We are combining responses to the two community comments CC8 and CC5 below. All three community comments come from the SAGE III team.

The gist of the CC8 comment is that the 510 nm channel is not very accurate compared to SAGE III (figures were attached) and CC5 makes a similar point. The color scale in the CC8 figures seems to indicate that all the channels compare poorly to SAGE with errors between 20-50 %. Taha et al. (2021) Fig. 6 also shows the relative bias between SAGE and OMPS extinction which indicates a dependence in altitude as well as latitude. In the Taha figure, the agreement with SAGE is within ±25% above 18 km and over most of the latitude range. The 510 channel performs about the same as the other short wavelength OMPS channels. Agreement with GloSSAC is better for channels at 745 nm and longer.

CC8 shows SAOD plots of the ratios of 510/997 and GloSSAC 535/1020. First, in our paper, we used the aerosol extinction rather than the reported SAOD. Furthermore, we restricted the extinction used to above 20 km altitude in the southern hemisphere (sh) tropics (Figure 14), as recommended by Taha et al. (2021). The SAOD ratio in Figure 1 (from CC8) is wrong in the southern hemisphere and the tropics because the 510 nm useful altitude range is restricted to above 20 km (see Figure 2). Note that the 869nm is mostly accurate for all stratospheric altitudes and latitudes.

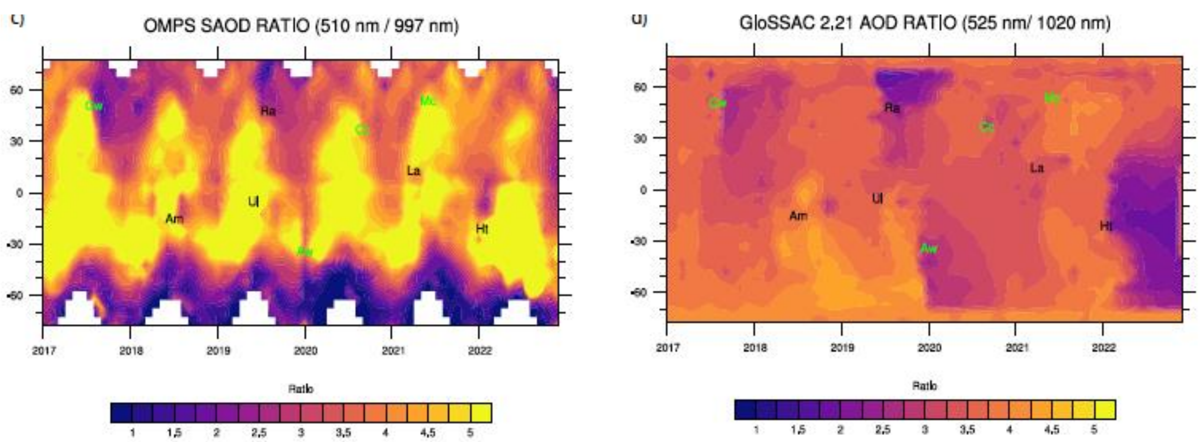

Figure 1. A copy of Figure 3 (c) and (d) from CC8.

The argument CC8 makes is that the two SAODs are unlike each other. The SAOD color ratio of ~ 5 for OMPS whereas the color ratio for GloSSAC is closer to 3. The high OMPS ratio SAOD after Hunga is unlike the GloSSAC ratio. Note that we do not use the wavelengths shown in CC8's figure.

Below is a redo of the above plot using our own color scale and our wavelengths, and restricting the plot to 0^{o}-60^{o} N to avoid the anomalous 510 nm retrieval in the SH below 20 km. OMPS SAOD is computed by integrating from 2 km above the tropopause (to avoid clouds) to 40 km. The SAOD color ratio between the OMPS and GloSSAC data sets is now more consistent except at high latitudes where OMPS appears to have lower values. This may be caused by the limited coverage of SAGE III at these latitudes compared to OMPS. If we use the wavelength ratio shown in CC8 (510/997) our results closer to the reviewer's. Notice that the SAOD shown here is only for comparison. For accurate color ratio, it is recommended to use the extinction coefficient at altitude ranges deemed accurate by (Taha et al., 2021) as we did in our paper.

The reviewer's point is that the paper should have more discussion of uncertainties in the OMPS extinction, and we concede the point. In the paper revisions, we add more discussion on the differences.

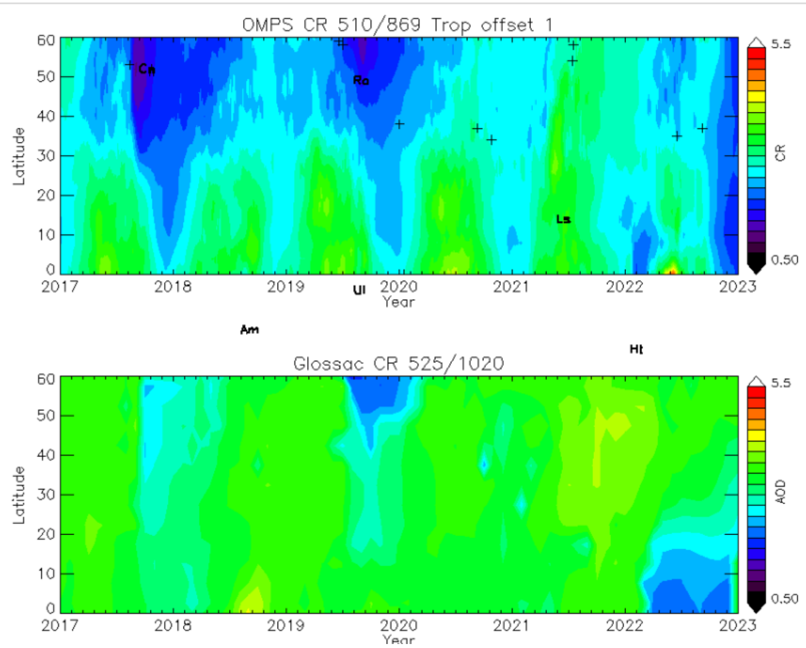

Figure 2. The figures are analogous to Figure 3 (c) and (d) from CC8, but with the extinction coefficient used to compute the color ratio, and the wavelengths adjusted to match those in our study. The colorbar scale has also been updated accordingly.

