

Interactive comment on “An Analysis of New Particle Formation (NPF) at Thirteen European Sites” by Dimitrios Bousiotis et al.

Anonymous Referee #3

Received and published: 24 February 2021

As the title suggests, the manuscript “An Analysis of New Particle Formation (NPF) at Thirteen European Sites” summarizes data on new particle formation events from a variety of sites. The manuscript focuses on describing how events differ based on location (urban, rural, roadside) and season. There is also discussion of regional events as well as an analysis of the contribution of NPF to ultrafine particle concentration.

NPF is a complex and poorly understood process. Studies such as this one that attempt to synthesize a large amount of data are valuable. However, these types of studies are inherently difficult owing to the complexity and uncertainties of npf. This may be what drives the largely descriptive nature of this paper. For this type of topic, I am not against a descriptive synthesis of information as I think it has its place and use. However, I think that the manuscript requires several major revisions before it is

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suitable for publication.

Major comments

1) This manuscript attempts to bring together many datasets, a difficult undertaking and one that requires careful presentation of the data in order to clearly communicate the results. After careful reading, the new knowledge and major take-home points of the manuscript were unclear to me. This may, at least in part, be the result of the structure of the manuscript. I found the presentation difficult to follow, in part because the text and the figures were not harmonized; the text was organized by country, each figure targeted a specific result and included the data for all the countries. As a result, one has to keep moving between figures. With the current format, it is extremely difficult to identify overarching themes since any such results are buried along with discussion about local matters (that are nevertheless important) such as wind direction.

In my opinion, the manuscript would be greatly improved through restructuring Sects. 3.1-3.5 (the ones that focus on countries) to instead focus on results such as npf frequency, growth rate, etc. and for each section to discuss all the countries. This type of organization is already in place for Sects. 3.6 (regional events) and 3.7 (effect on ultra-fine particle number). Alternatively, the sections could be organized based on location (urban, rural, background).

I also think a discussion section that summarizes the findings in a succinct way and clearly lays out the new findings and take-home points is warranted. Summarizing these along lines of “x is reduced under conditions of clean flow at all locations” would greatly improve readability and would allow one to judge the importance of the results more easily. To not add length to the paper, some of the more local details could be moved to the SI. Furthermore, some aspects of the conclusions (for instance, discussion comparing the results to results from some Asian cities) would be more appropriate in a section such as this one.

2) Although the manuscript is descriptive, it does draw comparisons between regions.

However, there is little to no discussion about how data limitations influence those comparisons. For instance, the sites in Germany have, on average, higher formation rates and frequency of events compared to the sites in other countries. Does this result still hold if the results are compared only to the results from 2008-2011 at the other sites (for those that have measurements)? In other words, is there significant interannual variability or are there trends that could affect the comparison between the countries given that the data coverage is not the same for each region? I am not suggesting that an in-depth analysis of trends or variability is required. I think a brief discussion about how such factors potentially impact the conclusions is sufficient.

Similarly, I would like to see some indication (table in SI) of the absolute number of events for each site for each season. That information is useful for the reader to interpret the results. Additionally, although data coverage is shown in Table 1, the current format doesn't provide information on if data coverage is biased towards specific seasons (which would impact how one interprets the seasonal results). From line 292, it sounds as if missing data may predominantly be in a few seasons at least for certain sites.

Other

1) Why are growth rates in Figure 3 provided as standard error of the mean, while in the text they appear to be standard deviations? It is also unclear to me if standard error of the mean is appropriate given the variability in drivers of npf and growth. This question also pertains to other figures where standard error of the mean is used – e.g. Fig. 6. This choice should be explained in the manuscript.

2) Some indication of variability is warranted in Figures 5, 7, and 8.

3) The explanation for how traffic related nucleation was removed from the data set (i.e. lines 156-157) is insufficient, particularly given the results shown in Fig. 6 that the formation rate is much higher at roadsides.

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Technical

- 1) The naming of the sites (3 letter country, 2 letter location abbreviation) needs to be introduced in the text at the start of Sect. 3 not just in the figure caption.
- 2) The reference list should be checked for accuracy. For instance, the ACP rather than the ACPD version of Ketzel et al (2004) should be cited.
- 3) Figures are cited out of order (Fig. 5 before Fig. 4).

Interactive comment on Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2020-414>, 2020.

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