Response to reviewer 1.

We thank the reviewer for taking the time and effort to comment on our paper and for their insightful and constructive comments. We respond below to each of their points in turn.

1. The abstract could also be more concise. Some of the background in the first paragraph could be left for the Introduction and some of the details in the 3rd paragraph could be consolidated into a more concise description of the results.

   Response: We agree with the reviewer that some of the first paragraph could be moved to the introduction, and that the third paragraph could be more concise. The abstract has been revised along the lines suggested by the reviewer. Material from the original first paragraph of the abstract has been moved to the introduction, lines 14-36 in the revised paper, and the third paragraph has been condensed to focus on the main results.

2. The authors have decided to combine the description of CCREST-M and the algorithm evaluation into a single manuscript. While I think I understand the motivation for this choice, these topics could probably be covered in two distinct, concise, and equally interesting, papers.

   Response: We thank the reviewer for their thoughtful suggestion and for indicating that they understand the motivation behind our choice. After careful consideration, we have decided to retain the integrated structure for the following reasons.

   Firstly, the CCREST-M campaign was designed primarily as a testbed for ice-cloud scattering and radiative transfer studies. With the radar-radiometer geometry, flight patterns, and in-situ sampling strategy all configured to support the PSD retrieval and validation presented in a single paper. We feel this is clearer in one paper, rather than in several. The campaign description, its motivation, and the retrieval methodology are intrinsically linked. The rationale for the figure-of-eight overpasses with zenith-pointing radars, the post overpass in-situ descents, the use of dropsondes for atmospheric profiles, only becomes fully transparent in the context of the retrieval framework that they were designed to enable. Separating these into two papers would require duplication of context in say a data paper to motivate the measurement strategy.

   Secondly, a standalone CCREST-M data paper say, would still require analysis of the data to demonstrate its utility and validity of the dataset through worked examples and analysis, which have already been presented in the present paper. Our understanding is that a data paper should not just be a catalogue, but a scientific contribution.

   Thirdly, we believe that the integrated paper is more useful for the community, as future users of the CCREST-M data, whether for radar and/or radiative transfer studies would have the benefit of a single citable reference that documents the campaign, flight strategy, the instrumentation and data processing, and a validated dataset. Splitting these up into two papers would require users to cite and cross-reference both and risks the papers being cited without the methodological context in one of them.

We do, however, fully agree with the reviewer that the manuscript is dense and repetitive, we have addressed this concern through the changes detailed in our response to point 3 below.

3. The results (Section 5) are very thorough, but somewhat repetitive. For example, many figures are repeated for different variables, temperature ranges, and different cases and several points are reiterated multiple times. I recognize that each case illustrates a distinct aspect of algorithm performance, but I wonder if the results would be more impactful if they were conveyed more succinctly, perhaps consolidating the complementary findings from individual cases/comparisons where possible. Also, could some of the figures that represent variants of the same plot be moved to an appendix or supplementary material?

   Response: We agree with the reviewer and have made substantial reductions to Section 5 along the lines suggested. The specific changes are as follows:

   For the case C374, the original Figs. 9 and 10 have been consolidated into a single new Fig. 9, in which the ML-predicted moments assuming the gamma and exponential PSDs for the retrieved 3 GHz IWC are compared together with the in-situ moments. This consolidation has consequentially decreased the length of the corresponding sub-section accordingly. The original Figs. 11 and 14 have likewise been consolidated into a single new Fig. 11, which shows the comparison between the mean retrieved PSDs, assuming the gamma and exponential PSDs for the retrieval of IWC at 3 GHz, with the composite in-situ PSDs for C374. The original Tables 2 and 3, which compared the estimated IWCs with the in-situ IWCs have now been consolidated into a new Table 2. For the comparison between radar reflectivity simulations and the GRaCE 200 GHz observations we have retained Fig. 13, assuming both PSD assumptions, and removed the original Fig. 15 assuming the exponential PSD.

   For C379, this section has been reduced by removing the original Fig. 18, which showed the measurement residuals << 1 dBZ, and so this is now just stated in the text, since the retrieval behaviour is no different to that already presented for the case C374. The figure presenting the moment comparisons in sub-section 5.2.1 on page 28 has been significantly improved in terms of resolution and text size. In re-plotting this figure, it was found that an outdated in-situ moment file had been used in the original submission. The corrected Fig 14 on page 28 of the revised manuscript shows that the PDFs of the ML-predicted moments overlap with the in-situ moments better than previously indicated. It has been verified that this correction is confined to the moment comparison figures and does not affect any of the other results presented in this sub-section.

   For C382, in sub-section 5.3.1, the original Fig. 19 has been replaced by Fig. 16 in the revised manuscript on page 32, and as for C379, an outdated in-situ moment file had been used in the original submission. In this case, however, the corrected comparisons are not improved, owing to the failure of the ML method for this case as discussed in the manuscript. Again, this correction is confined only to the moment comparison figures. To reduce sub-section 5.3.2, the original Figs. 21 and

22 have been removed. The investigation that those figures supported, using the in-situ derived PSD parameters, is now described in the text alone, since this approach did not improve the results and the figures are not strictly necessary to convey the result. Figure 18 (originally Fig. 23) of the revised manuscript has been improved in terms of resolution and text size and retained, since it demonstrates that for this case the retrievals are stable, supporting our interpretation that the discrepancy between in-situ and retrieved PSDs is most likely owing to cloud evolution between the times of radar sampling and in-situ measurements.

Together, these changes have reduced the length of Section 5 significantly while retaining the essential scientific content.

4. The labels on several figures are very small (e.g. Figures 4, 5, 8, 9, and 10), some to the point of being illegible (11, 12, 14, 17, 20 - 23).

   Response: We agree with the reviewer that the labels on the highlighted figures in the original submission were too small. All the flagged figures have been re-done in terms of label size (also ticks and legends), and resolution. Where figures have been consolidated or removed (as described in our response to point 3), this specific issue has been resolved by their replacement or removal.