

Answers to comments by anonymous Referee #1:

Dear Reviewer,

We thank you for doing this review and for your suggestions that helped to improve our manuscript. Below, please find your original comments in blue and our responses in black. When referencing page and line numbers, we are always referring to the original versions of manuscript and SI.

This study reported the new particle formation, aerosol hygroscopicity, and ice nucleation activities in the atmosphere at Cyprus. The manuscript is well-written and very clear. But, there are several questions should be addressed in the revised version.

(1) In conclusions, the author mentioned “frequently NPF and growth events were observed”. As described in the text, most of bursts in nucleation particles attribute to airport emissions, but not NPF. The wording “frequently” may not be properly.

We followed your recommendation, removed the “frequently” in this sentence. In this study, we only focused on 3 NPF events, since particles grown to this sizes makes them potential CCN. There are ~2 more NPF events that were observed in sub-10 nm but during these, particles did not grow to larger sizes. There will be an upcoming paper to discuss the NPF in the sub-10nm size range which will also compare with the data in this study.

However, here we would like to stress that the pollution from the airport was filtered out when we analyzed NPF events and CCN number concentration (as we say in 3.2: “Therefore, in the following, time periods affected by pollution from the airport were excluded from further analysis.”).

(2) The samples were separated into “ocean” and “land” samples. How about the effects of “land and sea breeze” on the samples? The “land” air may blow to the ocean, and later will come back again. This may explain why the “ocean” samples is similar to that of “land”.

We followed your recommendation, and extended the discussion after line 21, page 11.

“A source apportionment for INP examined in this study is therefore difficult to do. Considering that Cyprus is only a small island surrounded by ocean, its effect might be limited. Besides, for a location such as Cyprus, it is difficult to determine sources for different air masses only based on wind direction, alone.”

(3) In the abstract, “with a median κ value of 0.57, suggesting the presence of sulfate.”. Actually, 0.57 means almost of pure sulfate. The sea salt can also go down to accumulation mode particles. A high κ value may indicate the presence of sea salt.

Following one of the second reviewer’s remarks, we extended the discussion in lines 25- 30, page 10 and changed the abstract and conclusion accordingly.

“A few sea salt particles mixed with organic carbon might also be present in the accumulation mode, according to a previous study (Prather et al., 2013). But the absolute number concentration of sea salt mixed with organic carbon particle in the size range <200 nm is likely limited.”

(4) In page 6, Line 10: “Each filter was immersed into 1 mL ultrapure water”. 1 ml is enough to wash the particle off from the filter?

Obviously, N_{INP} from LINA (1 mL ultrapure water washed) agreed well with INSEKT (8 mL ultrapure water washed). Therefore, we think 1 mL ultrapure water is enough to wash off all particles.

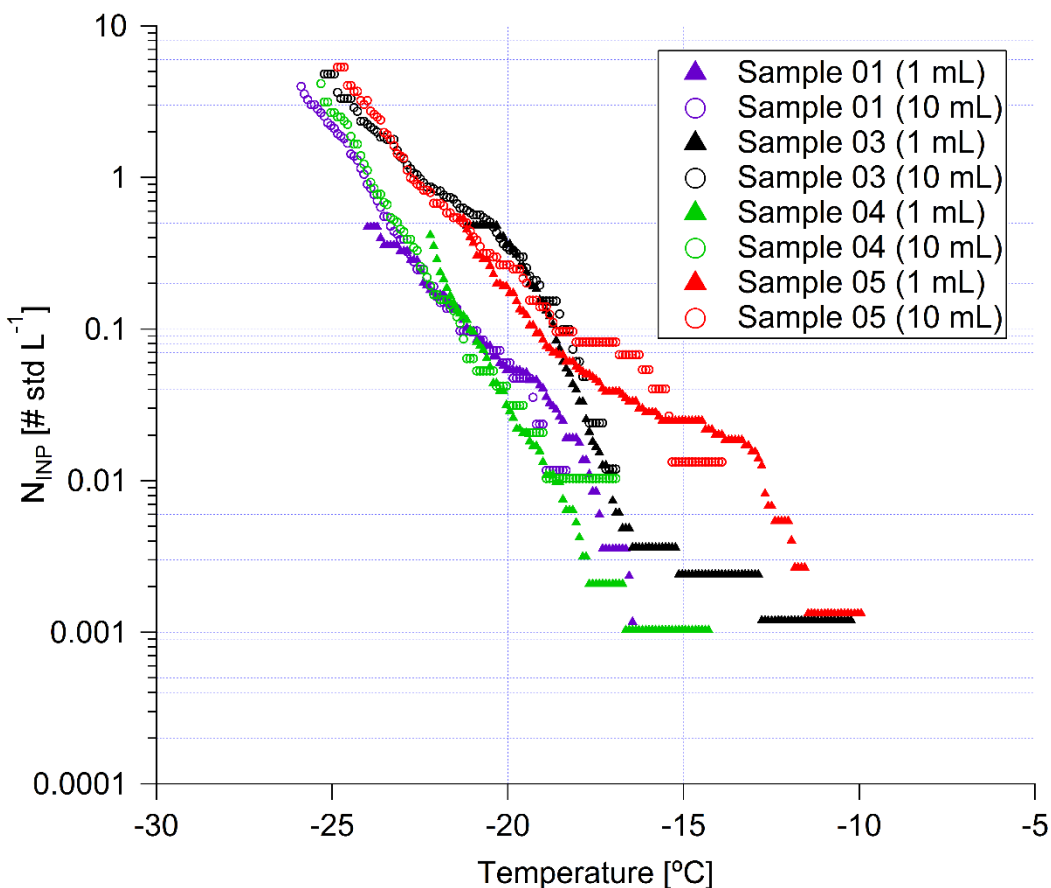


Figure S3. N_{INP} measured by LINA as a function of temperature. The solid triangles and hollow circles show N_{INP} from the samples washed with 1 mL and 10 mL ultrapure water, respectively.

When data evaluation was started for this set of samples, tests were made (as these were the first atmospheric samples on polycarbonate for which we did an analysis). A set of measurements was done in which filters were washed off with 1 mL of ultrapure water, first. This was done by shaking the centrifuge tube in which filter and water were situated. From this, 0.1 mL was used for a first analysis, directly taken from the tube in which the shaking had been done. Then 9.1 mL were added to the tube and the sample was shaken again, followed by a second analysis. The results from both dilutions can be seen in Fig. S3, and data in the overlapping temperature region are well in agreement. Based on this, we decided to use only 1 mL for washing, as this allows us to retrieve INP concentrations already at higher temperatures.

We added the above text and the figure to the SI, and the text below to the main text:

“It should be mentioned that results from separate tests using 1 mL and 10 mL of washing water were well in agreement (see Fig. S3).”

(5) Typically, the particle surface areas concentration is calculated assuming a spherical shape. While, dust particle may be more irregular, as a result, lead to increase in the surface areas.

We calculated the particle surface area concentrations by assuming a spherical shape. Actually, we considered the particle shape when we corrected the MPSS measured number concentration for multiple charged particles in the APS size range. The electrical mobility diameter (measured by MPSS) and aerodynamic diameter (measured by APS) were converted to the volume equivalent particle diameter.

The dry dynamic shape factor χ of mineral dust is $\chi = 1.25$ (Kaaden et al., 2009) for 1 μm particles, whereas the dynamic shape factor for sodium chloride is $\chi = 1.08$ (Kelly and McMurry, 1992; Gysel et al., 2002). We used the average shape factor of 1.17 in this study. We added this information in the Section 2.2.

References:

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