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Atmospheric Measurement Techniques Discussions

Interactive comment on "A simple insect removal algorithm for 35-GHz cloud radar measurements" *by* Madhu Chandra R. Kalapureddy et al.

Anonymous Referee #2

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I think the NER algorithm should be removed from this paper. There are much more general ways for thresholding between signal and "salt and pepper". I should be done by the radar software. so that it adapts automatically to the processing parameters.

I think the TEST algorithm for filtering insect echoes from the radar data is helpful if it is used in combination with LDR-filtering and or dual frequency filtering. The author comes to this conclusion in the lines around 285 and I agree to it. In the rest of the paper the algorithm is described as a standalone alternative to LDR or dual-frequency filtering. It should be clearly said that this does not work as in regions with much insects the insect signatures are as smooth as butter. There they are volume filling targets.

The theoretical background of the algorithm should be explained more general:

actually the signal from insects has a longer de-correlation time than signal from volume filling targets.

The signal from volume targets is a sum of many signals with statistical phases and amplitudes which causes noise with normal distribution (central limit theorem). Therefore even if the volume is filled with stationary targets (droplets falling with different speeds, some exiting the volume, some entering) each line of of the un-averaged complex spectra is normal distributed noise with zero mean and a variance corresponding to the power in the doppler spectrum. The doppler spectra are the abs-square of the complex spectra and therefore they are still noisy. Due to squaring the distribution is transformed from normal to exponential. After averaging over 1 s this noisiness has smoothed out by 1/sqrt(nave). In contrast the signal from a single insect is not noisy at all if its SNR is large. But there is another reason causing variance in the biota signals. Typically the insects are advected through the radar beam,entering with apparent downward velocity and leaving with apparent upward velocity. The pass through time depends on beam width (deg), height, and wind speed. this causes a spiky spectra. if there are not too many insects, then there is a maximum in the variance spectrum of biota signals at 1/(pass through time). For this reason the variance spectrum of volume targets is white and for biota with moderate densities it has a maximum at the frequency corresponding to the 1/(pass through time). The TEST-procedure extracts the variance caused by biota by cancelling the high frequency variance of the volume targets by 1 second averaging and by cancelling the low frequency variance with high pass filtering the variance of reflectivities. The remaining medium frequency componets of the variance spectrum is dominated by the beam passing of the single insects, and therefore it can be used for recognising if the signal is from biota or clouds. Without understanding the author found that the test method works in many cases. In cases with too high or too low wind speed this simplified filtering may fail.

Here are some minor notes:

45: sensible âĂŤ> sensitive

56: to our experience the reflectivities of biota are below 0 dBZ, reflectivities of rain are above 0 or 5 dBZ.

95: T-matrics âĂŤ> Rayleigh

96: I would change the sequence from large to small 1 droplets with .1 mm : -60 dBZ 64 droplets with 0.05: -60 dBZ 1e6 droplets with 0.01: -60 dBZ

I guess the author wants to say that hydro meteors are volume filling targets in most cases. For a single spectral component or say a single drop D size Z = N Dˆ6/V, where V is the radar volume which about 1000 to 25 000 mˆ2 depending on height, and N is the number of droplets in the radar volume. In case of single target N=1 and therefore Z_singletarget = Dˆ6/V or Z_volumetraget » Dˆ6/V. As D can be inferred from the terminal falling velocity which is roughly the doppler velocity at least for larger droplets, it can be found by analysing data that hydrometeors are volume filling in the the majority of cases. Sometimes large droplets in the beginning of a rain event are rather single targets.

98: is the PRF of this radar really adjusted to such a low value. this would allow for a maximum range of 300 km which is not useful in vertically pointing mode. a prf of 7 to 10 khz is more adequate in vertical mode. this allows a much larger velocity range. but this is not relevant for the scope or this paper.

I cannot understand or even guess the mening of this sentence.

126: ..more than 2 m/s and the de-correlation

137: This method will be fully explained in the following section âĂŤ> It seems it is in the rest of this section and then in the section Results and discussion beginning in line 214

139: fixing âĂŤ> thresholding

227: This is not true for cyrus clouds. The have a very soft top.

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