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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Combining airborne in situ and ground-based lidar measurements for attribution of aerosol layers" *by* Anna Nikandrova et al.

Anonymous Referee #4

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Review of : Combining airbone in-situ and ground based Lidar measurements for attribution for attribution of aerosol layers.

By Nikandrova et al.

The authors describe two case studies (clear sky and cloudy sky) observed over the SMEAR-II station during a field campaign in 2014. The authors used airborne measurements (mostly in-situ size distributions) associated to ground based HSRL Lidar. This manuscript is of interest for the scientific community but need major revisions before submission to ACPD.

Fist of all, the aim of the paper is pretty vague: ' investigate aerosol layers in a rural en-

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Discussion paper

vironment' and need to be clarified. This paper is showing size distribution differences that occur within each layer of the atmosphere as a function of time. The authors interpret each increase of the fine particle number concentration as a nucleation event within each layer. However, the differences of Aitken, Accumulation and Coarse number concentrations are only pointed out.

The conclusions of this paper needs some work : The comparison of the RH and HSRL profiles with HYSPLITT results are most of the times in good agreement but the ''heights did not always coincide". These height differences are not expressed in the main part of the paper and should probably be... A brief presentation of the Hysplitt model and especially the resolution of the data input of the model could help the authors to interpret these differences. Also the last conclusion of the paper is that the synergy between radiosounding, LIDAR and back trajectories gives more confidence in determining the air mass origin. Is this really the main conclusion ?

Last, the authors state: 'Evidence for cloud processing of aerosol particles was also seen in the BL but the amount of processing varied [...]'. The authors are showing Hoppel minimum that could be related to cloud processing but it's not supported by real evidence. It could also be due to different sources of aerosol with one source quite close to the instrumental site ? Moreover, I believe you can't talk about the 'amount of processing'...

Minor corrections:

P3 L 4 : Not well said. Please rephrase

Page 3 L15 : Needs to add references to support that like Crumeyrolle et al., 2010; Rose et al., 2015a, Berland et al., 2016.

P5 L25 : Please add explanations. I don't want to read Laakso et al. To understand what you did. The GF is usually dependant of the different compounds present in the aerosol. So how did you get this information ?

Figure 2 : You are always refering to the mode you define P5. Could you add on your size distribution plots the limits of each mode (nucleation, Aitken, Accumulation, Coarse). It would help the reader. No error bars on the Figure 2i within the small particles range for the middle layer ?

P7 L25 : Hard to tell cause there are no measurements of the fine particle number concentration within the middle layer. . .

Section 3.1.2 : If you are talking about erors you need to state the number of SD you used to get the average showed in figure 2. ..

P9 L27-29 : Please tell us more about the difference you see cause it's not obvious for me.

P10 L7 : 'A very high peak' : could you add in comparison to the rest of the profile ?

P10 L10 : Smoke or Dust are not known to be spherical particles . . .

P11 L14 : below 100nm instead of 30nm

P11 L 20 : If you are implying that the cloud base is playing a role in the mixing efficiency be more clearer

P11 L 22 : Please add 100nm to show the reader where the Hoppel minimium is located.

P12 L17 : around 100nm replace with around 70nm

P12 L 19 : Any interpretation why there is less particles above 500nm ?

P12 L22 : Do you mean that nucleation occurs over the cloud top ? Please add references to support this.

Figure 7. Not able to distinguish the 3 green shades. . .

Figure 9 : No error bars : Does it mean that you used only one spectra. If yes than it needs to be stated somewhere.

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