

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

### **Anonymous Referee #2**

Received and published: 12 February 2018

The manuscript “Combining airborne in situ and ground based lidar measurements for attribution of aerosol layers” focuses on investigating different layers present in the troposphere up to 3500 m. For this purpose, they combine aerosol particle size distribution data recorded on board of a research airplane with ground-based High Spectral Resolution Lidar (HSRL), radiosonde profiles and air-mass back trajectory analysis within the BAECC campaign which took place in Southern Finland 2014. The data is presented for two main case studies recorded at the same location but with differing meteorological conditions. The presence of several lofted layers was seen and compared to findings from the back trajectory analysis.

C1

I recommend the paper for publication in ACP after the following comments have been addressed:

P4, Chapter 2.1- HSRL: what is the minimum altitude that can be measured?

P4, line 32: What type of RH sensor was employed and what is the expected uncertainty?

P5, Chapter 2.2: It is stated that the SMPS data is corrected for elevated RH in the ambient with a certain GF. Is this correction implemented as a function of height, meaning that for each altitude the actual RH that was measured was used to determine the GF? What about the influence of elevated RH on the optical properties? It is not stated in the paper which index of refraction was used to determine the optically measured size distribution! As a correction for the SMPS is introduced I would strongly suggest to also apply a correction to changes in the index of refraction of the particles and adjust the actual size range measured by the OPS.

Figures 2&7: Could you add lines for the different layers in the plots depicting the back-scatter cross sections? It is not very clear where the boundaries were chosen.

P7, line 9: Where can the mentioned depolarization be seen?

P8, Chapter 3.1.3: Which data was used for the HYSPLIT trajectories (GDAS etc.?) and what resolution was employed? These two things can have a strong influence on the analysis.

P8, line 30: “close to surface” – I am a bit confused by this statement as from Fig. 5d the lowest height visible is around 1000 m, and I would not refer to that as “close to surface”. Could you rather state the actual altitude range? Such phrasing is also used later, and I would suggest changing that as well (for blue lines).

P9, lines 12-15: Can some possible reasons for the not-matching altitudes between HYSPLIT and the measurements be pointed out?

C2

P9, line 26+27: What is meant here by “the smaller size range”? I am also confused by the change mentioned for 10th of April. What is it referred to? I cannot see a clear difference between the lines in Fig. 4b?

Specific comments:

P2, line 3: change “vary” to “varies”

P4, line 23: change “stainless tube” to “stainless steel tube”

P5, line 4: change “campaigns” to “campaign”

P5, line 20: add “the” before “Cessna”

P10, line 2: change to “air masses of two different origins and heights intersected. The panels of Fig. 5 demonstrate the. . .”

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