

Atmos. Chem. Phys. Discuss., referee comment RC2
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Comment on acp-2022-261

Anonymous Referee #2

Referee comment on "Measurement report: Atmospheric new particle formation in a coastal agricultural site explained with binPMF analysis of nitrate CI-API-TOF spectra" by Miska Olin et al., Atmos. Chem. Phys. Discuss.,
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General comments:

In this paper, the authors investigated the new particle formation (NPF) events in a coastal agricultural site in Southwestern Finland by using a combination of a nitrate ion-based chemical-ionization mass spectrometer, and gas analyzers as well as aerosol samplers. The binned positive matrix factorization method (binPMF) was applied to the measured mass spectra, showing that eight factors could describe the time series of ambient gas and cluster composition during the NPF events. Before publication, I think there are several comments that the authors may need to consider.

- There are several uncertainties in this study that may lead to some problems or make this study not really convincing. First, the mass errors ranged from -10 ppm to 50 ppm (Line 211), so the identification of compounds with a high molecular weight maybe not be correct. How did the authors determine the confidence levels of the identifications in Table 1? Second, the authors said that "it cannot be certainly proved that a variable is actually forming new particles or growing them by examining the correlations. There is always a possibility that a variable is only observed simultaneously with NPF events due to the similarity of its source and the source of the precursor really causing the NPF events." I agree with the authors about this point, but does it also mean the results of this study are also based on this uncertainty?
- Where do the F8 compounds come from? I also think the authors need to give a map showing the sampling site and the meteorological information such as the wind speed and direction is also required to illustrate the sources of measured aerosols and gases.
- The time profiles of F7 compounds did not correlate with F8 compounds (Figure 7), I do not understand why the F7 formed from the F8?
- Did the authors detect halogenated organics due to the proximity of the measurement site to the sea?

Specific comments:

- Line 9: "Values of f_{F7} higher than 0.5 were typically observed during the NPF events". However, Figure 7c showed this value is lower than 0.5 during the NPF events on May 8-11 and 17.
- Line 75: What is the mass resolution of CIMS during the field observation?
- Line 108: "Ions smaller than 169 Th were omitted because there are many organic compounds that are unlikely the key compounds in NPF". However, methanesulfonic acid can also efficiently initiate NPF in the presence of small alkylamines and water (Chen et al., 2016; Dawson et al., 2012).

References:

Chen, H., Varner, M. E., Gerber, R. B. and Finlayson-Pitts, B. J.: Reactions of Methanesulfonic Acid with Amines and Ammonia as a Source of New Particles in Air, *J. Phys. Chem. B*, 120(8), 1526–1536, doi:10.1021/acs.jpcc.5b07433, 2016.

Dawson, M. L., Varner, M. E., Perraud, V., Ezell, M. J., Gerber, R. B. and Finlayson-Pitts, B. J.: Simplified mechanism for new particle formation from methanesulfonic acid, amines, and water via experiments and ab initio calculations, *Proc. Natl. Acad. Sci. U. S. A.*, 109(46), 18719–18724, doi:10.1073/pnas.1211878109, 2012.

Please also note the supplement to this comment:

<https://acp.copernicus.org/preprints/acp-2022-261/acp-2022-261-RC2-supplement.pdf>