We would like to thank Reviewer #1 for his/her constructive suggestions, which helped us to improve the manuscript. Specific answers are given in blue text and manuscript modifications related to the Reviewer's comments are given in green text. Line numbers below correspond to the clean revised manuscript.

Anonymous Referee #1:

The paper reports on a one-week measurement campaign collecting samples at two locations in the north and south of Mexico City, 16 km apart. Size-segregated samples were analysed for ice nucleating particle (INP) concentration, and aerosol chemical composition, bioaerosol concentration, concentrations of several gases, and meteorological parameters were monitored. The INP concentration was found to differ between the sites on at least one day of sampling, and a connection to aerosol chemistry is explored. The paper requires major revisions, in particular because of a temporal misalignment problem in the correlation analysis.

A/ Thank you for pointing out the temporal misalignment between the different measurements. We hope that the revised version covers all your concerns.

Specific comments:

Line 29: Specify which criteria pollutants ($PM_{2.5}$, SO_2, NO_x, CO, O_3) were measured. Not all readers may be familiar with the term.

A: The text was corrected as follows. Lines 28-30: "We found differences in the chemical composition, criteria pollutants ($PM_{2.5}$, O_3, CO, NOx, and SO_2), and biological content between northern and southern MCMA, separated by 16 km."

Lines 33, 34, 126, 259, 326, 421, 426, 429, 455, 524, 537, 544, 549, 567 and throughout the manuscript: Replace INP "efficiency", "ability", "activity", and "behaviour" with "INP concentration". This change is necessary because the study measures INP concentration, not the ice nucleation efficiency of a known substance with a defined surface area.

A: We thank the reviewer for this suggestion. The revised manuscript was modified accordingly.

Line 36f: Clarify how the role of aerosol in cloud formation was evaluated.

A: The sentence was modified as follows. Lines 35-37: "Although the urban aerosol's physicochemical properties, biological content, and its sources were found to differ at both sites, it did not strongly impact the INP concentrations, with the exception of the largest measured particles"

Lines 38, 353, 396: The concept of microclimates, including their definition and identification criteria, needs to be explained in the introduction. According to Met Office factsheet 14 (Microclimates), microclimate criteria apply on climatic timescales that cannot be determined based on one week of data. Please clarify which factors are assumed to create a microclimate within the MCMA.

A: The following text was added to clary the concept of microclimates. Lines 72-78: "A microclimate can be referred as a relative small-scale area with a distinctive climate over it as a whole (Met Office Factsheet 14). Thanks to its large area, and the clear variability of land use (e.g., industrial, rural, residential, commerce, and ecological preservation), the northern and southern MCMA present significant differences in temperature (heat islands), rainfall, wind patterns, humidity, aerosol and gas emissions, indicating the presence of a clear microclimate differentiation (Met Office Factsheet 14; Molina and Molina, 2004; Amador-Muñoz et al., 2013; Castro Romero et al., 2024)”.

Lines 39f, 81: The discussion of how aerosol–cloud interactions impact extreme precipitation events is limited to one sentence in the introduction. If this is a main motivation for the study, it could be summarized in more detail.

A: The following text was added to the revised manuscript. Lines 103-112: “Aerosol particles have the potential to influence the development of deep convective clouds those of which are typically associated with extreme rainfall events (Burrows et al., 2022). Efficient INPs can promote specific processes as the seeder-feeder mechanism (Ohneiser et al., 2025) triggering primary ice particle formation as well as ice multiplication, increasing the ice water content in MPC (Purdy et al., 2005). These ice particles can grow at expenses of the surrounding water droplets, via the Wegner-Bergeron-Findeisen process, enhancing precipitation rates (Heymsfield et al., 2020; Ohneiser et al., 2025). Toll et al. (2024) showed that the presence of anthropogenic particles hot spots can modify cloud microphysics, leading to cloud glaciation and precipitation events under stratiform non-convective clouds.”

Line 69f: Related to the previous comment, elaborate on what is meant by microclimate theory and provide a supporting reference. Molina and Molina (2004) do not discuss microclimate theory.

A: The following text was added to clary the concept of microclimates. Lines 72-78: “A microclimate can be referred as a relative small-scale area with a distinctive climate over it as a whole (Met Office Factsheet 14). Thanks to its large area, and the clear variability of land use (e.g., industrial, rural, residential, commerce, and ecological preservation), the northern and southern MCMA present significant differences in temperature (heat islands), rainfall, wind patterns, humidity, aerosol and gas emissions, indicating the presence of a clear microclimate differentiation (Met Office Factsheet 14; Molina and Molina, 2004; Amador-Muñoz et al., 2013; Castro Romero et al., 2024)”

Line 74: Elaborate on why microclimatic effects are considered highly important for local precipitation events in the MCMA and provide references. It would be expected that synoptic-scale moisture supply and dynamical forcing are at least equally important.

