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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Linking biogenic hydrocarbons to biogenic aerosol in the Borneo rainforest" *by* J. F. Hamilton et al.

Anonymous Referee #1

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Comment on manuscript ACPD-13-18113-2013 Linking biogenic hydrocarbons to biogenic aerosol in the Borneo rainforest by J.F. Hamilton et al.,

The authors analysed biogenic secondary organic aerosols (BSOA) collected in tropical rainforest of Borneo and BSOA produced in laboratory experiments. BSOA composition was determined using liquid chromatography mass spectrometry (LCMS) and Fourier transform ion cyclotron resonance mass spectrometry (FTICRMS). Focus of the authors' work was the detection of specific tracers for individual biogenic volatile organic compounds (BVOC). Tracers were determined from laboratory experiments. Synthetic BSOA were produced from individual BVOC and classified according to LCMS retention times and mass spectra. Compounds eluted at the same retention time and exhibiting the same mass spectra were regarded as identical. Detection of

identical compounds in BSOA collected in tropical forest and synthetic BSOA, respectively, was seen as proof for the respective BVOC serving as precursor for BSOA. That way the authors show that isoprene, the monoterpenes a-pinene, limonene, and a-terpinene and the sesquiterpene b-caryophyllene must have contributed to BSOA mass formation in the tropical rainforest of Borneo.

The manuscript is well written, easy to read, and in most parts understandable. I personally find the manuscript interesting and I'm impressed by the authors' work conducted to determine usable tracers. However, there are some parts that are not clear to me and I ask for more information. In particular the sentence written with respect to impacts of NOx on mechanisms of BSOA mass formation: "However, mechanisms suggest that there remain oxidation products in common that may act as tracers for a specific BSOA precursor .." (P. 18121, line 2) is vague and not convincing. Please sketch the mechanisms or give other justification for your assumption on the insensitivity of tracer compounds on NOx. I'm somewhat confused about the NOx addition during the laboratory experiments. Why were laboratory experiments conducted at NOx regimes different from those in field experiments? This certainly complicates finding an appropriate tracer. But, as I infer from the phrase "NOx levels were controlled by injection . . ." (P. 18119, lines 25 – 26) NOx was added on purpose. On the other hand no data on NOx concentrations at the field site are given. It is just stated that VOC:NOx $\sim$ 100 (P.18120, line 25). Using an average of 1 ppb isoprene and a monoterpene isoprene ratio of 0.3 during daytime (p. 18115 line 27), BVOC:NOx $\sim$100 ppb/ppb would indicate average NOx mixing ratios of $\sim$ 13 ppt. NOx around 13 ppt seems very low considering that soil might be a NOx source and furthermore, that there might have been impacts from biomass burning (p. 18127, line 17). Were the NOx mixing ratios indeed that low? For me it is not clear if NOx was added on purpose to obtain similar VOC:NOx in the laboratory experiments as found at the field site or if formation of particle mass is indeed independent of NOx.

There are results reported in literature that may support the authors' assumption. For

example Presto et al. (Environ Sci. Technol. 39, 7046- 7054, 2005) show that SOA mass formation is not affected by NOx if VOC : NOx is above 0.5 ppb / ppb. Also Eddingsaas et al. (ACP 12, 7413-7427, 2012) compare composition of a-pinene SOA for different conditions of NOx. The authors should check these references in order to find argumentation on the negligibility of NOx.

As far as I understand, there is just one usable LCMS measurement of BSOA collected in Borneo. This might be considered as lack. However, the samples were pooled indicating that the resulting sample can be regarded as representative. This allows qualitative statements and consequently the discussion of the authors' finding stays qualitative. I nevertheless find the manuscript interesting and judge the main conclusions drawn by the authors as correct: The authors give a proof that isoprene, several monoterpenes, and sesquiterpenes contribute to particle formation above an East Asian rainforest. However my confusion about the role of NOx for tracers should be abolished. Furthermore the following editorial remarks should be considered:

P. 18114, Abstract line 1: check grammar P. 18115, line 29: add unit for monoterpene to isoprene ratio P. 18117 line 9: "at the" is written twice, delete once P. 18118, line 10: please use SI units P. 18120, line 16. The "six" at the beginning of the sentence and the number of BVOC listed in that sentence differ. Please check. P. 18120, line 22: I do not understand the phrase "time resolved filter", rephrase P. 18120, line 24: VOC: NOx please add units to avoid misunderstandings (although obvious from Table 2) p. 18123, lines 2 and 7. Write tR = xy min. i.e. with equality sign consistent throughout the manuscript. At the example of P.18125, line 24: DBE is not defined: define all abbreviations when using them for the first time. P. 18127, line 4: typo, exchange "Fig. 1" by "Fig. 2" p. 18127 lines 18: The sentence describing possible differences in the O:C ratios should be phrased with more caution as both numbers given with this respect do not differ within the uncertainty limits. P. 18129, lines 5-6: two verbs, check sentence p. 18137, Table 2: There are several numbers written in bold but it is not explained why these numbers are written that way. Please explain. Explain also

meaning of "na".

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