We thank the reviewers for their helpful observations and suggestions which have considerably improved the manuscript. We have also taken the opportunity to further refine the text for minor grammatical and typographical issues.

Reviewer 1:

Second review of 'Using Formvar to Capture Ice Crystals and Retrieve Roughness Parameters' from Celebi et al. (2025)

In Celebi et al., a proof-of-concept study is presented to investigate the spatially high-resolved surface roughness of salt and ice crystals—generated in the Manchester Ice Cloud Chamber—using the formvar replica technique. As this is the second round of the review, I will avoid repetition and instead provide concise feedback. A significant portion of the earlier criticisms has been addressed in the revised version; for example, the authors have more clearly articulated the advantages of their study. However, there are still a few issues that, in my opinion, need to be addressed before the manuscript can be considered for publication in AMT.
I remain unconvinced that it is necessary to include the formvar brush technique in the main text, as it does not replicate the full crystal (as shown in Figures 4 and 5). I suggest either omitting this section or moving it to the supplementary information. Alternatively, if it is irrelevant because only one side of the crystal is used for roughness analysis, this should be clearly stated and justified.

Response: In response to your suggestion, we have revised and significantly shortened the section on the brush technique. However, we retained a concise reference to it as it provides context for our work which extends beyond and improves upon the classical brush technique for this specific application (Line 174-202).

Regarding Table 1: Why is there no direct comparison between the salt crystals and their corresponding replicas? Since only four crystals were analyzed, such a comparison seems feasible. If there is a reason this was not done, it should be explained.

Response: The original salt crystals used were common table salt, which made it impractical to precisely identify and reuse the exact same crystals for replica comparison. As a result, randomly selected replicas were used for the analysis. While this limited direct one-to-one comparison, it also provided a more generalized and statistically relevant evaluation of the replication quality. The low variation observed across randomly selected samples supports the reliability and consistency of the replication process (Line 236-239).

Specific comments:

Abstract (l7-8): I would delete 'weather and' as the direct connection is not clear regarding how ice crystal surface roughness will affect weather forecast.

Response: Deleted as suggested.

l29: This sentence is very general and therefore not meaningful. Please rephrase or leave it out.

Response: As suggested, it is rephrased to make it more meaningful (Line 29).

L37-38: What is the specific outcome in these studies? 'That these studies compared in many aspects' is very unspecific and hence not very meaningful.

Response: We've clarified the specific findings of the studies to better highlight their contributions to understanding ice crystal aggregation. (Line 35-40).

L43: 'are not affected too much' is very unspecific and a more precise description is needed.

Response: Numerical results are now given (Line 44-46).

L46-47: The introducing sentence sounds very generic and not very meaningful. Be a bit more precise and focus on the main points.

Response: Introduction sentence is now improved (Line 48).

L237: Insert 'salt' before 'crystal'.

Response: Missing word is inserted.

L261-262: 'initiate condensation under a supersaturated environment' do you mean droplet formation prior to freezing here?

Response: Further details are now given for clarity (Line 267-268).

L336: Insert 'salt' before crystal as it has only been shown for salt crystals.

Response: Missing word is inserted.

L366-368: Can this 1D information been extrapolated to 2D structures? This should be clarified or discussed.

Response: Line 165-172: We have added further detail to explain that the roughness calculation was performed one-dimensionally along both the x and y axes, separately over the area, and then combined. This approach enabled us to obtain a more generalized roughness value representative of the overall surface. Line 379-384: We have explained that extracting 2D roughness parameters to characterize surface anisotropy would require a slightly different methodological approach that goes beyond the focus of this study in presenting a proof of concept. Therefore, we have limited our analysis to 1D roughness calculations averaged over the area for an initial comparison.

L365-373: The whole text section sounds generic and lacks precision. For example: What is meant by 'cloud behavior'? I do not see any link between the ice surface roughness analyzed in this study and a general 'cloud behavior'. This needs to be improved. The conclusion and outlook section would improve when is more related to the specific topic.

Response: This section has been rewritten to be more specific (Line 376-388).

Technical corrections:

L17: 'Hong, Y' Citation style is not correct.

Response: This error is corrected.

L74: Delete 'Meanwhile'.

Response: This word removed.

References: 'dio' references are sometimes missing.

Response: Missing digital identifiers are added and references now align with the AMT template.

Reviewer 2:

I appreciate the efforts the authors made to answer the reviewers' comments and to revise the manuscript accordingly. I therefore recommend its publication after addressing the following minor comments:

1. The manuscript states (lines 146-147) that "Samples were initially examined with a lateral resolution less than 10 nm and vertical resolution less than 5nm, to ensure that the crystal replicas remained intact...". I don't quite understand why such a high resolution is required for initial examination, especially if the final target resolution for roughness measurements is stated to be 100 nm. Maybe it is "µm" and not "nm"? Please check.

Response: We have clarified this point (Line 148-150).

2. Second, from my own experience with formvar replicas of ice I know that the replicas of complex shapes (such as bullet rosettes or aggregates) are often deformed beyond recognition after solidification of formvar. The deformation arises when ice crystal's melting and evaporation proceeds along the hardening of formvar. For SEM, this is an insurmountable problem since the electron beam cannot penetrate the formvar layer; for laser scanning microscope that should not present such a difficulty. I would therefore strongly encourage authors to add a figure showing examples of optical images of the replicas to the manuscript. This would also strongly corroborate their statement that the replicas remain intact under the experimental conditions of their method. The SEM images suggest that was not always the case.

Response: In order to remove the uncertainty and support our arguments, we have added a selection of crystal images with varying shapes taken with optical microscope (Figure 3).

3. It is unclear from the description of the method if the ice crystals were allowed to sublimate or melt after immersion into formvar. Was the bell jar kept at the MICC temperature conditions or was it installed outside of the cold room? In any of this cases, if the ice crystals are completely immersed into formvar, where does the water go? Please add these details to the manuscript.

Response: Line 143-146: We have explained that the bell jar was kept at –20°C throughout the experiment including the pressure reduction and evaporative stages. Once the formvar had solidified, the samples were brought to room temperature to allow them to melt. Line 287-289: We observed small holes and fine cracks on the surfaces and at the base of the replicas and we understand these openings allowed water to escape although we did not observe this happening. As mentioned in the manuscript, roughness measurements were made in locations free of such imperfections.

4. Line 127: from the blue line in figure 1, the vapor pressure of chloroform at –20°C is reduced by factor 8, not 5.5 as compared to room temperature: ~200 hPa at +20°C, ~25 hPa at -20°C. Not that it matters a lot…

Response: Thank you for spotting this. We have corrected the error.

5. The References do not comply with the AMT template. The DOIs are missing everywhere. Some references are incomplete: "Cheric .: Vapor pressure of chloroform, 1995.", "Finnegan W. and Pitter R.: Atmospheric ice crystal processes, 1988.", "Hong Y L.: The impact of two coupled cirrus microphysics–radiation parameterizations on the temperature and specific humidity biases in the tropical tropopause layer in a climate model, Journal of Climate, 2015.", "Centre of Atmospheric Science, 2024."

Response: Missing DOIs are added and the reference list is now aligned with the AMT template.