A: The following text, added to the revised manuscript, reinforced this idea. Lines 80-85: “This is of high importance to understand the microclimates along the MCMA and their relationship with local precipitation events. Zhu et al. (2024) evaluated precipitation events across China, finding that precipitation characteristics could differ across climatic zones. Additionally, Li et al. (2019) showed that atmospheric circulation changes driven by warming modulated the intensification of extreme precipitation events across North America.”

Line 81: Extend the discussion on how INPs affect extreme precipitation, for example through their influence on deep convective clouds associated with extreme rainfall.

A: The following text was added to the revised manuscript. Lines 103-112: “Aerosol particles have the potential to influence the development of deep convective clouds those of which are typically associated with extreme rainfall events (Burrows et al., 2022). Efficient INPs can promote specific processes as the seeder-feeder mechanism (Ohneiser et al., 2025) triggering primary ice particle formation as well as ice multiplication, increasing the ice water content in MPC (Purdy et al., 2005). These ice particles can grow at expenses of the surrounding water droplets, via the Wegner-Bergeron-Findeisen process, enhancing precipitation rates (Heymsfield et al., 2020; Ohneiser et al., 2025). Toll et al. (2024) showed that the presence of anthropogenic particles hot spots can modify cloud microphysics, leading to cloud glaciation and precipitation events under stratiform non-convective clouds."

Table 1: Provide the sample volume in an additional column.
A: Table 1 was updated as suggested.

Line 180: In comparison, the inlet cut-size of 2.5 µm of the MiniVol excludes particle sizes collected on the two upper and partially the third of the four MOUDI stages used to obtain INP concentrations. As the four MOUDI stages contribute equally to the INP concentration (no size dependence observed), this indicates that over 60% of INPs are excluded from the MiniVol samples. This is the first reason why the correlation analysis between INP concentration and MiniVol-derived parameters can be misleading.
A: We agree with the reviewer and we have included in the revised manuscript the data corresponding to stage 6 (0.56 µm to 1.0 µm). Note that the inclusion of additional stages, i.e., stage 7 (0.32 µm to 0.56 µm) and stage 8 (0.18 µm to 0.32 µm) is not possible as the large particle concentration at these stages represent a technical limitation, as a large particle loading on the stages inhibits individual droplet formation. Also, it is important to note that submicron particles on stages 6 to 8 typically represent a small fraction (~10%) of the overall INP population at temperatures above -25°C (Ladino et al., in preparation).

Section 2.2: The MOUDI flow rate and sample substrate (line 263) could be included in this section to consolidate information on sampling procedures. It would be helpful to report sampling flow rates, time of day of collection, and time resolution for all samplers.
A: Thank you for this suggestion. Section 2.2 was modified and the following text was added. Lines 216-230: "The simultaneous sampling was performed using, per site, a MiniVol TAS (Tactical Air Sampler; Airmetrics) with a 2.5 µm cut-size inlet operated at 5 L min^{-1}, an eight stage micro-orifice uniform deposit impactor (MOUDI 100R; MSP) operated at a 30 L min^{-1} flow rate to separate particles as a function of their aerodynamic diameter (cut sizes of 0.18 µm, 0.32 µm, 0.56 µm, 1.0 µm, 1.8 µm, 3.2 µm, 5.6 µm and 10 µm), and a single-stage BioStage Quick Take 30 cascade impactor for viable particles (SKC Inc. USA) operated at a 28.3 L min^{-1} flow rate. The MOUDI samples, used to evaluate the INP concentrations, were collected one time a day from May 16th to May 20th, 2022, with the sampling times shown in Table 1 (more details are provided in section 2.2.6). The MiniVol samples were collected daily for 24 h on May 12th, May 13th, May 16th, May 17th, May 18th, May 19th and May 20th, 2022, on 47 mm Teflon filters (Pall Science), and were used for the ionic and elemental composition analysis. The BioStage impactor samples with a 10 µm cut-size inlet were used for culturable bacteria and fungi identification. They were collected once a day (at 10:00 am for 5 mins) on the same dates as the MiniVol samples (more details are described in section 2.2.5). The general description of the sampling campaign is shown in Table 1."

