

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.

Anonymous Referee #2

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1 General Comment

This work attempts at quantifying scale-dependence of MODIS-observed cloud fraction, LWP, and effective radius by analyzing their PDFs, means, standard deviation and normalized means (mean-to-standard deviation ratio) as a function of spatial averaging scales. The paper contains results that are useful for understanding the perplexing

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issue of scale-dependence of cloud properties and for upscaling cloud parameterizations. However, the paper is difficult to follow. Major clarification and elaboration are needed before I can recommend its publication.

2 Specific Comments

1. P21308, Section 2: it is mentioned, “a granule covers about $1364 \times 2030 \text{ km}^2$ and is treated as if it was a realization of a cloud experiment. This resulted in about 2880 realizations”. Please explain where 2880 come from?
2. There is no clear bimodal structure for the PDF for cloud fraction shown in Fig. 2a. Using a log ordinate may help. Also, the ordinate value is larger than 1, not consistent with PDF as claimed.
3. It seems to me that Figs d-f are used to demonstrate the performance of the different analytical functions as fits to the corresponding observations. But, these figures are not even mentioned in the corresponding discussion, and the discussion itself is difficult to follow. I have only got the guessed understanding after reading the discussion and fig several times.
4. Section 3 is difficult to follow, and much clarification is in order. For example, (1) $S_x(n)$ as given does not seem to be the generalized structure function, but simply the n -th moment. Typos here or I miss sth here? (2) For a Poisson distribution, the mean is equal to the variance, not the absolute deviation as discussed here. Again, typos or I miss sth here? Please clarify. Also, P21309, L15: Fig 2a should be Fig 3a?
5. The observational analysis of the scale-dependence is valuable. But some discussion on the physical mechanisms underlying the observations will be more

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valuable. For example, what is behind the decrease of normalized mean, or increase of standard deviation, with increasing scales?

6. The scale-dependence addressed here, especially for the PDF of effective radius, is highly related to the scale-dependence of cloud droplet size distribution as revealed by the systems theory developed by Liu and his coworkers (JAS, 55, 527-536, 1998; 59, 2279-2290, 2004, and Recent Research Development in Geophysics, 4, 119-142, 2002). Linking with these publications, especially in mechanism discussion, will enhance the presentation.
7. I do not see any connection with the subtitle “how the large scale signature of turbulence may impact statistical analyses of clouds”

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