The CC5 reviewer makes two important points which we abstract below:

The first point has to do with available information in the OMPS extinction measurements. These issues are summarized in Knepp et al. (2024). Basically, there is insufficient information to accurately determine the concentration as well as characterize the PSD mode radius and distribution width with the OMPS wavelengths. This is fair point. Wrana et al. (2021, 2023) and Duchamp et al. (2024) retrieve a median radius and log-normal distribution width using two SAGE color ratios, the second employing the 1.543 extinction. Because of the narrower OMPS wavelength range OMPS wavelengths, we cannot retrieve both r_m and s.

To estimate the log-normal size distribution width Knepp et al. (2024) takes a different approach from Wrana et al. (2022). Knepp varies log normal size distributions creating a solution space. Then they extract and equivalent radius and distribution width from the color ratios from the observed extinctions. This approach also yields a measure of uncertainty. We downloaded Knepp's files and generated a histogram of distribution widths for data between 45N and 45S between 20-30 km and before 2022 (to avoid Hunga). The normalized distribution of sigma values is shown below, the vertical line is the mean value.

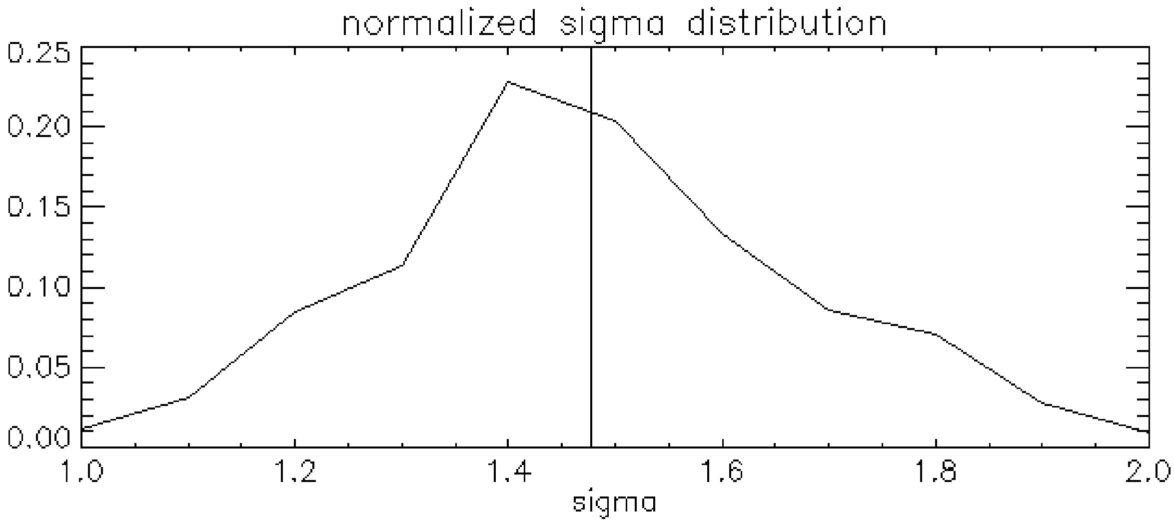

Figure 3. The normalized distribution of sigma values (distribution widths) for data obtained from Knepp et al. (2024) within the latitude range of 45°N to 45°S and altitude range of 20-30 km, prior to 2022 (to exclude the Hunga event). The vertical line represents the mean value.

The Knepp et al retrievals suggest that assuming 1.6 probably widens the distribution too much, and a universal value is hardly justified.

Our approach is related to Knepp's in that we are trying to estimate the error by varying the distribution width. We first assume that we can extract r_m from the color ratio. As pointed out by CC3 and CC8, there is difference in the OMPS extinction compared to SAGE. This uncertainty is reported in Taha et al. (2021) and noted in our text. CC8 argues that we should expand the discussion of the errors and we have done so.

In the discussion, the reviewer objects to using a PSD width of 1.6. Under ambient conditions there is plenty of observational data suggesting that a width value of 1.6 is reasonable (see Wrana et al., 2021, Fig. 6). The figure (above) we generated from Knepp's files supports a slightly smaller value for s, but 1.6 is not unreasonable. We certainly agree that under volcanic conditions, however, the width may be much smaller as determined by Duchamp et al. (2023). Using SAGE data, Duchamp retrieved Hunga particles with r_m =0.35μm. This agrees with our results using OMPS - our Fig 14. Duchamp used the method developed by Wrana et al. (2021).

Validation of the OMPS product is difficult since few balloon measurements intercept OMPS locations exactly. Aside from criticizing the lack of coincidences, the reviewer doesn't provide alternatives to validating the data. A comparison with Knepp's analysis is beyond the scope of this current work, but we have started to make comparisons with Knepp's analysis (see above), and that will be the subject for a future paper.

We have gone through the other specific comments and made appropriate changes.