Response to the reviewers' comments

On behalf of the co-authors, we are very grateful to you for giving us the opportunity to revise our manuscript. We really appreciate the reviewers' constructive comments and suggestions on our manuscript, entitled "Multi-angle aerosol optical depth retrieval method based on improved surface reflectance (ID: amt-2023-204) ". We have studied the reviewer's comments carefully and tried our best to revise the manuscript accordingly. Notably, the changes are **highlighted in blue in the revised manuscript.** Please see below for a point-by-point response to the reviewer's comments and concerns.

Reviewer(s) Comments:

Reviewer #1

General comments:

1. The authors have made a lot of changes in response to the reviewer comments. The quality of the manuscript has certainly improved as a result. However, some of my original concerns remain. In my opinion, the improvement in AOD results compared to AERONET values is not very impressive. For example, here are some of the listed R values (old and new) for Taihu:

Da 0.77 -> 0.80, Ca 0.70 -> 0.72, Aa 0.81 -> 0.82

Indeed, in some cases, the results become worse. For example, here are some of the listed RMB values for Taihu:

Ba 0.61 -> 0.70, Aa 0.68 -> 0.71, Df 0.47 -> 0.66

At the very least, the authors need to justify how this is a substantial improvement and how this affects downstream products based on the AOD.

Response: Thank you very much for this valuable comment or suggestion. We deeply understand the concerns raised by the reviewer. Because the improvement of the accuracy of AOD retrieval is

not an easy task, we feel that small improvements are also valuable.

As we know, the MISR sensor captures images from 9 different angles within a short span of 7 minutes. Although the time interval is relatively brief, these images are typically considered to be acquired almost simultaneously (Abdou et al., 2005). For features within the same pixel, there is only one shared pixel value. In the final retrieval results, we select the optimal AOD pixel value from the best angle. Prior to the improvement, the retrieval results at angle Aa were optimal (Taihu: R=0.81, RMB=0.68; Xuzhou-CUMT: R=0.73, RMB=0.78). However, after the improvement, overall, the retrieval results at angle An became better (Taihu: R=0.84, RMB=0.52; Xuzhou-CUMT: R=0.85, RMB=0.47). The improvements in the Xuzhou-CUMT site are more pronounced compared to the Taihu site, which may be related to the relatively smaller number of sample points in Taihu. We have also supplemented this part of the content in Section 4.3 of the manuscript. Comparing with MODIS AOD products, the improved AOD retrieval results exhibit better performance in spatial distribution range and trend. The algorithm used in this study refines the spatial distribution of AOD, providing higher spatial resolution and fewer missing pixel values.

In this study, we are dedicated to improving the accuracy and reliability of AOD data, and achieving significant improvements is no easy task. This highlights the challenges and difficulties we face in our research, while also underscoring the importance of ongoing efforts and exploring new methods to achieve more significant improvements. We thank the reviewer for this valuable comments, and we will continue our efforts to actively explore more effective methods to improve the quality and accuracy of AOD retrieval in future.

2. Also, in spite of the changes made, there are still numerous grammatical errors and the language is awkward in several places. For example, inputted is not common usage.

Response: We have modified the manuscript including language presentation and logic. These changes do not influence the content and framework of the paper. Here we did not list the changes but marked in blue in the revised manuscript. We appreciate for reviewers' warm work earnestly and hope that the revisions will be recognized.

Reference

Abdou, Wedad A. Comparison of coincident multiangle imaging spectroradiometer and moderate resolution imaging spectroradiometer aerosol optical depths over land and ocean scenes containing aerosol robotic network sites[J]. Journal of Geophysical Research, 2005, 110 (D10): 1-12.