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 #2

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General Comments:

This manuscript details an investigation of differences in CERES-like Aqua MODIS liquid water cloud effective radius retrievals at 2.1 and 3.8 µm, and corresponding liquid water path (LWP), as a function of cloud fraction (CF) and spatial heterogeneity. While the relationships shown generally support findings from previous investigations, the authors do not convince that using AMSR-E LWP yields significant new insights (other than as a screening mechanism for excluding precipitating clouds), nor do they make the case that LWP is a suitable proxy for cloud dynamics (as implied by the title). I therefore recommend major revisions.

Specific Comments:

p. 12728, line 25: Is the heterogeneity index calculated using the same pixel sampling as the PSSF (i.e., every other scan line and fourth element), or using all MODIS pixels within a CERES footprint?

p. 12728, line 28: Should be more specific that the Hs used in Zhang and Platnick (2011) is calculated from the 250m 0.86 µm reflectances, and was introduced by Liang et al. (2009).

Fig. 2b,c: Should use the same color scale for both effective radius plots.

p. 12730, line 15: Does the larger LWP “yield” (i.e., cause) more vigorous up and down drafts, etc., or is it associated with such dynamics/cloud processes?

p. 12730, lines 23-24: Stating agreement with the two previous studies is a little misleading, as Zhang and Platnick (2011) found little change in re3.8 as a function of sub-pixel heterogeneity, while Zhang et al. (2012) found smaller 3D RT effects at 3.8 µm compared to 2.1 µm.

Figs. 4 and 5: I’m assuming these figures are for footprints with CF > 98% (as in Fig. 3)? Should specify this in the text.

p. 12732, lines 6-8: I don’t think this statement can be made on the basis of Fig. 4 alone. Certainly the optical thickness is also increasing with increasing LWP, regardless of the heterogeneity index.

p. 12732, lines 24-25: Table 1 values are not necessary for explaining the smaller changes in LWP2.1 with increasing heterogeneity index – the smaller increases of re3.8 with increasing heterogeneity index (and decreasing optical thickness) shown in Fig. 5a is sufficient.
This statement, presumably referring to Figs. 4 and 5, is unsupported by the presented results. The increasing heterogeneity index in Fig. 4 cannot be considered equivalent to the increase of the heterogeneity index along the x-axis in Fig. 5. As the authors show in Table 1, LWP changes are dominated by changes in cloud optical thickness, thus there cannot be a "rapid decrease of optical thickness with heterogeneity index as the AMSR-E LWP increases."

Technical Corrections:

p 12726, line 25: singular “retrieval error” instead of plural “retrievals error”
p. 12727, line 6: remove comma from “3.8 µm channels, provides”
p. 12727, line 22: “used to generate the Clouds...”
p. 12729, line 4: need degree symbol after 0.5

References:

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