Response to the reviewers' comments

We are very grateful to the editor and reviewer for providing constructive comments on our manuscript and for giving us the opportunity to revise the manuscript. We have carefully considered the reviewers' comments and revised the manuscript accordingly. The responses to the comments or suggestions are shown below. Comments are shown in black font and **our responses are shown in blue font.**

Reviewer(s) Comments:

Reviewer #2

General comments:

In this manuscript, mainly based on the first author's previous works (Chen et al., Tellus B: Chemical and Physical Meteorology, 2021, 73, 1940758; Chen et al., Advances in Space Research, 2021, 67, 858-867) and with the same MISR and AERONET datasets (MISR data with 9 camera angles on June 12, 2018 for AOD retrieval map show, Taihu and Xuzhou AERONET sites), an improved linear correction Equation (Eq. 3) is used to update the MISR surface reflectance. With the new updated MISR surface reflectance, the aerosol optical depths (AODs) of 9 camera angles are retrieved by the lookup table by 6S, respectively, and further systematically validated by the AERONET, as well as the MODIS AOD products.

Response: We thank the reviewer for his/her positive suggestions and valuable comments. Point-by-point responses to the reviewer are shown below.

Specific Comments:

1. However, this manuscript didn't explain in what way to extract the semi-empirical relationship in Eq. (3), which plays a most import role in the completeness and logic of this manuscript. Besides, since the title of manuscript is about "multi-angle aerosol optical depth retrieval method", it is a great pity that this manuscript didn't discuss how to retrieve the AODs and other key aerosol optical parameters by taking the full advantage of 9 camera angles' measurements together with the Eq. (3), which is also very important to improve the MISR's aerosol retrieval accuracy. Moreover, the structure and content of this paper are very similar to previously published paper (Chen et al., Tellus B: Chemical and Physical Meteorology).

Response: We apologize for not clearly describing the details of the algorithm in this manuscript. The following are explanations and supplements to the content of the manuscript.

① According to Equation 12, the MISR calibration model is established by performing a linear regression fit between the previously estimated MISR surface reflectance based on the MODIS V5.2 algorithm and the newly estimated MISR surface reflectance based on MODIS atmospheric correction (randomly selecting 60% of the data).

② Applying Equation 12, the previously estimated surface reflectance of the MISR sensor at 9 angles is corrected for errors, resulting in improved surface reflectance values. These improved surface reflectance values are then used to retrieve the MISR Aerosol Optical Depth (AOD) at the same 9 angles.

After carefully considering the reviewer's comment, we have added to the manuscript what is not clearly explained. The manuscript analyzes the reasons for the overall high MISR AOD values previously retrieved by Chen et al. (2021), mainly due to the underestimation of surface reflectance. To obtain more accurate surface reflectance, the manuscript focuses on exploring

improvements to the MISR surface reflectance algorithm. The final improved surface reflectance was utilized to obtain a more accurate MISR AOD dataset. This manuscript is a follow-up exploration and algorithmic improvement based on previous research. Therefore, the focus and content of the research in this manuscript is distinct from previously published papers.

Technical corrections:

2. Figs. 1, 3, 4: for the surface reflectance results shown in these figures, which wavelength band is used?

Response: In Figures 1, 3, and 4, we utilized the MISR blue band (446 nm) as the data source for surface reflectance. We appreciate the careful review by the reviewer, and we have included this information in the manuscript.

3. Fig. 2: For figure 2, more detailed description needs to be added in section 3.3, such as what kind of aerosol type (model) was used for atmospheric correction and AOD retrieval? Have the authors considered the error transfer caused by the aerosol model and atmospheric correction?

Response: We appreciate the guidance and suggestions from the reviewer. In our study, we used continental aerosols for AOD retrieval and atmospheric correction using the 6S model. The selection of an appropriate aerosol type is crucial for obtaining accurate aerosol optical depth. Previous studies have shown that continental aerosols can be used to estimate aerosol optical depth in the Yangtze River Delta region (He et al., 2015). We employed the same aerosol type for AOD retrieval and atmospheric correction and utilized the 6S model for atmospheric correction. Thus, this study did not consider the potential error propagation caused by aerosol type and

atmospheric correction. Based on the reviewer's suggestion, we have added the above content in section 3.3 of the revised manuscript.