The authors present a methodology for deriving particle median radius and concentration from OMPS-LP color ratio (CR). It's worth noting that this paper appears to be a resubmission of a previous work submitted last year (Wang et al., 2023), with the new version containing somewhat similar content (Wang et al., 2024). The core concept of CR remains consistent with the latest submission (Wang et al., 2024). Figure 1 mirrors the previous version submitted (Wang et al., 2023), albeit with the axes swapped. While utilizing CR seems a reasonable strategy for size distribution retrieval, it's essential to recognize that the OMPS-LP aerosol extinction coefficients at 510, 600, 675, 745, 869, and 997 nm are initially derived under the assumption of a constant Gamma distribution (Taha et al., 2021; Chen et al., 2018) . Consequently, these extinction coefficients primarily reflect background stratospheric aerosols, and using them for number density and concentration retrieval during volcanic eruptions lacks robustness.

Furthermore, a recent study (Bourassa et al., 2023) highlighted that the OMPS-LP NASA (referred to as OMPS(NASA)) extinction coefficient product exhibits a twofold increase compared to the OMPS extinction retrieved by the University of Saskatchewan (OMPS(USASK)) and SAGE III/ISS following the Tonga eruption. Notably, this study (Wang et al., 2024) employs the same OMPS(NASA) product to retrieve median radius and concentration, potentially impacting the derived quantities significantly. A thorough examination of OMPS(NASA) extinction coefficients at 510, 745, 869, and 997 nm, compared with alternative stratospheric extinction products, reveals a notable overestimation by the OMPS(NASA) product. Major concerns regarding the paper are outlined below:

Major comments

- Similar to Wang et al. (2023), the authors discuss CR (510/869 nm) and CR (745/869 nm). It appears that the authors utilized CR of 510/869 nm for the retrieval, but the rationale behind showcasing CR for 745/869 nm remains unclear. I am uncertain about the utility of CR of 745/869 nm, given the proximity of these two channels. The crucial point here is the significant bias observed in the 510 nm channel, as evidenced by available SAGE III/ISS measurements at a wavelength of 521 nm, close to 510 nm. Evaluation of the extinction product reveals that the OMPS(NASA) product at the 510 nm channel is unusable due to bias/noise in the data. Therefore, employing the extinction coefficient at 510 nm from OMPS(NASA) itself is not the appropriate approach to compute CR. We conducted an analysis of extinction coefficient data at 510, 745, 864, and 997 nm of OMPS with 521, 756, 869, and 1022 nm of SAGE III/ISS. Figure 1 depicts the zonally averaged stratospheric aerosol optical depth (SAOD) time series percent difference plot of OMPS(NASA) and SAGE III/ISS. It is evident from Figure 1 that the 510 nm channel of OMPS(NASA) exhibits a significant bias, irrespective of volcanic events. In addition to the substantial bias in the 510 nm channel, it is noteworthy that significant overestimation of SAOD is apparent in Figure 1 following the Tonga eruption in all four channels. This corroborates the findings of Bourassa et al. (2023) that OMPS(NASA) overestimates the extinction coefficient at 745 nm by a factor of two following the Tonga eruption. Therefore, users of OMPS(NASA) must exercise caution when using the OMPS(NASA) extinction coefficient product, particularly following volcanic eruptions. Moreover, the use of the 510 nm channel is questionable, especially given the large bias in Figure 1a, regardless of any events. Additionally, other OMPS retrieval products from OMPS(USASK) and IUP Bremen (hereafter, OMPS(IUP)) are available to the public. It is worth noting that, in addition to the overestimation of aerosol extinction coefficient in OMPS(NASA) following the Tonga eruption, similar differences were noted following the Kelud (13 February 2014) and Calbuco (28 April 2015) eruptions at 745 (864) nm wavelengths when compared against OMPS(USASK) (OMPS(IUP)) products (not shown here). Therefore, following any events that perturb the stratosphere, OMPS(NASA) extinction coefficient product should be used with caution.

