

Atmos. Meas. Tech. Discuss., referee comment RC1
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Comment on amt-2021-419

Anonymous Referee #1

Referee comment on "Assessing the benefits of Imaging Infrared Radiometer observations for the CALIOP version 4 cloud and aerosol discrimination algorithm" by Thibault Vaillant de Guélis et al., Atmos. Meas. Tech. Discuss.,
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In this paper, the authors demonstrate and quantify to which extent the Imaging Infrared Radiometer (IIR) channels can improve the accuracy of the Cloud and Aerosol Lidar with Orthogonal Polarization version 4 (V4) cloud and aerosol discrimination (CAD) algorithm.

I believe that this paper is a useful contribution to the field of atmospheric science and I recommend publication. The radiative transfer simulations help to understand the meaning of the observations and the strengths and limitations are well explained. The proposed CAD improvement could be seen as minor (sometime as low as 0.1% of the cases). However, as the dataset covers 16 years, it could happen to be a critical contribution to specific analysis. In addition, this study demonstrates well the capabilities of the IIR for feature classifications.

Minor comments:

p.2 line 27-28 The word "mean" is used several times. I do not know what a "layer-mean" is. I would assume that the signal is averaged vertically on the detected layer. I would recommend to define it or remove the jargon.

p.2 line 38 "V3 CAD" this sentence would lead me to believe that the "V3 CAD" uses the

"infrared spectroradiometers" to "[reduce] the frequency of dense dust misclassified...". If it is not the case, I would suggest to rephrase or use a word like "identify" instead of "reduce".

p.3 line 70 Please add a short explanation to justify the use of 12 years. Specifically, please explain why 2006-2007 are excluded. It will help the reader to understand if there are limitations to extend your findings to the 2006-2007 dataset.

p.5 line 119 "Unfortunately, IIR will not provide any help..." It seems like a strong statement and I would be inclined to not fully believe it. It is definitely not within the scope of this study but complexity is not identical to impossibility. It's your call but I would suggest to weaken this statement.

p. 6 line 139 "*IIR signature*" OK but it took me a little while to figure out that the words in italic were a specific quantity. You may want to think about something here like adding quotes.

p. 9 line 218 – 219 "Note that, in agreement with the simulations," My understanding is that in the simulations (several sentences including this one and several figures including Fig. 3), the inputs of the surface and atmospheric properties (especially temperature) are different in the tropic and mid-latitude. I did not see a mention of cloud properties change so if it was done, I missed it. You may want to explicitly state the difference between tropics/mid-latitudes simulations (or point more explicitly to the appropriate reference) in both the text and one figure caption.

p. 14 line 368 "These IIR observations seem to provide independent global evidence..." I prefer the wording you used in the conclusions. This statement here seems a little too strong. I would suggest to rephrase.

p. 15 line 410 "very good working" I would suggest to mention that it shows consistency between the two relatively independent sets of information.