Referee #1

We would like to thank Reviewer 1 for his helpful comments. Our responses to the reviewer are listed below, the reviewer comments in italic and our response in regular font.

I congratulate the authors on improving the manuscript point-by-point. I am a bit surprised, with retrieval convergence only forced at 20 km, that the algorithm does so well at capturing the temporal and latitudinal variations at 25.5 km. While I believe this algorithm could easily be improved in this regard, the results speak for themselves. Here are some minor points:

L235: It is not physically correct to refer to O2-O2 collision complex as the O4 dimer. O4 dimers only exist at pressures higher than found in Earth's atmosphere (~1 atm). I was OK with O4 since, for a split second, it is a complex containing 4 oxygen atoms, but I am not OK with dimer.

The term "O_4 dimer" was referred to as such in (Wang et al., 2020) SAGE III/ISS ozone validation paper. However, we have now deleted "oxygen dimer", and we used "O4 absorption cross section" as referred to by Thomason et al., 2020.

L355: The positive bias for 510 nm aerosol extinction remains an unsolved mystery. I am fine with the hope that this may be resolved in the future. It is difficult to measure aerosol extinction at such a short wavelength from my experience because its contribution to the radiance becomes small relative to other variables such as ozone, and (pressure-dependent) Rayleigh scattering.

We have seen similar large values at 675 nm when the measurement vector (ASI) is very low. However, most of those large values were filtered out using a threshold of ASI value less than 0.01. As the referee pointed out, it is difficult to retrieve the aerosol at 510 nm low altitudes when the aerosol signal is very small relative to ozone absorption and Rayleigh scattering. We hope to better filter out most of those erroneous retrievals in a future release. We have revised the sentence to "This is an artifact in the OMPS retrieval algorithm, which often results in noisy and large extinction values when the measurement vector is too small relative to gaseous absorption and Rayleigh scattering (see Figure 12)."

Figure 6: Just to clarify my comment from review: the differences are not symmetric about the 0% line in the southern mid-latitudes, whereas in the tropics, there is a wavelength-dependent bias with little altitude dependence and in the northern mid-latitudes, the results are very encouraging below 24 km with a wavelength-dependent bias only above that altitude.

Thanks for the explanation. While we agree with the reviewer, figures 5, 7, and 9 show the longer wavelengths agreement with SAGE III is mostly within 10% for most altitudes and latitudes. Furthermore, some of the bias seen at the tropics and southern mid-latitude below 18 km is caused by the incomplete cloud clearing which might explain the non-symmetric differences.

Thomason, L. W., Kovilakam, M., Schmidt, A., von Savigny, C., Knepp, T., and Rieger, L.: Evidence for the predictability of changes in the stratospheric aerosol size following volcanic eruptions of diverse magnitudes using space-based instruments, Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2020-480, in review, 2020.

Wang, H., Damadeo, R., Flittner, D., Kramarova, N., Taha, G., Davis, S., Thompson, A., Strahan, S., Wang, Y., Froidevaux, L., Degenstein, D., Bourassa, A., Steinbrecht, W., Walker, K., Querel, R., Leblanc, T., Godin-Beekmann, S., Hurst, D., Hall, E.: Validation of SAGE III/ISS Solar Ozone Data with Correlative Satellite and Ground Based Measurements, J. Geophys. Res.-Atmos, https://doi.org/10.1029/2020JD032430, 2020.