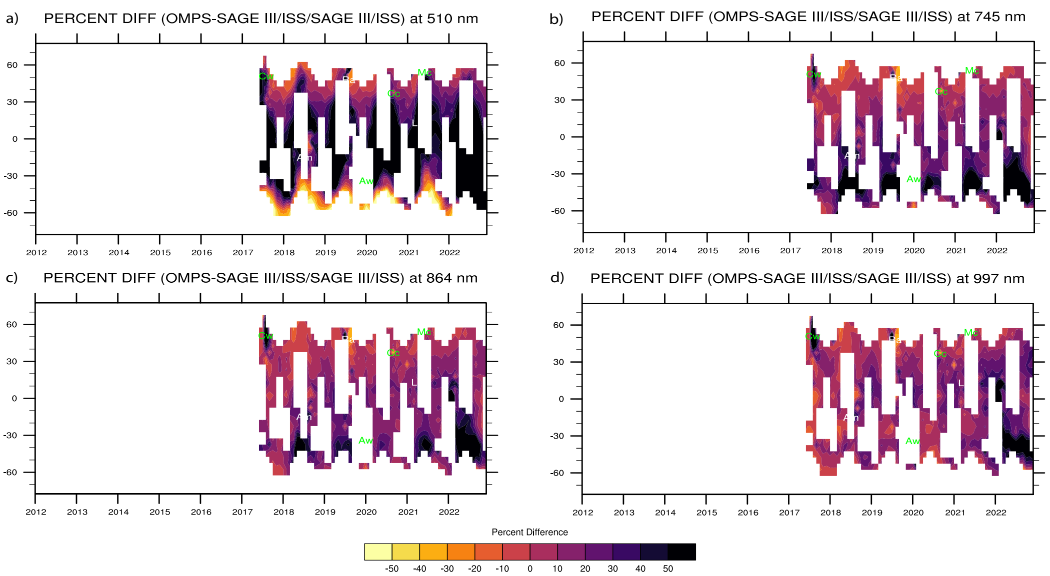

Figure 1: Latitude versus time dependence of zonally averaged stratospheric aerosol optical depth (SAOD) percent difference between OMPS(NASA) and SAGE III/ISS at (a) 510 , (b) 745 , (c) 864, and (d) 997 nm. For SAGE III/ISS the respective wavelengths used for computing percent differences are 521, 756, 869 and 1022 nm. Major volcanic eruptions (white) and wild fire events (green) with abbreviated two-letter code with their respective latitude and time of occurrence that are listed here. The event names shown are Canadian wildfire (Cw), Ambae (Am), Raikoke (Rk), Ulawun (Ul), Australian wildfire (Aw), California Creek Fire (Cc), La Soufriere (La), McKay Creek fire (Mc) and Hunga Tonga (Ht).

The authors employ the 510 nm channel to compute CR, leading to a biased CR that inevitably affects the retrieval of median radius and concentration. It's also worth noting that when SAOD is computed between the tropopause and about 21 km, the disparity between OMPS(NASA) and SAGE III/ISS is even more pronounced following the Tonga eruption. This discrepancy arises from the fact that OMPS(NASA) tends to overestimate extinction below the peak of the aerosol layer, as noted by Bourassa et al. (2023), as illustrated in Figure 2c,d. Additionally, OMPS(NASA) release notes (`https://disc.gsfc.nasa.gov/datasets/OMPS_NPP_LP_L2_AER_DAILY_2/summary?keywords=OMPS-NPP_LP-L2-AER`) state that low sensitivity of short wavelengths to aerosols may impact retrievals below 675 nm, advising caution in using LP aerosol extinction data below 17 km and scattering angles greater than 145 degrees for wavelengths 675 nm or shorter.

While OMPS(NASA) extinction coefficients show improvement towards higher wavelengths compared to the 510 nm channel, it's important to highlight that the OMPS(NASA) extinction coefficients at 745, 869, and 997 nm significantly overestimate following the Tonga eruption and other events. Hence, the robustness of the OMPS(NASA) product, particularly following volcanic eruptions, is questionable.

