

# ***Interactive comment on “Scanning Polarization Lidar LOSA-M3: Opportunity for Research of Crystalline Particle Orientation in the Clouds of Upper Layers” by Grigorii P. Kokhanenko et al.***

## **Anonymous Referee #3**

Received and published: 15 October 2019

The manuscript reports on a new scanning lidar instrument specifically designed for simultaneous measurements of linear and circular depolarization ratios of cloud particles. Because of this capability its main field of application is probably studies of elastic light-scattering effects associated with particle orientation in atmospheric ice clouds. After a thorough literature review on cloud-particle alignment and relevant observation and analysis techniques, a technical description of the instrument is presented, focusing on the depolarization-ratio measurements with the far-range telescope. The lidar receiver's apparently depolarization-insensitive fiber-coupled near-range subsystem and its Raman detection capability are barely mentioned. Calibration methods are discussed in detail, of which the technique for determining the relative sensitivity of

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the polarization channels is particularly noteworthy. Measurement examples highlight zenith scans of circular depolarization ratio in cirrus clouds. Main results are that, (1) the cross-polarized component is almost independent of lidar tilt angle while, (2) the co-polarized component is found to have an exponential dependence with a distribution width of about  $0.7^{\circ}$ - $2.5^{\circ}$ . The manuscript is well written, the results are interesting and worth publishing. Clarifications are required.

#### Experiment:

1. Lines 114 f.: Please, provide more information about the fiber (polarization-preserving?) and the shutter (coating?).
2. How is background scattering suppressed? There seem to be no filters in the setup, is this correct?
3. Lines 149-150: 150 Steps are required for a  $45^{\circ}$ -turn, which would take 102 ms (according to the information provided) and thus slightly longer than the time period between the 10-Hz laser pulses. Please, comment.
4. Lines 159-160: 'Only one... channel'. Please, provide more details.

#### Measurement examples:

1. Lines 242 ff.: It is not obvious what is meant with 'double lines'.
2. Line 264: Figs. 7-9 present data from April and June, 2018. Then, suddenly, 1 October is mentioned. Please, provide earlier on in the section an overview of the measurements to be discussed.
3. Paragraph, lines 286 ff.: This information must be provided before the measurements are presented, because otherwise the interested reader is waiting for the linear depolarization ratios to be shown.
4. Paragraph, lines 300 ff.: This information definitely belongs to section 2 or 3!

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## References:

1. Differences in citation style!
2. Line 465: Summa et al. have to be moved further down in the reference list.
3. Line 467: Thomas et al. have to be moved further down in the reference list.

Figures (Styles vary considerably. Please, try to make appearance as uniform as possible):

1. Fig. 3: Y-axis title.
2. Fig. 5: Axis titles.
3. Fig. 7: Panels a-c need to be as large as possible. Panel d is probably not necessary.
4. Fig. 8: Panels a-c need to be as large as possible (and same size as in Fig. 7). Panel d is probably not necessary.
5. Fig. 9: Axis titles.
6. Fig. 9, caption (and running text): Please, use always the same date style, for instance, 6 April 2018.
7. Figs. 10-12: It is irritating that the y-axis titles are not attached to the axis.

Phrasing (Some sentences are difficult to understand. Please, consider rewording):

1. Line 100: 'Immediately'
2. Line 104: 'This... time.'
3. Line 182: 'distinguished' -> 'separated'
4. Lines 186-188: 'If... sounding.'
5. Line 269: 'record in Fig. 10b'

6. Line 305: 'thus. . . value.'

Typos:

1. Line 53: 'Neely et al.'
2. Line 55: 'Kaul et'
3. Line 66: 'The authors', full stop missing
4. Line 177: 'Alvarez'
5. Line 198: 'Spinhirne et al.')
6. Line 231: '6 April'
7. Line 233: 'University'
8. Line 244: 'Fig. 8a'
9. Line 305: 'ony' ?
10. Line 329: 'GP' is not on the author list.
11. Line 341: 'Alvarez'
12. Line 367: 'Burton' ?
13. Line 436: 'and Walker'

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