

# ***Interactive comment on “Extreme levels of Canadian wildfire smoke in the stratosphere over central Europe – Part 2: Lidar study of depolarization and lidar ratios at 355, 532, and 1064 nm and of microphysical properties” by Moritz Haarig et al.***

## **Anonymous Referee #1**

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The authors present in their paper very interesting lidar observations during an exceptional smoke event captured above Europe during August 2017. They present measurements of the extinction coefficient, lidar ratio and particle depolarization ratio at three wavelengths, providing thus a unique dataset for characterizing the optical and microphysical properties of aged smoke. The highlight of the paper is the different depolarization ratio observed for the same smoke event in the troposphere and the stratosphere. These observation add new information to the database of optical and

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microphysical properties of smoke particles which is extremely valuable for aerosol typing algorithms. The paper is suitable for publication in ACP and should be accepted after considering and clarifying few issues mentioned below:

#### General comment:

Although the paper is generally well written its structure leads to many repetitions. For instance there is a large paragraph in the introduction describing the three lidar systems and then a similar in length description is found in section 2.1. In the introduction on page 3 the authors comment in detail on the importance of their measurements before showing them. I guess that this part belongs to the discussion or the conclusions and possible outlook.

Similarly in section 3.2.1 the authors first summarize and interpret their findings before presenting them in more detail in 3.2 and 3.3. The authors should reconsider the structure of section 3.

#### Specific comments:

Page 5, line 6: What do the authors consider as reasonably low uncertainty? What is the vertical resolution of the 1064nm extinction profiles when considering a regression window of 2500m?

Page 5, line 19: The authors use the method developed by Vesolovskii et al but provide reference for the theoretical background to Ansmann and Mueller 2005. Are there differences between them?

Page 6, lines 26-29: This description is confusing. What is “trustworthy estimate”? A figure would help to present the problem and its solution. As written it looks like an arbitrary adjustment to the extinction profile. How this adjustment would affect the estimated lidar ratio? Please comment.

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