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Discussions

Interactive comment on "Polarimetric radar observations during an orographic rain event and the performance of a hydrometeor classification scheme" *by* M. Frech and J. Steinert

Anonymous Referee #1

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Summary

This manuscript presents a study of an orographic precipitation event that occurred in Germany during which the precipitation type at the ground level change from rain to snow. The analysis is based on measurements from two polarimetric radars (distant of about 65 km) and surface observations from a weather station and a disdrometer. The manuscript focuses first on a feature of the event called "mesoscale event" by the authors, and second on the (partial) evaluation of the new hydrometeor classification scheme to be implemented by the German operational weather service.

The vertical profiles of reflectivity and vertical velocity collected by the research radar allows the identification of different phases during the event (e.g., transition from rain to snow at the ground, occurrence of a “mesoscale event") and a first assessment of possible (microphysical) explanations.

The hydrometeor classification scheme is applied for the considered event. The resulting classification is used to further investigate the “mesoscale event" and finally compared with the surface observations. The latter aspect is difficult in particular because of the difference in sampling volume, but the authors conclude that there is no blatant inconsistency between the radar product and the surface observations.

Recommendation

In my opinion, the scientific objectives and even more the results are not clear in the sense that the reader is left wondering what is the conclusions of the study about the two topics mentioned in the introduction: (1) what is this mesoscale event? (2) How good/bad is the new hydrometeor classification algorithm to be operationally run in Germany? These are interesting questions, but, in my opinion, this manuscript fails to correctly address them. In addition, there are some typos and the figures could be improved. Overall, I think that this manuscript is not ready for publication and should be sent back to the authors for major revisions. I provide below a list of comments and questions that will hopefully help the authors to improve the quality of their manuscript.

An additional concern is the fact that although the topic fits HESS’ scope, I have the feeling that this manuscript would better fit in a more hydrometeorological journal. But I leave this to the appreciation of the Editor.

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General comments

1. From the title, I was expecting the manuscript to focus on the orographic aspect of precipitation, but the influence of topography is not mentioned at all in the analysis. Moreover, the considered event is said to be orographic, but the authors do not provide any element to explain why it is an orographic precipitation event. A (brief) description of the synoptic situation is necessary I think to better introduce this event at the large scale before zooming to the mesoscale event. I hence question the title as it is now...

2. According to the introduction (p. 8848, l.22-24), the main objectives of this manuscript are (1) to analyze an orographic event (not clear to me what this means exactly...) and (2) to evaluate a hydrometeor classification algorithm. In my opinion, none of these two objectives is satisfactorily fulfilled: the analysis of the orographic event is essentially a description of the radar and surface data collected during one event, with a focus on a 1h period during which something different is happening; and the evaluation is very limited in terms of objective assessment of the quality of the hydrometeor classification.

   (a) For the first objective, a more in-depth analysis is needed and possible explanations should be provided (supported by the data). In its present form, the manuscript only offers very speculative and limited explanations (see P.8854, l.21-24) about the microphysical processes that could lead the pattern found in the data. To this extent, I am surprised that the possible occurrence and effect of riming are barely mentioned. If COSMO runs are available for the considered event, it would be relevant and fruitful I think to look into the simulated fields to get additional information on the state of the atmosphere at this time (with all necessary care).

   (b) For the second objective, I do not really understand what is evaluated, as only the occurrence of snow and wet snow is considered. No analysis is

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performed for the other classes, which makes this evaluation rather limited.

Specific comments

1. Introduction: the introduction needs to be significantly revised: the relevance of investigating orographic precipitation should be better explained, previous work about similar studies should be mentioned to put the present work into a more general context, and most importantly, the scientific objectives should be clearly defined and explained.
2. Introduction, l.16: by fully polarimetric, do the authors mean that the cross-polarization power are also measured?
3. Introduction, l.22-28: this should not be in the introduction, but later in the text when presenting the data.
4. P.8849, l.16-19: please explain (briefly) how this classification works.
5. P.8849, l.27-28: why introducing the ML class in addition to WS (wet snow)? The melting layer is formed by wet snowflakes...
6. P.8850, l.8: in horizontal “polarization" rather than “channel".
7. P.8850, l.9-10: specific differential phase SHIFT, and it is repeated twice.
8. P.8850, l.13-14: please provide more detail about the attenuation correction technique employed. Is it corrected in both liquid and mixed-phase? Neglected in the solid phase?
9. P.8853, l.20-21: this shift between the peak in Z_H and the minimum in ρ_{hv} is due to the fact that Z_H is dependent on the concentration of hydrometeors while ρ_{hv} is not. See *Giangrande et al.* (2008) for instance.

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10. P.8854, l.5-6: low ρ_{hv} values at the edges of cloud/precipitation can also be related to low signal-to-noise ratio.

11. P.8855, l.2: The reference cited here refers to Parsivel, another optical disdrometer. And there is a typo in the bibliography (PARSIVAL should be PARSIVEL).

12. P.8856, l.11: “snowfall height" is a bit misleading here I think, maybe “freezing level" should be used...

13. Figure 4: the color scale should be changed so that positive and negative values are easily distinguishable.

References

Giangrande, S. E., J. M. Krause, and A. V. Ryzhkov (2008), Automatic designation of the melting layer with a polarimetric prototype of the WSR-88D radar, *J. Appl. Meteor. Clim.*, *47*(5), 1354–1364, doi:10.1175/2007JAMC1634.1.

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