Review on the manuscript:

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Investigation into chemistry of new particle formation and growth in subtropical urban environment

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For the present study the authors measured particle chemical composition in a subtropical urban environment by means of an Aerosol Mass Spectrometer (c-TOF-AMS). During the measurements five new particle formation (NPF) events were observed. Regardless of the instrument's lower detection limit of 50 nm, the authors asses the data with the clear aim to evaluate particle chemical composition during NPF and the consecutive growth. One major result of the study is that all measured particles are predominantly composed of organic molecules, both when NPF takes place and also on non-nucleation days. From calculating the mass fractions f43 and f44 the authors assign the particle chemical composition to different classes of organic species. By plotting f43 vs. f44 it is shown that the chemical composition of particles on NPF event days differs from composition during non-event days. According to the authors the f43 vs. f44 plotting method can be used to distinguish the particle source, whether they are pure traffic generated particles or origin from NPF.

The study is giving valuable information on particle composition in a subtropical urban environment. The allocation of the particle composition to different sources, by means of the f43 vs. f44 plot, is a straight forward approach and is a considerable contribution to the scientific community. The manuscript is written in a comprehensible way and is well structured.
Therefore, the manuscript is suited for publication in ACP. However, several issues need be assessed before publication.

General comments:

A major deficiency of the study is the fact that the lower detection limit of the c-TOF-AMS is in the size range between 50 and 100 nm. This size range is not appropriate to analyze the chemistry driving NPF. However, in many parts of the manuscript the authors state that the data gives insight into the chemistry of NPF. In my opinion, this is not the case. The data obtained from the c-TOF-AMS can only be attributed to the growth of particles several hours after the nucleation process. This fact should be made much more clear throughout the whole manuscript.

A possible distinction of traffic related aerosols from particles originating from NPF, by means of the f43 vs. f44 plot, is the principal finding of the present study. However, these conclusions are only based on three measured nucleation events. In my opinion some more evidence should be supplied. According to the authors two more NPF events were recorded. Therefore, at least these two events should also be analyzed in respect of the f43 vs. f44 plot.

Further, the c-TOF-AMS is giving the possibility to analyze chemical composition for different particle size ranges. In my opinion, this is a clear advantage of the instrument. Unfortunately the measurements were not analyzed in this respect to a satisfying degree. Especially in section 3.3, where the chemical composition is assessed, the size information should be considered. I think it would be beneficial for the study to compare the chemical composition of particles in different size ranges. Therefore, some insight into the growth process could be obtained.

Additionally, the captions of virtually all figures should contain more information. Detailed descriptions give the reader the possibility to understand the figures in a minimum of time.

Specific comments:

Abstract

Page 27946, line 6:
Please state in which diameter range the chemical composition and number size distribution was measured.

Page 27946, line 11:
Please state whether you relate to absolute- or relative humidity.

Introduction

Page 27947, lines 7-8:
Please add some references for the statement:" … *these events are one of the main sources of ultrafine particles (UFPs; particles smaller than 100 nm), in addition to combustion emitted particles.*"

Page 27948, lines 4-6:
Please state clearly that particle chemical composition was not measured during NPF but during the following growth process.

Materials and methods

Page 27949, line 11:
Please state which meteorological parameters were measured.

Page 27950, line 7:
Which particle diameter definition does D_{va} stand for?

Page 27951, line 6:
Generalised Additive Model (GAM): Why was a modeling approach necessary to analyze the diurnal patterns? Some more explanation would be appropriate at this point. A figure comparing the measured data and the model results would be helpful.

Results and discussion

Page 27951, lines 18-20:
Please state how many non-event days were considered at each site.

Page 27952, lines 3-4:
What could be the reason for a lower CS on nucleation days? Perhaps on NPF event days there was less traffic or another prevailing wind direction. Did the authors observe a typical wind direction during NPF?

Page 27952, lines 24-26:
The authors state that "*… the role of precursors on the NPF events can still be investigated as the condensable vapours responsible for NPF events do condense on pre-existing particles which are detectable by the instrument.*"
I am not convinced by this statement. It was shown by Winkler et al. (2012) that different organic species condense on particles of different diameters. In their study Winkler et al. (2012) found that particle chemical composition differed significantly when comparing particles with 10 nm to particles with 40 nm diameter. As the lower detection limit of the c-TOF-AMS is somewhere between 50 nm and 100 nm no conclusion on the composition of freshly formed particles can be drawn from this data.

