Atmospheric Measurement Techniques Discussions

Atmos. Meas. Tech. Discuss., referee comment RC3
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Comment on amt-2021-371

Anonymous Referee #2

Referee comment on "The impact of sampling strategy on the cloud droplet number concentration estimated from satellite data" by Edward Gryspeerdt et al., Atmos. Meas. Tech. Discuss., https://doi.org/10.5194/amt-2021-371-RC3, 2022

Review of The impact of sampling strategy on the cloud droplet number concentration estimated from satellite data by Gryspeerdt, et al.

This manuscript compares data sampling strategies employed in several studies of cloud droplet number concentration (Nd) retrievals from MODIS observations. It also compares retrieved values using these strategies with in situ observations from several aircraft campaigns. Accurately estimating Nd from satellite has been a challenging issue, given the number of artifact sources encountered in the remote sensing of cloud properties in the visible and near IR spectrum. An intercomparison of these sampling strategies is of benefit to those involved in cloud remote sensing as well as those validating models with MODIS estimates of Nd.

I found the science to be sound and the manuscript well written. However, I was disappointed that the study was largely limited to the r^2 metric when comparing strategies in the absence of *in situ* observations. While this is a good first order metric in assessing agreement in a relationship, I think including a comparison of measurement bias between techniques or comparing them to a retrieval that is agnostic with regard to filtering technique would improve the manuscript. Additionally, I think it would be beneficial to include error estimates, especially if considering bias. This could be as simple as propagating forward the uncertainties of optical thickness and effective radius given in the MODIS cloud product and reasonable assumptions on systematic or random errors of the other input parameters.

Individual comments:

Throughout the manuscript: Please change “insitu” to “*in situ*” and italicize.

P4L1 – Using “degeneracy” will likely confuse readers that don’t have a physics background. Perhaps refer to it is “ambiguous retrievals for small re”?

P11L1 – While 15 microns is an upper limit associated with drizzle above that threshold, would using something like the H^3/N ratio in vanZanten, et al. (2005) result in the rejection of less data greater than 15 microns while preserving the assumption of an adiabatic profile? Since geometrical thickness is relatively simple property to calculate with N, it could easily be used to filter data on the fly.

P11 Table 3 – Please place the wavelengths in the table in ascending order.

P11L10 For estimating Nd, wouldn’t 3.7 microns generally be the preferred wavelength since the re used in Eq 1 is assumed to be at cloud top? I think section 3.2.4 could be eliminated since regardless of r^2, a retrieval from 1.6 microns is generally of limited utility.

Figure 1 – Please add a legend to this figure.

Figure 5 – Why is 1.6 microns being used here. Wouldn’t 3.7 or 2.1 be a better choice for comparison?