Line 243: At what time of day were the samples collected, and how many samples were collected per day?
A: This information is now included in Section 2.2.

Line 294: Do you mean the area on which aerosol is deposited? Is aerosol deposited exclusively on the coverslip and not over the entire impaction stage? $A_{deposit}$ is defined as the coverslip area also in Manson et al. (2016); however, their Fig. 7 shows that the coverslip

covers only about one third of the impaction stage. For normalization of the sampled volume, the entire area over which aerosol is deposited should be used. Please include a photo of a loaded sample stage in the reply to this comment for clarification.
A: Yes, you are right. We use $A_{deposit}$ as the area of the coverslip on which the aerosol is deposited. Therefore, we incorporate correction factors to account for not using the complete stage as described and discussed in Mason et al. (2015). Although there could be additional corrections, these are the most important ones that allow us to report a confident INP concentration. As shown in Lacher et al. (2024), the INP concentrations delivered by the UNAM-MOUDI-DFT are comparable with those reported by other six different ice nucleation setups from Europe and the US.

Lacher, L. et al.: The Puy de Dôme ICe Nucleation Intercomparison Campaign (PICNIC): comparison between online and offline methods in ambient air, Atmos. Chem. Phys., 24, 2651–2678, https://doi.org/10.5194/acp-24-2651-2024, 2024.

Section 3.1: Figures S4, 2, and 3 show only one sample per day, while Table 1 indicates that two samples were taken on both 17 and 18 May. Please include these samples to show diurnal variability in INP concentration and add a corresponding discussion.
A: We are sorry for this confusion. We accidently included two samples in Table 1; however, this information is not available. Table 1 was corrected accordingly. We agree that it would be valuable to evaluate the INP concentration diurnal variability; however, this was not an objective from the present study, and hence, we don't have data to address this point.

Line 320: Selecting a restricted size range is not necessary. Using all eight MOUDI stages allows investigation of ~100% rather than 70% of INPs. There are two additional reasons to include the lower stages: (1) these stages are better represented by the MiniVol samples with a 2.5 µm cut-off (see previous comment), and (2) the main finding of no size dependence in INP concentration could be further supported. There is a potential contradiction between "no size dependence" and "70% of INPs are super-micron" that could be resolved. The analysis could clarify whether the lack of size dependence applies only to super-micron particles or across a broader size range.
A: We agree with the reviewer that it would be ideal to use all MOUDI stages; however, as mentioned above, the high particle loading on the lower stages inhibits the proper formation of individual spherical droplets. We have now included the stage 6 data (0.56 μm to 1.0 μm). Below, Figure A1 from Mason et al. (2016) shows the INP concentration for the 8-stages at six different locations (most of them remote places). From the Figure it is concluded that the INP concentrations on stages 7 and 8 are extremely small compared to the other stages.

We forgot to specify that the stage-based data discrimination was applied to Figs. 5 and S4 only (this is now corrected in the supplementary material). The rest of the figures, except the performed correlations, were plotted using all available data (i.e., stages 2 to 6). For the correlation heatmap we only use the three final stages of the MOUDI in order that the cut-sizes of the used instruments match between them.

