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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Towards the connection between snow microphysics and melting layer: Insights from multi-frequency and dual-polarization radar observations during BAECC" *by* Haoran Li et al.

Anonymous Referee #3

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The research links the snow microphysical processes and melting layers through characterizing the radar signatures of multi-frequency and dual-polarimetric radars. This article is well-organized and documented. There are some comments, concerning the scientific methods and goals, that need further clarification.

Major comments:

1. The authors focus on how rimed and unrimed processes relate to the precipitation intensity. How do the authors eliminate or separate the effect of "aggregation" for the

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analysis in Sec 4?

2. The method used for classifying the rimed and unrimed process is based on the observations in the winter cases. Then, the method is applied for cases not only in the wintertime. This is creative. But, I'm curious how much the riming conditions (e.g. the characteristics of supercooled water content) in different seasons will affect the application of the method?

3. The authors did a very nice literature review in the manuscript to support their findings. However, more discussion is required to present the new findings in this long-term analysis in addition to the previous studies.

Minor comments:

1. p.6 What is the temporal resolution of sounding used for calculating rhoair?

2. Fig. 1 It will be helpful for readers to read the plot if you can move the legend outside of the figure 1a.

3. Fig. 1 The outliers (e.g. in Fig 1c) seems affect the fitting a lot. How much uncertainties does these outliers affect the fitting and results for rimed/unrimed classification?

4. Why is the PR intensity classified into these four PR regions?

5. P.7 and table 1: The definitions of rimed and unrimed condition need to be documented.

6. Fig. 3 What is the height difference (interval) considered here for the reflectivity enhancement? Is the unit dB/km?

7. I'm confused about the purpose of mentioning the known fact of attenuation in Sec 4.2.2. What are the purpose for this discussion?

8. P. 16 "Precipitation intensity has strong impact on melting layer properties." Please revise this sentence. There is a correlation between these two, but it's odd to make this

causation statement.

9. P.17 In the summary, the authors address the non-Rayleigh scattering effect on the radar signals at different wavelengths, but don't mention how to distinguish the non-Rayleigh effect before. Adding some comments on how the non-Rayleigh affect the radar signals and how to tell these non-Rayleigh effect will help readers to better understand this statement in the summary.

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