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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Cloud-type dependencies of MODIS and AMSR-E liquid water path differences" *by* M. de la Torre Juárez et al.

M. de la Torre Juárez et al.

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Response to reviewer # 2

Thanks for the promptness and for taking the time to go through our manuscript. We hope to address with the revisions and this response the major concerns expressed by the reviewer. Our responses refer to changes made in the revised manuscript by giving page_nr:lines..

Interactive comment on "Cloud-type dependencies of MODIS and AMSR-E liquid water path differences" by M. de la Torre

Juárez et al.

Anonymous Referee #2

Received and published: 24 March 2009

This paper uses AMSR and MODIS data to study differences in LWP estimates between the two instruments. There have been various other papers lately with the same general research direction, most of them cited by the authors (Horvath, Bennartz, Greenwald, and others).

This paper uses auxiliary information, such as cloud top pressure or cloud top temperature, to stratify differences in microwave and near-infrared LWP estimates. While this is a new approach in a sense, I do not believe it provides much new insight into the problem. Particular retrieval issues associated with the two sensors are only mentioned briefly or not discussed at all. There are various assumptions made in the two retrievals that be investigated to help understand biases, such as: Three-dimensional radiative transfer, cloud screening, partitioning in rain and liquid, mis-alignments of the sensors, aerosols, and others. Instead of trying to gain insight into which processes cause the differences, the authors merely discuss them.

The authors have collectively intercompared a variety of geophysical parameters from approximately ten satellite and in situ observing systems, leading to about thirty peer-reviewed papers. In our experience, even retrieval experts have limited understanding of the strengths and weakness of the data sets they are making publicly available. This experience inspired us to write proposals to do the kind of work described in this study; the success of those proposals in turn led to this manuscript. As in earlier studies, we asked some basic questions. Where do the two data sets agree? How correctly do quality flags reflect that agreement? Are there other internal measures of retrieval effectiveness? What geophysical conditions lead to poorer agreement? In an

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optimally constructed retrieval algorithm, the data set would self-consistently indicate the shortcomings of the methodology listed by the reviewer. Thus, our fundamental goal was to gain insight into the physical representativeness of the reported data. So, while we have access to the analytical tools needed to assess the retrieval algorithm, we deliberately chose to answer the questions just posed.

Underpinning all these other questions was the most fundamental one: could we create a global climatology using these publicly available data sets? Note that the current literature hardly addresses this last question. Almost all the studies cited have examined one cloud regime: warm, low clouds mostly west of the subtropical continents. There was a clear need to assess other geophysical regimes and other areas. For example, we examined ice flags because of the high scientific importance of mixed-phase clouds, and because of the prevalence of cirrus ice over shallow cumulus. Similar issues motivated the entire study.

That said, it is entirely our responsibility to make clear our viewpoint. The reviewer remark shows that we failed to do so in the submitted version of the manuscript. To address that shortcoming we made the following changes:

- Added the previous statement at the introduction in p3:76–80.
- Added one sentence in lines 3–4 of the abstract: "The study addresses the differences in LWP climatologies emerging from the datasets that have been made publicly available."
- Added one sentence in lines 329–333 of the Summary and Conclusions: "The objective is to asses a wide range of geophysical regimes and areas. Specific retrieval approaches to reduce the differences are outside the scope of this work, causes for the differences are diverse and require testing of the retrieval algorithms at levels within the competence of the retrieval teams. The classification of the differences by cloud type provide hints on what cloud scenes are more appropriate to study different cloud processes with each instrument."

In addition there are some other disturbing shortcomings in this paper. For example,

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some of the histograms show a significant amount of liquid clouds down to 190 K cloud top temperature and down to pressure levels well below 250 hPa. Are those really liquid clouds?

These were the values reported in the publicly available data, and we were also surprised by this inconsistency. Lines p16:278–299 discuss the reason for this inconsistency based on a preliminary analysis of one scene by Prof. S. Nasiri, where she found that cirrus contamination had led the MODIS algorithm to ascribe the CTT to the cirrus clouds while the phase corresponded to some lower clouds. There are further problems in phase identification that could cause further contributions to this anomaly (Nasiri and Kahn, 2008).

Also, the authors state that AMSR data is averaged over 0.25x0.25 degree, which is one of the level 3 gridded products offered by Wentz/RSS. Then, they claim this to be the Field of View of AMSR, which is simply wrong.

We have corrected the nomenclature from level 2 to level 3 for AMSR-E and changed the word FOV to resolution of the gridded AMSR-E dataset.

A more thorough analysis would have used AMSR level 2 data instead of level 3 and explicitly accounted for the actual field of view of AMSR.

No AMSR-E Level 2 data are publicly available at RSS, so we used the quarter-degree gridded fields. A variety of published studies have used level 3 of AMSR-E (Horvath & Davies, 2006) and MODIS (Bennartz's 1 degree, 2007). Because we wanted to understand their results and compare similar magnitudes, we examined similar data levels.

In summary I do not think this paper provides much insight and I recommend this paper to be rejected.

We agree that the paper does not provide additional insights into the details of the retrievals algorithms but it was not our goal. Instead, we have tried to provide greater

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insight into the available data themselves, over a broader range of conditions than have earlier studies. We ask the reviewer to reconsider this recommendation.

We think that by having included wider ranges of variables we have identified issues unnoticed in works limited to cloud types where both retrievals are more likely to agree.

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