

Interactive comment on “Regional effect on urban atmospheric nucleation” by Imre Salma et al.

Anonymous Referee #1

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The manuscript presents a thorough analysis of observed new particle formation (NPF) and factors affecting the phenomenon in both rural and urban sites in the Carpathian basin. The authors discuss the similarities and differences between the two locations, concluding that the NPF is a common process that occurs over wide areas while there are local alterations in the features of the observed NPF events. The manuscript is well written and the results clearly presented. I recommend it for publication in ACP after the authors have addressed the following comments:

Specific comments:

1) Determining the quantities used in the analysis:

i) GR:

-How much does the choice of the method for assessing GR (the log-normal fitting

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method) affect the obtained values? The maximum concentration method (see e.g. Kulmala et al., 2012) is also very often used; would the values change if this method was used instead?

-Is GR corrected for coagulative losses, as proposed by Leppä et al. (Atmos. Chem. Phys. 11, 4939–4955, 2011)?

-Are the GRs from literature (page 5, lines 39-41) determined for the same size range (and with the same method)?

ii) J :

-It is not clear how J is in practice determined. The first paragraph of Section 2.3 lists the works by Kulmala et al. (2012), Kulmala et al. (2001) and Dal Maso et al. (2002) as references to how the DMPS data analysis was done; however, all these give somewhat different approaches for determining a formation rate J .

-Does J depend on the determined GR as in the expression of Kulmala et al. (2012)? If so, the dependence should be brought up in the discussion for clarity.

-Is J determined for $d_p = 6$ nm for all the data? Information on the size is missing in e.g. Section 2.3, and Figs. 6 and 7. If the size is always 6 nm, how is J determined for the K-pusztá site, for which the lower limit of the DMPS is 10 nm?

iii) t_1 :

It is stated that "The time t_1 also includes the time shift that accounts for the particle growth from the stable neutral cluster mode at (1.5±0.4) nm to the smallest detectable diameter limit of the DMPS systems". How was this done exactly? Presumably this calculation requires a growth rate for the sub-detection sizes; which values were assumed? How much does the inclusion of this time shift affect the determined times t_1 ?

2) Page 4, lines 23-26: The quantity τ is used to assess if the air mass was transported from one site to the other for $\tau = 1$ and $\tau < 1$; for $\tau > 1$, it is only stated that " $\tau > 1$ is often caused by large (>7 m s⁻¹) WSs." Can anything be hypothesised about the origin of the air mass in the last case? Also, τ isn't really discussed in the Results section; could it be e.g. added to Table 2?

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3) Figure 3 and discussion on page 6: What does the dividing line describe, i.e. is there a physical reason to fit a line to the (sink, source)-data? (Isn't it quite clear also without the line that most of the red dots corresponding to events are at higher source values?)

4) Page 7, lines 21-22: Discussion on the effect of the condensation sink on NPF events: "This implies that the CS affected the NPF in the Budapest area, and that it can have preventing influence on the events. In contrast, the mean CS values for K-pusztá station showed much less or even little effect." Why is the effect smaller in the K-pusztá site? Are the absolute values of CS lower than in Budapest?

5) Page 8, line 23: "Fig. 8" should read "Fig. 7". Moreover, this Figure is only briefly mentioned in one sentence; it should be discussed more in the text to justify its existence.

6) Figures:

i) Figs. 4, 5 and 7: It would be useful for the reader to estimate the H₂SO₄ proxy also in units molec./cm³ (e.g. as an additional y-axis), as well as the source in units molec./cm³/s (Fig. 3).

ii) It would be useful to have also the hours, not only the day of year, in the time axis of Fig. 5. Also, in the bottom panel, the scaling factors could be written in the y-axes labels for clarity, and the legend could be removed (as now both the y-labels and the legend give essentially the same information)?

Technical comments:

-Page 1: The sentence "Despite the fact that NPF..." starting on line 28 should be tied to the previous sentence; on its own it doesn't mean anything. Also, the following sentence should be somehow modified, as it's not entirely clear to what kind of studies the expression "for such studies" refers.

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-Page 5, lines 26-27: The English of the sentence "At present knowledge, advection of nucleating air masses cannot be excluded only in a few cases" is somewhat unclear; please modify.

-Page 7, lines 17-18: Tie the sentence "In spite of the fact that the estimated reduction..." to the previous sentence.

-Reference list: Seven references to works of one of the authors seems a bit unbalanced; the authors should cite also works other than their own in these occurrences.

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