

Interactive comment on “The effect of local sources on particle size and chemical composition and their role in aerosol-cloud interactions” by H. Portin et al.

Anonymous Referee #2

Received and published: 6 March 2014

General comments

The manuscript presents results from a study of aerosol-cloud interactions, where effects of pollution and local pollution sources are investigated. Measurements were conducted at the Pujo observation tower in Kuopio, Finland, which seems to be a suitable location for this type of study. The manuscript presents novel techniques to study aerosol-cloud interactions, and the results and conclusions confirm the present understanding of the cloud formation dependence on aerosol concentration, size and hygroscopicity. The manuscript also presents more detailed insight in chemical composition dependence. My overall picture of the manuscript is that the research presented

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may not be of highest novelty, but makes use of more advanced and novel instrumentation and methods to study pollution impact on cloud formation. Evaluation of previous research is an important contribution to increased scientific understanding. The manuscript is well written, relevant scientific questions are addressed, substantial conclusions are reached. I recommend publication in ACP after minor revisions.

Specific comments

Abstract: Parts of the abstract seem to be a bit unclear. In lines 6-9 it is stated “The polluted air masses contained more particles than the clean air masses in all size classes, excluding the accumulation mode. This was caused by cloud processing, which was also observed for the polluted air but to a lesser extent.” It is not clear what the authors mean by this. A clarification is needed. The statement also does not agree with the results in Table 2. From Table 2 it is quite clear that there also are differences in the accumulation mode between clean and polluted air.

Further in the abstract, on lines 14-16 it’s stated that for the case study “Clear differences in the total and accumulation mode particle concentrations, particle hygroscopicity and chemical composition during the cloud event were observed.” The part about differences in the accumulation mode particle concentrations doesn’t agree with the general statement on lines 6-9 that the accumulation mode particle concentrations were similar in both polluted and clean air masses.

In the abstract on lines 20-21, it is stated that: “The variable conditions during the event had a clear impact on cloud droplet formation”. This also contradicts the statement on lines 10-12: The average size and number concentrations of activating particles were quite similar for both air masses, producing average droplet populations with only minor distinctions.”

It seems that the general conclusions in the abstract (lines 6-12) doesn’t agree with the conclusions from the case study. Please clarify!

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Section 1. Introduction: Maybe the time periods of the two intensive measurement campaigns 20 September-22 October 2010 and 26 September-31 October 2011) could be mentioned already in the last paragraph of the introduction. That would help the reader to follow the presentation in section 2, and understand what you mean with long-term in-situ observations.

Section 2.2: It seems reasonable to classify cloud events according to visibility, but how is the visibility measured?

Section 3.2.1: The removal of water from droplets and interstitial particles both from the total inlet and the interstitial inlet could be described a bit more in detail. Is heating to 40 deg C really sufficient to evaporate the water? Are the measurement instruments also at 40 deg C. If not, water might condense on the particles again when the temperature decreases to room temperature. Is the air from the interstitial inlet also heated to 40 deg C? Can you describe the drying process in a bit more detail, in order to make sure that all droplets and interstitial particles really are dry before entering the instruments.

Section 3.2.2: If my understanding is correct, the first paragraph, discussing activated fraction, etc., deals with results from the Twin-DMPS. The second paragraph, discussing droplet concentrations, deals with results from the CDP. Maybe the instruments or type of results could be mentioned more clearly. E.g. on page 32144, lines 14-15, you write "... within instrumental uncertainty of 20-30%". Is this the uncertainty for the CDP or the Twin-DMPS, or both?

Section 3.2.3 Particle chemical composition: I understand that it might be difficult to draw any conclusions from the results presented, but do you have any ideas? Maybe you can speculate a bit? If not I think it might be good to write that you don't fully understand these results, or something similar. I suppose the mass concentrations should be more or less constant, since there are no major removal processes (as long as it's not raining). The reasons for the observed variations might be mainly sampling and/or instrumental reasons. Or what do you think?

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Technical corrections

Page 32138, line 4: Is the inlet PM 1 or PM 10? It says PM 1 but DPM 10 sounds like a PM 10 inlet. Please check!

Interactive comment on *Atmos. Chem. Phys. Discuss.*, 13, 32133, 2013.

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