

Interactive comment on “Cloud thermodynamic phase inferred from merged POLDER and MODIS data” by J. Riedi et al.

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Response to Interactive comment on “Cloud thermodynamic phase inferred from merged POLDER and MODIS data” by J. Riedi et al. P. Pilewskie (Referee)
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This is an interesting work on improving current cloud phase retrievals by merging independent algorithms currently applied to MODIS optical and infrared channels and POLDER polarized radiance. The end result will be cloud phase discrimination and a confidence level based on the performance of the merged algorithms. This quantification should benefit a number of applications, as stated in the text. There are two concerns that I have and that I would like to see addressed: 1. The way in which the

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confidence level is quantified is not described at all. For example, 14113.15 “... low confidence value (about 70) ...” is presumably not what the authors intended by establishing this index. If it is to be useful the user must know how it is defined. How are the individual methods weighted to get to the final number?

For each pixel, what are the products? Does the number 0-200 indicate liquid...ice and a confidence value? Or is there only the number 0-200? 2.

The definition and interpretation of the phase index has been identified by both reviewers as not clearly described and the authors agree that ample space existed for improvements. In particular, the initial text was confusing regarding the phase index and the associated confidence level which may have appeared as two distinct values. In practice, there is only one index ranging from 0 to 200 and the confidence is carried by the exact index value within this range. This is now clearly stated in the text.

We have made significant changes in the text to explain better how the individual results of the three methods are being merged to provide a unique phase index. The logic used to create the final index is described in more details and the interpretation of the index values has been improved. Also a flowchart of the logical decision tree has been included to help in the understanding.

Potentially more troublesome is the definitions of mixed phase. Perhaps I misunderstood but the conclusion of mixed phase seems to follow when the different algorithms give different results. That should really be low confidence for any phase. How about high confidence for a mixed phase cloud? Have the authors simulated mixed phase signals in their algorithms? Many users would be very interested in a high confidence for a mixed phase signal. Granted, this is not likely very simple. At the very least a distinction should be made.

This leads back to item 1) that the quantification of confidence level should be clearly defined.

We have now included a better description of the phase index and specifically

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addressed the case of "Mixed" phase which should clarify the interpretation. The difference between "Mixed" and "Undetermined" is also discussed. It is made clear in the paper now that "Mixed" is an indication of inconsistent decision from the individual methods whereas "Undetermined" results of none of the three methods being able to provide information. The value of 100 for Mixed cases therefore stands at equal distance between the high confident liquid (0) and the high confident ice (200) to indicate not the lack of information but rather the occurrence of both liquid and ice signature in observations.

The following are minor comments. In general the paper would benefit from a thorough editing.

We are responding only to questions or request for modifications. Simple corrections and typos have all been addressed carefully in the paper.

14105.3-5: "Cloud thermodynamic phase is an important indicator used by forecasters to determine hazardous road conditions." Is there a reference for this? Seems like phase is not sufficient; must have knowledge of temperature structure below cloud base. A reference to aircraft icing conditions may be appropriate here.

A reference has been added to Tremblay, A. and A. Glazer, An Improved Modeling Scheme for Freezing Precipitation Forecasts, Monthly Weather Review, 128, 5, 1289-1308, 2000.

14108.10-14: The polarization technique of phase determination is not well explained, although it is certainly true that it is well known to those who know it well.

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It is difficult to provide a detailed description of the polarization technique within this short theoretical background section. We are referring to publication by Goloub et al (2000), Riedi et al (2001) and J. Riedi (PhD thesis) for interested readers.

141109. 14 "droplet size does not increase too much" and l. 23 "size become too large" imply that changing particle size impacts retrieval when in fact it is meant that when drops are not too large (too small for crystals) that the retrievals work. Please give some quantitative thresholds.

We have rewritten the sentence and now make reference to section "Theoretical performance consideration" for definition of thresholds derived from Figure 5.

14112.12: explain "poor observation geometries".

This is now explained clearly. It relates to the possibility or not to observe scattering angle range corresponding to cloud bow.

14115.8: quantify the "given threshold".

This is a general statement indicating tendency not absolute thresholds values.

14116.25: Spherically equivalent volumes for ice crystals? This is a poor representation of ice crystal scattering. Please refer to the work on P. Yang. These are used for MODIS ice cloud retrievals. Or am I misinterpreting this statement?

This is misinterpretation. We indeed used non-spherical ice crystal models in our

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simulations but we provided the spherically equivalent volume of ice crystals to ease comparison with spherical liquid droplets.

14120.14-15: Isn't "confident mixed" = 100, just like "low confidence liquid and ice"? Explain how this is different, and which additional parameter (extra confidence parameter?) is used to make this distinction.

This is now better explained in the discussion of the index construction and interpretation.

14123.20: This confidence index is not introduced in the text -explain.

Same as above. There was some confusion in the original text that could lead to misinterpret the existence of separate phase and confidences indices when these are actually the same thing. We have made our best effort to improve the description of this final phase index and how to interpret it.

Interactive comment on Atmos. Chem. Phys. Discuss., 7, 14103, 2007.