

Review Report for the manuscript entitled “**Retrieval of cloud fraction and optical thickness of liquid water clouds over ocean from multi-angle polarization observations**” with the identification number “**EGUSPHERE-2024-1180**”.

General comments:

The manuscript has improved substantially, and my major concerns have been addressed properly by authors. Nevertheless, I have spotted a few points that I believe require to be attended before publication. For this reason, I suggest “**minor revisions**” for the manuscript at this stage. I have referred to these points in my comments below.

Technical comments:

1. Line 14 (Abstract): Please specify what kind of algorithms (e.g., ... existing “aerosol and cloud” retrieval algorithms).
2. Lines 52-64 (Introduction): This paragraph could benefit from some words on a recent paper published on the use of polarimetric measurements for retrieving sub-pixel cloud fraction: **Yuan, et al. 2024. Cloud detection from multi-angular polarimetric satellite measurements using a neural network ensemble approach, Atmos. Meas. Tech., 17, 2595–2610, <https://doi.org/10.5194/amt-17-2595-2024>.**
3. Line 58 (Introduction): The acronyms “GOME” and “SCIAMACHY” have been defined, but never used again. They can be removed.
4. Line 143 (Section 2.1): from? Do you mean “around”? Please clarify.
5. Line 144 (Section 2.2): Please specify the how the cloud optical thickness values are distributed between 1 and 50.
6. Line 265 (Section 4): “on” -> “to the”.
7. Section 4.1 (optional): I believe combining figures 6 and 7 into one figure with two panels may help the reader to see the differences between both cases.
8. Figure 7 caption: Please write the full caption.
9. Figure 8 caption: Retrieval lookup table derived in section 3 “(Figure 2)”
10. Figure 8 and 2: Please use color-codings that show a better contrast between values and variables (i.e., different shades of blue and black look very similar to the eye –at least to mine– and the contrast among different values of the same variable are not easy to spot). One could also try writing the values beside the corresponding lines and consider having two colors to discriminate the horizontal and vertical lines from each other. Also, if possible, try using two completely different symbols for the scattered dots (X and O, for example). One needs to focus a lot to see the different shapes. This applies to all the figures provided in the manuscript.
11. Lines 294-309 (Section 4.1): I sense that the paragraph could benefit from including a take-away message that concludes what conclusion can be derived from figure 8?
12. Figure 9: color coddings are not consistent with the other plots in the manuscript. Please harmonize. Is there a reason for why the scattered dots to be located on a horizontal line? Please mention why it is like that. Also, I don’t fully understand what the linear regression lines in this figure tend to show/prove. Could you please elaborate on that?

13. Line 311 (Section 4.1): lines -> dots.
14. Lines 331-333 (Section 4.1): this part seems to be about the sun glint only. It would be beneficial to give similar explanations for the cloud bow as well.
15. Line 350 (Section 5): Is there a reference paper for the EUREC4A campaign? Seems like Stevens et al. 2021 is the one. If so, please include it here.
16. Figure 12: maybe worth it to say a few words on the difference among the points that fall exactly on the 1:1 line and those that fall apart from that.
17. Line 418 (Section 5.1): ... τ_1 and c_1 are, “respectively”,
18. Line 434 (Section 5.1): Do you mean that the “difference” in the cloud optical thickness is small?
19. Line 452 (Section 5.1): has -> have ; (i.e., smaller than 0.2).
20. General comment (Section 5): merge section 5 with subsection 5.1. As there is no subsection 5.2, I don't see a need for having 5 and then 5.1.
21. Section 6 (Conclusions and Outlook): Outlook -> outlook
22. Line 459 (Section 6): ... optical thickness of liquid clouds over ocean ...
23. Line 475 (Section 6): This demonstrates that ...