

Interactive comment on “Radar-radiometer retrievals of cloud number concentration and dispersion parameter in marine stratocumulus” by J. Rémillard et al.

Anonymous Referee #3

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Review of “Radar-radiometer retrievals of cloud number concentration and dispersion parameter in marine stratocumulus” by Rémillard, Kollias and Szyrmer

This paper describes and evaluates a new retrieval of cloud droplet concentration N and dispersion parameter for use in nondrizzling marine stratocumulus clouds that uses chiefly the vertical profile of radar reflectivity and the microwave radiometer-derived LWP. The approach, I think, assumes an adiabatic cloud liquid water content profile. The dispersion parameter, which necessarily is assumed constant with height, together with the vertical profile of cloud droplet concentration, are derived independently. From

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the retrieved parameters (and the input LWP), the cloud optical depth can be derived. This is compared with the observed optical depth from a narrow field of view radiometer (NFOV). As a byproduct, the equilibrium supersaturation in the cloud can be derived.

This is a useful new retrieval and the paper describes the approach well. Initially I had some problem understanding how one can retrieve both the vertical profile of N and the dispersion parameter. But once I realized that the LWC profile is essentially assumed, it becomes clear. The authors should make it a little clearer that the LWC profile is assumed. They also should assess the potential for subadiabatic clouds due to entrainment mixing (see e.g. Nicholls and Leighton 1986, Section 5b). I’m not sure how this might impact the retrieval.

Overall, the paper is well-written, concise, and shows that the retrieval has considerable promise for more routine application to radar-radiometer datasets. I have only a few minor suggestions for improvement.

1. The estimated errors in the input parameters used to perform the error breakdown seem a little small. No one thinks that one can achieve 6 g/m² error from microwave LWP estimates. And is the radar calibrated to better than 1 dBZ? Perhaps it would be worth making the errors a little more realistic.
2. P 7512, L8, “of the distribution”
3. The authors should clarify exactly how the microwave LWP is used. I am still a little confused. If one knows the base and top, isn’t it sufficient to assume adiabatic, or is something else done?
4. Eq 11, center part, numerator: remove superfluous “(r)”
5. P7516, line 3. By “edges”, do the authors mean “cloud top and base”, or do they mean cloud sides?
6. An obvious test here would be to take the MWR and the NFOV and derive an effective radius to compare with the retrieved one. How good is the agreement?

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