

Atmos. Chem. Phys. Discuss., referee comment RC2
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Comment on acp-2022-512

Anonymous Referee #2

Referee comment on "Characterization of ultrafine particles and the occurrence of new particle formation events in an urban and coastal site of the Mediterranean area" by Adelaide Dinoi et al., Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2022-512-RC2>, 2022

This work reports long-term (4 years) measurements of particle number size distribution at two locations in south Italy. It aims to grow the knowledge on the regional new particle formation events in a large area. It is a complex and extended dataset and analysis, and the results will fit within the scope of ACP, being of interest for the international research community. However, the manuscript should be improved before it is published in ACP, and I would suggest some aspects to be considered in order to improve the manuscript and/or strengthen its impact.

Major comments

- The manuscript is mainly descriptive, with some statistical analysis but no conclusions about the differences between both sites. I would suggest the authors to include some additional analysis to identify the factors that affect to the differences, specially on NPF events. The growth rate is not clear how it is retrieved or for which size range (see comment below), I would also suggest the authors to calculate the formation rate and include discussion about it. I expect to see some differences between both site on GR and formation rate, if there are differences, means that the vapours contributing to the formation and the growth are different at these sites. Also, I would suggest to include the analysis of H₂SO₄ instead of SO₂ (solar radiation and CS are available and could estimate the sulfuric acid from proxies as Petäjä et al. 2009, ACP).
- I recommend the authors to combine sections 3.4 and 3.5, and try to answer in these sections why there is that large differences in the event frequency in this two nearby locations? What promotes the regional NPF events? There is cases when NPF events are observed at both sites?
- In the introduction the authors focus on the importance of regional NPF events,

however, the manuscript lack of results and discussion on this topic. I would suggest to include more analysis on this topic, but if no further analysis, discussion, results are included about this, I would suggest to shorten that part in the introduction.

Minor comments

L12 – change “occurred” by “occurring”?

L89 – which different meteorological dynamics?

L94-95 – please rewrite this sentence

L95-97 – would move this sentence after L89 about dynamics and would add other sentence about meteorological dynamic at ECO site.

L103 – move this sentence with the next paragraph, where the authors present the quality control. Are the instrument routinely calibrated or psl checked or compared with total particle concentrations? Have the instruments been intercompared before?

L109 – multiple charged instead of negatively?

Section 2 – I would recommend to name this section “Measurements and methods”, then section 2.1 “Measurement sites and instrumentation” that unifies sections 2.1 and 2.2, and section 2.3 I would rename it as “Data analysis”, “methodology”, “methods”,... “Evaluation of NPF events”, I think is not the most appropriate. Include in this section the formulas for the CS that is later discussed.

L132 – the authors use frequently paragraphs of just one sentence, please avoid this.

Table 1 includes Events, Undefined and Non-event days, that sum the total number of days. However, line 134 says that there is a 78% of data coverage? How can classify more days than the data coverage ($\sim 0.78 * \text{TotalNumberDays}$).

L140 – “confirming what was already observed in Dinoi et al. (2021a)” I would suggest to rephrase, something like “showing similar results than those presented by a shorter measurement period presented by Dinoi et al. (2021a)”.

L146 – where these numbers come from?

L156-160 – GR is a quantity that depends on the diameter. Here the authors don't define the diameter range where the GR is being retrieved. If the GR changes with time, probably because the diameter range change?

L162 – avoid the term “emission levels”, mainly because the authors are not really measuring emissions, only measuring atmospheric concentrations.

L166 – use the correct significant numbers, the table is correct. Same in the following paragraphs.

L176 – add space before ~3100

Eq2 – use subindex for E and NE.

L213-218 – I would add some references were this method has been previously used at different locations and compare how important NPFs are in other locations compared to those presented in this work (e.g., Bousiotis et al., 2021; Casquero-Vera et al., 2021; Thén et al., 2022). Are the values reported averages for the NPF time of for the whole day?

L240 – I would not say is surprising, if there is less CS, probably there is also less precursor vapors too...

References

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Thén, W.; Salma, I.: Particle Number Concentration: A Case Study for Air Quality Monitoring. *Atmosphere*, 13, 570, <https://doi.org/10.3390/atmos13040570>, 2022.