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Hydrology and Earth System Sciences
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

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First we thank for the helpful and constructive comments by the reviewers. We first of all have a general statement, as this seemed to be an issue for all of the reviewers. This indicates to us the necessity to sharpen the manuscript so the main points become clearer.

Since the birdbath scan is part of the operational scanning this scan opens the opportunity to provide high-resolution information on the precipitation process to the (end-) user that has not been available before. Furthermore the combination of operational

high resolution profile measurements (birdbath scan), surface measurements and visual observations is in our opinion a unique combination to investigate radar products based on volume scans. To our knowledge there aren't that many studies published where this operational set-up is available. So in the first part we demonstrate what can be seen in birdbath scan, focusing on an observation above the melting layer that is not often revealed, but which has a direct link to surface rain rate, especially if the orography plays a crucial role.

Detailed response (we follow the numbering of the reviewer):

The verification of the hydrometeor classification (Hymec) is perhaps overemphasized by the inclusion into the title. Here, we suggest to rename the title to "Polarimetric radar observation and hydrometeor classification during an orographic rain event"

1. orographic precipitation (caused by the Alps as a natural barrier for the synoptic flow and special synoptic patterns; the flow is forced to ascend which further enhances the precipitation intensity) is a common feature. We can include a synoptic map showing predominant Northerly flow towards Alps responsible for sometimes long-lasting precipitation events along the Alpine ridge. In addition we refer to the work of Houze and Medina (2005)

Furthermore we will include sounding information showing the synoptic warm air advection alof associated with substantial vertical wind shear, inorder to convince the reviewer 1 that this a precipitation event that is intensified by the presence of the Alps.

2. (a) we provide a possible mechanismn explaining the variability in the radar data. The suggested lifting and the associated microphysical mechanisms can and will be substantiated using radiosounding information from Munich in relation to results from Houze and Medina (2005), who study common features of orographic predicipation effects based on the MAP and IMPROVE2 experiment. The analysis in Houze and Medina (2005) fit very well to our observations (they also find pockets of enhanced reflectivity upwind ahead of the Alpine barrier.

With this instrumental setup we can reveal those processes and the mesoscale variability in rainfall intensity operationally.

A COSMO model analysis of this event (which would in itself require a thorough discussion on the validation of the microphysical scheme for such a precipitation event) is beyond the scope of this work.

2. (b) Hymec is in an evaluation phase. This is a crucial task for a hydrometeor classification scheme : to properly guide the forecaster when and where precipitation phases change. As such this has to be considered as a case study and not as a thorough verification of the hydrometeor classification. In particular in areas, where there is no ground instrumentation is available, the forcaster relies on radar data. We are talking about the performance of the scheme for a particular scenario (so the analysis confined to the hydrometeors that expected for this type of moment and time of season. This fits well in the results and aspects shown by Schuur et al., 2014 at the ERAD 2014.

Response to the specific comments. (ok means we will work on the text to make the paper more concise).

1. We can include some references of flooding events related to orographic forcing. And we can sharpen the main points we intend to cover in this work (see also the general comments above).

2. LDR mode is possible, but not used operationally.

3. ok

4. ok

5. The additional marking of the melting layer (ML) class is related to a user request. Because of this, the wet snow class, which shall reside in this regions, is suppressed by highlighting the ML class. Furthermore a post processing is applied on the ML detection and lead to combined ML segments. In addition single wet snow classified range bins retained by using this ML detection technique.

6. ok

7. ok

8. The attenuation correction is applied to all meteorological classes by using the proposal of Testud et al. (2000) together with an adaptive adjustment of the model parameter alpha, which is exemplarily reported in the book of Bringi et al. (2001). For every ray the radar data is separated in clutter-free segments with an equal hydrometeor class. After that the adaption of alpha is done on the individual range segments.

9. as discussed in the cited reference, the mixture of HM is also of relevance explaining the rhohv minimum Matrosov et al

10. ok, included.

11. agreed, but the the cavaets of an optical disdrometer apply to an Parsival and a Thies instrument.

12. ok

13. ok

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