Response to RC1

General Comments:

This work tends to provide a regionally adaptable framework for converting observations of space-borne lidars into cloud-relevant aerosol properties, such as CCN and INP. The use of conversion factors, to calculate the bulk particle properties form a single extinction coefficient, when the aerosol type is known, is a promising direction. Authors consider dust-related conversion factors at numerous AERONET sites, which cover major dust transport pathways. They demonstrate that dust-related conversion factors decrease with distance from source regions. The study also compares CCNC from POLIPHON and OMCAM revealing discrepancies between these approaches. This study presents an important contribution to global characterization of CCNs and INPs from space. The manuscript is well written and is suitable for publishing in AMT. I have just some technical comments.

Response: We appreciate the reviewer's thoughtful review and constructive comments. All the comments have been addressed in the revised manuscript, and the responses to each comment are given below.

Specific comments:

Comments: Ln 58. "or a 1020-nm particle linear depolarization ratio >53%". Why it is so high?

Response: Thank you very much for pointing out this mistake. We have modified the related text to '**a column-integrated dust ratio >53% (based on the 1020-nm particle linear depolarization ratio)**'. (please see L58)

Comments: Table 1. LR is not introduced.

Response: We have added the introduction as below '**dust lidar ratio (LR)**'. (please see L88)

Comments: Ln 123 "We calculate the column-integrated dust ratio…" Would be good to explain meaning of dust ratio.

Response: We have added the following sentence **'Within the atmospheric column, $\boldsymbol{R_{\mathrm{d,1020nm}}}$ reflects the contribution of dust to the total particle backscatter coefficient of an external aerosol mixture (Tesche et al., 2009).'** (please see L128-130)

Comments: Eq.3. Subscript 1020 is written not everywhere. Should be harmonized.

Response: We have rechecked Eq. (3) and confirm that its current form is correct. $\delta^{\mathrm{p}}_{1020\mathrm{nm}}$ is the linear particle depolarization ratio derived from sun photometer measurements. The dust $\delta^{\mathrm{p}}_{\mathrm{d}}$ and non-dust $\delta^{\mathrm{p}}_{\mathrm{nd}}$ PLDR values are both set to be constants; since they are not obtained from actual measurements at 1020 nm, we prefer not to include '1020nm' in their subscripts, and we appreciate the reviewer's understanding.

Comments: Ln 125 "PLDR values are set to 0.30 and 0.02, respectively" In the beginning authors mentioned depolarization above 50%, for this calculation they use 30%. Should be explained.

Response: In introduction section, we intend to mean that 53% is a criterion of column-integrated dust ratio for identifying the dust-presence/dominated data point, instead of a linear particle depolarization ratio value. We have modified the related statement in introduction (please see L58). Therefore, here the set of dust and non-dust PLDR is reasonable. Thank you for pointing this out.

Comments: Ln 131. What is Jd?

Response: We have added the following description **'where J_d is the number of identified dust-containing data points'.** (please see L139-140)

Comments: Table 2. Is it possible to estimate uncertainties of presented parameters?
Response: We have added the uncertainties into Table 2.

References:

Ansmann, A., Mamouri, R.-E., Bühl, J., Seifert, P., Engelmann, R., Hofer, J., Nisantzi, A., Atkinson, J. D., Kanji, Z. A., Sierau, B., Vrekoussis, M., and Sciare, J.: Ice-nucleating particle versus ice crystal number concentration in altocumulus and cirrus layers embedded in Saharan dust: a closure study, Atmos. Chem. Phys., 19, 15087–15115, https://doi.org/10.5194/acp-19-15087-2019, 2019.