Page 27953, lines 10-13:
In line 10 the authors state that "*…no distinctive trend in sulphate mass concentration was observed during the first event.* ". However, contradicting this statement the authors state in line 13: "*Sulphate followed similar trend to this during the events observed at S25.*" The paragraph clearly needs to be rephrased.

Page 27953, lines 22-23:
Referring to Fig. 5 the authors state: "*Ammonium, sulphate and nitrate mass fractions peaked around the start of nucleation and subsequently decreased after the event.*" With a little good will I can see this behavior for site S12 in Fig. 5. But at site S25 I cannot see this behavior. Especially sulphate does not behave as the authors stated. I suggest the authors focus on the temporal behavior of the individual mass fractions after the particles reached the detection limit of the c-TOF-AMS. This is reasonable, as it is not clear where the signal comes from before the particles reached the threshold diameter.

Page 27954, lines 10-11:
I miss information on particle size in Figs. 6 and 7. Which particle diameters are plotted? I think it would be most interesting to add different particle diameters to the figures. This could be done by differently coloring the single particle diameter ranges.

Page 27954, lines 18-20:
Please rephrase or delete the sentence, as its content seems to be already stated in the sentence above.

Page 27954, lines 21-27:
At the beginning of the paragraph the authors state: "*… the aerosol components reached the bottom left side of the triangular region*". Contradicting this statement, the authors write at the end of the paragraph: "*… they clustered at the middle right hand side of the triangle.*" I suggest a revision of the paragraph.

Summary and conclusions

Page 27955, lines 23-26:
Please state that the nucleation events were only observed at two of the five measurement sites.
Please state whether you relate to absolute- or relative humidity.

Table and figures

General comment: Please add more details to the figure captions.

Page 27962, Table 1:
Please state for which particle size range the growth rate was determined.

Page 27963, Figure 1:
What do the shaded areas denote?
Please replace *humidity* by *relative humidity*.
How many nucleation and non-nucleation days were averaged for the figure?
Comparing Fig. 1 to Figs. 3 and 4, I cannot consent that all nucleation events started at 10 AM. Is the point in time an average value? The same fact applies to Fig. 2.

Page 27965 & 27966, Figures 3 & 4:
The figures would be much easier to read with the colorbars moved to the right hand side.
The time scale of the figures should be revised, with focus on an even hourly spacing of the ticks.
Please denote what the blue vertical lines indicate.

Page 27967, Figure 5:
Please denote the particle size range in which the chemical species were determined. I'm aware that it is already mentioned in the text but it is still helpful to have this information also in the figure caption.
The time scale of the figures should be revised, with focus on an even hourly spacing of the ticks. In the moment a period of 15 hours is denoted by 5 and 10 ticks, respectively.

Page 27968, Figure 6:
Which particle size range is considered in this figure?
How many non-event days were analyzed for this plot?

Page 27969, Figure 7:
It would be interesting to denote at what times the growing particles reached the detection limit of the AMS.

Page 27970, Figure 8:
How can the authors be sure the red arrow represents the typical composition of traffic aerosol, did other studies find similar patterns?
How many NPF event and non-event days were analyzed for this plot?
Did all considered days show comparable meteorological conditions (e.g. wind direction & solar irradiance)?
Are only workdays considered, with typical rush hours, or does the figure also include weekends?
Did the authors apply the f44 vs. f43 plot also for measurement site S25? Are the patterns comparable at S25 and S12?

Page 27971, Figure 9:
Why is the unit on the y-axis denoted in hours? According to my understanding f57 should have no unit, as it is the ratio of m/z 57 divided by the total c-TOF-AMS signal.
For better comparison, both y-axis in the figure should be scaled equally.

Technical comments

Page 27946, line 26: Please add "e.g." in front of the references.
Page 27947, line 13: Please delete "been".
Page 27947, line 17: Please replace "process" with "NPF".
Page 27948, line 10: "UPTECH" is mentioned twice in the same line, please delete one.
Page 27949, line 8: Please remove the brackets of "*(Crilley et al., 2013)*".
Page 27953, line 26: Please replace "reaching" with "reached"

References

Winkler, P. M., Ortega, J., Karl, T., Cappellin, L., Friedli, H. R., Barsanti, K., McMurry, P. H., and Smith, J. N.: Identification of biogenic compounds responsible for size-dependent nanoparticle growth, Geophys. Res. Lett., 39, L20815, 2012.