Reviewer 2

We would like to thank the reviewer for taking the time to evaluate our manuscript and provide valuable feedback. We have modified the manuscript with the proposed changes along with step-by-step answers to the suggestions. Please note that changes have been highlighted in the manuscript and the corresponding answers to the reviewer by text below. The original comments are presented in black.

The manuscript by Filioglou and co-authors reports depolarization ratios at 1565 nm for very fresh and long-range transported smoke plumes. Additionally, they report observations from a southern hemispheric volcanic ash plume. Previously, such values were reported at 355 and 532 nm and rarely at 1064 nm. Therefore, the measurements at 1565 nm add novel information. Ideally, this information would have been accompanied with simultaneous observations at shorter wavelengths to derive the spectral behavior for the same event. However, it is understandable that in such close proximity to the active fires not every lidar can be operated. Also in South Africa, it is not easy to operate a standard polarization lidar. The manuscript is clearly written and could be published after addressing minor revisions.

Minor Comments

L43-47: The statements about the spectral depolarization ratio are not correct. Looking at Freudenthaler et al., 2009, lower values at 1064 nm were reported compared to the values at 532 nm. Also, Haarig et al., 2022, reported lower values at 1064 nm compared to 532 nm. And Vakkari et al., 2021, reported for one case study higher values at 1565 nm (Saharan dust) and for another (dust from Egypt) lower values at the longer wavelength.

Thank you for your comment. We have revised the statements accordingly as: 'Freudenthaler et al. (2009) studied Saharan desert dust aerosols at 532 and 1064 nm and concluded that δ tend to be slightly higher at 532 nm compared to the longer wavelength. In contrast, Sugimoto and Lee (2006) concluded the opposite for Asian dust particles. In line with Freudenthaler et al. (2009), Haarig et al. (2022) found that mineral dust δ values are slightly higher at 355 and 532 nm compared to the longer wavelengths of 1565 and 1064 nm, respectively. In turn, Vakkari et al. (2021) reported higher values at 1565 nm than at 355 and 532 nm for a mineral-dust-dominated case while for dust mixed with other aerosol they reported higher depolarization ratio at 1565 nm compared to the shorter wavelengths.'

L110-112: New conversion factors were reported recently in Ansmann et al., AMT 2026, now also at 355, 910 and 1064 nm, but not at 1565 nm. Nevertheless, the value at 532 nm remained unchanged to the one used here.

We have updated the reference as suggested.

About the fresh smoke plume, might saturation or overlap effects affect the results?

The minimum range for the HALO Doppler lidar is 90 m due to impact by the outgoing pulse at shorter range; there is no overlap given the monostatic fiber-optic design of the instrument. In this study, we use data only above 90 m. If saturation would occur, it would appear first in the co-polar signal for near-spherical aerosol. In such case, δ_{1565} would appear artificially elevated for the highest co-polar signals, which here correspond to the highest ATB_{1565} in Figure 3. However, in Figure 3 the δ_{1565} stays rather constant with increasing ATB_{1565}, which indicates saturation did not occur.

L266-268: Please repeat the literature values for fresh smoke here, so that the reader has not search in the indicated papers (De Rosa et al., 2025).

Added according to the reviewer's suggestion.

L306-308: The weighted average is a good way to cope the noisier signals at lower backscatter coefficients. Please provide a little more detail on how you did the weighted mean of the depolarization ratio.

We have added the weighted average equation in the manuscript (Lines 352-353) and down below.

$$\frac{\sum w\,\delta_{1565}}{\sum w} \quad where \quad w = \left(1 - \frac{\frac{\sigma_{\delta_{1565}}}{\delta_{1565}}}{\max\left(\frac{\sigma_{\delta_{1565}}}{\delta_{1565}}\right)}\right) \frac{ATB_{1565}}{\max(ATB_{1565})} \tag{1}$$

L360: I would not use the term near-spherical, because it is used to describe highly depolarizing particles with close to spherical shape as discussed in Bi et al., Optics Express, 2018. Better use "almost spherical" or something similar.

Good point! We have updated the text accordingly.

Sect 3.4: I see that the depolarization ratio at 1565 nm is a good indicator for large non-spherical particles. Besides the non-sphericity, I would emphasize the size effect, because at longer wavelengths the sensitivity to the larger particles is stronger. All particles with an enhanced depolarization ratio at 1565 nm listed in Tab. 1 are usually large particles (dust, pollen, volcanic ash). It has been shown for stratospheric smoke particles, that the size matters and that a small particle even if it is non-spherical in shape might show a low depolarization ratio at longer wavelengths.

Thank you for your suggestion. We have updated the text to include the size effect dimension.

L385-386: In general, the measurement of the depolarization ratio improves the aerosol classification. It is not so specific for your new observations. However, I would see the benefit of the HALO depolarization ratio, if it is deployed additionally to a classical single or dual wavelength polarization lidar. Together with my previous comment, it might provide important size information, e.g., for pollen or smoke particles.

Thank you for your comment.

Appendix: To my opinion, the appendix is not necessary. The 1-hour resolution plots do not add significant new information to the already shown 15-min resolution plots. Furthermore, Fig. 10 might be more focused on the plume without the so long observations before and after. I leave the decision to the authors.

Thank you for your comment. Since Figs. 7, 9 and 12 are extracted from the hourly lidar observations we prefer to have them included for transparency.

Technical Corrections

Please keep a unique date format, e.g., 6 June 2024, also in the figures (e.g., Fig. 2, 5, 6 . . .).

Figures updated according to reviewer's comment.

Fig 5: The symbol for the SMPS-OPC measurements is missing in the legend, where just the black line is provided.

The symbol is now added.