

Atmos. Chem. Phys. Discuss., referee comment RC1
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Comment on acp-2021-512

Anonymous Referee #1

Referee comment on "Chemical composition of nanoparticles from α -pinene nucleation and the influence of isoprene and relative humidity at low temperature" by Lucía Caudillo et al., Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2021-512-RC1>, 2021

Caudillo and co-authors present and discuss the gas and particle phase composition of pure biogenic nucleation events measured with a nitrate chemical ionization atmospheric pressure interface time of flight mass spectrometer (coupled with a thermal desorption-differential mobility analyzer for the particle phase) in the CLOUD chamber at a range of conditions representing free tropospheric conditions. Specifically, alpha-pinene and a mix of alpha-pinene and isoprene were oxidized at -30 deg C and - 50 deg C, and at 20 % or 60 - 100 % relative humidity. The authors find C8-10 monomers and C18-20 dimers as major compounds, and C5 and C15 compounds contributing to particle growth when isoprene is present in the system. I very much appreciate the systematic analysis. The manuscript is well-written and the experimental results are thoroughly discussed. In my opinion, this is an original and valuable contribution to the field. Therefore, it should be published in ACP after minor revisions.

Specific comments:

In the abstract, the last sentence ("Besides the chemical information...", lines 64-66) was confusing to me. After reading section 3.4.1, I suggest to be more specific in the abstract, e.g. "Compared with previous studies, we found lower nucleation rates measured at 1.7 nm, very likely due to higher alpha-pinene and ozone mixing ratios used in the present study."

In section 2.1, there is no information about GCR conditions during the experiments, please add.

In section 2.2, please add some more information about the heating procedure of the filament. Is the temperature slowly ramped up, or do you apply high temperature directly to instantaneously vaporize the sample? This is also relevant for the discussion of potential thermal decomposition of molecules in section 3.2.2.

Regarding the non-size selective mode of operation of the TD-DMA, it would be helpful to

get an idea about the contribution of freshly nucleated particles vs. grown particles to the sampled mass. From the measured particle size distributions and the PSM and CPC total number concentrations, could you calculate a rough estimate of the volume/mass fraction of particles < 15 nm in the samples collected in the periods shown in Figure 1 as shaded areas? Please add this information to Table 1.

In Figure 3f, to me it is not obvious that specifically C4-5 and C13-16 compounds are enhanced as stated in lines 237/238. Please clarify.

In section 3.3, looking at Figures 5 and S4 I agree with the statement that mainly LVOC and ELVOC compounds were detected in the particle phase, however, the ULVOC compounds appear to be a minor fraction.

Section 3.4.2: Regarding the discussion of isoprene suppression of new particle formation, please consider adding a reference to Lee et al. (2016), doi:10.1002/2016JD024844.

In Figures 6 and 8, please explain the meaning of "1 σ run-to-run uncertainty".

Technical comments:

lines 225, 301, 322 : Make sure that there is no line break between sign and number in "-30" and "- 50".

line 226: "While the gas..." is not a full sentence.

Section 3.2, first paragraph: When presenting and discussing Figure 2, add a reference to supplementary material Figures S1 and S2 for other systems.

line 248: "While GR..." is not a full sentence.

line 285: Change "autooxidation" to "autoxidation" to be consistent throughout the manuscript.

lines 204, 312, 336, 375: Here, "new particle formation rate" is used, while $J_{1.7\text{nm}}$ is introduced as "nucleation rate" in the manuscript. For consistency, I recommend using "nucleation rate" throughout the manuscript.

In Figures 6 and 8: "GRC" should read "GCR" in the figure legend. Also, in the last sentence of the figure caption, remove "and" before "is not shown".