Furthermore, we evaluated the OMPS(NASA) extinction product at 510 and 997 nm for a relatively unperturbed stratosphere (June 2017) and following the Tonga eruption (April 2024) (Figure 2) using GloSSAC version 2.21 data. The percent difference between OMPS(NASA) and GloSSAC clearly indicates a significant disparity at the 510 nm channel (> 50%) below 24 km, even in June 2017 (Figure 2a). This underscores the bias in the 510 nm channel regardless of any perturbed event. However, the 997 nm channel appears reasonable during June 2017 (Figure 2b). However, following the Tonga eruption, both the 510 and 997 nm channels exhibit significant differences compared to GloSSAC (Figure 2)c,d.

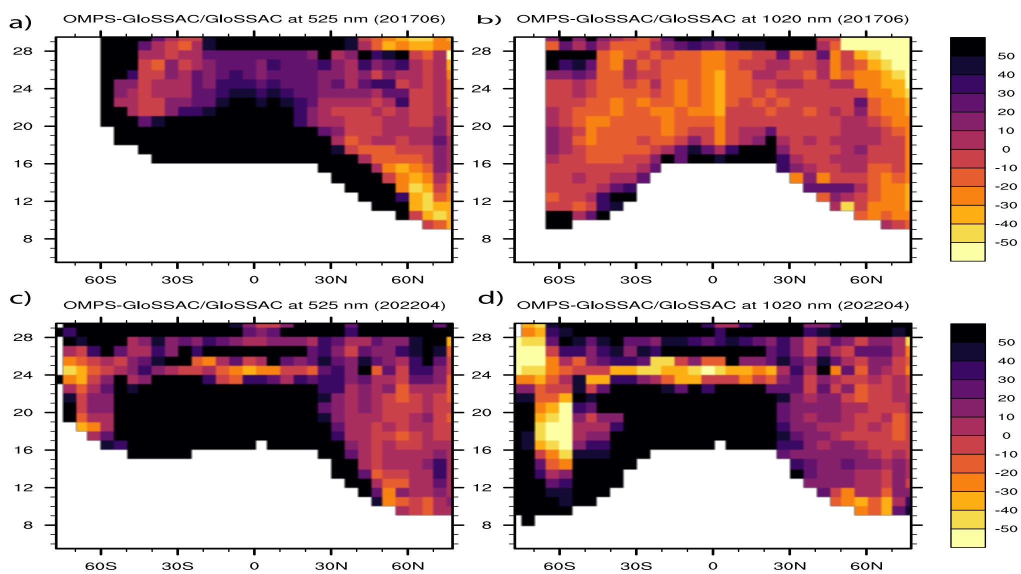

Figure 2: Zonally monthly averaged percentage difference of OMPS(NASA) and GloSSAC (version 2.21) for 525 and 1020 nm on an altitude versus latitude plot. (a, b) for June 2017 and (c, d) for April 2022 following Hunga Tonga eruption.

- Since the 510 nm channel exhibits a significant bias, any CR computation involving this channel will inevitably yield incorrect ratios. Figures 3a and 3b illustrate the percent difference of SAOD between OMPS(NASA) and GloSSAC at 525 nm and 1020 nm, respectively (note that we utilized SAOD at 510 nm and 997 nm to calculate the percent difference with GloSSAC). It's apparent from Figure 3a that the OMPS 510 nm channel consistently exhibits a high bias, regardless of any perturbed event. Therefore, employing the 510 nm channel to retrieve particle size-related quantities would introduce bias and yield unreasonable results. While the bias in the 510 nm channel persists throughout the record, Figure 3b shows some improvement when comparing the 997 nm channel against GloSSAC's 1020 nm channel. However, there is an overestimation of OMPS(NASA) SAOD following perturbed events such as the Canadian Wildfire, Ambae, Australian Wildfire, and the Tonga eruption.

