Review of 'Ground-based Observations of Cloud and Drizzle Liquid Water Path in Stratocumulus Clouds' by Cadeddu et al.

This manuscript presents a new methodology for retrieving simultaneously the cloud liquid water path as well as the drizzle water path below and in the cloud layer. This is achieved by combining active and passive ground-based instrumentation. This work is largely based on previous research by the authors and the foundations for this retrieval algorithm have therefore already been evaluated. The novelty consists in the way active and passive measurements are merged to infer more precise in-cloud information. Further analyses are provided, in particular concerning the importance of scattering effects for such retrievals. Finally, 10 days of retrievals for open and closed-cell marine stratocumuli are statistically analysed.

The manuscript is well written, and the retrieval technique (although relatively complex) seems promising. I do not see any particular issue with the retrieval technique, although a main issue is of course the difficulty to evaluate its results. The authors here offer quantitative evaluations through comparisons with radar Doppler spectra or with expectations based on previous literature results. It might be too limited to make strong conclusions on the cloud and drizzle properties in open/closed cell stratocumuli, but I acknowledge it is difficult to go further in the absence of in situ measurements and without more statistics than the 10 days analyzed here. Overall, I think this is convincing and interesting work, and would suggest for publication after minor revisions, following the comments below.

General comments:

1. One of the main findings of this paper concerns the importance of considering scattering effects in microwave retrievals. However, I have a few concerns with the ways these results are obtained.

A first way to evaluate the scattering effect is through comparisons between the retrievals and their associated a priori values from a neural network algorithm that doesn't consider scattering. I am not very convinced with the impact on C_f, which seems to stay close to its a priori value, but a reduction of LWPt is indeed clearly observed. Is the optimal estimation framework used for this study based on a Levenberg-Marquardt scheme, i.e. is a departure from the a priori value actually showing a reduction of the cost function (rather than being possible iteration noise in a Gauss-Newton approach)? Please comment on this, and for future study I'd suggest using more quantitative metrics like the cost function, information content or degrees of freedom to reach such conclusions.

Another way the importance of scattering is quantified is by comparing the retrievals of the new technique to those of MWRRET2, a similar retrieval algorithm. Considering the importance of these results, more details of the similarities / differences between the retrieval algorithms should be given in section 2.1. But why not simply turn scattering off (forcing the single-scattering albedo to 0) in your current retrieval algorithm, instead of using a different retrieval algorithm? That would avoid being impacted by retrieval technique differences and be much more convincing.

2. The impact of shafts on retrievals is discussed, first in the algorithm description and then in the result discussions. But it is still not clear to me, especially in the discussions surrounding

Tables 2 and 3, what part of the conclusions concern impacts from retrieval limitations or from actual microphysics differences during shafts. Please clarify the exact (expected) impact of shafts on retrievals, so that the readers can more clearly understand your results.

Specific comments:

3. The title could be slightly more specific to reflect better the main findings of this study (e.g. concerning the in-cloud drizzle retrievals, or the importance of scattering).

4. p3 l87-88: Do I understand correctly that non-spherical and oriented particles models are used to describe cloud droplets and drizzle? Is there any particular reason?

5. p4 l98: I think it would be worth expliciting the DSD and its 3 parameters, as different DSD shapes are used in the literature.

6. p4 l105-107: Dealing with a mixtures of cloud droplets and drizzle within the same pixel clearly is a challenge. Is there a reference to justify the choice of a lognormal shape with fixed width?

7. p7 l194: typo: “in”