Reply to Editor

We would like to thank the editor for his helpful comments and time. Below are the original comments in normal with our responses in *italic* text.

Comments to the author:

1. Abstract: it would be helpful to clarify that M-COP and M-AOT are downstream EarthCARE products, e.g. replace "which are essential parameters for the cloud optical and physical properties (M-COP) as well as for the aerosol optical properties (M-AOT)" to "which are essential inputs to downstream EarthCARE algorithms providing cloud optical and physical properties (M-COP) and aerosol optical properties (M-AOT)".

Thanks, done (new line 8).

2. Reviewer #2 requested changes at the original line 27: your reply provided the new text but the new manuscript does not include this text. Please add it, and also include some of the papers that you reference in the reply.

Sorry, we include now at the new line 27: "If for instance cloudy areas are misclassified as clear or vice versa this could negatively impact subsequent retrievals of aerosol or cloud optical properties which underlies the importance of an accurate cloud masking algorithm. Different comparison studies and intercomparison studies have been done like the Cloud Masking Intercomparison eXercise (CMIX) to evaluated the cloud masking algorithms (Skakun et al., 2022; Zekoll et al., 2021)."

3. Reviewer #2 requested changes at the original line 77: your reply provided the new text but again the new manuscript does not include this text. Please add it.

We apologise for that. We include now at new line 79: "It exploits the full spectral information content of the MSI instrument (e.g., the cloud type is determined using three-dimensional histograms of the VIS, SWIR-2 and TIR-2 channels)."

4. L118: "way how" -> "way that". Also you probably want to replace "adopted" with "adapted".

Thanks, done (new line 120).

5. L120: "As the thresholds varying globally only" -> "As the thresholds vary globally, only".

Thanks, done (new line 122).

6. L121: "determine the probability how close the observation is to the limits" is not clear. Perhaps you mean "determine the probability that a cloud is really present based on how close the observation is to the limits"?

This is true. We changed it (new line 123).

7. Reviewer #1 asked how the surface-dependent thresholds were defined (L130 in the original manuscript) but your reply does not answer this (you just say they are "defined before") and no

change appears to have been made to the paper. Please explain in the manuscript how these thresholds were defined.

Sorry, for being not clear enough. The cloud flag algorithms is adapted from the MODIS cloud mask algorithm and we started with MODIS thresholds as a first guess. But the values has been already tuned based on simulated MSI properties and further adaptation will follow in a later stage, with real data. We added (new line 130):

"These thresholds are initially taken from the MODIS cloud mask algorithm. These thresholds have been tuned based on simulated MSI properties, while further adaptions are planned at a later stage, when actual MSI data will become available."

8. L158: "The pixels identified as cloudy if" -> "The pixel is identified as cloudy if". Moreover, the two sentences on lines 155-157 are each their own paragraph. Generally speaking a paragraph should be composed of more than one sentence, so I suggest these two sentences are combined into the paragraph beginning on line 158. Likewise line 166 is another one-sentence paragraph.

Thanks, done (new line 161).

9. Eqs. 11 and 12: NDVI and NDSI are acronyms so should be rendered in upright roman in equations, just like in the text. In Latex equations this can be done with \mathrm{NDVI}.

Thanks, done (new line 250).

10. L304. "confusion matrix" may not be familiar to some readers, so I suggest this is replaced by "hits, misses, false alarms and correct negatives (i.e. occurrences of elements of the confusion matrix)".

We added: new Line 298: "Figure 7 illustrates the performance of the M-CF cloud flag compared to the reference cloud flag (using a threshold of COT >=0.1) by showing the results of the confusion matrix (e.g., true positive, true negative, false positive, false negative)."

Figure 7: "M-CF cloud flag (left) and confusion matrix (right) indicating the classification performance (e.g. true cloudy, true clear, false cloudy, false clear) of the binary M-CF and the reference cloud flag (using a threshold of COT >= 0.1)."

11. L316: "(MOD021KM) seven similar" -> "(MOD021KM) of seven similar" (your reply to reviewer #2 included the "of", but not your new text).

Sorry, done (new line 311)).

12. Many of your references say "to be submitted" but I think all but one (Eisinger et al.) has now been submitted, so you can replace these with the proper references including the DOI.

Yes, we updated all. We not sure what we should do with Eisinger et al. paper.