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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Influence of ice particle model on retrieving cloud optical thickness from satellite measurements: model comparison and implication for climate study" *by* Z. Zhang et al.

Z. Zhang et al.

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Response to anonymous referee 2

Thank you for your suggestive comments. We have adopted almost all of your suggestions.

1) The title is not entirely satisfying. The "model comparison and implication for climate study" seems to be a bit misleading, as in showing climate model results and/or intercomparisons, rather than presenting differences between two data sets. Should mention that this is about MODIS and POLDER. Here s a suggestion: "Sensitivity of ice scattering model on retrieving cloud optical thickness from MODIS and POLDER" I am sure the authors can come up with something better.

Response: We have changed the title to “Influence of ice particle model on satellite ice cloud retrieval: Lessons learned from MODIS and POLDER cloud product comparison“. We hope this new title is more satisfying.

2) Abstract, line 17: how about “cancel each other out“

Response: We would like to keep it as “cancel each other“, because the cancellation is not perfect.

3) p. 1768, line 13: “in good correlation“ is a bit awkward

Response: Changed to “highly correlated with“

4) p. 1769, lines 9-13: This sentence is really long and unclear. Can probably clarify better and/or split up into two sentences.

Response: Changed to “It is known that the retrieved 964; tends to be smaller than the averaged 964; of the scene due to cloud heterogeneity and the nonlinear dependence of cloud reflection on 964; “

5) P, 1771, title of sub-section 4.1: how about “Implications for the calculation of ice cloud radiative forcing from satellite observations“

Response: Ok, changed

6 8) p. 1774, lines 1-6: This also comes up in the Conclusions section. The reviewer would argue that there is, in fact, no correct scattering model, ever. Perhaps the Baum et al. model is more realistic than the POLDER model some of the time. This begs the question about using the true power of the A-train to do a simultaneous retrieval of size and/or habit distribution characteristics. There is even some sensitivity within measured vis, near IR, and mid IR spectra to constrain the size/habit distributions a bit better. The reviewer is not suggesting to develop a retrieval for this paper, but rather consider it for future work. But, this paper should be revised to include some discussion of this, and especially de-emphasize that there is in fact a correct answer,

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yet to be shown what it is, for appropriate scattering models.

p. 1778, lines 20-26: The reviewer suggests that the authors reconsider the substance of the conclusions here. Really, what the community should be striving for is using everything available in a simultaneous retrieval to maximize the information in the retrieval. Of course, this comes with its own infinitely large set of caveats. Also, what about some mention of the power of other measurement platforms like CALIOP, and its ability to say something about the microphysical nature of ice crystals? A careful reconsideration of the conclusions is worth the effort and time.

Response: We agree with the reviewer that both the Baum05 model and the IHM have their limitations. We have added a detailed discussion on this issue.

We also feel necessary to use "everything available in a simultaneous retrieval to maximize the information in the retrieval". We added some discussion on the synergetic use of the A-train instruments, including the CALIOP, for ice cloud retrieval. Following the suggestions, Baran and Francis (2004), Cooper, S. J., et al. (2006), L8217;Ecuyer, T. S., et al. (2006), Wendisch, M., et al (2007) and Yue, Q., et al. (2007), are cited in the discussion.

On the other hand, we kept our conclusion that a consistent "ice particle model should be used to provide a consistent way to interpret satellite-based decadal measurements, so that comparable retrievals can be derived from different satellite missions and a long-term record of ice cloud optical thickness can be established for climate studies." It is mainly because we do not see any reasons indicating otherwise.

Other comments *6) p. 1771, line 7: retrievals*

p. 1775, lines 15-16: "there is still a considerable"

p. 1777, line 3: "in the literature"

p. 1777, line 7: "uncertainty in real retrievals"

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Response: All corrected

7) p. 1778, line 7: Is this true? I think the authors showed that this is definitely a big issue in the VIS/near IR, but what about the thermal IR?

Response: We changed statement to “This sensitivity makes our inadequate knowledge of the microphysics of ice particles a major source of uncertainty in ice cloud retrieved from solar reflection.“

Interactive comment on Atmos. Chem. Phys. Discuss., 9, 1757, 2009.