

Reply to comments of Reviewer #1:

Thank you for your comments. We are addressing the raised issues (copied in blue) in a point-by-point way below.

The only notable criticism of the paper is that only one event, which lasted less than an hour, was studied. The authors do attempt to justify this and do state this type of data represents a “golden sample”. This fact could be made more evident to the reader, for example, adding it to the abstract.

Reply: We stressed the fact of focusing on the ideal case in the abstract and added the sentence: The focus is on the “golden sample” case study for this type of analysis based on observations collected during the deployment of the Atmospheric Radiation Measurement Program’s (ARM) mobile facility AMF2 at Hyytiälä, Finland during the BAECC (Biogenic Aerosols – Effects on Clouds and Climate Snowfall Experiment) field campaign.

Abstract. “reasonably well” - This could be more quantitative.

Reply: We agree that “reasonably well” is a quite general description and that expanding on it would be an option, for example by relating the uncertainty ranges of the observations and the models: The range of uncertainty in the observations is on the same order as the variability caused by the selected microphysical schemes. However, considering the limited length of the abstract, we prefer to leave the phrasing “reasonably well”.

Introduction, p28622 line 6. “the level of effort required to analyze...” This suggests that it is very demanding to do this type of analyze but this could be more quantitative. Is this task just time-consuming or technically challenging?

Reply: It was indeed a very time-consuming task to find a period characterized by noise floor separated peaks in the cloud radar Doppler spectra were present. However, we decided to replace “level of effort” with “steps” in this sentence.

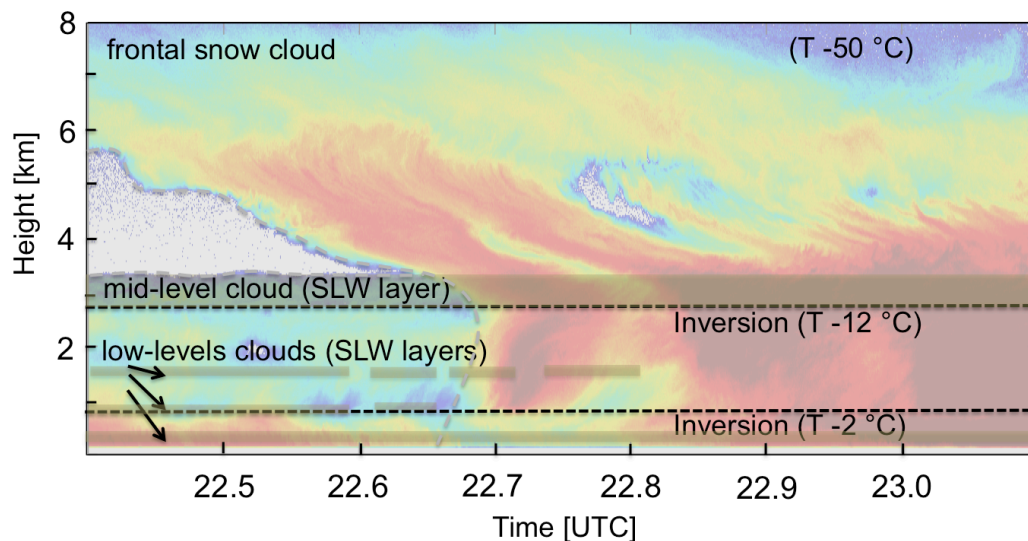
Section 2.2, p28623, line 24. “as well as the two-channel MWR”. Previously in this paragraph it is state “an MWR”. If the detail “two-channel” is needed it should come at the first mention of the MWR unless there were 2 different MWR?

Reply: We added “two-channel” at the first mentioning of the MWR and simply refer to it as MWR subsequently.

Section 3. The description of the some-what complicated frontal / cloud structures is difficult to follow. There are 2 inversions (a boundary layer inversion and I assume a frontal inversion) but are there 2 or 3 cloud layers? It is clear there is a low-level BL top cloud and then the main frontal cloud band, but the mention of a “mid-level cloud” (p 28626 line 23) confused me. Since the situation is quite complicated, an schematic diagram may help the reader. The cloud layers and SLW layer and the inversion could be marked. It would also help to label the “seeder” and “feeder”

clouds which are referred to else where in the manuscript.

Reply: According to the suggestion, we made a schematic sketch of the cloud layers (overlying the KAZR reflectivity) which we will include in the updated manuscript:



Section 3, p28626 line 5. Fronts are not just advected by the wind. They often travel at a different speed to the mean wind speed and thus propagate. I suggest this is re-worded.

Reply: True. Since we prefer not to expand more on the synoptical situation though, we simply replaced “advected” by “moved” which is meant to comprise advection+propagation.

Section 3, p28626, line 9. “Upstream”. Should this be downstream? It might be clearer to use East / West here. i.e. On 21 Feb 2014, two warm fronts were located over southern Finland, farther to the East, than the occluded front which is the focus of this study”. Alternatively, if these 2 additional warm fronts did not produce any cloud / precipitation at Hyytiälä during the times that are presented here, it may be easier to omit any mention.

Reply: We went for the second suggestion and omitted the sentence “Upstream of this frontal boundary, two warm fronts influenced Southern Finland throughout the day on February 21, 2014 before the arrival of the occlusion in the evening.”

Section 3.2 p28627, line 9 “maximum observed diameters”. Is this the length of the longest axis of the particles or the area-equivalent diameter?

Reply: PIP records particle diameter D which is defined as an equivalent diameter of a disk that has the same area as the shadow of the particle. We changed the sentence to “area-equivalent maximum diameter”.

Section 3.3, p28630 line 20-21 “The observed reduction in the LWP can partly be attributed to..” Is “partly” used here just because there is SLW elsewhere in the

profile that cannot be effected or is there some additional processes occurring?

Reply: As stated just below this sentence (lines 23—27), the “partly” refers to the fact that not the entire LWP can be attributed to the thick SLW layer at 2.9-3.4 km since multiple thin and intermittent SLW were present at lower altitudes.

Section 3.3.1 p28631, line21. “ t_{rad} ” rad should be a subscript.

Reply: In the pdf-version of the manuscript available for download at the ACP website, it correctly reads “ t_{rad} ” with “rad” being a subscript.

Section 3.3.1 p28632 line 4 “the uppermost SLW layer at...” This is one example where the upper or lower layer of something is referred to. It is difficult for the reader to remember all of these layers. Hence I strongly encourage the inclusion of a schematic diagram.

Reply: We agree with your suggestions and are including a schematic diagram shown above.

Section 3.3.3 p28633 line 19 “based on all simulated fall streaks”. How many fall streaks were simulated?

Reply: Fall streaks were simulated at the original time resolution of the KAZR (2s). Thus, for the time period in question 110 profiles were considered which was added in the manuscript.

Section 3.4.1 p28636, line 11. “The rimed fraction of snow particles at the model’s uppermost layer is set to 0”. How good an approximation is this?

Reply: The rimed fraction is one of the many unconstrained parameters. However, we can justify this assumption of totally unrimed particles at 3.3 km by the very low increase of mean Doppler velocity (V_d) from cloud top to 3.3km. – We relate this small V_d gradient to depositional growth only. Had there been a supercooled liquid layers higher up in the snow frontal system, it would have led to higher V_d gradients.

Section 4, p28640, line26. Punctuation – there is a en-dash at the start of a sentence.

Reply: Removed.