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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Observation of absorbing aerosols above clouds over the South-East Atlantic Ocean from the geostationary satellite SEVIRI – Part 2: Comparison with MODIS and aircraft measurements from the CLARIFY-2017 field campaign" *by* Fanny Peers et al.

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The authors have done an excellent job of addressing the concerns of the two reviewers and I do not feel they need to be asked to re-review. As editor, I am motivated to make an additional comment on the MARSS-SEVIRI LWP comparison shown in Fig 11 and

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Discussion paper

discussed on p. 16. I'm surprised to see the authors rely solely on an assumption of a LWC profile that is constant with height (their eqn 2) when many papers now point to the more realistic applicability of an adiabatic profile. Painemal and Zuidema 2011, which they cite, is just one of many examples and indeed they mention applying a linearly-increasing LWC with height on line 14, p. 19. This would change the factor 2/3 to a factor of 5/9 in eqn 2, further reducing the SEVIRI-retrieved LWP and increasing the discrepancy from the MARSS values.

Given that the effective radii retrievals match reasonably well in Fig. 10, another explanation for the LWP difference might be in the MARSS LWP. There is no error analysis included within the description of the MARSS data and we do not know its retrieved LWP uncertainty. Larger drizzle/precipitation sized drops will increase the microwave emission beyond that expected by the microwave retrieval algorithm - the authors don't say, but I suspect the algorithm assumes Rayleigh scattering. The C050 comparison, for which the drop sizes are the largest in Fig. 10, could be an example of that. C042, in which the MARSS and SEVIRI LWPs match fairly well until about 10:15 (which actually serves to support both retrievals, up to that point), breaks down thereafter, and precipitation could explain this, as it would also reduce the visible optical depth. I am not sure why an ref comparison is not included in Fig. 10 for C042 - was the CDP not working for this flight? I note that Seethala and Horvath, 2010, 10.1029/2009JD012662, use a threshold of 180 g/mˆ2 to distinguish when precipitation starts impacting satellite microwave LWP retrievals, and the MARSS instrument operates at higher frequencies than the satellites, with the MARSS frequencies more susceptible to enhancement of the brightness temperature by rain (there's also some relevant discussion in Grosvenor et al., 2018, 10.1029/2017RG000593 p 435-436, containing other references).

Another cause for the discrepancy could be that the SEVIRI-retrieved cloud top effective radius for the two-layer cumulus-under-stratocumulus regime that dominates the cloud field at Ascension (some examples are shown in the cited Abel et al., 2020; others overlapping with the CLARIFY time period are also shown in Zhang and Zuidema,

2019, ACP SI), is not representative of the column, with the upper stratiform layer consisting of smaller drops than the lower-lying cumulus. The authors could use the aircraft data to test for this; it also seems suggested by Fig. 9.

The LWP comparison is summarized on p. 18, line 11 as revealing a limitation to the COT retrieval (the upper limit), but I am not sure that that is what is going on here.I would like to ask the authors to discuss whether or not precipitation may be unrealistically enhancing the MARSS LWPs - is there data from ascent/descent profiles that could be used to look for precip? The ref/LWC profile? And to revisit the relevant text in their manuscript based on the considerations raised above.

A small further comment is to revisit the reference list and update where appropriate; the Wu paper is now published for example.

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