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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Optical properties of Central Asian aerosol relevant for spaceborne lidar applications and aerosol typing at 355 and 532 nm" *by* Julian Hofer et al.

Anonymous Referee #2

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The manuscript titled "Optical properties of Central Asian aerosol relevant for spaceborne lidar applications and aerosol typing at 355 and 532 nm" by Hofer et al., present a dataset of aerosol properties derived by an advanced lidar system, that the authors claim were never available in this geographical location (Dushanbe, Tajikistan, Central Asia). The dataset show a large range of optical properties reflecting the complex aerosol mixture of background aerosol (mainly soil dust and salt dust from over 400 desiccating lakes in Central Asia and the Aralkum desert), long-range transport of mineral dust from the deserts in Middle East and from the Sahara, regional desert dust, local and regional anthropogenic haze and fire smoke. The authors focus the study on those properties that are used in aerosol-typing efforts with present and future space-

borne lidars. The manuscript is well-written and it can be published in ACP. Although there are several issues and technical comments that can improve it.

Firstly, the manuscript is the third about the campaign, as the authors mention in the conclusions section, and some analysis is based in the two previous articles. Since this isn't clearly established by including in the title "part I, II and III", to inform the reader about previous reads, the manuscript should be self-contained. For instance, the authors explain the variability of the aerosol properties by complex aerosol mixtures (pag. 5, lines 12-13). Further details must be included about the procedure to do so, despite the full explanation may be provided in other article. In the same line, the most relevant results regarding aerosol typing are based on the "dust fraction", that the authors don't describe, just mention (pag. 8, line 30-31) the reference where its determination is provided. A brief description should be included with the same aim to make the manuscript self-contained.

Secondly, the oddly low lidar ratios found during background conditions are attributed to salt dust emissions from desiccating lakes (pag. 10, lines 18-20) without any evidence. Such conclusion is not properly supported by experimental data and a better data analysis, identifying temporal situations when the low lidar ratios are observed, supported with additional information, as in-situ measurements or backtrajectory analysis, must be studied. As it stands now, it seems just a speculation.

Finally, some technical issues: The polly system detects cross-polarized and total backscatter signals (pag. 3, lines 21-25) instead of cross- and co-polarized components. Why is the total backscatter signal instead of the co-polarized signal component detected?. Although the details might be presented in the mentioned references, a brief explanation would be useful.

The number of aerosol profiles available (pag. 4, line 23) isn't clear. There are 487 days with data and 276 of those with data at night. But this 328 are nighttime data, some from the same night?, or daytime profiles are also included, in that case, why

they don't add up to 487?

In page 2, line 26, a database is mentioned but it is not clear if it is a project of the authors or they refer to a general database being collected worldwide by the scientific community. Please be more specific, including relevant references.

Figure 8, explained in pag. 8, lines 29-35, shows another relevant feature, the decrease in spread in the 532 nm lidar ratio when depolarization values increase from <0.1 to 0.2. The figure shows values between 20-30 sr at about 0.2, that later increase to 30-40 sr as depolarization increases to 0.3. It doesn't occur to the LR@355nm. What explanation can the authors provide to that feature?

Figure 1 X-axis labels are hard to read, it would be clearer to separate each graphs by a space that allows the last x-axis label of each graph to be shown.

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