Review2

This study developed a novel method to retrieval aerosol optical depth and single scattering properties from low cost sky cameras. It serves as a potentially useful supplement for the more sophisticated sun photometer approach. The manuscript is also in general clearly presented and well constructed, which is a great contribution to the community by providing AOD and SSA simultaneously. I suggest several points need further clarification before it can be accepted by AMT.

Specific comments:

1. The manuscript states that previous studies mainly focused on AOD, while this study additionally retrieves SSA. This is an important point and should be emphasized more clearly in the Introduction and Summary. It would be helpful to briefly compare the present method with previous ASI-based AOD studies in terms of input features, retrieval targets, validation strategy, and computational efficiency.

   Response: Thank you for pointing this out. We agree that the simultaneous retrieval of AOD and SSA should be emphasized more clearly. We have revised the Introduction and Summary sections to distinguish the present method from previous ASI-based studies, which mainly focused on AOD or size-related aerosol parameters. We have also added Table S1, comparing representative studies in terms of input features, retrieval targets, validation/reference data, and retrieval methodology.

2. The feature set includes RGB means, RBR, SZA, and RGB values sampled along an annulus. These choices are reasonable, but the manuscript could better explain how each feature relates to aerosol extinction, scattering, or absorption. This would make the AI model less like a black box and help readers understand why the method can retrieve both AOD and SSA.

   Response: We have expanded Section 2.3 to explain the physical motivation for each feature group. The revised manuscript discusses how the global RGB means relate to aerosol extinction, how RBR reflects the spectral dependence of aerosol radiance, how annulus RGB values provide directional scattering information, and how SZA accounts for solar-illumination geometry and optical path length.

3. The SSA retrieval is an important contribution, but its performance varies strongly by

site and wavelength. For example, the Beijing SSA correlation decreases at longer wavelengths. The manuscript notes the narrow dynamic range of SSA values, which is reasonable, but a more detailed discussion would be useful. The authors could consider showing the SSA value distributions, sample sizes, or uncertainty ranges by wavelength to support this interpretation.

Response: In the revised manuscript, we have provided additional support for this interpretation in Figure 5 and the accompanying discussion. Because you specifically highlighted the decreasing long-wavelength SSA correlation at Beijing_PKU, Figure 5 focuses on the Beijing_PKU clean-regime samples (AOD440 < 0.2). It presents the wavelength-dependent distribution of AERONET reference SSA values, together with the sample size, mean value, 95% bootstrap confidence interval, and interquartile range. The sample size is identical at all four wavelengths (N = 618), indicating that the decrease in correlation toward longer wavelengths is not caused by unequal sampling. The figure also shows that the reference SSA values are concentrated within a relatively narrow range. Under such restricted variability, even small absolute retrieval differences can substantially reduce the Pearson correlation coefficient. This helps explain why the Beijing_PKU SSA correlation decreases toward 1020 nm while the RMSE remains low.

4. The chronological split within each month is a good attempt to reduce temporal leakage. However, because aerosol conditions can be strongly autocorrelated, adjacent observations may still be similar. The authors may consider adding a more stringent sensitivity test, such as day-based, week-based, or event-based splitting, to demonstrate that the model is not mainly learning local short-term persistence.

   Response: We agree that adjacent observations may remain temporally autocorrelated under a within-month chronological split. We therefore added a day-block sensitivity experiment in Section 3.4. All observations from a given calendar day were assigned exclusively to either the training or test set, so no day contributed data to both subsets. The model architecture, features, and hyperparameters were kept unchanged. The results show broadly consistent performance with the baseline split, indicating that the retrieval skill is not primarily caused by short-term temporal persistence.

5. The manuscript suggests that the method can help establish dense aerosol observation networks and bridge gaps between satellites and ground stations. This is a promising direction, but the current validation is limited to two sites and selected time periods. I suggest slightly moderating these claims and presenting them as future potential,

pending further validation across more environments, seasons, instruments, and aerosol types.

Response: We agree that the claims regarding network-scale application should be moderated because the current validation is limited to two sites and selected observation periods. We have revised the Abstract and Summary sections to describe the study as a proof of concept and to state that broader validation across instruments, seasons, surface types, aerosol mixtures, and cloud-screening conditions is required before operational deployment.

6. The reported correlation, RMSE, and MAE provide useful validation metrics, but additional uncertainty analysis would strengthen the manuscript. For example, the authors could discuss how retrieval errors depend on solar zenith angle, aerosol loading, season, image brightness, or instrument type. This would be particularly helpful if the method is intended for future low-cost aerosol monitoring networks across diverse environments.

Response: We have added a stratified uncertainty analysis in Section 3.3, examining the dependence of retrieval errors on solar zenith angle, aerosol loading, season, and image brightness. The results show that the retrieval uncertainty is conditionally dependent, with larger errors under lower aerosol loading and lower image brightness. Because the present dataset contains only two sites and two instrument configurations, the independent effect of instrument type cannot be robustly isolated.