al. 2008, Hofzumahaus et al 2009) it would be interesting to consider whether the same species X that converts HO₂ into OH could probably interfere with the proposed RO₂ that would form new particle in absence of isoprene?

The use of ion induced nucleation mechanism in explaining the observed evening nucleation events is not well motivated. It should be discussed more clearly that/which other nucleation mechanisms could be responsible for the observed evening NPF events.

Technical: Page 11050 line 22: Wrong reaction

Page 1155 line 12: Why do the authors not use IUPAC recommended values for rate constants?

At a couple of places in the manuscript, the authors should recheck the grammar.

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References:

Lelieveld J, Butler TM, Crowley JN, Dillon TJ, Fischer H, Ganzeveld L, Harder H, Lawrence MG, Martinez M, Taraborrelli D, Williams J (2008) Atmospheric oxidation capacity sustained by a tropical forest. *Nature* 452: 737-740

Hofzumahaus A, Rohrer F, Lu KD, Bohn B, Brauers T, Chang CC, Fuchs H, Holland F, Kita K, Kondo Y, Li X, Lou SR, Shao M, Zeng LM, Wahner A, Zhang YH (2009) Amplified Trace Gas Removal in the Troposphere. *Science* 324: 1702-1704

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