The paper “POLIPHON conversion factors for retrieving dust-related cloud condensation nuclei and ice-nucleating particle concentration profiles at oceanic sites” presents and discusses the dust-related conversion factors as extracted over remote oceanic/coast sites using the AERONET database around the globe. These different conversion parameters are of critical importance for the POLIPHON methodology in order to compute dust-related CCNC and INPC globally. 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 minor comments.

Comments:

1. Central component of the analysis provided is the AERONET-based depolarization ratio, which is established according to the model of randomly oriented spheroids. Thus, I would suggest to the authors to dive into significantly more discussion and details on the major building component of their approach, including methodology, approach, assumptions, and accuracy.
2. Since a significant number of PollyXT lidars operate at same time AERONET stations, my suggestion would be the extended intercomparison and evaluation of the AERONET-based depolarization ratio against the Polly lidar depolarization ratio, under events of dust, polluted dust, 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 over land should be a first stepping stone before attempting over ocean, where lidar systems are less frequently operated, and eventually before the claim of supporting 3D CCNC and INPC dust-related studies globally.
3. The authors should go into more details on the dependencies between the AERONET-based depolarization ratio to extract CCNC and INPC conversion factors around the globe and the discrepancies 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. Moreover, the authors should discuss, possible through study cases, the change of the extracted and proposed CCNC and INPC conversion factors as a function of aeolian transport and distance, for aging and mixing with non-dust aerosol subtypes, even under the hypothesis of external mixing, alters the columnar observations of AERONET, thus affects the total conversion factors.
4. The aforementioned approach should be as robust a possible, for once the conversion factors are extracted and established for the dust CCNC and INPC over a region, the product output should consist a fingerprint of the dust related sources affecting the region as well, interconnecting the dust plumes over the oceanic sites with the dust sources. Towards this, I would suggest the authors to perform a cluster analysis of the dust sources affecting each oceanic site (i.e., backtrajectories).

5. Please discuss the effect on the extracted AERONET-based depolarization ratios and accordingly on the CCNC and INPC conversion factors of different dust regions – with different dust properties (i.e. LR), affecting the same marine site.
6. Table 2 provides the available number of data points for total, dust-dominated mixture, and pure dust, in AERONET inversion products. In specific cases the dataset is characterized by a very low number of cases. The authors should discuss on the fail-safes considered in order to guarantee the robustness of the conversion factors extracted, even in the low number of cases AERONET stations. Moreover, please provide at the table for each of the site (Table 2), with the basis AERONET products, for the Total Obs., DDM Obs., and PD Obs. (i.e., AOD+AOD_SD, AE+AE_SD, …). How does the low number of cases affect the uncertainties and confidence of the conversion factors? Please discuss providing additional input where necessary.
7. In table 1 the authors provide the uncertainties of the approach. The uncertainties have been established on the basis of long-term ground-based observations (i.e., EARLINET, PollyNET). Since the objective of the study, as mentioned in the very beginning of the manuscript, is to "to characterize the 3-D distribution of dust-related Cloud Condensation Nuclei Concentration (CCNC) and Ice Nucleating Particle Concentration (INPC) globally", which can be achieved only based on satellite-lidar systems (i.e., CALIOP, CATS, ATLID), where the uncertainties of backscatter and particulate depolarization ratio are of the same order of magnitude as the backscatter and particulate depolarization ratio. In this case, as the higher uncertainties are used as input in the error propagation, the final uncertainties will be significantly higher in satellite-based lidar products than when ground based products are extracted. Please discuss.