

Interactive comment on “Combined effects of boundary layer dynamics and atmospheric chemistry on aerosol composition during new particle formation periods” by Liqing Hao et al.

Anonymous Referee #2

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The authors present analysis of SP-AMS data combined with modelled data on the boundary layer height and supporting data of aerosol size distribution measurements. Their main finding is that sulfate aerosol mass concentration behaves differently than the organic aerosol during NPF event times: the sulfate concentration decreases less than the organic aerosol, and the same type of behaviour can be found for LVOOA with respect to SVOOA.

There are two main explanations for this observation: either it is a) a mixing effect of the PBL and the residual layer, with two different types of aerosols mixing, or b) there is formation of sulphate/LVOOA aerosol during the same period.

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The authors study explanation b) by exploring the possibility of low- or nonvolatile vapors condensing on the existing aerosol and comparing the resulting aerosol mass to the observed one. Based on the discrepancy of the thus computed aerosol mass and the observations, the authors then conclude that the condensation of sulphuric acid cannot explain the sulphate time evolution and the sulphate aerosol is entrained from the residual layer. Similar results and conclusions are obtained for LVOOA aerosol.

This result is an interesting and important one, and the paper is well written and very well suited for ACP. I suggest that the paper is published, but I think that the conclusions could be supported more strongly by some additional discussion of the possible origin and composition of the entrained aerosol and the mixing process:

Firstly, what is the origin of the sulphate aerosol in the residual layer? Can its composition be estimated? (even approximately, e.g. amount/fraction of sulphate, LVOOA, SVOOA in the residual layer could be back-calculated from the data quite easily, I think).

Secondly, is there any indication of an external mixture when the mixing is occurring? In the case of a mixing, I guess there would be two different modes of aerosol (the entrained, sulphate-dominated mode and the PBL mode with less sulphate), while in the case of sulphuric acid condensing, the sulphate should be evenly distributed over the pre-existing aerosol. Is there any data available to test this assumption (e.g. the size information in the SP-AMS)?

Below are also some more minor comments:

P7 l22: If the DF is defined as in Eq. 2, then the initial concentration should be multiplied and not divided by the DF. (Typo?)

P8 l6: It seems that the mass_{SA} depends strongly on the CS_{SA}; if I understand correctly, the SA concentration estimate from the proxy is also depending on CS_{SA}, and therefore the uncertainty in Eq. (3) is proportional to CS². I think it would be interesting to compute the uncertainty in this, and also indicate the range of uncertainty

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in the figures.

P9, l26: as it was just mentioned that [HOM] measurements were not quantitative, how was the concentration determined here?

p10, line 3: as the calculation is done assuming a non-volatile HOM, but then the statement says that HOM contributes to semi-volatile aerosol; could this be elaborated on as this seems contradictory?

Interactive comment on Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2018-538>, 2018.