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Atmospheric Measurement Techniques Discussions

Interactive comment on "Reduction of radiation biases by incorporating the missing cloud variability via downscaling techniques: a study using the 3-D MoCaRT model" *by* S. Gimeno García et al.

Anonymous Referee #3

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The paper's objective is straightfoward: To estimate radiance and flux biases due to unresolved cloud condensate variability. The paper consists of two parts: (1) A presentation of the Monte Carlo radiative transfer (RT) code used for assessing the biases, which includes a validation study with I3RC project reference data; and (2) The actual application of the code on fields from a cloud resolving models either at their original or altered forms. The technique to produce subscale variability is critical for the conclusions of the study, but is not presented in this paper (it is available in the literature). The study finds that when the small-scale cloud variability is smoothed out via averaging,

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significant radiation errors occur; when the variability is restored artificially, the domain radiation can be recovered to a pretty high degree of accuracy.

I'm somewhat surprised this paper has been submitted to AMT. While there are remote sensing applications in the problem considered here, and some of them are discussed in the concluding section, there is no clear path offered on how the findings of this paper will be applied in satellite retrievals. It is widely accepted that while 3-D forward modeling is well-understood the inverse retrieval problem is still pretty tough to solve. What I would expect in an AMT paper would be a simulated field (like the one from the cloud resolving model), a simulation of what the satellite sees (the 3-D radiation simulation), and then a retrieval of a physical property of the cloud field (like the cloud condensate) that improves upon the standard 1-D inversion, followed by comparison with the original field. The paper doesn't do that, so while I think it'd be fine fit for the sister ACP journal, I have some reservations for it to be considered as a contribution to "Measurement Techniques", and therefore appropriate for AMT.

Specific comments

(1) One thing that is extremely important to get straightened out is the resolution of the CRM cloud field at its original form and when used for simulations: I can find 40x40 in P1556L7, P1556L8, P1557L11 and P1561L25, while I can find 100x100 in P1554L23, P1555L23 (implicitly), P1559L11. Which one is it?

(2) When the Venema scheme is applied to produce the subgrid variability, does it use any info from the original field? And since a lot of the remote sensing discussion is on clear vs. cloudy, can the subgrid variability produced by the scheme also result in clear pixels? While it is acceptable that a full description of the scheme is not repeated here, something about its capabilities and required input needs to be mentioned.

(3) Since the work is presented to have remote sensing implications why is the error presentation framed in terms of domain averages? I would expect to see something like frequency distributions of errors at the pixel level, and yes, I understand that to create

AMTD

5, C223–C226, 2012

reference results at the pixel level is computationally much more expensive (how noisy are the reference radiance fields in Figs. 4 and 5?)

(4) Figure 8: Why are transmitted and absorbed flux panels smaller in size than for reflected flux? Why is the difference not shown for these panels? Do the authors imply that these fields are less important? Why are you calling the absorbed flux "power"? Why does the caption talk about flux "density" when actual fluxes are shown? (I'd use "density" if the fluxes were normalized)

(5) In P1554L2 the authors mention an "incomplete 3D view of clouds" (from current measurement techniques). I'm curious as to what technique they have in mind (example).

(6) Last sentence of the abstract: it is stated what is done, but not what the finding is (as is appropriately done in the preceding sentence).

(7) P1548L20-24. Just wanted to point out that the way CPPHA is described, it is implicitly equivalent to random cloud overlap which is a pretty poor approximation.

(8) I think that the two mentions of Jensen's inequality (P1560-1561) are quite esoteric for the general reader. Explaining this a bit better (ie., the reflectance curve is convex) would be helpful.

(9) P1560L9-11, while true most of the time, this is strictly not always true in the left panel of Fig. 6.

(10) Typos, other errors, and suggestions for different word choices: - P1545L6, "skies" - P1545L7, "that" instead of "what" - P1545L11, "traversing" instead of "traveling" - P1546L4, don't understand "renouncing" here. - P1550L9, "appropriateness" instead of "adequacy" - P1550L11, "traversing" instead of "flying through" - P1550L18, "reaching" instead of "to reach", "and this" instead of "what" - P1550L26 "take" instead of "adopt" - P1552L3, delete second "of" - P1552L5, delete "of", "extend" instead" of "extends", "about" instead of "circa" - P1552L28, delete two "the" - P1560L25, "flux"

AMTD

5, C223–C226, 2012

instead of "power" - P1561L4, "coarsely" instead of "coarse".

Interactive comment on Atmos. Meas. Tech. Discuss., 5, 1543, 2012.