Interactive comment on “Characterisation of the melting layer variability in an Alpine valley based on polarimetric X-band radar scans” by Floor van den Heuvel et al.

Anonymous Referee #2

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General Comments

This paper presents an analysis of small scale variability mainly of melting layer height in complex terrain (the region of Alps) using close range data from RHI scans acquired with X-band polarimetric radars. The analysis focuses on the identification of the larger spatial scale which can explain most of the variability of the melting layer height and less details are showed for other characteristics of the melting layer. The paper shows the significance of accounting for the spatial variability of melting layer for more accurate operational radar products in complex terrain. Some clarifications and modifications are needed before final publication.
Specific Comments

Page 4, line 18: In PPI scans azimuth scanning is assumed. Consider using a term like "vertical beam recording" instead of "vertical PPI scan", unless the antenna is actually rotated while pointing in the vertical direction.

Page 5, lines 15-20: Some details on DPP and FFT modes and ZDR calibration could be given. Also, beam width and antenna rotation rate/dwell (rays) averaging should be given for an indication of vertical resolution in RHI scans. Was an interpolation of RHI scans in a regular vertical grid performed before analysis?

Page 6, line 18: A comparison of RHI melting layer detection with common in space and time detections in near horizontal PPI scans could be useful for spatial variability for melting layer.

Page 6, line 24: It should be mentioned that the 10 km short range was used for analysis to e.g. avoid beam broadening effects (assuming even smaller non-uniform beam filling effects). This can be seen in Fig. 4. In addition, in that figure there is a significant rapid decrease of melting layer at distances larger than 10 km. Is there an explanation for this observation, e.g. proximity to the edge of the rain cloud?

Pages 7-8: The details (equations) of FFT are well known and could be omitted if they are not really useful.

Page 9, line 1: Spatial lags probably correspond to wavelengths? In this case, the term "spatial scales" is probably closer to this meaning.

Page 9, Fig. 5: According to this figure, the melting layer detections are not consecutive with relatively large range gaps where linear interpolation (rather than median filter) is done. Some explanation for these missing detections could be given like a quality check of melting layer detection. This could lead to significant errors in spectral analysis of small "lags". If the raw detections are as shown in Fig. 6, the abrupt changes (spikes of more than 100m) should be "noise" in the detection algorithm and it should
be removed (filtered) before spectral analysis.

Page 10, Fig. 7: Spatial "lags" up to about 20 km are shown, but even if the RHI scans are from 0 to 180 degrees antenna elevation (which is not likely due to terrain, like it is shown in Fig. 4) the 10 km range should give spectral information for "lags" up to 10 km (or less) similar to the limitation of Nyquist frequency in FFT.

Page 11, Fig. 8: The copolar correlation coefficient values from DX50 radar are too low. This may indicates e.g. some synchronization problem in H-V channels rather than a physical explanation. Thus, this could lead to significant errors in melting layer detection where the correlation coefficient is the critical parameter. This is probably indicated by the results like for the larger "lags" in Fig.10.

Page 12, Fig. 11: The plots are too crowded by lines. Maybe some kind of standard deviation could be used instead of showing all lines.