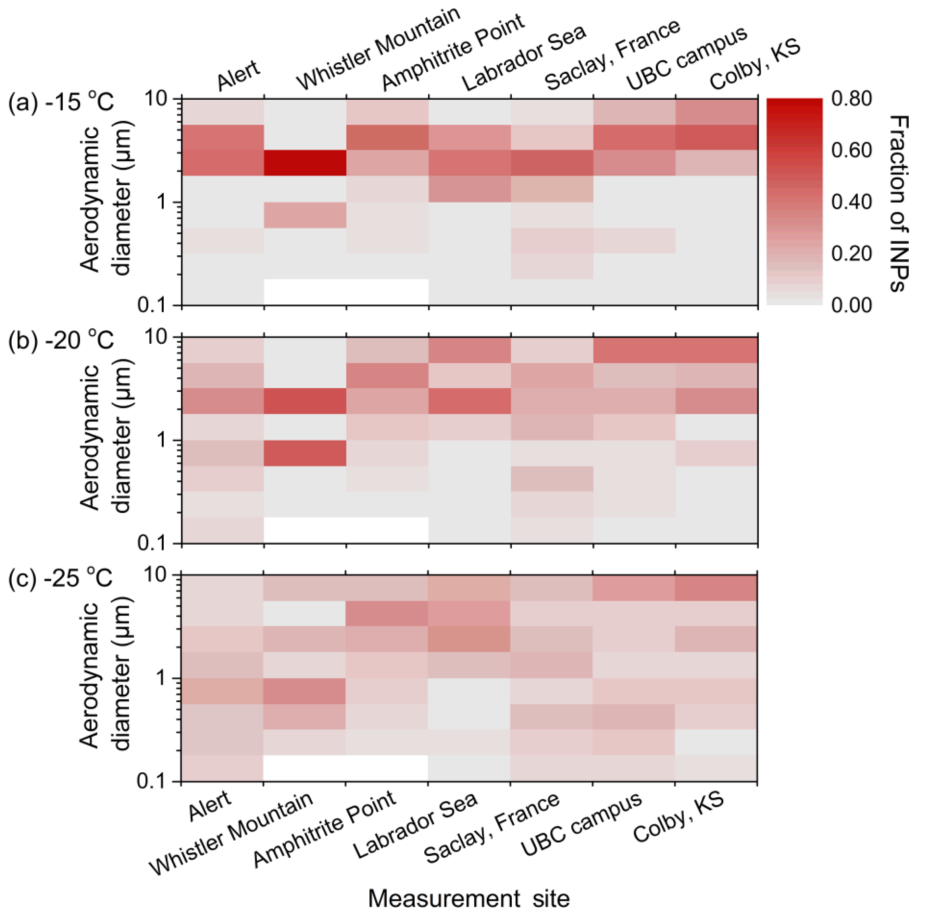

Figure A1. Fractional INP concentrations as a function of aerosol particle size, location, and activation temperature: **(a)** -15 °C; **(b)** -20 °C; and **(c)**-25 °C. The color bar indicates the fraction of INPs measured in each particle size bin. Aerosol particle sizes correspond to the 50% cutoff aerodynamic diameters of the MOUDI stages (Marple et al., 1991). Missing sizes for the Whistler Mountain and Amphitrite Point sites are uncolored.

Mason, R. H., Si, M., Chou, C., Irish, V. E., Dickie, R., Elizondo, P., Wong, R., Brintnell, M., Elsasser, M., Lassar, W. M., Pierce, K. M., Leaitch, W. R., MacDonald, A. M., Platt, A., Toom-Sauntry, D., Sarda-Estève, R., Schiller, C. L., Suski, K. J., Hill, T. C. J., Abbatt, J. P. D., Huffman, J. A., DeMott, P. J., and Bertram, A. K.: Size-resolved measurements of ice-nucleating particles at six locations in North America and one in Europe, Atmos. Chem. Phys., 16, 1637–1651, 2016.

Line 324: Describe how the homogeneous freezing line was determined and how it compares with published measurements, for example those in Shardt et al. (2022) for 100 μm droplets.

A: To clarify this, the following text was added to the revised manuscript. Lines 364-369: "The homogeneous freezing line was determined using the same procedure described in section 2.2.6 with a brand-new substrate (i.e., without aerosol particles impacted on them). The average onset freezing temperature (T_0) of the homogeneous freezing experiments (i.e., -34.3 ºC) is comparable with other data for supercooled liquid drops such as the 100 μm (-34.2 ºC) and 89 ± 7 μm (-35.5 to -36.7 ºC) liquid water drops reported by Shardt et al. (2022) and Tarn et al. (2021), respectively."

Line 327: Explain how the averages and error bars in Fig. 2 were calculated. In particular, clarify how freezing curves from different MOUDI stages were combined and how differences in droplet numbers between experiments were accounted for.

A: The average was calculated as the mean of the T_0 and T_{50} values for each MOUDI stage freezing curve. To clarify this, Figure 2 was replaced with a box plot. Regarding the droplet number differentiation, this was assessed using the "correction for non-uniformity aerosol deposit" (Mason et al., 2015, section 3.4) to estimate INP concentration; however, for the frozen fraction, we report normalized data as a function of droplet number.

Line 332f: Please quantify and analyse the causes of the differences in T_{50} and T_0 compared to literature. For example, the introduction notes that Knopf et al. (2010) reported ice nucleation at cirrus conditions, whereas the present study measures freezing of droplets in the MPC regime.
A: The sentences in Lines 332 (original manuscript) simply wanted to let the readers know that we found warmer temperatures than previous studies. The observed differences in T_{50} and T_0 between previous studies and the present study could come from different sources such as different equipment, different time of the year, different pollution levels, different specific sampling location, and different meteorological patterns during sampling, etc. Therefore, it is very difficult to identify the main cause of these differences, a task that it is out of the scope of this study.

