Atmos. Chem. Phys. Discuss.,
https://doi.org/10.5194/acp-2017-819-RC2, 2017

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Quantification of atmospheric nucleation and growth process as a single source of aerosol particles in a city" *by* Imre Salma et al.

Anonymous Referee #2

Received and published: 31 October 2017

The authors present an analysis on the impact of regional new particle formation (NPF) events on the aerosol particle number concentrations in urban and near-urban environments. They aim to quantify this impact by applying different versions of nucleation strength factors (NSFs), which are determined to describe the relative impact of NPF events on the particle concentrations. The goal of the study is of importance for considerations of improving urban air quality. However, I find that the main parameter applied in this study, NSF, might not be suitable for drawing accurate conclusions, and should at least be investigated and explained in more detail. Based on my main comment below, I cannot recommend the publication of this manuscript without further analysis on the behavior of the parameter NSF.

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Discussion paper

Major comment

The actual meaning of the NSF is not clear, due to the normalization of nucleation + Aitken mode concentration with the accumulation mode (why not e.g. with the mean N6-100 from 6 to 9 am on the same morning?). The applied normalization may cause unintended signals: for example, if we consider two days during which the N6-100 is exactly similar, but on the latter (called here a nucleation day just to show the point) N100-1000 is lower than on the first by a factor of 1.5, the NSF would by 1.5. This would not only be a false signal but also to the wrong direction: during lower sink conditions the equal source should lead to higher concentrations, and if equal N6-100 was observed, the source should be weaker and thus NSF smaller than 1. This does not necessarily mean that the applied definition of NSF would not make sense, but it's behavior with the applied data set should be analyzed and its meaning explained much more in detail.

Minor comments

On the terminology:

The word nucleation is used in the manuscript for regional new particle formation events. It is misleading, since many of the anthropogenic particles also are formed in through nucleation processes, as the authors know. This should be revisited through the manuscript.

The word background seems to be applied with (at least) two different meanings, one for the background site and one for the background concentrations (e.g. lines 159-161, lines 226-227), which here, if I understood correct, refers to concentration of accumulation mode particles in general. Additionally, it seems that on lines 322-323 and 329 the term background means the concentration without nucleation event, otherwise "increment of background concentration on nucleation days" would mean higher N100-1000 than on non-nucleation days. Why not simply use the term accumulation mode?

Specific notices:

Lines 41-43, should these sentences be one?

Line 68-70: Open (NH4)2SO4, NH4NO3 and TC

Line 105: N6-100 referred to as Aitken mode, should be nucleation + Aitken mode, compare e.g. to lines 22-23.

The time over which the daily mean is calculated for seasonal or annual NSFs should be mentioned in the methodology part (perhaps line 130), now it appears only on lines 322-323.

Line 131: reference for the site in question, in some/many locations more nucleation days.

Lines 143-144: describe shortly the “second group”

Lines 159-160: What are the background concentrations meant here? In the context of the table it is logically connected to background site, but from the sentence it seems not to be so.

Line 277: maybe “of what” instead of “which”, or modify the sentence otherwise.

Lines 384-387: It seems that the growth of these particles is considered as a loss of these particles in this analysis. The share of particles grown out of nucleation mode size range should be possible to determine from the dmps measurements with the normal methodologies (e.g. Kulmala et al., 2012, referred to in the manuscript).

Lines 404-405: I don’t believe the authors mean the particles of e.g. 20 nm diameter are thermodynamically unstable.

Interactive comment on Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2017-819, 2017.