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Atmospheric Measurement Techniques Discussions

Interactive comment on "Learning about the vertical structure of radar reflectivity using hydrometeor classes and neural networks in the Swiss Alps" *by* Floor van den Heuvel et al.

Anonymous Referee #1

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This paper aims to investigate a new localised vertical profile of reflectivity (VPR) correction technique by using machine learning. Radar reflectivity and hydrometeor proportions at equally spaced altitude from 30 precipitation events are taken as input for the training of an artificial neural network which then predicts the vertical change in reflectivity. This innovative method is able to provide a spatial variability for the VPR, tackling one of the major limitations of the standard techniques used operationally. The method outperforms the swiss operational VPR correction algorithm in predicting the growth and decay of precipitation during their fall.

The paper covers an important topic, has significant novelty and is well written. Con-

sequently, I recommend its publication with some minor issues.

- General comments:

1) The shape of the VPR is particularly driven by the freezing level height. This latter also helps discriminate liquid and solid hydrometeors within the classification algorithm used (Besic et al., 2016). Can the worst performances of the "dBZ-only model" compared to the "HC + dBZ-model" be just attributed to the lack of information about the isotherm 0°C? In your opinion, would a "freezing level + dBZ-model" perform as well as the "HC + dBZ-model" or do the hydrometeor proportions bring valuable information?

2) Does the new method perform similarly in the different type of precipitation events studied (stratiform, convective)?

3) Please explicit in the text all variables used in the equations.

- Specific comments:

1) Section 2.1: Are the radar data time synchronized?

2) Figure 4: Median reflectivities are weaker in the lower atmosphere (<4000 m) in the convective event than in both other cases displayed. How do you explain this ? Is it due to the presence of large stratiform precipitation areas?

3) Section 4.2: Do you have any explanation of why the dBZ-only models have difficulty with predicting growth values higher than 10 dB?

- Technical corrections:

1) p4 l22-24: For more clarity, I suggest to write "-10 to 60 dBZ" for the reflectivity range as well as the following radar variable ranges.

2) p4 l26: "ice, hail or high density graupel (IH/HDG)"

3) p5 l7: "a range of unidirectional wind speeds..."

4) p5 l8: "3 km height"

5) Figures 7, 8, 9, 10 and 11: labels of lower x-axis as well as right y-axis overlap

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