The paper “Extended POLIPHON dust conversion factor dataset for lidar-derived cloud condensation nuclei and ice-nucleating particle concentration profiles” presents and discusses the dust-related CCN- and INP- conversion factors as extracted using AERONET observations at stations established and operated around the globe. These different conversion parameters are of critical importance for the POLIPHON methodology to be applied in order to assess dust climate impact, at least with respect to clouds and ACI. The study falls within the scope of AMT. The authors have done a thorough job, the manuscript is well-written / structured, the presentation clear, the language fluent and the quality of the figures high. Furthermore, the authors give credit to related work and the results support the conclusions. However, in order to help improving the manuscript, I would kindly suggest the authors to take into account the following comments and recommendations.

1. One of the central component of the analysis is AERONET columnar particle linear depolarization ratio at 1020 nm (δ_{1020nm}), according to my understanding, provided according to the model of randomly oriented spheroids. Thus, I would suggest to discuss on the impact of this assumption. Please provide – maybe as a supplement if do not want to include in the manuscript – a sensitivity study on how the CCN and INP conversion factors change with different AERONET δ_{1020nm} thresholds considered. For instance here 80% is used. Which would be the change in the case of 70% or 90%, or 95% is used?
2. Since a significant number of PollyXT lidars operate AERONET stations, my suggestion would be include and discuss intercomparison and evaluation of the AERONET-based depolarization ratio against the Polly lidar depolarization ratios, even if it is a different wavelength, under events of dust, polluted dust, dusty marine, and non-dust, in order to strengthen the argument of the suitability of the AERONET-based depolarization ratio to extract CCNC and INPC conversion factors. This comparison will greatly support the argument on the value of 3D CCN and INP dust-related studies globally. Similar studies in the framework of the POLPHON family have been performed, however, the present study claims a global dataset of conversion factors, thus a global implementation of Polly observations can be used to support the value of the dataset to address the climatic effect of dust at a global scale.
3. The authors should go into more details on the variability in dust microphysical properties of dust around the globe, for the main objective is to apply the conversion factors eventually in lidar observations through POLIPHON, possible at regions and conditions of dust transport significantly different than the observed at the specific stations of the present study. The authors should discuss the change of the extracted and proposed CCNC and INP conversion factors as a function of aeolian transport and distance, for aging and mixing with non-dust aerosol subtypes alters the properties of dust, thus affects the proposed conversion factors. For instance, though dust is hydrophobic, polluted dust following long-distance transport in the atmosphere may not be, may be hydrophilic, acting better as CCN than INP. Moreover, the authors discuss deposition of larger dust particles during atmospheric transport. However, depolarization ratio is a function of dust PSD. Applying uniform d_{dust} in decoupling dust and then discussing the removal of coarse dust particles during transport raises thoughts on the impact of the decoupling d_{dust} considered in the methodology and on the impact of CCN and INP factors. More important, the assumption of external aerosol

mixtures is crucial in POLIPHON. Discussing changes in microphysical properties possible related to mixing of different aerosol subtypes is crucial however also raises thoughts. Thus, please also include a discussion on the impact on the external mixing assumption of possible mixing of different aerosol subtypes and what is expected in terms of microphysical properties, possible through AERONET observations, since this is a cornerstone also of the study. How do CCN and INP factors affected? Please discuss.

4. Please discuss the impact of the selected dust LR on the extracted CCN and INP conversion factors. For instance, several studies have demonstrated that over the Atlantic Ocean higher than the CALIPSO applied -applied also in the present study- universal 44 sr dust LR are observed. Which would be the impact of a LR higher, i.e. 45 sr on the conversion factors? This is the case of all deserts around the globe. The dataset applying a universal dust LR of 44 sr makes it suitable for universal studies however, when trying to address a scientific question at a regional scale or running an RTM at a specific set of coordinates the CCN and INP conversion factors that have been established, possible with not proper dust LR, will lead to not suitable conversion factors. Please discuss in the manuscript.
5. The outputs -in order to facilitate studies of CALIPSO- should provide dust related CCN and INP conversion factors over regions not covered by AERONET stations, for instance interconnecting the dust plumes over the oceans with the dust sources. The authors mention "… when applying this conversion factor dataset, we recommend selecting values from the nearest available site". In order to facilitate implementation of the proposed conversion factors to satellite observations at least a geographical dependent clustering over the globe plus with information of the variability has to be provided, accounting the boundary areas for discontinuities. The nearest available site may be not the proper selection or several sites in the proximity to be characterized by very different values.
6. At different parts in the manuscript the authors mention "Only data points with aerosol extinctions exceeding 20 Mm-1 are considered …", "Note that only data points with aerosol extinctions between 20 Mm-1 and 600 Mm-1 are considered …", "… only results with the regression coefficient χ ranging from 0.5 to 1.2 are included …" without providing a robust -or any- explanation on the selected criteria. Please discuss in the manuscript including references on the selection of the boundaries, and how these selections impact the outcomes. For instance, the lower boundary of dust extinction of 20 Mm-1 may not be insignificant in terms of DOD when integrated in a profile, depending on vertical extend of layers. Though this reference here is columnar, still the reason why not applying "larger than zero values" is no discussed or justified properly. Moreover, the 600 Mm-1 significantly impacts the outcomes over deserts where extreme events may be frequently a norm. Please provide a table with all the assumptions and thresholds considered per implementation step of POLIPHON, or an additional column in Table 1.
7. How does the high/low number of cases affect the uncertainties, variability, and confidence of the conversion factors? Please discuss providing additional input where necessary and a figure showing the number of cases per station.
8. The colorbars / colormaps of figures 4 and 6 should be modified. Please include more colors, since they are not clear for possible readers with related deficiencies (such as myself).