Atmos. Chem. Phys. Discuss., 10, C1195–C1197, 2010
www.atmos-chem-phys-discuss.net/10/C1195/2010/

Atmospheric Chemistry and Physics Discussions

Interactive comment on "A comparison of ship and satellite measurements of cloud properties in the southeast Pacific stratus deck" *by* M. A. Brunke et al.

Anonymous Referee #3

Received and published: 2 April 2010

General comments

Overall, this paper presents a worthwhile comparison of a unique set of ship observations in an important cloud regime with satellite retrievals and output from a climate model. The results show biases in CloudSat/Calipso retrievals that are to be expected, but whose magnitude is rather alarming, even for very lightly drizzling clouds.

G1) The authors build a compelling case that Cloudsat/Calipso retrievals of LWP and cloud base (and thus geometrical cloud thickness) are not believable, especially when the maximum radar reflectivity exceeds -18 dBZ. In this case, they should not be used for model evaluation, and this point should be made very clear. Calipso cloud tops and

Full Screen / Esc
Printer-friendly Version
Interactive Discussion
Discussion Paper

passive microwave LWP do seem worth comparing with models.

G2) It would have been nice to show a more complete ship/CloudSat comparison using only data from both sensors screened to times with less than -18 dBZ column-max reflectivity, to test the authors' suggestion that this will remove most of the CloudSat bias.

G2) The comparison with CAM3.1 is a good idea, but deserves its own short section if it is to be included. One paragraph in the conclusion doesn't do it justice. There are issues of interpretation to consider. For instance, perhaps you are interpreting the CAM cloud base/top as being the lowest/highest grid level with a nonzero cloud fraction (even though this cloud fraction may be quite low). If so, this will inevitably lead to lower cloud bases than an instantaneous measurement. A vertical profile of mean cloud fraction would be a better model-observation comparison. In addition, the model cannot resolve clouds that are less than one model level thick, placing a lower bound of order of 200 m on cloud thickness. I recommend that the model/data comparison use dedicated figures that focus on data that can be measured reliably compared to model products that can be meaningfully compared with that data (e. g. a LWP or cloud top height histogram, or profiles of cloud fraction compared with the ship data).

Specific comments

S1: 3308 lines 19-20: Calipso should be able to accurately measure cloud top. Is the 345 m discrepancy between the diurnal cycle of Calipso and ship-observed cloud top possibly due to sampling variability, or does it suggest a real systematic bias? If you just used Calipso passes with a local cloud fraction near 1 for assessing the diurnal cycle, would the same diurnal cycle bias persist?

3305 and 3310: Are the ship-observed, satellite-observed and model LWPs conditionally sampled to be in-cloud or are they gridbox (or time)-averaged values including both cloudy and cloud-free regions? For example, AMSR values are averaged over some footprint and might include cloud-free regions, while I'd imagine the CloudSat retrievals

ACPD

10, C1195–C1197, 2010

are quasi-instantaneous. Especially if comparing histograms, it is necessary to make apples-to-apples intercomparisons.

3315 Fig. 1a: It would be more transparent to just show AMSR-E and SSM/I LWP on the vertical axis rather than their differences with CloudSat, since the differences are so large (over 50%).

3315 Fig. 1b: Can you also include histograms from the cruises as a benchmark?

3316, 3318 Fig. 2a,b and 4a,e should also include the AMSR and/or SSM/I microwave LWP, which might compare much better with the ship observations. 'Satellite' should be relabeled 'CloudSat' so readers don't get the idea that we can't do better from satellites.

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 3301, 2010.