

Interactive comment on “MODIS Collection 6 shortwave-derived cloud phase classification algorithm and comparisons with CALIOP” by B. Marchant et al.

Anonymous Referee #1

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‘MODIS Collection 6 shortwave-derived cloud phase classification algorithm comparisons with CALIOP’, submitted to AMT, by B. Marchant, S. Platnick, K. Meyer, G. T. Arnold, and J. Riedi

This is a very nice, straightforward, and useful study on the MODIS cloud optical properties (COP) phase mask from the point of view of algorithm improvements (from C5 to C6) and independent validation (using CALIOP phase). The MODIS COP phase mask has a value of ice, liquid, or undetermined, and these estimates are used to guide each pixel to the optimal location within the look-up tables for cloud optical thickness (COT) and cloud effective radius (CER). The comparison methodology between MODIS and

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CALIOP is discussed. The algorithm flow is detailed in a few additional supplemental figures. A few representative case studies of typical conditions as well as more challenging retrievals (ice clouds and phase misidentification over land) are described. Global statistics for one month are shown. A skill parameter is used to show the improvement of MODIS cloud phase between MODIS (both C5 and C6) and CALIOP. The paper is well written and in general the logical flow of the analysis is well described and detailed. After addressing some suggestions for minor revisions as listed below, this paper will be useful for cloud researchers since there is not much published to date on the topic of MODIS cloud phase retrievals and their evaluation.

Line 19, page 11894: what is meant by ‘location’? Latitude/longitude? Cloud regime? Cloud detection?

Lines 1-7, page 11895: a fairly new infrared-based cloud phase retrieval is produced from the hyper-spectral AIRS sounder on EOS Aqua and is described and validated against CALIOP in Jin and Nasiri, 2014, J. Appl. Meteor. Climatol.

Lines 12-15, page 11898: what happens if both liquid and ice tests are triggered at the same time for the same pixel? From an infrared point of view, this happens roughly 1% of the time according to Jin and Nasiri (2014) and in those cases the equivalent phase is assigned as ‘unknown’ (the same as undetermined in the present work)

Lines 8-16, page 11899: with regard to the ‘large vote’ and ‘weak vote’, are these adjustments to the ‘one test, one vote’ approach in figure 2? This related ‘large’ and ‘weak’ discussion isn’t entirely clear in the algorithm flow.

Line 19, page 11902: since what year/month is the 1.6 micron detector not operational?

Lines 10-21, page 11903: the color scheme of figure 4 is somewhat confusing. In the upper right panel, the ‘purple’ shading looks like gray and my eyes want to match it to the ‘clear sky’ gray pixels in the two panels in the lower row. Also, is there a reason why C5 CTT isn’t shown?

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Lines 27-28, page 11904: how about '...an expected result...'?

Lines 9-10, page 11908: in the Jin and Nasiri (2014) paper, statistics are subdivided by 'homogeneous' and 'heterogeneous' to account for CALIOP phase variability within the AIRS field of view. Since the 5 km phase mask is used, I would posit that roughly 5 MODIS pixels fall within the 5 km CALIOP phase feature. How frequently are these heterogeneous versus homogeneous phase? How many are fully cloudy versus partly cloudy? How many are single layer features versus multilayered features? The paper would benefit from some additional discussion, maybe a small table – it does not have to be extensive and detailed – to give the reader some context of whether this study is considering 20% of matched data, 80%, some other number? Does the phase agreement fraction reduce for multilayered or heterogeneous clouds?

Table 1: the details on how the CER and COT thresholds play into the algorithm flow and voting process isn't immediately clear in figure 2 and the discussion.

Figure 3: Would suggest using different colors for upper left, lower left, and lower right. The burgundy and grayish blue look rather similar. Also, in the upper left and lower right, are these the thresholds from Table 1?

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