Atmospheric
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Discussions

Interactive comment on "Long-range atmospheric transport of volatile monocarboxylic acids with Asian dust over high mountain snow site, central Japan" *by* Tomoki Mochizuki et al.

Anonymous Referee #1

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General Evaluation

This manuscript entitled "Long-range atmospheric transport of volatile monocarboxylic acids with Asian dust over high mountain snow site, central Japan" by T. Mochizuki et al. describes analytical results of monocarboxylic acids together with inorganic ions etc. in snowpack samples collected from a snow pit in Japan. The authors insist that Asian dusts can uptake volatile monocarboxylic acids during long-range transport and the dusts coated with organic acids act as effective ice nuclei to cause snowfalls. There have been only few reports which discuss the atmospheric uptake of organic compounds to Asian dust particles. Thus, the topic of this paper is interesting and also needs to be investigated from the view of the climate science. Hence, this manuscript is

recommended for publication in Atmospheric Chemistry and Physics, although needs several modifications.

Specific Comments

1) P.2, L23: "IN" has already been defined in the line 6.

2) p.3, L.30: "The sample was concentrated down to 10 ml using a rotary evaporator under vacuum at 50 °C"; p.4, L.4: "... and then dried using a rotary evaporator under vacuum, followed by blown-down with pure nitrogen gas"

The authors should describe how long it usually takes to reduce the water volume via each process. Such information would help readers who will try this method.

3) p.5, L24: "We found that differences in the concentrations of each monocarboxylic acids between sample #4 and sample #4' are within the analytical uncertainties."

How large was the analytical uncertainty? The QA/QC for all the analytical methods should be mentioned in the paper.

4) p.7, L.5: "...the ratios of Mg/Ca at the Murodo-Daira site ..."

Are the ratios based on the mass concentration or the molar concentration? Should be clearly described.

5) P.7, L.10: "To investigate the effect of Asian dust on LMW monocarboxylic acids, we plotted major LMW monocarboxylic acids (i.e., formic plus acetic acids) against nss-Ca2+ using all the data points (Fig. 4)."

Why did the authors use the log-log plot? Should be explained. In addition, p values for r2 should be added. Why did the author use r2 (coefficient of determination) instead of r (correlation coefficient)?

6) P.7, L.26: "Figure 5 presents the relationship between formic plus acetic acids and pH of melt snow"

What function did the authors use? In addition, p values for r2 should be described.

7) p.7, L.13: "The atmospheric transport of Asian dust over the Japanese Islands is a dominant factor to control the concentrations of nss-Ca2+ and formic and acetic acids in snow precipitations during winter to spring"

As the authors mentioned, it is reasonable that Asian dust is a dominant factor to control the [nss-Ca2+]. However, why is it also acceptable for the concentrations of formic and acetic acids?

8) p.7, L.21: "Average concentrations of formic and acetic acids and nss-Ca2+ in 2009 are higher than those in 2011. Total rainfall during December to February in Urumqi near the Taklamakan desert, China in 2009 (31 mm) was half of that in 2011 (60 mm), suggesting that soil moisture in 2009 should have been lower than that in 2011 and thus the soil surfaces in 2009 should have been more dried. The higher concentrations of organic acids and nss-Ca2+ in the 2009 snow pit samples should be caused by a strong influence of the Asian dust events in this year when the soil surfaces were more dried in the arid regions, although the detailed records of the Asian dust events in North China are not available."

This part seems too speculative. Does the water content on the dust surface really depend on the amount of rainfall? In addition, I wonder why the higher concentrations of the organic acids and Ca2+ should be caused by the more dried soil surfaces.

9) P.8., L.1: "The adsorption process of acidic components by aerosols may be different between gaseous organic acids and inorganic gases such as SO2 and NOx"

How different are they? Do the authors have any ideas?

10) P.8, L.9: "Based on a good correlation between monocarboxylic acids and nss-Ca2+, it is very likely that organic acids in aerosols exist in the form of salts such as Ca(HCOO)2, Ca(HCOO)(CH3COO) and/or Ca(CH3COO)2"

Did the authors check the ion balance?

11) P.8, L.15: "and thus organic acid salts can be long-range transported as particles in the atmosphere from the Asian Continent to the Japanese Islands without serious photochemical degradation"

How can the authors find "without serious photochemical degradation"?

12) P.8., L.29: "Therefore, benzoic acid can be used as an anthropogenic tracer."

Why can benzoic acid be used as an anthropogenic tracer? It is unclear which is the specific reason why the benzoic acid can be used as the tracer.

13) P.8, L.31: "Formic plus acetic acids showed a strong positive correlation with benzoic acid (r2 = 0.81)"

Which function did you use for the correlation analysis? The scatter plot should be displayed. (Also for the other correlation analysis results.)

14) p.10, L.14: I think the authors have incorrectly used "loss" instead of "loess".