

Interactive comment on “Long-term sub-micron aerosol chemical composition in the boreal forest: inter- and intra-annual variability” by Liine Heikkinen et al.

Anonymous Referee #3

Received and published: 6 December 2019

The manuscript studies the sub-micron on-line aerosol composition at the research site of SMEAR II situated in the boreal forest of Finland for a long period spanning from 2012 to 2018 using an Aerosol Chemical Speciation Monitor to derive the inter- and intra-annual variability. Overall, organics represent the most abundant species, followed by sulphate, nitrate and ammonium. PM₁ concentrations present a bimodal distribution peaking in February and in summer. The winter peak is mostly linked to enhanced inorganic components such as nitrate and sulphate, while the summer maximum is mostly linked to significant increase of organics, probably due to secondary organic aerosol formation. The study also takes into account parameters such as temperature, insolation, wind speed and direction when interpreting the diurnal and

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seasonal patterns of the different aerosol components. Finally two case studies are examined, derived from this inter- and intra-annual variation, the enhanced concentrations during two summertimes (2014 and 2018) and enhanced sulphate loadings during September 2014.

The paper is well written and easy to follow, though there are some issues and more thorough discussion should be made in specific sections. Other than that the paper can be recommended for publication after addressing the issues listed below.

General comments:

- There is overall an inconsistency in figure numbering and their reference within the text e.g. P11L330 Figure 1a should be 2a and L338 should be figure 2b, P18L478 Figure4a should be 6a, P18L502 Figure d of which? Etc.

Specific comments:

- P12L361 It would be interesting to see whether OM/OC changes within the year as, e.g. SOA formation is expected to lead to more oxidized species and thus, higher OM/OC. I would suggest maybe color-coding Figure 2e based on the date. This would also be interesting further on in the manuscript, as 2018 is the case study having very warm summer (Section 3.1.1)

Technical corrections:

- P12L357-358 There seems to be something wrong with this sentence and what is inside the parenthesis.

- P18L504 only one week (delete “ca”)

Interactive comment on Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2019-849>, 2019.

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