General comments

This paper evaluated the impact of three different ocean bio-optical models on retrieval accuracy, based on the Multi-Angular Polarimetric Ocean coLor (MAPOL) joint retrieval algorithm and data from the airborne Research Scanning Polarimeter (RSP). The average differences between the MAPOL retrievals and MODIS products were reported, and the applicability of bio-optical models along geographically varying waters were evaluated.

In general, the subject of this study is suitable for AMT, but the research goal and the innovation are not clear. The retrieval performance with 1, 3 and 7-parameter bio-optical models were validated, and the findings showed that the 3 and 7-parameter models were suitable to apply over both open and coastal waters whereas the 1-parameter model was less robust over coastal waters. The findings are similar to the results in Gao et al (2019) and Hannadige et al (2023). Compared with Gao et al (2019), the 3-parameter bio-optical model was added, but the physical reason for the similar performance between 3 and 7-parameter models were not be explained. Also, the physical meaning of the model parameters, and their relationship with retrieval parameters and water properties can be explained, which helps to better analyze the impact of different models on retrieval performance. I therefore recommend major revision.

Specific comments

● Although the research contents have been compared with previous literatures in lines 110-122, the research subject corresponding to the study contents and the innovation of this study are not clear. In addition, the results of this study may not be presented in the introduction. The key issues and the methods used in this study can be included, to better explain the research aims.

● Line 125-127: I don't think this work can make significant impacts on the Earth science community by developing more efficient and robust retrieval algorithms for aerosols and ocean color. The joint retrieval algorithm was proposed and developed in Gao et al (2019), and this work mainly evaluated three bio-optical models in the retrieval algorithm. It is important to exactly describe the goal and significance of the study in the introduction.

● Section 3: The section 3 describes the MAPOL joint retrieval algorithm, which has been developed in Gao et al (2019). The heading of "the MAPOL framework" is usually used for algorithm development. In section 3, the retrieval algorithm can be briefly

introduced, with a focus on describing the three models to be evaluated.

● Line 198-220: Since the prior assumed uncertainties of σ_t and σ_p directly influence the χ^2 value, I recommend elaborating the setting and calculation of σ_t and σ_p in the study.

● Line 241-242: The difference between the 3 and 7-parameter models is important for model evaluation. Compared with 7-parameter model, four parameters are set as fixed values. It is better to explain why these parameters are set to this value.

● The physical meanings and influencing factors of the parameters such as Sdg, Sbp, and SBp in different models can be explained. This could help to analyze the potential retrieval effects of different models.

● Figures in this paper: To increase the readability of the figure, the letters can be provided in the subfigures.

● Figure 4: Is there no MODIS product on the figure of $\lambda = 410nm$? Similar phenomena appear in Figures 8 and 9 ($\lambda = 470nm$).

● In the ACEPOL-Mix case that is with moderately turbid waters, the retrieval precision of C1P1 model is good, and the uncertainties are small. This seems to be inconsistent with the conclusion that the C1P1 model is successful over extremely clear waters and unsuitable for turbid waters.

● For the performance comparison tables including tables 3-6, I recommend adding a description of the sample size.

Technical corrections

Language: I am not a native speaker, so take my comments with some caution.

● Line 13: are → were ?

● Line 40-43: It is better to give a brief description of the algorithm not just the algorithm used by MODIS, and the possible reason for the uncertainty.

● Line 50: what is the meaning of " the estimation of aerosols is thus important for aerosol retrievals" ?

● Line 61-62: What kind of efforts? What's the problem?

● Line 160: are excluded → were excluded ?

● Line 193-195: Does the uncertainty refer to the variance? How to determine the forward model uncertainty, and the pixel average variance?

● Line 210: How to fit the parameters?

● Line 365: Figure 8 shows that the retrieval results with C1P1 model agree well with the MODIS product for the NAAMES-Coastal case with highly turbid waters, which is not consistent with the conclusion.

● Figure 12: There is no MODIS product in the subfigure of λ=470 nm, but the table 6 presents the relative difference between MODIS and 3 bio-optical models at 470 nm.

● Line 466: widest → wider ?