

# ***Interactive comment on “Two-dimensional and multi-channel feature detection algorithm for the CALIPSO lidar measurements” by Thibault Vaillant de Guélis et al.***

## **Anonymous Referee #1**

Received and published: 24 November 2020

This paper describes a new feature detection algorithm (2D-McDA) based on several channels and utilizing two dimensions (height vs. time/hor. distance) for the elastic lidar onboard the well-known CALIPSO platform.

The methodology is well explained and plots and table are used to illustrate this complex matter. Even though the paper is very technical, describing an algorithm for the spaceborne-lidar CALIOP, it is of very wide interest for the scientific community as CALIPSO products are widely used. Furthermore, I guess adapted versions of the algorithm could be also used for other lidars.

Some of the methodologies are based on empirically found thresholds, which is ok,

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given the large data set and experience of the CALIPSO team. It is furthermore mostly well explained.

I have only some minor/specific comments which should be addressed before the paper can be published. I therefore compliment the authors on their excellent work and I am sure the new feature mask will drive new science based on CALIOP.

Specific comments:

Text:

Page 2. Line 42: Are this really profile processes? I guess you mean processing based on single profiles?

Page 2, line 43: "Scene processing" instead of "scene processes"

Page 3, line 45: Replace "If" by "Because" for better readability?

Page 3, line 47: improves→ improve

Page 3, bottom: Do you have any reference for the given formula? If not, more explanation is needed, because it is not evident why this formula can be used. Is there any theoretical background for this formula?

Page 4, line 75: Bins should be explained when used the first time. Even it might be clear for all lidar experienced persons it might not for others.

Page 6, 116 ff. Please make sure that you talk about the Earth' surface and not any other surface (like the one of clouds)

Page 7, caption Figure 7: Needs more explanation. Within the Figure caption it should be explained what  $k$ ,  $s$ ,  $n$ ,  $a$ ,  $d$  is and a proper reference to within the text should be given.

Page 7, line 150: why is data resolution duplicated? Is the image resolution always double? Or do you mean multiplied to... Please clarify!

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Page 7: 154: What happens if you apply your e.g. 11x11 filter at the edges, e.g. close to the surface, do you have to decrease the window extent accordingly? Or is the number of pixel reduced due to the averaging?

Page 10, 178: I would make it more clear: small clusters of pixels→ small clusters of noise pixels.

Page 10, 179-180: This step is not clear to me. what is the minimum numeric threshold in this case?

Page 10: 193-195: I really do not understand this sentence: “Pixels flagged as AFA are those vertically between two detected features if more than 30 % of them have their signal less than 10 % of the threshold for the 532 nm parallel channel, or more than 90 % and 85 % of them have their signal less than the threshold for the 532 nm perpendicular and 1064 nm channel respectively. “ Please rephrase!

Page 10, line 202-203: In table 1 there is no alpha only a! Can you describe more what an edge-preserving Gaussian sliding window is or give reference?

Page 10, line 207: What does “unique feature” mean? Is the low confidence band counted or just detected as single feature?

Page 11: 228: ... layer is transparent ...: Is transparent the correct word? Would semi-transparent be better? Please emphasize that attenuation is also taking place at 1064 but less than at 532.

Page 11: I propose to discuss case 4.2. first. Because you explain much more for this case what can be seen in your provided plots. Thus Case 4.1 should come afterwards or more explanation need to be added to case 4.1.

Conclusion:

250-252: This sentence is very complicated, please try to rephrase.

271-274: Concerning the 1064 apparent cloud base: Do you expect no multiple scat-

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tering effects which influence that altitude? Is thus a direct link to the amount of long-wave radiation escaping the Earth at the top of the atmosphere as stated in the outlook reasonable?

275-277: The statement that the 1064 channel can generally penetrate dense smoke layers is for sure not true. It should be rather stated that due to the weaker attenuation, the 1064 channels can more often penetrate the full vertical extent compared to the 532 nm channel.

280: For aerosol-cloud interactions you do not necessarily need a more accurate optical depth, instead you need the vertical profile (i.e. the extinction or better the concentration at the height were the cloud is forming) . . . . Please rephrase.

283-287: I do not understand why for "taking the full advantage of the new algorithm", companion scene classification algorithm need to be developed. Why can't you simply use the one you just presented?

Appendix:

In general, the Appendix seems to need a little bit more explanation, e.g.:

Page 14, 305ff: "In general, shift for a few range bins is needed for the full resolution (30 m) samples. Redistribution and rebinning of two neighboring samples whose range resolutions are coarse (60 m, 180 m, and 300 m) are performed. . . ." What are a few range bins? How is the redistribution done? Maybe introduce Fig. A1 first and explain the methodology briefly or give reference.

Page 16. Line 341: step 7: why is the  $z_{\max}$  squared? Can you give explanation?

Page 16, line 350: I do not understand step 10 as in my opinion it is in contradiction to step 4. Why is only  $i_{\text{surf}+1}$  allowed? Can you explain?

Furthermore, please briefly introduce indices "i" and "k" and explain that "i" is used for the vertical while "k" is used for the horizontal dimension.

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Code availability:

This is usually a section now included in Copernicus paper: Do you plan to make your code available?

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Interactive comment on Atmos. Meas. Tech. Discuss., doi:10.5194/amt-2020-369, 2020.

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