# Digital supplement for "Synergistic radar and sub-millimeter radiometer retrievals of ice clouds"

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#### 1 Introduction

This digital supplement complements the analysis of the retrieval results presented in the main article. Due to the large size and quantity of figures, only the most relevant results were included in the main article. For completeness, the figures that were left out are included in this supplement.

## 5 2 Test scene one

2.1 IWC



Figure 1. IWC retrieval results for the GemCloudIce particle model. Panels are similar to Fig. 6 in the main article.



Figure 2. IWC retrieval results for the GemSnow particle model. Panels are similar to Fig. 6 in the main article.



Figure 3. IWC retrieval results for the 8-ColumnAggregate particle model. Panels are similar to Fig. 6 in the main article.



Figure 4. IWC retrieval results for the PlateType1 particle model. Panels are similar to Fig. 6 in the main article.



Figure 5. Reference and retrieved number densities of frozen hydrometeors for the GemCloudIce particle model. Panels are similar to Fig. 12 in the main article.



Figure 6. Reference and retrieved number densities of frozen hydrometeors for the GemSnow particle model. Panels are similar to Fig. 12 in the main article.



**Figure 7.** Reference and retrieved number densities of frozen hydrometeors for the 8-ColumnAggregate particle model. Panels are similar to Fig. 12 in the main article.



Figure 8. Reference and retrieved number densities of frozen hydrometeors for the PlateType1 particle model. Panels are similar to Fig. 12 in the main article.



Figure 9. Scatter plots of retrieved number densities for the remaining particle models. Panels are similar to Fig. 13 in the main article.



Figure 10. Reference and retrieved LWC for the GemCloudIce particle model. Panels are similar to Fig. 16 in the main article.



Figure 11. Reference and retrieved LWC for the GemSnow particle model. Panels are similar to Fig. 16 in the main article.



Figure 12. Reference and retrieved LWC for the 8-ColumnAggregate particle model. Panels are similar to Fig. 16 in the main article.



Figure 13. Reference and retrieved LWC for the PlateType1 particle model. Panels are similar to Fig. 16 in the main article.



Figure 14. Reference and retrieved LWC for the LargePlateAggregate particle model. Panels are similar to Fig. 16 in the main article.

#### 3 Test scene two

## 10 3.1 Observations



**Figure 15.** Total hydrometeor content (HMC) and simulated observations for the second test scene. Panel (a) displays the total hydrometeor content in the scene, i.e. the sum of the mass densities of all hydrometeor species of the GEM model. Panel (b) shows the simulated radar reflectivities. Panel (c) displays the simulated brightness temperatures for a selection of the channels of the MWI and ICI radiometers.



Figure 16. IWC retrieval results for the GemCloudIce particle model. Panels are similar to Fig. 6 in the main article.



Figure 17. IWC retrieval results for the GemSnow particle model. Panels are similar to Fig. 6 in the main article.



Figure 18. IWC retrieval results for the 8-ColumnAggregate particle model. Panels are similar to Fig. 6 in the main article.



Figure 19. IWC retrieval results for the PlateType1 particle model. Panels are similar to Fig. 6 in the main article.



Figure 20. IWC retrieval results for the GemCloudIce and GemSnow particle models. Panels are similar to Fig. 7 in the main article.



Figure 21. IWC retrieval results for the remaining particle models. Panels are similar to Fig. 8 in the main article.



Figure 22. Reference and retrieved number densities of frozen hydrometeors for the GemCloudIce particle model. Panels are similar Fig. 12 in the main article.



Figure 23. Reference and retrieved number densities of frozen hydrometeors for the GemSnow particle model. Panels are similar to Fig. 12 in the main article.



**Figure 24.** Reference and retrieved number densities of frozen hydrometeors for the 8-ColumnAggregate particle model. Panels are similar Fig. 12 in the main article.



Figure 25. Reference and retrieved number densities of frozen hydrometeors for the PlateType1 particle model. Panels are similar to Fig. 12 in the main article.



Figure 26. Reference and retrieved number densities of frozen hydrometeors for the LargePlateAggregate particle model. Panels are similar to Fig. 12 in the main article.



Figure 27. Scatter plots of retrieved number densities for the remaining particle models. Panels are similar to Fig. 13 in the main article.



Figure 28. Scatter plots of retrieved number densities for the remaining particle models. Panels are similar to Fig. 13 in the main article.



Figure 29. Reference and retrieved LWC for the GemCloudIce particle model. Panels are similar to Fig. 16 in the main article.



Figure 30. Reference and retrieved LWC for the GemSnow particle model. Panels are similar to Fig. 16 in the main article.



Figure 31. Reference and retrieved LWC for the 8-ColumnAggregate particle model. Panels are similar to Fig. 16 in the main article.



Figure 32. Reference and retrieved LWC for the PlateType1 particle model. Panels are similar to Fig. 16 in the main article.