

Earth Syst. Sci. Data Discuss., referee comment RC1
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Comment on **essd-2022-108**

Anonymous Referee #1

Referee comment on "Climatology of aerosol component concentrations derived from multi-angular polarimetric POLDER-3 observations using GRASP algorithm" by Lei Li et al., Earth Syst. Sci. Data Discuss., <https://doi.org/10.5194/essd-2022-108-RC1>, 2022

This study presents the climatology of aerosol mass burden for different components based on a newly developed algorithm GRASP/Component with the input of POLDER-3 multi-channel radiance observations. Global observations of aerosol component concentration are crucial for both the estimation of aerosol effective radiative forcing from satellite observations and also the evaluation of the performance of global aerosol models, but retrieving those information from satellite has been challenging. Most of previous studies just used the column aerosol optical properties (e.g., AOD/AODf/AI) to estimate aerosol forcings, it seems somewhat rough but is the only feasible option. The dataset presented here is thus very valuable and useful for our scientific community. This manuscript is well organized, the analysis methods are technically sound. I personally think this manuscript is suitable for publication after a minor revision.

Detail comments:

Figures showing annual mean concentrations of different aerosol components (2005 - 2013) are quite interesting, but not much mentioned in the main text. Many recent studies revealed the aerosol effective forcing changed during last two decades due to the change in anthropogenic emissions (<https://doi.org/10.5194/acp-2022-295>; <https://doi.org/10.5194/essd-12-1649-2020>). I feel that it could be quite interesting to plot the long-term trends of different aerosol components over main industrial regions (West Europe, East U.S., China and India) and discuss the potential implication or linkage to the observed radiative forcing trend.

Line 281: How can the authors conclude 'the GRASP/Component provided the overall most consistent both total and detailed aerosol properties' based on the findings by Zhang et al. (2021)? I don't understand the causal link. Could the authors develop a bit on this?

Figure 2: I guess STD here is calculated from daily data? Anyway, it is better to specify how the authors do the calculation.

Also, in my opinion, the manuscript would benefit from editing help from someone with full professional proficiency in English.

Minor correctons:

Lines 24: an intermediate retrievals ->intermediate retrievals

Line 30: 'concentration' □'concentrations'

Line 32: 'aerosol' □'aerosols'

Line 45: the full name of IPCC is needed when first mentioned.

Line 58: 'the importance of having sufficient spectral resolution of measurements to capture the differences' □ 'the importance of sufficient spectral resolution of measurements on capturing the differences'

Line 85: I feel that 'and sometimes the same' is not necessary here.

Lines 101: 'has' □ have

Line 106: 'the impact of satellite polarimetry on aerosol monitoring remains fairly'. I do not quite understand this sentence. Can the authors rephrase it?

Lines 122-123: the full names of MAP and SRON are missing.

Line 147: 'This is significant'->'This is a significant'

Line 160: '. This study' □ ', this study'

Line 183: 'has' □ 'have'

Line 223: '0.1° and 1°' did the authors mean 0.1° and 0.1°?

Line 225: It is better to clarify how the authors transform from original resolution to MERRA-2 resolution, by interpolation or aggregation?

Line 234: 'contribution' □ contributions

Line 239: 'factions' □ fraction

Line 241: Can authors explain 'fractions of 6 components' a bit more? Is it the mass fraction or extinction fraction?

Line 253: 'seem' □seems

Line 277: 'and considering the apparent of aerosol composition climatological patterns. ' this sentence is difficult to read with grammar error (apparent of). Can the authors rephrase it?

Line 310: 'columnar' □colume

Line 619: 'Moreover, possible the hygroscopicity of aged dust'. Can the authors rephrase this sentence to a more readable format?