

Atmos. Chem. Phys. Discuss., referee comment RC1
<https://doi.org/10.5194/acp-2022-147-RC1>, 2022
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Comment on acp-2022-147

Anonymous Referee #1

Referee comment on "The effect of clouds and precipitation on the aerosol concentrations and composition in a boreal forest environment" by Sini Isokääntä et al., Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2022-147-RC1>, 2022

Referee Comment:

General scientific comment:

The study offers interesting findings to improve the understanding of wet removal processes of aerosols. In addition, the phenomenon of cloud processing is investigated for the case that wet removal has not taken place. The analysis focusses on the changes of physical parameters as e.g. particle number as well as on the change of the chemical composition of the aerosol population. In general, I have only few comments that I like to be addressed before final publication.

Detailed scientific comments:

Abstract

Line 22:

... particle number size distribution ...

Line 27:

... as a function of ...

Line 34:

... that had no contacts to clouds or ...

Line 27:

... particle number size distribution measurements ...

Introduction

Line 45:

... particle number size distributions ...

Line 59:

... precipitation event.

Line 74 (Comment):

I would rather more say "Scavenging of aerosol particles is not only affecting their number, but also their mass and other microphysical properties can change ...

Line 98:

An Eulerian ...

Line 99:

... arriving at the measurement site ...

Line 101:

... advantage compared to Eulerian ...

Line 104:

.... Russia at the arctic ...

Line 110:

.... particle number size distribution ...

Line 123:

... environments ...

Line 124:

.... particle number size distribution observations ...

2 Data and Methods

2.1 Observations at SMEAR II, Hyytiala, Finland

Line 135:

Leave out "various".

Line 135 (Comment):

Is this density realistic, seems very small, and does at least not represent any inorganic partitioning.

Line 145:

... was ...

2.2 Trajectory calculations and air mass source analysis

-

2.3 Statistical mixed effects model

-

2.3.1 General description of the multivariate mixed effect model

-

2.3.2 Selection of relevant variables and determining the relative contribution of variable groups

-

▪ Results and Discussion

3.1 Effect of wet scavenging on the aerosol concentration

Line 273:

... number size distribution ...

Line 279 (Comment):

Does Figure S6 now include particle mass of BC as stated in S7? This is now unclear to me, when discussing the ACSM data. Please clarify.

Line 293 (Comment):

What do you mean by “when the air parcel it passing the cloud”? The cloud is built within the air parcel. Maybe, consider rewording this.

Line 301 (Comment):

This is very hard to see from Figure 3. I suggest to place here a Figure that presents size fractions as (10 – 100nm, 100 – 300nm, etc.) as a function of accumulated precipitation in a two-dimensional plot.

General comment:

I find your argumentation in this section quite reasonable except from your statement in Line 305, where you say that the size of small activated particles decreases because of less competition with available supersaturation. Please clarify! Also, can you explain why number and mass concentrations are no longer decreasing at a certain set point of accumulated precipitation (see Figure 1)?

3.2 Effect of wet scavenging on the aerosol composition

Line 347:

... components ...

General comment:

The scattering in Figure 4d might be largely due to the fact of local contribution of aerosols during the warmer months. The analysis idea that you apply and which is in general very nice does then fail as the accumulated precipitation is not connected to the mass concentrations you measure here as fresh and local emissions are dominating. For the cold months I agree with your explanation that the aerosol is well internally mixed because of the long-range transport character leading to similar removal rates for the different species.

3.3 Effect of in-cloud processing on aerosol concentrations and composition

Line 531 (Comment):

Check bracket types.

Line 531:

... clearest in size ...

Line 563 :

... following ...

General comment:

Figure 9 needs in my view more clarification. For the smaller size fractions there seems to be also a mass decrease from group nr.1 to group nr. 3. Can you comment on this?

4 Conclusions

Line 568:

... affect the ...

Line 582:

... effect on ...

Line 597:

... airmass trajectory ...