Atmospheric Chemistry and Physics Discussions

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Comment on acp-2022-374

Anonymous Referee #1

Referee comment on "In situ and satellite-based estimates of cloud properties and aerosol–cloud interactions over the southeast Atlantic Ocean" by Siddhant Gupta et al., Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2022-374-RC1, 2022

The paper is well written and I only have a few minor comments. The paper is thorough, which is appreciated as it documents the steps of the retrieval and the satellite comparison in a way that will be helpful to others.

Line 55: It seems like the authors are only discussing the first indirect effect and not adjustments. They could also cite work by others discussing aerosol cloud adjustments in the context of meteorological confounding variables and causal ambiguity (Gryspeerdt et al., 2019; McCoy et al., 2020). They may also wish to cite (Wood et al., 2012).

Line 146: What is the scale of the profile? Does this mean that on a research flight the max height at which cloud occurred and the min height were used? If the profile is too extensive it is not clear if this is a particularly good assumption and it is unclear why the median was not used. I may have understood what is being referred to and a small amount of additional information here might be helpful to readers.

Line 343: this compensating uncertainty is consistent with earlier studies such as (Painemal & Zuidema, 2011) and (Grosvenor & Wood, 2014).

Line 402: Assuming uncorrelated random errors would tend to overestimate the error since earlier the authors showed that there were compensating errors?

Line 431: Nit-picky, but since these distributions are non-normal (N is lognormal) the two sample t-test is not appropriate here.

Section 4: this section is interesting as it compares places where aerosols touch the cloud layer with places where they do not. The section is a bit excessively descriptive of the figures and could be shortened a bit. Rather than listing differences a table with (for instance) Mann-Whitney U-test statistics could be given. Giving values for differences between contact and non-contact is useful, but a bit hard to contextualize in that no information on the aerosol loading is given.

Line 432: Why would SST, stability (either EIS or LTS- they are nearly identical in this region) be affecting N? It would only apply to tau and re I believe.

Grosvenor, D. P., & Wood, R. (2014). The effect of solar zenith angle on MODIS cloud optical and microphysical retrievals within marine liquid water clouds. *Atmospheric Chemistry & Physics*, *14*(14), 7291–7321. https://doi.org/10.5194/acp-14-7291-2014

Gryspeerdt, E., Goren, T., Sourdeval, O., Quaas, J., Mülmenstädt, J., Dipu, S., et al. (2019). Constraining the aerosol influence on cloud liquid water path. *Atmospheric Chemistry & Physics*, *19*(8), 5331–5347. https://doi.org/10.5194/acp-19-5331-2019

McCoy, D. T., Field, P., Gordon, H., Elsaesser, G. S., & Grosvenor, D. P. (2020). Untangling causality in midlatitude aerosol–cloud adjustments. *Atmos. Chem. Phys.*, *20*(7), 4085–4103. https://doi.org/10.5194/acp-20-4085-2020

Painemal, D., & Zuidema, P. (2011). Assessment of MODIS cloud effective radius and optical thickness retrievals over the Southeast Pacific with VOCALS-REx in situ measurements. *Journal of Geophysical Research-Atmospheres*, *116*. https://doi.org/D24206 10.1029/2011jd016155

Wood, R., Leon, D., Lebsock, M., Snider, J., & Clarke, A. D. (2012). Precipitation driving of droplet concentration variability in marine low clouds. *Journal of Geophysical Research: Atmospheres*, *117*(D19), n/a-n/a. https://doi.org/10.1029/2012jd018305