Knopf et al. (2010) reported onsets for northern Mexico City via immersion freezing and deposition nucleation relevant to mixed-phase and cirrus clouds, respectively. The introduction was slightly updated to indicate that Knopf et al. (2010) includes data from both types of clouds. Therefore, in Line 332 (original manuscript) we compared our data with the immersion freezing experiments from Knopf et al. (2010).

Line 342, Fig. 3: The error bars of South-20220520 overlap with those of North-20220520. Please clarify what is meant by statistically significant INP concentrations. What do the error bars represent, and how are they calculated? For South-20220520, why are the error bars smaller at −13 and −14 °C than at −12 and −15 °C? Consider using the method of Agresti and Coull (1998) to calculate 95% confidence intervals.
A: We have updated Figure 3 to improve its readability. Error bars were calculated using the same method described by Mason et al. (2015), which accounts for the experimental uncertainty carried through all corrections applied to INP concentration calculation. We decided to rearrange Fig. 3 to show the May 20th data only. In this case, we can see a visually significant difference (no overlap of error bars) between the northern and southern samples between -22 °C and -19 °C. Additionally, we use the Agresti and Coull (1998) method as recommend. We obtain significance difference (Group 1 (North) Adjusted Proportion: 0.875, Group 2 (South) Adjusted Proportion: 1.400, Difference (p1 - p2): -0.525, 95% Confidence Interval: [-0.525, -0.525], Result: Significant difference found) between both group of data for May 20th (we use n = 5, which represent all MOUDI stages we have for May 20th).
The following text was added to the revised manuscript. Lines 398-403 "The total INP concentrations (i.e., the accumulated INP concentration, represented by the sum of each MOUDI stage INP concentration for each sample) at both sites are shown in Fig. 3a. Although the INP concentrations measured at both sites were comparable, the exemption was the May 20th sample (Fig. 3a), where higher and statistically significant differences in INP concentrations were measured in the southern site between -19 °C and -22 °C (considering the Agresti and Coull (1998) method to calculate 95 % confidence intervals)."

Line 345, Figure 3: Explain why Beijing is an appropriate city for comparison of INP concentrations. Consider adding data from Rodríguez-Gómez (2021) and Pereira (2021) to Fig. 3 (see comment on Fig. 4).

A: Although Beijing is not a tropical city, it is a megacity like Mexico City with high pollution levels. Therefore, we consider that the comparison with the Chen et al. (2024) data is appropriate. While we did not include the data from Pereira et al. (2021) in Fig. 3 because the units are not comparable, as they reported L^{-1} in water, the data from Rodríguez-Gómez (2021) was added to Figure 3.

The following text was added to the revised manuscript.

Lines 403-406: "Figure 3a also indicates that the INP concentrations from the present study agree well with those reported by Cabrera-Segoviano et al. (2022) for Mexico City and by Chen et al. (2024) for Beijing (between -19 °C and -22 °C), a polluted megacity such as the MCMA".

Lines 425-427: "As shown in Fig. 3b, the INP concentrations measured in the present study agree with those reported for southeastern (Rodríguez-Gómez, 2021) and southern sites (Cabrera-Segoviano et al., 2022) of the MCMA."

Line 353: Specify how the average accumulated INP concentration is calculated, which data are averaged, and what the error bars in Fig. 4 represent.

A: The text was modified as follows. Lines 418-421: "To better assess the differences in the INP concentration across the two microclimates within the MCMA, the average INP concentrations (represented by the average of all samples' total INP concentration) for both sites at four different temperatures (-15 ºC, -20 ºC, -25 ºC, and -30 ºC) were calculated, as shown in Fig. 3b."

Line 357: The difference between the north and south samples at −15 °C is not clearly evident in Fig. 4, given the overlapping concentration ranges.

A: The sentence was modified as follows. Lines 422-425: "Although at -15 °C, a clear difference close to one order of magnitude can be observed between both sites (C5 ($0.04 \pm 0.04\ L^{-1}$) and CU ($0.38 \pm 0.31\ L^{-1}$)), the difference is not statistically significant (Agresti and Coull, 1998)."

Figure 4: The figure does not provide substantial information beyond what is already shown in Fig. 3. It could be removed, with the reference data added to Fig. 3 instead. In addition, the yellow data symbol is difficult to see; a darker colour would improve visibility.

A: Thank you for pointing this out. Figure 3 and Figure 4 were merged in the revised manuscript.

