Dear Ralph,

Thank you very much for your careful review of our manuscript and for providing valuable comments and suggestions that have helped us improve the quality and clarity of our work. We sincerely appreciate your time, effort, and insightful guidance throughout the review process.

The detailed and constructive comments have been extremely helpful in strengthening the scientific presentation and improving the overall quality of the manuscript. We have carefully considered all of your suggestions and have incorporated corresponding revisions into the revised manuscript. We hope that the revised manuscript and our point-by-point responses adequately address your comments and concerns.

Please find our detailed responses to each comment below.

Yours sincerely,

Yong Xue

Thank you for considering my suggestions, Yong. This is important work. After reading over your notes, I have a couple of additional thoughts, in case they are of use:

I think it might be worth emphasizing the point you make about using intensity and polarization in the ALH retrieval, rather than a purely geometric approach, because the HARP-2 pixel resolution is relatively coarse. This contrasts with MISR, which lacks polarization, but includes steeper view angles and has higher pixel resolution.

Response:

We appreciate your suggestion to highlight the differences between our HARP2-based ALH retrieval approach and purely geometric retrieval methods. Following your comments, we have added a discussion in the revised manuscript to emphasize that HARP2 and MISR represent complementary approaches for ALH retrieval. MISR primarily utilizes high spatial resolution and large angular diversity to identify aerosol-layer geometric contrast features, whereas HARP2 provides an additional polarization dimension that enhances constraints on aerosol scattering properties and vertical structure, despite its relatively coarser spatial resolution.

A surface contribution, due to some combination of low AOD and bright surface, can limit our ability to perform an ALH geometric retrieval at all with MISR. But unlike radiance retrievals, this does not really contaminate the retrieval, because we can perform an ALH retrieval only if we can see contrast features at multiple angles in the aerosol layer itself. The steeper-angle views enhance the aerosol-layer contribution relative to the surface contribution, which helps improve aerosol-layer contrast-feature visibility. As such, the 60˚ and 70˚ view angles make important contributions to the MISR ALH retrievals.

Response:

We appreciate this helpful explanation of the physical mechanism underlying the MISR geometric ALH retrievals. Exactly, the contribution from surface reflectance and aerosol loading conditions plays an important role in determining the applicability of geometric retrieval approaches. In MISR retrievals, sufficient aerosol-layer contrast features observed from multiple viewing angles are essential for successful ALH retrieval, and the enhanced aerosol-layer contribution at large viewing angles provides important constraints by increasing the visibility of these contrast features.

Following the suggestion, we have added a discussion in the revised manuscript to clarify that MISR and HARP2 rely on different but complementary physical

constraints for ALH retrieval. While MISR benefits from high spatial resolution and large angular diversity to exploit geometric contrast features, the HARP2-based approach developed in this study constrains ALH through radiative transfer modeling of multi-angle radiance and polarization signals. The additional polarization information provides complementary sensitivity to aerosol vertical structure, particularly under conditions where geometric contrast features may be limited.

With MISR, we perform the ALH retrievals with each of the red and blue spectral bands. The red band is reported at ~250 m at all nine view angles, so if the aerosol is sufficiently visible in this band, the red retrieval provides results with the highest vertical resolution. However, the AOD is generally greater in the blue band, especially when small smoke or pollution particles dominate, and in such cases, the blue channel, reported at 1.1 km at all MISR angles except nadir, sometimes offers greater sensitivity.

Response:

We are grateful to you for providing this further clarification regarding the roles of different spectral bands in the MISR ALH retrievals. The complementary characteristics of the red and blue channels, including the higher spatial resolution of the red band and the enhanced aerosol sensitivity of the blue band under conditions dominated by fine-mode aerosols, provide important constraints for geometric ALH retrievals.