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Interactive comment on "Detecting the Melting Layer with a Micro Rain Radar Using a Neural Network Approach" *by* Maren Brast and Piet Markmann

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The authors have shown that a suitably trained neutral network *can* identify the melting layer in MicroRainRadar data. They have yet to show whether this is useful in the context of previous work. In my view, the paper is incomplete in its current form.

General Comments:

There is no comparison between the new neural network method and established methods to determine the identification of the melting layer height in vertically-pointing radar data. Both the neural network method and most of the previous empirical methods use radar reflectivity and Doppler velocity. The new method needs to *demonstrate* that is a superior in some useful ways to previous methods. There is some

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Discussion paper

discussion that the neural network method can identify two melting layers whereas the previous methods could not but that circumstance is rare and it is not clear if it worked well in the example shown in Figure 6 (see 6) below). Currently the main comparison is with training and validation data sets determined by eye and entered by hand with a mouse.

A comparison to a previous empirical method from the literature needs to be added. The method used by Perry et al. (2017) with MRR data is relatively simple to implement: From Perry et al. (2017) "In our analysis, the bottom of the melting layer is identified as the most negative gradient in Doppler velocity in the profile and the top of the melting layer as the most negative gradient in reflectivity. To determine the top of the melting layer, the average hourly melting layer thickness (top minus bottom) was combined with the 1-minute values of melting layer in that hour. We elected to discard any melting layer height values greater than one standard deviation of the hourly mean."

Specific comments

1) Page 1 Lines 11-12, Please correct. As melting occurs the snow particle is not "coated" with liquid water, rather is contains a mixture of liquid droplets and ice (see Knight 1979, JAS). The coating idea was a simplification used by some investigators to model melting (e.g. Yokoyama and Tanaka 1984).

2) Page 1 line 14-15 "particle density decreases due to acceleration and the smaller size of particles" this implies the density of water changes. . .please correct.

3) Page 2 Lines 21-22 and Page 17 line 5-6. Please correct. Vertically pointing radar data cannot determine occurrence of supercooled rain (i.e. freezing rain and icing) without an accompanying temperature profile. The radar can determine where the melting takes place. Once liquid, the drops have identical observed radar properties whether or not they are supercooled.

4) Lines 14 and 1. Please clarify the details regarding how the lower and upper boundary of the melting layer were determined by different variables. The necessity to use these other variables appears to contradict later statements in relation to description of method later that says that only ZEA and VEL are used.

5) Section 3.3 Please clarify the radar resolution volume size in the vertical of the C-band radar resolution volume over the MRR. For 90 km distance this is likely more than 1 km spatial resolution.

6) Page 10, lines 7-10, Figure 6 Please show the temperature profile from Greifswald at 12 UTC as part of this figure and explain why at 12 UTC there are no melting layers shown, just before 12.5 UTC the radar data shows only one melting layer and it is not until about just after 13.5 UTC that two melting layers one aloft and one at the surface are evident.

7) please convert x-axis times in Figures 1-7 and 9 to UTC hours and minutes.

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