Line 371ff: It is correct that particle size and surface area affect the ice nucleation efficiency of particles with the same composition. When multiple particles of different compositions are present in a droplet, the combined abundance of ice-active sites at a given temperature determines ice formation. The amount and composition of particles on different MOUDI stages likely differs but is unknown. It is also unknown how the amount and composition of particles changes from day to day and between the sampling locations. Because only INP concentration per stage is known, interpretations involving coatings or physicochemical heterogeneities require supporting evidence or should be omitted.

A: The reviewer is right; we cannot hypothesize without a robust evidence. The text was modified as follows. Lines 429-437: "The impact of particle size on the frozen fraction at both sampling sites does not show a clear trend (Fig. S4). Likewise, Fig. 4 shows that the mean INP concentration (which represents the average of all samples for each MOUDI stage) measured on urban particles from the MCMA is not clearly size-dependent.In theory, particle size and INP efficiency are related. This relationship is attributed to surface active sites, as larger particles contain a higher concentration of active sites (Vali, 1996; Hoose and Möhler, 2012; Kanji et al., 2017); however, as urban ambient particles are a complex mixture of particles with different compositions, the relationship between particle size and INP is not straighforward as it requires deeper chemical analysis to undertand the heterogeinity in particles chemical compostion on each MOUDI stage."

Figure 5: Consider avoiding "dynamite stick" plots. Showing individual data points would be more informative. In general, bar plots on a logarithmic scale can be misleading because bar area has no physical meaning.
A: Thank you for this suggestion. Figure 5 (now Figure 4) was modified accordingly.

Line 399ff: It may be useful to note that NO_x and measured radiation are higher at the northern site; thus, elevated O_3 concentrations at the southern site could reflect higher VOC levels, which were not measured. Any impact on INP concentration remains speculative. Wang et al. (2012) measured naphthalene, an anthropogenic VOC associated with combustion rather than biogenic SOA, and investigated ice nucleation at cirrus conditions, outside the experimental range of the present study. Moreover, typical SOA particle sizes are below 1 µm, whereas super-micron particles were used for the INP analysis.
A: Although we are confident that the VOC concentrations are higher at the southern site (this is well known along the MCMA), the reviewer is correct that they were not measured in the present study, and therefore, we cannot draw any conclusion about VOC vs. INPs.

The Wang et al. (2012) sentence was deleted and the text was modified as follows. Lines 469-473: "It is well known that VOCs may participate in O_3 production by photochemistry and lead to higher concentrations (Pinto et al., 2010; Amador-Muñoz et al., 2016). Therefore, the southern site is likely enriched in biogenic secondary organic aerosols (SOA) compared to the northern site (Aiken et al., 2009; Cooke et al., 2024), with unknown implication in the INP population."

Line 414: Describe how these measurements were processed and averaged to match the INP sample collection periods.
A: The text was modified as follows. Lines 479-492: "Figure 5 shows the calculated Pearson correlation coefficients between the measured criteria pollutants with T_0, T_{50} and INP concentration at -20 °C, -25 °C, and -30 °C for both sampling sites (for particles ranging between 0.56 µm and 3.2 µm). Mean criteria pollutant concentrations between 08:00 h and 13:00 h local time were used to match the INP sampling periods. Figure 5 shows high correlations between $PM_{2.5}$, O_3, and the INP parameters at the southern site, implying that both pollutants can impact the physicochemical properties of the INP population at this site. On the other hand, no significant correlations were found at the northern site. As the INP sizes in both sites are identical, the observed differences are likely linked with differences in the $PM_{2.5}$ composition. As shown in Figs. 6 and S5, the $PM_{2.5}$ elemental and ionic composition in the northern and southern sites have important differences. As the composition is clearly different, the interaction between the fine particles, and hence INPs with O_3 is expected to differ in both sites as well. As the $PM_{2.5}$ sampling time was much larger

(24 h) than the 4 h INP sampling, a direct correlation between the elemental and ionic composition with the INP concentrations was not assessed.”

Line 425: Provide an explanation of how different compounds may influence INP concentration and why these effects could differ between sites. Clarify why INP parameters correlate with chemical parameters at one site but not the other. The small number of data points (n = 5) makes the correlation analysis sensitive to outliers. Inspecting scatterplots could help identify non-linear relationships or outliers. In addition, explain how high correlations with T_{50} can occur without corresponding correlations in INP concentrations at −20 or −25 °C, the temperature range where T_{50} is located. Please assess how robust the correlations are at ±1 °C from the chosen temperatures. The possibility of spurious correlations due to limited sample size (second reason why the correlation analysis may be misleading) should be addressed by presenting scatterplots.
A: The correlation between the elemental and ionic composition with the ice nucleation parameters was removed in the revised manuscript because of the large differences in the sampling times. The following text was added to the revised manuscript. Lines 489-492: “As the composition is clearly different, the interaction between fine particles, and hence INPs, with O_3 is expected to differ in both sites as well. As the $PM_{2.5}$ sampling time was much larger (24 h) than the 4 h INP sampling, a direct correlation between the elemental and ionic composition with the INP concentrations was not assessed.”