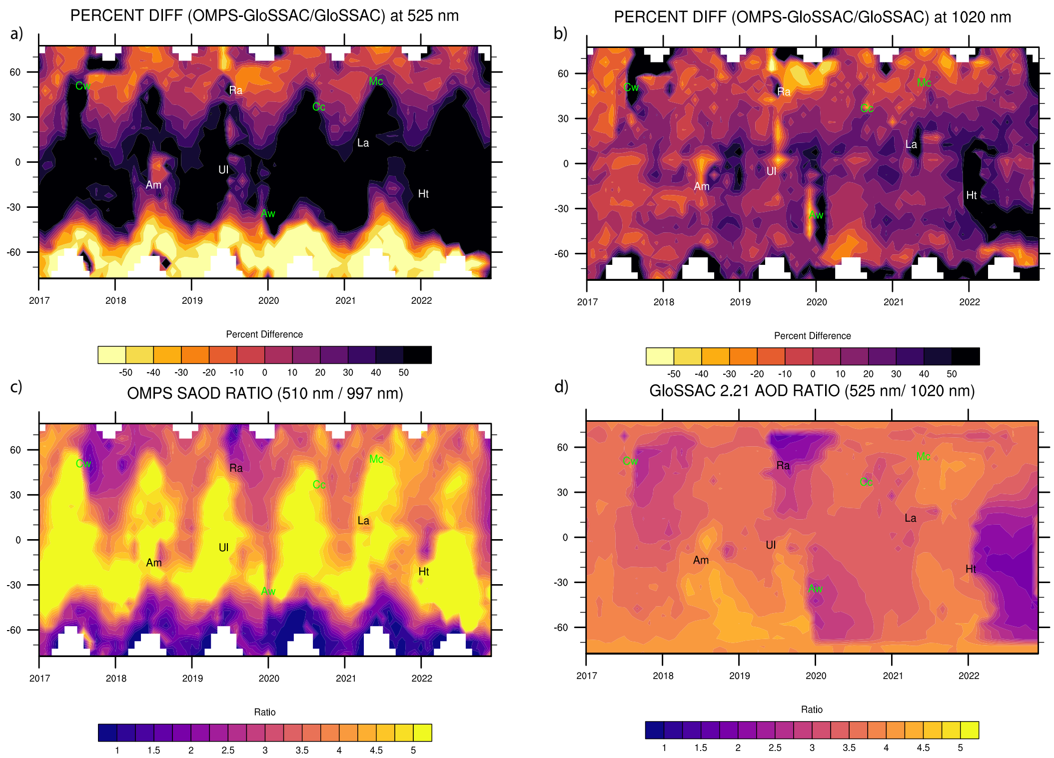

Figure 3: Latitude versus time dependence of zonally averaged stratospheric aerosol optical depth (SAOD) percent differences from OMPS(NASA) and GloSSAC (v 2.21) (a,b) and SAOD ratios (c,d). OMPS(NASA) SAODs are computed for 510 and 997 nm, while for GloSSAC SAODs are computed at 525 and 1020 nm. Ratio between 510 and 997 nm of OMPS(NASA) AOD is shown in (c), while (d) shows ratio between 525 and 1020 nm of GloSSAC 2.21 for the same time period. Major volcanic eruptions (white) and wild fire events (green) are same as in Figure 1.

We also evaluated the SAOD ratio between the 510 nm and 997 nm channels, as well as between the 525 nm and 1020 nm channels of GloSSAC. This comparison offers insights into how two wavelengths can inform about aerosol extinction coefficient ratios, thereby aiding in the inference of aerosol particle sizes. It's essential to note that we focused on the time series from 2017 through 2022 due to the availability of SAGE III/ISS multi-wavelength measurements from 2017. Figure 3c clearly demonstrates that the OMPS(NASA) SAOD ratios do not provide meaningful information, indicating that these wavelengths cannot be utilized to infer size information. Notably, most of the bias stems from the 510 nm channel. In contrast, the aerosol SAOD ratio from GloSSAC offers valuable insights (Figure 3d) into how ratios change following each volcanic/fire event, particularly after events like the Canadian Wildfire, Ambae, Ulawun, Raikoke, Australian Wildfire, and Hunga Tonga. Each event behaves differently in terms of the aerosol SAOD ratio. For instance, the Canadian wildfire, Raikoke, Australian wildfire, and Hunga Tonga show a smaller SAOD ratio, suggesting relatively larger particles, while Ambae and Ulawun eruptions exhibit a larger SAOD ratio, suggesting smaller particles.

Consequently, utilizing the OMPS(NASA) extinction product to retrieve size-related information would introduce bias and may not accurately represent the underlying aerosol size information.

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