

Interactive comment on “Observations on aerosol optical properties and scavenging during cloud events” by Antti Ruuskanen et al.

Anonymous Referee #1

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Review of “Observations on aerosol optical properties and scavenging during cloud events” by Ruuskanen et al.

This study reports on aerosol optical properties and scavenging during cloud events in Kuopio, Finland between October 2010 and November 2014. Measurements included aerosol size distributions and scattering coefficients, and absorption coefficient. The clouds examined were of a stratus type. The topic of wet scavenging is important and not well understood and therefore of relevance to this journal. The data collected were unique and of good value. There are scarce reports of the size dependent aerosol properties within the context of scavenging in stratus clouds. This work didn't use a CVI inlet but rather relied on the use and difference between separate inlets sampling interstitial and total aerosols.

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Selected findings include: accumulation mode particle concentration being temperature dependent (higher with increasing T) presumed to be due to biogenic aerosol; in-cloud data show that scattering and absorbing materials scavenging efficiencies have a slight increasing T dependence; higher fraction of absorbing materials (relative to scattering materials) at smaller sizes in cloud. In terms of the presentation, I found the reporting of the results to be a bit confusing at times. English editing is required as many sentences had writing issues that made it hard to understand. I have some major comments below that most certainly should be addressed along with more specific comments at the end. The paper has potential to be published in ACP but needs major revisions.

Major Comments: Have the sampling inlets been characterized? Provide more information about their performance and provide also relevant references to detail their construction and how they perform in terms of size cuts and transmission efficiencies.

There is a lack of meteorological and thermodynamic data provided for the study site to help with data interpretation. I suggest adding data for boundary layer height for the sample times in addition to other relevant weather data such as rain amounts. Figure 1 is somewhat helpful but it doesn't show how much sampling occurred in the broad range of October 2010 and November 2014 and it doesn't show characteristics associate with boundary layer height or cloud types/properties.

Some discussion about the location is needed such as population characteristics and local/regional pollution sources.

When discussing trends in the data such as comparing results as a function of temperature and humidity, there is very little discussion of statistical tests to prove there is any significant difference or trend. Please provide more detailed statistical analysis for all trends/differences discussed in paper.

More discussion about the types of clouds studied is needed. What were there characteristics in terms of liquid water amount, depth, base heights, etc? More information is

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needed, and if the authors did not measure such information, try to obtain information from reanalysis or remote sensing products. This is important to put into better context what types of clouds were examined. Simply saying “stratus” in my view is insufficient.

Specific Comments: I suggest adding a map figure showing the sample site in relation to its surroundings.

Page 1, Line 25: “the” should be “there”

Page 2, line 16: I suggest a reference after “microphysical processing” such as:

Ervens, B., et al. (2011), Secondary organic aerosol formation in cloud droplets and aqueous particles (aqSOA): A review of laboratory, field and model studies, *Atmos. Chem. Phys.*, 11, 11,069–11,102, doi:10.5194/acp-11-11069-2011.

Wonaschuetz, A. et al. Aerosol and gas re-distribution by shallow cumulus clouds: An investigation using airborne measurements. *J Geophys Res-Atmos* 117, doi:10.1029/2012jd018089 (2012).

Page, Line 36-40: the use of these two inlets makes sense in the context of this study but are there any limitations to this method? Would a CVI be beneficial in such studies? I recommend a sentence or two to address this point for those planning to do similar studies in the future. Figure 1: what are the bars and what are the colored curves?

Page 5, line 33: provide some kind of evidence or support for this claim about lack of biogenic emissions.

Page 6, Line 9-12: this sentence doesn’t make sense as written.

Page 7, Line 31: are these slopes even important or significant? There is a lack of any statistical analysis.

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