Figure 6: Indicate the confidence level associated with values marked by an asterisk.
A: The following text was added to the former Figure 6 (now Figure 5). “The statistically significant coefficients (with 95 % confidence level) are marked with an asterisk.”

Line 432ff: INP samples were collected during a 4-hour morning period, whereas filter samples were collected over 24 hours. As shown in Fig. S6, air mass origin changed during the 24-hour period, indicating that different aerosol populations were analysed for composition and INP concentration. For correlation analysis, sampling intervals must be temporally consistent. Correlating temporally misaligned samples constitutes a methodological issue. This is the third reason why the correlation analysis involving MiniVol data can be misleading. I recommend removing this part of the analysis and the associated discussion.
A: We agree with the reviewer that the differences in the MOUDI and Minivol sampling times could bring us to unintentional misleading conclusions. Unfortunately, the MOUDI is not an automatic instrument and we did not have the possibility to have two online aerosol composition spectrometers such as the ACSM.

In the revised manuscript the bulk aerosol composition was used to show the differences in the aerosol composition in both sampling sites, but the direct correlations with the INP concentrations were removed.

Line 454: In Fig. 6, the correlation with INP concentration at −20 °C is shown as not significant.
A: This part was removed in the revised manuscript.

Line 466ff: This appears to contradict the discussion of O_3 concentrations in lines 399–407. If VOC concentrations are higher in the north, higher O_3 concentrations would also be expected there.
A: The sentence was deleted.

Lines 470–473: This discussion repeats points made in lines 452–456.
A: The sentence was deleted.

Line 475: Provide the altitude of the trajectories. Overlaying Figs. S7 and S6 could clarify which trajectories are influenced by biomass burning and why this effect is more pronounced at the southern site. Potassium, a tracer for biomass burning, is higher at C5 than at CU on most days (Fig. 7).
A: The figures were overlayed considering the HYSPLIT backward trajectories for the sampling period only (May 12th to May 20th, 2022), and the text was modified as follows. Lines 544-549: "Figure S6 shows that the HYSPLIT backward trajectories at 250 m AGL at both MCMA sites overlaid on the NASA FIRMS real-time active fire locations for the sampling period (i.e., May 12th to May 20th, 2022). Even though not all backward trajectories pass through active fires, the overlap between some back-trajectories and active fires suggests that the local and regional transport of BB particles could contribute to the observed differences in the chemical composition, as shown elsewhere (e.g., Carabali et al., 2021)."

Line 481ff: The interpretation of the three clusters requires further explanation. For example, why are Pb, Cl^-, Mn, and Ca assigned to the soil cluster in the north but to the anthropogenic cluster in the south? Briefly explain the clustering method and how to interpret the dendrogram produced using Ward's method with Pearson correlation coefficients. Clarify how clustering leads to source identification and whether these sources relate to observed INP concentrations.
A: The sentence was added as follows. Lines 555-561: "Hierarchical clustering was conducted using Ward's method, with Pearson correlation coefficients employed as the similarity measure. This technique groups variables by minimizing increases in within-cluster variance, leading to clusters of species with similar temporal patterns. The resulting dendrogram illustrates the level of similarity among variables, where shorter linkage distances represent stronger relationships. Principal cluster components can be linked to a potential source as shown in previous literature analysis of similar samples (Reynoso-Cruces et al., 2023)."

Line 510: Explain how the finding that 57% of bacteria are Gram-positive affects the analysis, given that ice-nucleation-active bacteria are predominantly Gram-negative.
A: In this paragraph we did not performed any correlation between bacteria and INPs. This is an introductory paragraph where we compare our measured bacteria concentrations with literature data.

Figure 8: INP concentrations were measured between 16–20 May. Why is a longer time series of bacteria and fungi shown? What additional insight is provided by comparison with $PM_{2.5}$?
A: Thank you for pointing this out. The figure was adjusted to the same time period of the INP concentrations, and PM2.5 data was removed.

