

Interactive comment on “Variability of depolarization of aerosol particles in Beijing mega city: implication in interaction between anthropogenic pollutants and mineral dust particles” by Yu Tian et al.

Anonymous Referee #2

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The authors present a study of aerosol particles in Beijing, China, with a polarization optical particle counter (POPC). They present 8 months of statistics and 3 case studies of polluted conditions, dust conditions and a dust-pollution mixture. Especially the results presented in Fig. 7 are of interest, because they give insight in the mixing process of dust and pollution and help in the discussion about external and internal mixture.

While reading the manuscript, I was missing the main new points. In the revision process, I would strongly recommend to strengthen the impact of the study: the separation

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of dust and pollution with a POPC and the discussion about internal or external mixture. Then, this can be applied to the statistics collected over an East Asian megacity, which lies in a global hot spot of dust and pollution mixtures.

The main point, why I have to reject the paper is that the retrieved depolarization values are questionable. I further checked the publication by Kobayashi et al., AE 2014, and I could not find any information on the calibration process of the depolarization ratio measured with the POPC. Especially the depolarization ratio can be influenced by multiple factors. I am sure, that the authors developed a calibration process to check the trustworthiness of the measured data, but it is missing in the publication. Also there are no comparisons of the retrieved depolarization ratios at 120° scattering angle to existing measurements or simulations of spherical or non-spherical particles. The uncertainties of the depolarization ratio values are not given. These points are essential to present trustworthy results. And as the depolarization ratio is one of the main quantities measured in this study, I have to insist on a proper calibration. Therefore, I recommend resubmitting the paper after clarifying the uncertainties of the depolarization ratio.

Further comments for improving the manuscript:

- Add an outline of the paper at the end of the introduction
- Mention, which size range is covered with your optical particle counter.
- The term “fine mode particles” normally refers to particles with a diameter smaller than $1 \mu\text{m}$. PM1 data would be helpful to assess the fine mode particles.
- State clearer the difference between the depolarization ratio used in lidar studies (s-polarized to p-polarized ratio at 180° backscatter) and the depolarization ratio used in the POPC study (s-polarized to s+p polarized ratio at 120° backscatter). To add value to the lidar studies by using single particle analyses, it would be better to use the same depolarization ratio or at least to present a method to convert the POPC depolarization ratio to a lidar retrieved depolarization ratio. But I dare, that this would

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be rather complicated for non-spherical particles.

- Add the distance and the direction (north, east, . . .) to the description of the two additional measurements sites (Olympic Sport Centre state control site and meteorological station) and not just the coordinates. It makes it easier for the reader.

Interactive comment on Atmos. Chem. Phys. Discuss., <https://doi.org/10.5194/acp-2018-511>, 2018.