Atmos. Chem. Phys. Discuss., 15, C2726–C2728, 2015
www.atmos-chem-phys-discuss.net/15/C2726/2015/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Biotic stress accelerates formation of climate-relevant aerosols in boreal forests" *by* J. Joutsensaari et al.

Anonymous Referee #1

Received and published: 19 May 2015

The submitted manuscript titled "Biotic stress accelerates formation of climate-relevant aerosols in boreal forests" written by Joutsensaari and co-authors discusses a potentially important but under-assessed source of organic aerosol: enhancement in VOC mixing ratios due to insect herbivory. The authors used a triad-approach to address this topic. These included 1.) laboratory-scale experiments that measured monoterpene and sesquiterpene emissions from pine weevil damaged Scots pine and Norway spruce trees followed by organic aerosol formation using ozonolysis, 2.) field-scale measurements of monoterpene and sesquiterpene emissions of Scotch pine trees in Finland, and 3.) modeled global scale assessment of the impact of the insect damaged regions on aerosol optical depth in North America. Taken together, the authors show that insect damage to boreal forests will likely play a role in organic aerosol levels and

climate forcing.

The study is well-executed and relevant, and the use of complementary techniques (field, lab, and model) supports the authors' thesis. A few minor issues should be addressed: 1.) The authors used seedlings in the laboratory experiments. While this is certainly required to make the lab experiments tenable, could the authors comment on potential VOCs emissions difference between adult and juvenile trees? Does the VOC distribution or the total emission change as maturity is reached? 2.) The authors randomly selected insect-stressed ares for the model portion of the study (see Figure 6 figure caption). While the need for random selection is sensible for initial application, insect outbreaks are not random and are driven by local climate and geography (see Aukema, Ecography, 2008). Outbreak clustering could lead to concentration of VOCs in a more limited geographic range, in comparison to random outbreak, and this could lead to a different AOD distribution, causing local minima. How does the insect outbreak location impact the results of model? 3.) The analytical precision of the measured values was likely overestimated in a few places. For example in Table 3, the average limonene emission from Neodiprion sertifer damaged was listed to six significant figures, and this level of precision is not practicable (or needed). In addition, the average alpha-terpineol emission was listed as zero, whereas a true zero cannot be reasonably measured, and instead "below detection limits" (with the detection limit listed) is a more commonly accepted practice.

Suggested Typographical Corrections: p. 10870 line 20 insert the "Figure 7 shows the mean AOD values..." p. 10870 lines 21-24 is run-on sentence and would be more effective as two sentences. p. 10871 line 2 omit "was" in ..."the mean AOD was decreased..." because it implies that the AOD was controlled or tuned by the authors rather the the change of AOD dependent on the model. p. 10872 line 23 Insert "The" at he beginning of this sentence. p. 10872 line 25 replace was with "were" for subject verb agreement with "differences" p. 10873 line 1 what does "they" refer to in this sentence? Please replace with more specific noun. Figure 3 and Figure 4, bottom panels:

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some of mass concentration and number concentration data points are connected by lines and some are not. What do the lines indicate? And why is this inconsistent–were some of the data points removed or averaged/smoothed?

Interactive comment on Atmos. Chem. Phys. Discuss., 15, 10853, 2015.