Final response to anonymous referees

AMTD contribution by Maahn and Kollias:
Improved Micro Rain Radar snow measurements using Doppler spectra post-processing

Original Referee comments are in italic
Replies to reviewer queries begin with a bold **R**
Added text is in courier style

Anonymous Referee #1
A number of corrections have been identified below: General –
use of dBz rather than dBZ?
R1a: The authors would like to follow the convention proposed by Paul Smith (JAOT, 2010: The Unit Symbol for the Logarithmic Scale of Radar Reflectivity Factors)

P4772, L13: replace 'at' with 'over' P4472, L26/P4473, L1:
'also extends' rather than 'extends also' P4473, L8: remove 'a' before 'better' P4474,
L7: 'month' rather than 'months', P4475, L8: remove hyphen between
's' and 'data' (i.e. '10 s data') P4780, L8: replace 'relation' with 'relationship' P4782, L1:
replace 'normal' with 'normalised' P4782, L12: replace 'would be' with 'is' P4783, L1:
consider replacing 'neighbouring' with 'adjacent' P4783, L1: replace 'bins of' with 'bins
to' P4783, L6: replace 'had to be' with 'was' P4783, L15: replace '"halfs"' with 'halves'
P4783, L22: replace 'from' with 'of' P4785, L11: replace 'extend' with extent' P4785,
L14: replace 'of all peaks the smallest 10%' with ' the smallest 10% of all peaks' P4789,
L11: replace ' exemplary the' with 'the exemplary' P4790, L2: replace 'detect also' with
'also detect' P4793, L11: replace 'no bias' with 'unbiased'
R1b: Thanks for the detailed comment, we changed the corresponding parts as you suggested.

P4474, L12-14: repetition of the MRR description
(check elsewhere also – e.g. bottom P4777).
R1c: Regarding P4773/P4774: L.12 of the introduction was shortened to
The Micro Rain Radar 2 (MRR) is a profiling Doppler radar (Klugmann et al., 1996) originally developed...
Regarding P4777: The repetition of the moments available in the standard product was made less obvious, the beginning of Section 3.1 is now:
To derive the moments available in Metek's standard product Averaged Data (amongst other things reflectivity Z, Doppler velocity W and precipitation rate R), the observed Doppler spectra are noise corrected:

P4475, L10: replace 'ratio' by 'difference' or 'bias' (also
in associated Figure 2).
R1d: We replaced dual wavelength ratio by dual wavelength difference.

Figure 2: suggest that it
might be worth adding a sentence in the caption regarding the regular biases in the
MRR-MIRA35 plot.
R1e: We changed the caption to
Fig. 2. Time-height effective reflectivity plot of MRR Ze (top), MIRA35 Ze (centre) and their dual wavelength ratio ΔZe (bottom). **The presented data is already corrected for constant calibration**

offsets. The operation time of MIRA35's heating is marked in grey in the bottom panel.

Anonymous Referee #2

A sensitivity of -14 dBZ is good as it is closer to -17 dBZ, a threshold used for drizzle detection. Hence, with the new processing the MRR would be able to observe all types of precipitation. But as pointed out by the authors, the sensitivity is also dependant on the number of spectra averaged (58 in this study) and the number of FFT points used to calculate the spectra (page 4793, line 15). I wish the authors could elaborate a little more on how the sensitivity, temporal resolution and spectral resolution interplay in the MRR. Eventually, it will be great to have a MRR with finer spectral and temporal resolution with same sensitivity. I understand if the authors would have to speculate a little addressing the issue as data at finer resolutions might not be available.

R2a: We changed line 17-19, page 4793 to:

The current MMR processor has a data efficiency of 60% (ratio of pulses digitized and used for moment estimation to number of pulses transmitted) due to its inability to receive and transfer data at the same time. Thus, the data acquisition is intermitted. A better digital receiver with 100% data efficiency will improve our ability to extract weak SNR signals by 2-2.5 dB. Additional sensitivity can be acquired by further averaging (post-processing) of the recorded radar Doppler spectra. However, this should be subject to the scene variability. Finally, a higher number of FFT points (e.g., 256) will enable better discrimination of radar Doppler spectra peaks and better higher moment estimation, eg., Doppler spectra skewness (Kollias et al., 2011).

Kollias, P., Remillard, J., Luke, E., and Szyrmer, W.: Cloud Radar Doppler Spectra in Drizzling Stratiform Clouds. Part I: Forward Modeling and Remote Sensing Applications, J. Geophys. Res., 116, D13201, doi:10.1029/2010JD015237, 2011.

Minor Comments: A number of minor comments have been pointed out by the other reviewer, so I will not echo them here again. Below are few which did not overlap with the other reviewer.

1) Page 4772, line 23; The absorption in snow is negligible at 24 GHz, but not at 35 GHz or 95 GHz. Please mention the frequency in this line.

R2b: We have modified the line to

For observations at K-band, absorption is negligible in ice,...

2) Page 4786, line 7;

Instead of saying "no.", I would say "Data from the second (32nd) range gate was not used for data processing . . .")

R2c: We agree that the referee's suggestion is easier to read, but we want to stick to our notation to be in accordance with Metek's documentation.