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Atmospheric Measurement Techniques Discussions

Interactive comment on "Version 4 CALIPSO IIR ice and liquid water cloud microphysical properties, Part I: the retrieval algorithms" *by* Anne Garnier et al.

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This is a very thorough article that discusses improvements and modifications to the cloud microphysical and optical property retrieval algorithms in Version 4 of the CALIPSO products from the Imaging Infrared Radiometer (IIR).

This paper is suitable for publication but could use some improvements on general readability. For me, the issue is that the manuscript is full of terms for both measured and simulated radiances and brightness temperatures, emissivities, beta indices for the microphysical retrievals, and also a large number of acronyms and abbreviations. This became quite difficult to track since many these parameters have multiple subscripts -

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it is very difficult to keep these straight. A glossary of parameters/subscripts/acronyms would have really helped me.

Line 20: the authors discuss reducing biases found at very small emissivities in V3 of their products, both here and in Section 3.2.1 beginning at line 190. My interpretation of this is that there is a significant low biases in the ice cloud microphysical indices at very low values of the cloud emissivity, which is the same thing as stating that there is a bias at very low ice cloud optical depths. On lines 26/27, the authors state that V4 improved retrievals in ice clouds having large optical depths. My point is to be consistent in the use of cloud emissivity or cloud optical depth. In fact, lines 569-570 say this very clearly: “The IIR Level 2 algorithm has been modified in the V4 data release to improve the accuracy of the microphysical indices in clouds of very small (close to 0) and very large (close to 1) effective emissivities.” Perhaps this sentence should also be in the Abstract.

Line 25: why is the IIR channel at 8.65 microns written as 08.65 here and throughout the manuscript? Is there a reason for including a leading zero on this wavelength?

Line 26: suggest changing "aimed at improving" to "improved"

Line 31: define what is meant by “dense ice clouds” here and on lines 112, 122, 296, and 587.

Line 33: mostly a comment: this is the first of 24 references to “ice crystal models” or something similar in the text. The term “crystal” generally suggests a pristine shape such as a column or plate. The term “particle” includes all habits, pristine or very complex. Naturally occurring ice particles mostly defy description. This article more properly describes the adoption of two “ice habit models” composed of either single hexagonal columns (first found on line 33) or aggregates of columns (line 34).

Line 41: add a sentence to provide background and a reference for the A-Train for those readers who may not be familiar with it.

Line 41: define spectrum of wavelengths meant by visible and infrared

Line 42: suggest changing "combination of infrared" to "combination of passive infrared"

Lines 127-128: provide a description of the new types of scenes that have been introduced when at least one cleared cloud is present in the column

Lines 185 and 186: define what is meant specifically by optically very thin and very thick cloud here.

Line 218: suggest changing "Earth Surface" to "surface"

Line 218: interpolated atmospheric profiles: how many layers/levels are in the interpolated profiles? Do these profiles include trace gases? Are these augmented at very high altitudes by a climatology, e.g., for ozone if this is part of the profile?

Line 222: suggest changing "thanks to the advances" to "to take advantage of recent advances"

Section 3.4.1, lines 313-317: the discussion on calculating a centroid altitude and temperature for multi-layered cloud cases is a bit confusing to me. If a vertical column contains optically thin ice cloud overlying a low-level water cloud, can the resulting centroid be in the mid-troposphere where there is no cloud layer? If this is a possibility, there should be a flag provided to indicate that multilayered clouds are present for that retrieval so that these cases can be filtered out if so desired. More specifically, the flag should be provided with the cloud properties such as the centroid altitude and temperature so that a user does not have to look at potentially multiple products (e.g., cloud mask or cloud phase) to find this detail. The availability of a flag would certainly be of help when comparing your cloud product to a simulated cloud field based on, for example, large eddy simulations.

In Section 4 somewhere, it would be quite interesting to know the range of the effective diameter (De) values for ice clouds inferred from both V3 and V4. Does the range

change between V3 and V4? Additionally, does the range ever approach the boundaries of the LUT, either very low or very high values? How often does this happen?

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