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Atmospheric Measurement Techniques Discussions

Interactive comment on "Detection and characterization of drizzle cells within marine stratocumulus using AMSR-E 89 GHz passive microwave measurements" *by* M. A. Miller and S. E. Yuter

Anonymous Referee #4

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The paper by Miller and Yuter introduces a new method to infer heavy drizzle characteristics in marine stratocumulus. While the method is rather simple its advantage lies in the higher horizontal resolution of the AMSR-E 89 GHz channel compared to the classical AMSR LWP that make use of the low frequencies and thus has coarser resolution. The paper is well written and fits well to AMT. However, I would have liked the paper to be more quantitative in the comparison with radar, AMSU-LWP and MODIS data. In particular this concerns the size distribution. The reader should get a better

understanding of the limitation and advantages of the different products.

Though I realize that the comparison with radar data is not trivial I would urge for a quantitative analysis of Fig. 3 or even better including more available radar data. The simplest would be to average the radar data onto the AMSR grid, apply a dBZ threshold and derive HIT and FALSE Alarm rate (or any other skill core). Best would be to plot these as a function of threshold. Using a standard Z-LWC relation an indication of the detection limit of drizzle amount can be gained - you can even show LWC on the upper axis. Of course to be really correct one should also account for the loss in sensitivity with distance (about 9 dB over 30 km) and the increasing height (volume) of the radar beam with distance. What was the elevation angle? However, I am fine to leve these radar characteristics out as they unnecessarily complicate things.

Fig. 8 is rather important as it summarizes the advantages of the new drizzle product. I do not understand why not all cases are combined to get better statistics. In the end you want to give a clear information on the quality of your algorithm, e.g. "80 % of small (< 50 km2) cells are missied in comparison to MODIS" or "the algorithm reveals the presence of x% of large drizzle cells (>300 km2) from which MODIS only sees y%". The case from the southern Atlantic (Fig. 6) has a large number of small cells in the upper right in MODIS LWP which are missed by the new algorithm. This is dominating Fig. 8. I suggest to improve the text and Figure such that such quantitative statements can easily be drawn. For better comparison you could put the 3 columns next to each other (and show these for all 3 cases)or make cumulative distributions..

Minor points:

Title: It needs to be mentioned that it only works for heavy drizzle

Abstract: I would move "Clouds containing ice are screened out." one sentence up. Or you even don't need it if you somewhere say that you focus at warm clouds at moderate SSTs. I would like that as I find the sentence that background temperature is constrained by IWV and SST misleading. The only way you take SST into account

is by focusing on a limited SST range.

Page 4574 line 9. It is not clear if also a MODIS nighttime LWP product is used. Without solar reflectance information the quality is strongly degraded and therefore should not be used! As ViS is shown for the three sample cases (Fig.4) this should not be a problem.

Page 4575 line 20. Saying that the horizontal TB is used because it is less noisy is misleading as it points at an instrument problem. In fact the ocean emissivity is lower for horizontal than for vertical polarisation and therefore the dynamic range is higher.

Page 4576, line 6 Please check the AMSR specification. With an antenna size of 1.6 m the resolution is 14 x 8 km at 36.5 GHz and 6 x 4 at 89.0 GHz. I am pretty sure that the LWP product also includes the 23.8 GHz channel which must have worse resolution than the 36.5 GHz channel. This implies that the real resolution of the standard LWP product is worse and emphasizes the advantage of your algorithm. Anyway note that an LWP algorithm making uses of different frequency channels with different footprints interpolated to a fixed grid probably is not well suited to identify cell structures.

Page 4576, line 15 The sentence about dBZ and LWP is not strictly correct. Wood et al say "..with peak values of liquid water path at the center of the mesoscale cells exceeding 400 g m$-$2 and a mean LWP of 150–200 g m$-$2. Our observations from RF06 are indicating that this surrounding cloud contains significant cloud base precipitation. Since elevated LWP is known to be associated with enhanced precipitation in marine stratocumulus." The connection between LWP (integral) and cloud base precip is missing - so it depends where the radar beam hits the "drizzle" (see also Woods Fig. 13). Maybe it is worth mentioning that 0 dBZ relates to 1 mm diameter drop in a cubic meter or 1 million of 0,1 mm drizzle droplets - so it is all about the occurence of a few larger drops...

Page 4576, line 19 I think the Comstock reference has the wrong year Page 4577, line 2 reference for O, connor is missing

Page 4578, line 19 IWV should be kg and probably in Eq (1) as well – note global average is about 25 mm or 25 kgm-2.

Page 4579, line 10 onwards You need to give the resolution of the MODIS cloud top and the AMSR SST product. The latter must be based minly on the 6.9 GHz channel which has coarse resolution. I don't see any problem to downscale the SST but you should mention it and also that SST is a smoothly varying parameter. Why did you choose to take the mean cloud top and not the minimum or som epwercentile?

Page 4579, line 25 A lot of drizzle features are mentioned here so I was disappointed to only see a simple area distribution in this paper. Maybe say here that you later will show exemplary the size distributiion.

Page 4582, line 17 Say why you know that there is cirrus.

Table 1 Why not exchange columns and lines and then add total number of detected cells and average (median) size.

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