

Interactive comment on “The impact of horizontal heterogeneities, cloud fraction, and cloud dynamics on warm cloud effective radii and liquid water path from CERES-like Aqua MODIS retrievals” by D. Painemal et al.

Anonymous Referee #1

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General Comments:

This is a fairly limited analysis that supports many previous findings that have shown that effective radius derived from two near infrared channels differ. Little new information is presented however the methodology is generally sound. There are several incorrect or unjustified statements that need to be corrected before publication. I recommend major revisions.

Specific Comments:

C2435

Title: ‘The impact of’ should be changed to ‘relationships between’ or something along those lines. ‘cloud dynamics’ definitely needs to be removed. You can’t equate microwave LWP retrievals with cloud dynamics.

Line 16: same comment as above

Line 26: Later in the text you claim that the positive biases are indeed associated with vertical structure. Don’t you really have some evidence that both vertical and horizontal structure may play some role and that horizontal structure is most likely more important.

Line 97-99: This argument makes no sense to me. The bias in retrieved r_e is mostly coming from internal pixel heterogeneity (<1km) not external (>1km) pixel heterogeneity. You are better off arguing that heterogeneity at small scales is associated with heterogeneity at larger scales.

Figure 2: Can you use the same data range for 2b and 2c so that the color scales can be compared?

Line 140: change ‘an’ to ‘a’

Lines 142-144: This is a bit of a stretch and extremely speculative. This physical interpretation just isn’t justified or really necessary. Just state that variation in LWP might be associated with variations in cloud dynamics.

Line 140: Are the results in Figure 3 only from grids with $CF > 98\%$?

Line 145: AMSR-E LWP is not insensitive to 3D radiative effects [Greenwald, 1997].

Figure 4: The comparison could be better shown as a data density plot. The apparent high bias of MODIS at low values of AMSR-E LWP is simply the result of binning one positive definite variable against another which will always give the impression of biases as one approaches zero. In fact, this particular microwave retrieval is known to have a high bias as MODIS LWP (cloud fraction) tends toward zero.

Line 212-213: This statement needs to be removed. This study deliberately attempts

C2436

to avoid considering precipitating clouds by imposing a $LWP < 150 \text{ gm}^{-2}$ data filtering. Therefore, no statement regarding the role of precipitation can be justified.

Line 217: 'Spurious' is probably too strong a claim. An association between H_{σ} and Δr_e is insufficient to claim any causality. It would be better to emphasize that effective radius retrievals should be treated cautiously.

Line 217: Many cumulus have very small LWP. It is enough to just state that H_{σ} is larger in cumulus than stratocumulus.

Line 243: Anything like this seems really arbitrary since you haven't actually demonstrated what the true LWP or r_e is. I think that you put a bit too much trust in the microwave LWP, which may potentially have biases equally as large or larger than those in the optical retrievals.

References:

Greenwald et al., (1997) Cloud liquid water path comparisons from passive microwave and solar reflectance satellite measurements: Assessment of sub-field-of-view cloud effects in microwave retrievals, *JGR*, 102, 19585-19565.

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