Dear reviewer, Dr. Robert Damadeo

Thank you very much for your comments on our paper. We took your comments into account in the revised version of the manuscript. Please find below our detailed replies (black font) on your comments (blue font).

## Comments:

I find it strange that one of the wavelengths from the residual spectra that is used for aerosol is one in which the instrument does not even measure (i.e., 750 nm). I understand the motivation is to match wavelengths measured by other instruments for validation purposes, but this wavelength is now essentially an extrapolation of the smoothing that is performed on the residual spectra. Additionally, why is it that the spectra shown in Fig. 2 do not cover the entire range of the IR spectrometer (thus further reducing the reliability of the smoothing out in this spectral region)?

Yes, the main reason for using 750 nm is comparison with other datasets and a potential use in the merged aerosol dataset. GOMOS measures at a very close wavelength, 755-759 nm, therefore aerosol extinction at 750 nm is very close to that of 757 nm. This is illustrated in Figure 1 below (similar to Figure 3b in the paper), when more wavelengths are included in the vertical inversion.

The IR B1 spectrometer wavelengths are for O2 retrievals. In principle, the wavelengths 770-774 nm could be also used in the aerosol retrievals. This wavelength region is slightly noisier, and overall GOMOS IR spectrometers are affected by a combined effect of pixel response non-uniformity and intra-pixel sensitivity. Including of additional wavelengths does not improve aerosol retrievals at 750 nm. The retrieved aerosol profiles at 750 nm, 757 and 772 nm are very similar, and all three disagree with VIS spectrometer data above ~32 km (See Figure 1 below). We discuss this disagreement in the revised version.

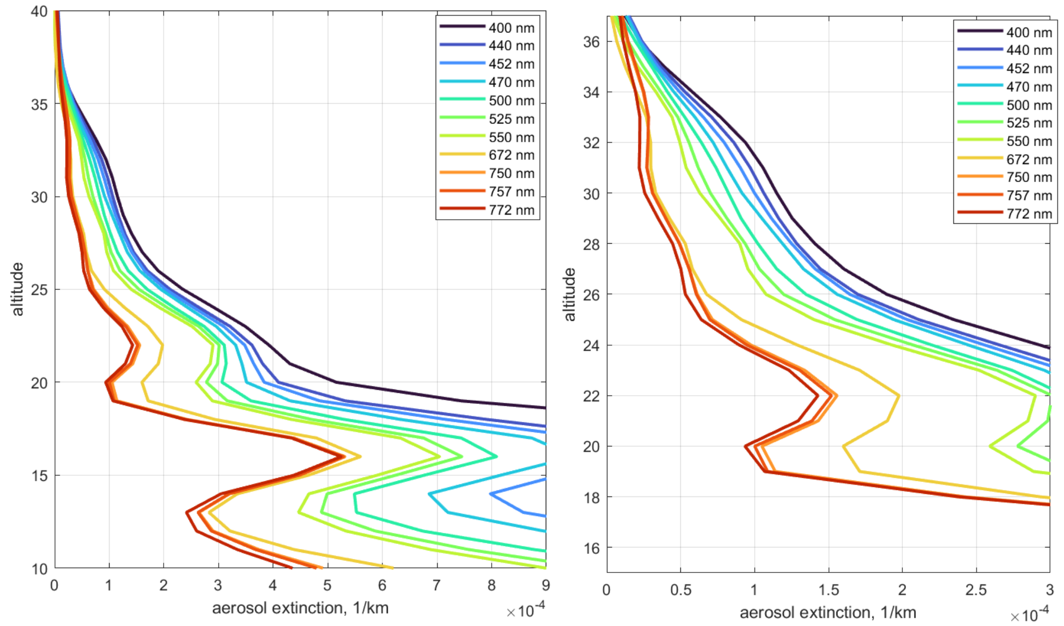


*Figure 1. Left: The retrieved aerosol extinction for September 2002, 10°-20° S (wavelengths are indicated in the legend). Right: zoom at high altitudes.*

Why not show the comparative Angstrom exponent in Figure 5 as is done for Figure 6?

In the revised version, the figures are modified. Aerosol extinction spectra are shown in new Figure 4 (which contains the information from original Figs. 5 and 6), for FMI-GOMOSaero, SAGE II and AERGOM. Global distributions of the Ångström exponent are shown in new Figure 5.

Pg 10, Ln 210: "The reason for positive bias near the tropical tropopause is GOMOS aerosol retrievals is not fully understood at the moment."

How is it not just clouds? If you are averaging all of the transmission profiles without filtering for clouds, then of course clouds are going to bias your aerosol retrievals near the tropopause. Perhaps you cannot easily quantify how much of the bias is from clouds versus any other potential source, but the expected presence of clouds will obviously create a bias like what is shown in Fig. 7.

We corrected this statement in the revised version.

I think the better question is why does the bias appear significantly larger than the averaged SAGE II profiles in Fig. 4?

From a statistical point of view, a strong positive bias near the tropical tropopause between FMI-GOMOSaero and non-filtered SAGE II aerosol profiles is not observed.

In the revised paper, we restructured the discussion of biases near the tropical tropopause.

Pg 10, Ln 213: "We tried to apply various methods for cloud filtering in averaging GOMOS transmittances– according to absolute values of extinction and ratio at different wavelengths." This is no trivial task, and it may not be possible for all but the thickest clouds.

Yes, it is difficult in the GOMOS wavelength range.

As a curiosity, I wondered what the impact of using averaged transmittances would be for your comparisons. The authors compute an average transmittance profile, then convert it to an average optical depth profile, then perform the retrieval. The comparison profiles from other instruments are averages of individual profiles. As a simple test, the following relationship is true: MEAN(-LOG(T_i)) > -LOG(MEAN(T_i)). In other words, averaging the transmittance profiles first will always result in a slight low bias to your optical depths when compared with the mean of the optical depths derived from individual profiles. I am unsure of how this propagates through the two inversion steps. I would imagine the spectral inversion is less affected by this, allowing the bias to mostly propagate into the residuals. I cannot intuit how this would propagate through the vertical inversion step. If the bias still propagates proportionally (as opposed to inversely in some fashion) into the resulting extinctions, it would mean the positive bias you see in your comparisons is actually smaller than the true comparisons because a small amount of negative bias should be introduced from averaging transmissions first.

The relation  MEAN(-LOG(T_i)) > -LOG(MEAN(T_i)) is true for mean estimates. However, we use median, for which this relation does not hold.