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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Acidic reaction products of mono- and sesquiterpenes in atmospheric fine particles in a boreal forest" *by* M. Vestenius et al.

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We thank the referees for valuable comments on the manuscript. The comments were very useful, they have all been carefully considered when revising the manuscript and we think they improved the quality of our manuscript a lot. The changes made to the manuscript are described in detail below following the chronology of the comments by the respective referee.

-The text has been corrected by native English speaker

-The reviewer was worried about our comparison in VOC and acid concentrations although the measurements were not completely overlapping. This is true and we clearly state that our calculated ratios are approximates only. We also added a sentence "In

the on-line VOC measurements, there were several breaks due to malfunction of the instrument and because the sampling times of the acids where sometimes several days, the overlapping of VOC and acid analysis are not complete. Thus comparing these seasonal means represents approximates only. However, since the daily variation in VOC mixing ratios is quite modest compared to the seasonal variability, it is justified to compare VOC and acid concentrations." We are not claiming these ratios are production yields, but only ratios in the air.

- When calculating the monthly mean values, the samples were considered to belong to the month where most of the sampling took place.

-We have added standard deviations to the figures and they are also tabulated. We removed figure 2, since we though it is similar compared to the Fig.3. We added caryophyllenic acid concentrations to the fig.3.

-The reviewer 2 claims that "If terpenes and their acid products are derived from emissions from the industry (e.g., sawmills) then one would expect no correlations with aerosol In addition, might it be possible that for some terpenes a local source would skew the concentrations towards the precursors. ." This is not true, they are strongly correlated as shown by Liao et al. (2011). Aerosol particle concentrations substantially increased during episodes and monoterpene mixing ratios showed strong connections with Aitken mode particles both in number and volume concentrations. We added this to the text.

The reviewer 2 thinks that the correlation between caryophyllenic and caric acids are poor. They are not good, but we think that correlation exists and correlation coefficients are shown in figures. We added a word "somewhat" in front of "correlated" in the text.

The detailed corrections are all taken into account and corrected as suggested by the reviewer 2.

P2858 L6 inserted "respectively" in the end of the sentence.

L13 added “from”, L15 corrected “precursors”, “winter, indicating”

L16 added “the” in sentence “during the cold”., L24 added “,”.

P2859 L10 deleted “the”, L24 “the reaction products” was changed into: “specific acid reaction products”

From line 24, the paragraph is changed to: ”In this study, specific acid reaction products of biogenic VOCs, which affect the formation and growth of fine particles, were analyzed from ambient aerosol from boreal forest. Fine particle filter samples were taken at the SMEAR II station (Station For Measuring Forest Ecosystem-Atmosphere Relations; Hari and Kulmala, 2005) in Finland from June 2010 until October 2011.”

P2860: L6: changed to “The most common vegetation on the sampling site. . .”

L11 added “A”, “Before sampling, “ L16 added “a”, L24:”electrospray”. . .

L19: changed to: “Efficiency of the denuder was checked by taking samples of more volatile organic compounds (aromatic hydrocarbons and monoterpenes) than measured in this study using pumped adsorbent tube sampling and TD-GCMS analysis.”

P2861 L 3: ACN is defned, L17 “it’s” changed to “its”.

The reviewer suggested that “a brief paragraph should be provided for discussion of the standards and the details of the synthesis should be provided in the SI. “ We still think that because using of the authentic standards are one of the main things in the article, section 2.3 is needed and we would like to keep it as it is.

P2864: L4 sentence is corrected

L8 table A1→table 3

L13 added “emissions”, L28 changed into r2 , there has been some technical issues with this.

L28 “precursors, i.e. they. . .”

P2865,L1 “averagely changed to “The average concentrations. . .”,

P2865 L18: The reviewer was worried about our comparison in VOC and acid concentrations although the measuring times were not matching together all the time. This is true and we clearly state that our calculated ratios are approximates only. We also added a sentence: “In the on-line VOC measurements, there were several breaks due to malfunction of the instrument and because the sampling times of the acids where sometimes several days, the overlapping of VOC and acid analysis are not complete. Thus comparing these seasonal means represents approximates only. However, since the daily variation in VOC mixing ratios is quite modest compared to the seasonal variability, it is justified to compare VOC and acid concentrations.”

L8: added reference: “(Warnke et al. 2006, Parshintsev et al. 2010, Kourttchev et al., 2008)” .

P2866 L16 “quite” changed to “relatively good”

P2868: L2, “or”→”and/or”

The reviewer commented Figure 2: “I suggest spelling out “mean temperature” in the legend. Also I think it would be important to show the uncertainties of the measurements on this plot. Also it is quite difficult to see trends for individual species since a stacked bar graph is used. Perhaps a separate plot showing individual concentrations could be also presented here”. We removed figure 2 and added individual concentrations of all compounds in figure 3 (now figure 2), as suggested by the reviewer. The uncertainties are presented as standard deviations.

The reviewer commented Figure 4: “To be clear, the left side of the figure are the measurements from this study, and the right side is from the modeling study, correct? Please make this clearer in the plot and caption”. We have added which figure is which in Fig. 4.

Interactive comment on Atmos. Chem. Phys. Discuss., 14, 2857, 2014.