

Response to Referees – General modifications

We would like to thank all reviewers for carefully reading the manuscript and providing useful suggestions to improve the paper. Following the comments from 3 reviewers, we made the following modifications (in red) in general for the manuscript:

1. Presentation of the method and the structure of manuscript

We have simplified the presentation of method, and separated the presentation of the methodology from the presentation of the results. The structure of revised manuscript will be:

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- 1 Introduction
- 2 Site and instruments
- 3 Methodology – a synthetic simulator
 - 3.1 Direct model – generation of synthetic optical profiles
 - 3.2 Inverse model – retrieval of depolarization ratio
 - 3.3 Uncertainty study
- 4 Results
 - 4.1 Pollen grain and intense pollination period
 - 4.2 Optical properties of pollen layer
 - 4.2.1 Pollen layer
 - 4.2.2 Lidar-derived optical properties
 - 4.3 Estimation of optical properties for pure pollen from lidar observations
 - 4.3.1 Pollen optical properties at 532 nm
 - 4.3.2 Pollen optical properties at 1064 nm and 355 nm
- 5 Summary and conclusions

”

The number of figures and tables are changed correspondingly.

2. Manuscript title

We have changed the title, because the title was a bit misleading as the reader might expect observations from an aircraft. We have also removed “in Finland” as the presented method can also be applied to other sites. The new title is:

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Optical characterization of pure pollen types using a multi-wavelength Raman polarization lidar

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3. Equations, abbreviation and data format

We have changed PBD to χ_{pollen} for the whole manuscript.

We have modified the equations in section 3 (Methodology – a synthetic simulator) to make the presentation clearer.

We also added 2 sections of equation calculations in the supplement for:

- 1 Particle linear depolarization ratio calculation (Eq.3 in the manuscript)
- 2 Relationship of $\hat{A}_{\text{particle}}$ and χ_{pollen} (Eq.5 in the manuscript)

We changed the format of depolarization ratio value from xx% to 0.xx for the whole manuscript.