Line 530: Pseudomonas, Pantoea, Alternaria, and Fusarium from other locations have been reported to nucleate ice above −10 °C. Are local strains not producing ice-nucleation proteins?
A: The following text was added to the revised manuscript. Lines 609-611: "Although some of the identified bacteria and fungi genera and species have been reported to act as INPs at warm temperatures (Tables S5 and S6), it is completely unknown if the MCMA microorganisms contained the INA protein."

Line 533: Clarify why cross-correlation analysis was performed in the context of this study.
A: We performed Pearson correlation instead on cross-correlation analysis in the original manuscript. This was corrected on Tables S7 and S8 as well in Lines 614-618: "The behavior of bacterial and fungal concentration between the northern and southern sites were evaluated by the Pearson correlation analysis shown in Tables S7 and S8. As expected, mixed values of Pearson coefficients reflect that not all bacteria and fungi found at the southern site (closed to vegetated areas) are present in the northern site."

Line 550: Explain why correlations with these parameters imply compositional effects rather than simply reflecting aerosol amount (e.g., $PM_{2.5}$).
A: The following text was added to the revised manuscript. Lines 636-639: "The present results clearly demonstrated the existence of microclimates within the MCMA. The INP parameters of the MCMA urban particles correlated with $PM_{2.5}$ and O_3, at the southern site, corroborating that particle mass concentration and ozone concentration are very important for the southern MCMA microclimate"

Lines 552–556: Clarify the connection between these particle types and INP concentration.
A: The following text was added to the revised manuscript. Lines 639-641: "Nevertheless, urban aerosol particles show similar INP concentrations across both sites, suggesting that INP activity does not depend on a specific aerosol type, but rather on the bulk complex mixture of aerosol particles".

Line 559: Specify which atmospheric processes are referred to and how particle formation is linked to INP concentration.
A: The following text was added to the revised manuscript. Lines 648-650: "aerosol sources and atmospheric processes linked to particle formation and aerosol aging (e.g., gas-to-particle conversion, organic coatings, and photochemistry) are quite different".

Lines 560ff, 543: Explain why INP concentrations are compared with those from Beijing. Similar concentrations might suggest that, contrary to the conclusions, urban INP concentrations are not strongly linked to the listed factors.
A: Please see our answer above (Line 345, Figure 3)

Line 566: Specify what concrete information was obtained.
A: The following text was added to the revised manuscript. Lines 662-665: "Although the present work shows that air pollutants such as $PM_{2.5}$ and ozone can be linked with the ice nucleating abilities of urban aerosol particles, it is important to understand the role and the origin of the super-micron particles as they are a large contributor to the MCMA INP population.

Table S6: Consider adding a column indicating Gram-positive or Gram-negative classification and another listing temperature ranges over which species are reported to act as INPs, based on literature data.
A: The requested information was added to Tables S5 and S6.

Figure S1: Fig. S6 suggests predominantly westerly winds at midday, whereas these wind roses show mainly easterly winds. Restricting the wind analysis to the MOUDI sampling periods could be informative.
A: Thank you for the suggestions. Figure S1 was modified accordingly.

Technical corrections:
Line 80: something is missing in this long sentence. Do you mean "… information on *the interplay* …"?
A: Corrected.
Line 118: Delete the "B" before *proteobacteria*.
A: Corrected.
Figure 6: Br is missing from panel (a) but appears in Fig. S8. CO is missing from panel (b) but is shown in Fig. S2.
A: The correlation between the INP concentrations and the chemical composition was removed in the revised manuscript.
Figure 7: Replot the figure including zero on each ordinate rather than overlapping y-axes.
A: Corrected on new Figure 6.
Figure 8: Red stars without connecting lines are filled symbols in the plot but shown as open symbols in the legend.
A: Corrected on new Figure 7.
Figure S3: "*Adapted*" implies modifications. "Reprint of Fig. 3 from Córdoba et al. (2021)" would be accurate.
A: Corrected on Figure S3.
Figure S5: The y-axis labels of individual subfigures seem irregular. Replot including zero on each ordinate.
A: Corrected on new Figure S6.
Figures S8 and S9: Blue lines below the green cluster are difficult to see. Consider using different colours for clusters in Fig. S9, as they do not correspond to the same sources as in Fig. S8.
A: Corrected on new Figures S8 and S9.

References:

Agresti, A. and Coull, B. A.: Approximate is better than "exact" for interval estimation of binomial proportions, Am. Stat., 52, 119, https://doi.org/10.2307/2685469, 1998.

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