Ansmann et al. provide an update to the widely used POLIPHON technique for deriving several aerosol microphysical properties from lidar observations. Due to the simplicity of the POLIPHON framework, it has been widely adopted in the lidar community. In this manuscript, the authors incorporate a larger set of AERONET observations covering a broader range of aerosol conditions and provide updated optical-to-microphysical conversion parameterizations for multiple aerosol types, including continental haze, biomass-burning smoke, volcanic sulfate, mineral dust, and marine aerosols. The updated parameterizations include wavelengths commonly used by ground-based ceilometers, thereby enabling their direct application for deriving aerosol microphysical properties. The study also includes the ATLID operating wavelength (355 nm), and the aerosol types considered in POLIPHON are consistent with those used in the ATLID aerosol model. This alignment should facilitate the application of the POLIPHON approach to spaceborne lidar observations and help bridge the transition from CALIPSO to EarthCARE products.

I have a few minor comments that are mostly aimed at highlighting some missing information and discussion that may further improve the clarity of this already well-written manuscript. I recommend publication in Atmospheric Measurement and Techniques after the authors address these comments.

Minor comments:

Table 2: It would be helpful to indicate the expected uncertainties associated with each of the particle microphysical properties, similar to what was provided in previous studies by the authors (e.g., Table 1 in Ansmann et al., 2019).
Ansmann, A., Mamouri, R.-E., Hofer, J., Baars, H., Althausen, D., and Abdullaev, S. F.: Dust mass, cloud condensation nuclei, and ice-nucleating particle profiling with polarization lidar: updated POLIPHON conversion factors from global AERONET analysis, Atmos. Meas. Tech., 12, 4849–4865, https://doi.org/10.5194/amt-12-4849-2019, 2019.

Line 121: It would be worthwhile to state that conditions with RH>75% are particularly relevant for aerosol observations in the vicinity of clouds, where retrieving aerosol microphysical properties accurately is key to studying aerosol-cloud interactions.

Line 140: Choudhury et al. (2026) recently reported a similar inefficiency of dust particles (with radii larger than 100 nm) to act as CCN, based on their observed negligible impacts on liquid cloud droplet concentrations. I suggest the authors provide a short discussion on whether dust n_{100} can still be used as a proxy for dust CCN concentrations. The parameter n_{60} may instead be more appropriate, as the authors later suggest that these particles may be contaminated or mixed/coated with soluble continental aerosols. It should also be noted that such mixtures represent internal mixing states, whereas the aerosol backscatter separation technique of Tesche et al. (2009) and Mamouri and Ansmann (2014) assumes externally mixed aerosols. This inconsistency may introduce additional uncertainties in the separated aerosol properties, which may propagate to the converted microphysical properties.
Tesche, M., Ansmann, A., Müller, D., Althausen, D., Engelmann, R., Freudenthaler, V., and Groß, S.: Vertically resolved separation of dust and smoke over Cape Verde using multiwavelength

Raman and polarization lidars during Saharan Mineral Dust Experiment 2008, Journal of Geophysical Research: Atmospheres, 114, D13 202, https://doi.org/10.1029/2009JD011862, 2009.

Mamouri, R.-E. and Ansmann, A.: Potential of polarization lidar to provide profiles of CCN- and INP-relevant aerosol parameters, Atmospheric Chemistry and Physics, 16, 5905–5931, https://doi.org/10.5194/acp-16-5905-2016, 2016.

Choudhury, G., Goren, T., & Tesche, M. (2026). Satellite observations show negligible impact of mineral dust on cloud droplet number. Geophysical Research Letters, 53, e2025GL120234. https://doi.org/10.1029/2025GL120234

Section 3.3: Reference to AERONET v3 is missing in the manuscript:

Sinyuk, A., Holben, B. N., Eck, T. F., Giles, D. M., Slutsker, I., Korkin, S., Schafer, J. S., Smirnov, A., Sorokin, M., and Lyapustin, A.: The AERONET Version 3 aerosol retrieval algorithm, associated uncertainties and comparisons to Version 2, Atmos. Meas. Tech., 13, 3375–3411, https://doi.org/10.5194/amt-13-3375-2020, 2020.

Lines 261–274: This section may be confusing to readers. The rationale for treating the wavelengths 355 nm and 1064 nm separately is not clearly explained. In particular, it would help to state at the beginning of the paragraph that the absorbing properties of dust and smoke in the UV cannot be accurately reproduced by simply extrapolating AOT from other larger wavelengths. Presenting this point upfront would clarify why special attention is required for the 355 nm channel. In addition, the statement in line 264 about downloading additional AOT data appears unnecessary and could be removed to improve clarity.

Line 275: It is unclear what is meant by "closest to the observations". Please clarify which observations are being referred to here.

Line 371: It is also worth noting that spaceborne lidar applications rely on aerosol observations in the lateral vicinity of clouds to study aerosol–cloud interactions. However, enhanced hygroscopic growth at high relative humidity can increase aerosol scattering by up to ~80% near these cloud boundaries (Twohy et al., 2009). Therefore, studies considering POLIPHON application to spaceborne lidar should consider excluding profiles in direct contact with a cloudy column (approximately ~5 km for a CALIOP Level-2 profile).

Twohy, C. H., J. A. Coakley Jr., and W. R. Tahnk (2009), Effect of changes in relative humidity on aerosol scattering near clouds, *J. Geophys. Res.*, 114, D05205, doi:10.1029/2008JD010991.

I presume that the range reported for the mean values in Table 12 corresponds to one standard deviation. I suggest including similar ranges in Tables 8–11 for other aerosol types. This would also allow the uncertainty range to be propagated to the overall mean of the conversion factors reported in Table 13. Also adding similar standard deviations to other tables (Like Table 14) would improve clarity.

<u>Typos and language edits</u>:

Line 15: replace "observations and that permit" with "observations that permit"

Line 17: replace "monitor aerosol" with "continuously monitor" and delete "and this continuously" part at the end.

Line 52: replace "considering" with "representing"

Line53: replace "caused by" with "because of"

Line 141: There is an additional space before the period. Also, remove the word "side" after "On the other hand…"

Line 147: Check the citation format

Line 187: Correct "and and"

Line 192: remove "study"

Line 370: Correct "microphysiccal"

Line 415: Please rephrase the sentence *"The highest R^2 values are given in the regression analysis to obtain $c_{s,i}$ and $c_{v,i}$"*. For example, change it to *"The highest R^2 values are usually obtained for $c_{s,i}$ and $c_{v,i}$."*

Line 540: Remove repeated words "at lower extinction"