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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Scale-by-scale analysis of probability distributions for global MODIS-AQUA cloud properties: how the large scale signature of turbulence may impact statistical analyses of clouds" *by* M. de la Torre Juárez et al.

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[english]article amsmath color

Response to Reviewer #1:

First, we would like to thank the reviewer for his/her comments. We hope the changes improve the explanations, especially in the points specifically identifed by the referee.

The reviewer remarks are in blue ink. The responses are in black. We list below a summary of the actions undertaken to address his/her remarks. We refer to each correction by giving the section number, paragraph within that section and sentence number within that paragraph. For instance, 2:3:4-5 means section 2, paragraph 3, sentences 4 to 5.

My main problem is with Sec. 3 and beyond. It is stated that 1st the local mean is subtracted to the variable, and then the global average of this quantity is calculated. But if I have understood right, this average should be zero. Each pixel of size L has a contribution to the global mean equal to zero, and therefore this quantity should be zero. It is possible that I am not understanding what the authors are doing, and then this means that the explanation is not clear enough. Please explain in more detail, including some mathematical formulas.

In the previous version we used the verb "extracting" as a synonym of "calculating". Now it reads "by calculating" in 2:1:10 and 4:1:2. We have expanded the explanation also in 2:1:10 Text and figure captions have also been changed.

Other comments:

Abstract: "... compared to predictions for turbulent". This statement is too vague. In the paper only a lognormal function is fit.

The connection is through the non-gaussianity (lognormal distributions), the generalized flatness factor for LWP, the scaling of the standard deviations, the entropy maximization theories of Liu for cloud droplet radii that require a non-laminar system where one of the parameters depends on the turbulence intensity. the abstract specifies now in 1:1-6 that the predictions refers to the scaling of the generalized flatness factor for homogeneous turbulent systems. We have expanded also a bit more on how the predictions of a Weibull distribution for cloud effective radii are based on assuming a turbulent system that maximizes Shannon entropy underlying the cloud droplet size formation.

Figure 2 is not clear also. L=5 km should correspond to the "original" data, but the PDF of CF takes a non-zero value at CF=0.5, whereas CF should only take the values 1 and 0. Also, for L=10 km, CF=0.65 has a nonzero pdf, whereas the possible values would be 0, 0.25, 0.5, 0.75 and 1. Please clarify. Perhaps a logarithmic y-axis would be better to see this.

This is an unintended consequence of having our 5-km grid fixed to geographical locations, rather than the observation. So, a MODIS 5 km cloud structure may be observed at a location that overlaps two, three or four 5-km grids, hence a few intermediate values. This is now explained in 2:2:3-5. Thanks.

Check what happens in Fig. 2b if both axis are logarithmic. Do the distributions share a similar shape?

The distributions are similar for the higher values but there are increasing deviation between the log-normal function and the low LWP values. We have added the figure to the paper because it might help understand empirically why the means evolve with scale towards larger values. We mention of the effect are now included in the Summary and conclusions section.

In the equation for Y_LWP(1) a symbol "$<$" is missing.

Corrected, thanks.

Which are the units in table 1?

Added. Thanks.

Fig. 1 caption. It corresponds to the W and NW of the Canary Island (correct).

Right, corrected now. Thanks

Which is the color scale for CER and LWP in Fig. 1?

Added, thanks.