

I thank the authors for their modifications to the paper, which is certainly improved from the previous version. I have only one comment of any significance:

I disagree with the authors statement that comparison to Boutle et al. (2014) is out-of-scope of the current paper. Firstly, we are all in the process of model development. How is a model developer to decide which parametrization they should use if authors only ever compare their own parametrizations to the dataset used to construct the parametrization - this is no use to the community in deciding which parametrization to use, since all parametrizations will always look best when compared to the data used to derive them. But secondly, and perhaps more importantly, the comparison is directly relevant to the results of this paper. Boutle et al. (2014) is the only study that directly compares different observational estimates of the same quantity, showing how the estimate of sub-grid variability can be affected by the measurement technique used. In particular, they showed that CloudSat significantly under-estimates the true variability. The fact that the Boutle et al. (2014) data and parametrization shows more variability than the estimates presented here from MODIS suggests that MODIS could suffer from the same sampling and pixel-size issues as CloudSat (as discussed in Boutle et al. (2014)), meaning that the variability estimates provided here from MODIS could be an under-estimate of the true variability. I agree it's beyond the scope to give a full investigation of these differences, but it does need noting that these differences exist and that the MODIS variability could be an under-estimate of the true variability.

*Reply: following the suggestion, we have updated the Figure 7. In particular, we have added the parameterization in Boutle et al. (2014) to Figure 7a and added some brief discussion.*

A couple of minor comments:

L124-130 - I'd suggest moving this discussion to after L137 - it currently reads like your criticism of previous studies for lacking a global perspective applies to these papers, which is not true because they both make use of the same global CloudSat dataset as Lebsock et al. (2013) (in addition to ground based and in-situ measurements).

L451-452 - something has gone wrong with the referencing of Wood et al and O et al.

L517-534 - apologies for missing this last time, but it would be worth noting here that the somewhat bland results obtained from a simple parametrization of the mean  $v(f_{liq})$  value are part of the motivation for a variable (regime-dependant) parametrization of  $v(f_{liq})$ , such as Hill et al. (2015).

*Reply: We have also revised the manuscript based on these minor comments.*