

Interactive comment on “Esrangle lidar’s new pure rotational-Raman channel for measurement of temperature and aerosol extinction in the troposphere and lower stratosphere” by P. Achtert et al.

Anonymous Referee #1

Received and published: 19 November 2012

This manuscript describes the implementation and performance of the rotational Raman channels of the lidar system at Esrange, Sweden, in the Arctic. The technical information which is given is concise. Measurement examples illustrate important applications. The manuscript is well written. My recommendation is to accept the manuscript for publication after minor modifications, see below.

Specific comments:

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The approach of how the rotational Raman signals are extracted is unique and very interesting: First they are collected with three telescopes then, second, separated depending on their polarization, third, guided by optical fibers to a first bench (“Main Rayleigh Bench”) and separated from the elastic signals, forth, both polarization directions are combined and guided by fibers to a second bench (“Rotational Raman bench”) and, finally, separated in a low-J and high-J rotational Raman channel. I think, the description of this approach should be extended at least a little bit to explain the motivations to the reader. What are the advantages (simultaneous analysis of polarization and rotational Raman channels), why do you use three telescopes (more cost efficient?), what is the optical efficiency of this approach for all channels, ...?

Title: I suggest changing the title to "Pure rotational-Raman channels of the Esrange lidar for temperature and particle extinction measurements in the troposphere and lower stratosphere" or similar – one needs two rotational Raman channels and the authors discuss cloud and not aerosol measurements.

Esrangle is the abbreviation for “European Space and Sounding Rocket Range”. This should be explained somewhere.

Page 6456, line 7: ...resolution is...

Page 6456, line 22: ...capable of measuring...

Page 6457, line 6: To my best knowledge, nobody has achieved reliable temperature measurements with the DIAL technique yet – even in the boundary layer. Or can you give references? I suggest rewriting this paragraph and putting focus on mature techniques. The rotational Raman technique is the technique of choice for lidar temperature measurements from the ground up to about 30 km because in these heights the extinction of aerosol and cloud is substantial compared with molecular extinction.

Page 6459, line 18: ...diameters...

Page 6459, line 19: The backscattered light collected by each telescope...

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Page 6460, line 3: ...used tentatively for receiving rotational Raman signals... I think, the correct reference is Behrendt et al. 2000b, see below.

Page 6460, line 4: Here you could explain why it is beneficial to combine both polarizations for the rotational Raman channels, namely, because the rotational Raman signals show a depolarization of 75 %.

Page 6461, line 16: Better references for this statement are Behrendt 2000 and/or Behrendt 2005.

Page 6461, line 23: Better references for this statement are Behrendt 2000 and Behrendt et al. 2000a.

Page 6465, line 11: To avoid misunderstanding with the term "integration technique", I suggest writing "...collected over..."

Page 6474, figure 2: What is your laser wavelength?

Page 6477, figure 5a: Please explain where these data are coming from (measurements of Esrange lidar following the PSC categorization of (...) Is there any "ice" present in this case? If not, omit "ice" in the legend.

Figures 4, 5, and 6: Delete the texts above the plots; add this information to the figure caption where appropriate.

References:

Behrendt, A.: "Fernmessung atmosphärischer Temperaturprofile in Wolken mit Rotations-Raman-Lidar (Remote Sensing of Atmospheric Temperature Profiles in Clouds by Use of Rotational Raman Lidar)", Doktorarbeit, Universität Hamburg, 2000. <http://ediss.sub.uni-hamburg.de/volltexte/2000/255/>

Behrendt, A.; J. Reichardt, A. Dörnbrack, and C. Weitkamp, 2000a: Leewave PSCs in Northern Scandinavia between 22 and 26 January, 1998: Lidar Measurements of Temperature and Optical Particle Properties above Esrange and Mesoscale Model

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Analyses. In: G. Amanatidis, J. Pyle (Eds.), Stratospheric ozone 1999, Air Pollution Research Report 73, European Commission, ISBN 92-827-5672-6, p.149 - 152.

Behrendt, A.; J. Reichardt, J. Siebert, K.-H. Fricke, and C. Weitkamp, 2000b: Tropospheric and Stratospheric Temperature Measurements by Lidar above Esrange in January and February 1999. In: G. Amanatidis, J. Pyle (Eds.), Stratospheric ozone 1999, Air Pollution Research Report 73, European Commission, ISBN 92-827-5672-6, p.153-156.

Interactive comment on *Atmos. Meas. Tech. Discuss.*, 5, 6455, 2012.

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