

Interactive comment on “Distributions and sources of gaseous and particulate low molecular weight monocarboxylic acids in a deciduous broadleaf forest from northern Japan” by Tomoki Mochizuki et al.

Anonymous Referee #1

Received and published: 11 June 2018

Manuscript describes the results from the measurements of low molecular weight acids in the forest air in Japan. These acids have effects on atmospheric chemistry, acidity and clouds, but their sources and concentrations in the air are poorly known. Even with very limited data set, study gives new knowledge on these poorly known compounds. However, major improvements on interpreting the results is needed.

Major comments: It would be very interesting to see how big fraction of the particulate mass these acids comprise. Could you add some information on particle mass?

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More discussion on other possible sources are needed. For example production in the air in gas phase may be very important and also transport from anthropogenic or other sources.

Please discuss also on lifetime of these compounds and background levels. For example for acetic acid lifetime in the air is around two week while for decanoic acid only few hours.

Page 5, line 24-25: From only ambient air concentrations you cannot state that some are emitted from forest floor and soil microorganisms. Or do you have data on microorganisms? If so, please show it in manuscript. There are several different sources and sinks possibly affecting the concentration levels and for some compounds even background levels may be relatively high.

Page 5 and 6, lines 30 and 1-2: Even ambient air concentrations of monoterpenes, with clear temperature and light dependent emissions, do not most often show direct correlation with temperature since there are several processes affecting on ambient concentration levels in the air (e.g. mixing layer height, vertical wind, background levels and reactivity). Therefore I recommend you to remove this statement on contribution of soil being higher than forest canopy.

Page 6, lines 10-18: This paragraph is very unclear. It was not clear to me, when you discuss on gas phase and when particulate. I would expect that lots of formic and acetic acids are formed in the gas phase reactions of BVOCs and then these formed acids partition into particulate phase. Of course some additional could then be formed also in particles or their surfaces.

Page 6, line 23-24: BVOCs with double bonds do react in the air with O₃ and NO₃ also during the night. But after first reactions they have lost the double bonds and continue reactions with OH radicals, which are formed only during the day. Double bonds from BVOCs are lost well-before they form formic and acetic acid and therefore I expect that formic and acetic acids are formed in the reactions of other VOCs only during the day. I

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would expect that due to partitioning between gas and aerosol phase more is detected in particulate phase during colder the nights and then during the day when temperature increases they are evaporated. You should add discussion also on this.

Page 7, line 4-8: If lactic acid is more polar and more water soluble it will partition more to the particulate phase. Discuss also on this possibility.

Page 7, line 13. Effect of temperature applies also during nighttime.

More discussion on also sinks and lifetimes and effect of local chemistry is needed.

Page 8, line 29. Add references on branched chain monoacids being an indicator of soil microorganism processed.

Page 8, line 30: Based on the data, it cannot be stated that microorganisms are source of these acids. They can as well be produced in the local reactions of other emitted compounds

Page 8, line 32: Do you have any data on microbial activity? If not, remove this statement.

Page 9, line 3: Based on the data shown here, this cannot be stated. Maybe they give some indication that soil could be a source, but it cannot be stated.

Even with low concentrations C4-C10 acids can be very important and have higher local effect and higher emissions/sources that you would think by their concentrations. This is because their reactivity and lifetimes in the air are much shorter. Especially for these acids data on ambient concentrations and sources are very limited. Please, add more discussion also on these acids.

Could you add a table on the comparison with other studies?

Minor comments:

Language should be checked by some native speaker

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Page 4 lines 15-18. First you tell that isopentanoic acid is most dominant in particles and then nonanoic acid. Please, correct these sentences.

Page 4 line 25. What temporal trend? Please explain more clearly.

Fig. 4. It is very hard to deviate between the days. Could you add for example some dashed lines between the days?

Interactive comment on Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2018-444>, 2018.

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