Atmospheric Chemistry and Physics Discussions

Atmos. Chem. Phys. Discuss., referee comment RC1
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Comment on acp-2021-729

Anonymous Referee #1

Referee comment on "An evaluation of new particle formation events in Helsinki during a Baltic Sea cyanobacterial summer bloom" by Roseline C. Thakur et al., Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2021-729-RC1, 2021

General Comments

This paper by Thakur et al. explores new particle formation events in Helsinki from gaseous precursors of marine (iodic acid, sulfuric acid) and anthropogenic (sulfuric acid) origin. Importantly, this study highlights the complexity of nucleation in a semi-urban location with marine and anthropogenic influence. The authors use a wide range of ground-based instruments to monitor particle size and concentration, in addition to measurements of key gas-phase species. These measurements are paired with meteorological and satellite observations to identify the source of the precursors to NPF. This study fills a measurement gap of nucleation events in coastal urban areas.

This paper has some interesting results that are valuable to the NPF community. With that, I find it suitable for publication in ACP. However, this paper would benefit from clearer explanations of how the conclusions were reached, or perhaps some softening of their conclusions. Furthermore, I believe this work could use some editing for clarity.

Specific Comments

- In the abstract (L49), the authors indicate that the type of phytoplankton species and the intensity of the bloom was one of the most important factors affecting aerosol precursor vapor concentrations (IA and SA). How was this conclusion reached, when the only measurements made in this study to link their gas and particle phase measurements to biological activity were satellite measurements of Chl-*a,* which does not differentiate between species?
- The authors also conclude on L696 that the type of phytoplankton species, bloom

intensity, and distance from the bloom plays an important role.
  - How does the phytoplankton specie affect the gas-phase concentration in their measurements?
  - Is there an instance where there was a sea wind with less intense phytoplankton bloom, and no NPF events?
- I'm also not convinced by the importance of the cyanobacterial blooms on the IA concentration, especially when compared to the other algae and marine sources. The authors timed their study to match with the cyanobacterial blooms that are expected in the Baltic Sea and coastal regions of Finland. In section 3.1.2 however, the authors emphasized that the cyanobacterial blooms were reduced below normal in July and August, which were the time periods in which they observed the NPF events. The authors also point out that the low tide and high irradiance could be a source of macroalgae iodine, as was observed in McFiggans et al., 2010.
  - How important is the contribution of cyanobacterial blooms vs exposed macroalgae?
  - Would Chl-*a* measurements also measure the contribution from macroalgae?
- L485: The authors indicate that the change in wind direction 'apparently discontinued the precursor vapor source', however I'm not sure why this is apparent? From Figure 5(d), the concentrations of SA, MSA and IA remain relatively constant with the change in wind direction.
- Figure 6: Is the green trace called 'particles' the measured particles? Perhaps make that more clear.
- L593: How do you know all the I2 was oxidized to IA?
- The authors often use parentheses to provide additional details within the text. In some cases, the parentheses are unnecessary and interrupt the flow of the text. I suggest the authors review their use of parentheses for clarity. Some examples:
  - L32: Several studies have investigated New Particle Formation (NPF) events from various sites ranging from pristine locations, including (boreal) forest sites to urban areas.
    - There have been studies of more than just boreal forests, I'm not sure why boreal was specified here. Can remove the parentheses and/or the word boreal.
  - L101: The parentheses around 'produced from macroalgae' can be removed.
  - L499: Can be rewritten as 'The high normalized signals…' to remove the parentheses.
  - L355: Can use 'The daily mean' instead of The mean (whole day).

Technical Corrections:

L42: Keep the chemical names in lowercase "sulfuric acid (SA)" to match L78.

L46: Chemical names in lowercase "iodic acid (IA)"

L150: Use the abbreviation for New Particle Formation (NPF)

L196: I'm not sure what 'mlpm' is, define it?

L205: Define HOMS when it is first used.

L208: extra ‘The’. Don’t need to define UMR if you only use it once.

L263: Don’t need to redefine growth rate.

Table S1: O3 instead of O2?

447: Missing a period?

556: Replace HIO3 with IA

Figure 4 caption: Not sure what the yellow circles are for ‘all time’ – is it just the other time except the morning and evening?