

Interactive comment on “Unsupervised classification of vertical profiles of dual polarization radar variables” by Jussi Tiira and Dmitri N. Moisseev

Anonymous Referee #1

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This paper presents an attempt at objectively classifying vertical profiles of polarimetric variables in the solid precipitation medium. It then tries to establish links between the resultant classification and known fingerprints of microphysical processes in the upper layer of the atmosphere. The methodology proposed is quite novel and it may open the door to move from the interpretation of the data by an expert to the automatic extraction of relevant features from the data. Moreover, the same methodology may be applied to the study of other phenomena. The paper is clear and well written. I recommend its publication provided some issues I expose below are addressed.

General comments:

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1. Generally speaking the paper is well written but it is clear that the authors do not have English as their mother language. In particular, oftentimes articles are missing in the sentence. This does not hinder the understanding of the text so I will not go through the list of what I have spotted but a conscious correction should be performed prior to publication

2. My main concern is with the method used for the clustering. To my understanding, the k-means algorithm expects all clusters to be of similar size. This is an unreasonable assumption in the case of weather phenomena since there are processes that are fairly common whereas others happen rarely. The authors, rightly, do not make any a-priori attempt to balance the data but I suspect that leads to classes that are a mix of various phenomena and hence difficult to link to specific microphysical processes. Other clustering methods such as Expectation Maximization (EM) clustering may be more adequate for the sort of data at hand.

3. Given that microphysical processes in the solid phase of precipitation are highly dependent on the ambient temperature and the authors have available an estimate of the temperature profile via the NCEP GDAS I would be very interested in having a look at the results of the clustering when including the full temperature profile instead of just the surface temperature.

4. I am a bit surprised by the choice of algorithm to compute KDP. The Maesaka algorithm targets primarily the liquid layer of precipitation and works under the assumption that there is a monotone increase of Φ_{DP} . In my opinion this algorithm is not adequate to compute KDP in the solid precipitation. Negative KDP can be linked to important phenomena such as electrification.

5. It is not clear to me what the authors do if the values of the polarimetric variables fall out of the range provided for the normalization. It is also not clear to me how gaps in the data are treated.