Responses to reviewer 2:

The authors would like to express the gratitude for the efforts that the anonymous reviewers dedicated to provide constructive comments and suggestions which help us to improve the quality of the manuscript. Below we provide detailed response to each of the comments of the reviewers:

General comments:

This paper is highly innovative. As stated by the author, it not only realizes the first application of the GRASP algorithm in the retrieval of geostationary satellite data, but also synergetic retrieval between AHI/Himawari-8 and micro-pulse lidar (MPL). The significance of this article is prominent, as it not only improves the accuracy of aerosol product from geostationary satellites and provides surface parameters synchronously, but also confirms the reliability of the vertical profile of MPL for satellite retrieval accuracy. But there are still some works in this article that need to be improved and perfected:

Answer: We are grateful for overall positive evaluation of our paper.

The point-by-point responses:

1. This article is actually very rich in content, but the title of the paper is relatively weak to generalise all the contents. It is recommended to consider modifying the title of the article to more comprehensively display the content of this article.

Answer: We appreciate the reviewer's insightful comment regarding the title. After careful consideration, we decided to retain the current title with only a minor adjustment - "Retrieval and Validation of Diurnal Properties of aerosol and surface from geostationary satellite Himawari-8 using Multi-Pixel Approach", as we believe it effectively summarises the main approach and focus of our study. Specifically, the title prefers to main novelty of our work - the multi-pixel approach used in both the AHI/Himawari-8 and AHI/MPL retrievals. Aslo it emphasises that the retrieval allows for the characterisation of the aerosol diurnal variations, that make the new retrieval product especially valuable compared to conventional aerosol products. We therefore consider the current title to be representative of the key methodology and objectives presented in the paper.

2. The resolution of some Figures in the article is too low, for example, Figure 21. It is recommended to increase the resolution of these images.

Answer: We thank the reviewer for the comment. The resolution of Figure 21, as well as other figures (Figures. 2,3,4,5,6,7,18) with low resolution have been improved to enhance the clarity and readability.

3. To improve the readability of this article, the author can provide some explanations of professional terms. For example, starting from line 56 of this article, the author discusses the impact of the surface reflectance on aerosol retrieval. line 63-65 introduce the solar geometry condition influence surface albedo. Suggest the author briefly mention the correlation and difference between reflectivity and albedo to improve the understanding of graduate readers.

Answer: We thank the reviewer for this valuable suggestion. To improve the readability for a broader audience, we have added brief explanations in Lines 61-64 clarifying the correlation and difference between surface reflectivity and albedo, and how solar geometry influence the surface albedo in the aerosol retrievals.

- Lines 61-64: “Surface reflectance refers to the fraction of incoming solar radiation that is reflected by the surface at a given wavelength and viewing angle, while surface albedo represents the fraction of total incident light reflected in all directions. The geometry condition, including the solar zenith and azimuth angle, affects the apparent surface albedo observed by the satellite and, in turn, influences aerosol retrieval.”

4. There are many Figures in this article, and the author usually lists each case one by one (day by day, for example Figure 22, 24, 26). Can we consider reducing the number of pictures and integrating and displaying these cases.

Answer: We thank the reviewer for the suggestion. Figures 22, 24, and 26 have now been integrated into as Figure 22 to reduce the number of figures and improve the overall presentation.

5. line 838-839, "the new approach also improves upon the potential issues of non-physical negative values or the abrupt spikes that may occur with the Fernald method." Indeed, for Fernald and Mie scattering lidar (do not like Raman or HSRL), some hypothesis parameters may introduce significant errors. However, the signal emission frequency of MPL is very high, and have more time/opportunity to realize the synchronous observation with geostationary satellites. Did the author attempt to average multiple MPL profiles to smooth out these errors or remove erroneous signals to ensure the validity of MPL data? After all, ground-based observation equipment is usually the reference for satellite.

Answer: We thank the reviewer for the valuable comment. In this study, we did consider the potential errors in MPL observations. The MPL has a temporal resolution of 15 seconds, and during the pre-processing, the profiles are averaged within a 15-minute window centered on the AHI/Himawari-8 measurement time to improve the signal to noise ratio as indicated in Line 241.

- Line 241: “The data is averaged within 15 minutes centered at the satellite observation time, similar to Lopatin et al., (2021,2024);”