

Interactive comment on “Lidar and radar measurements of the melting layer in the frame of the Convective and Orographically-induced Precipitation Study: observations of dark and bright band phenomena” by P. Di Girolamo et al.

Anonymous Referee #1

Received and published: 16 January 2012

General Comments

The authors present a study of simultaneous lidar, radar, and aircraft in-situ observations of a precipitating stratus cloud which shows dark and bright band features. In contrast to previous studies of the same phenomenon, the experimental data have been extended (three lidar wavelengths, different types of radar at different wavelengths, both radar and lidar depolarization data, Doppler radar data, in-situ aircraft observa-

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tions of the precipitating particle size distribution etc.). The data are interpreted with a simulation of the lidar backscatter coefficient of hydrometeors consisting of an ice core with a water shell.

My recommendation is to accept the manuscript after minor revision.

Specific Comments

The measurements discussed in this study were collected during the COPS field campaign. This is of course worth mentioning in the text. However, the manuscript deals with hydrometeors observations of a stratus cloud. Therefore, it is misleading to focus the reader on “convective and orographically induced precipitation” in the title and at beginning of the abstract.

The readability would benefit from separating the description of what was observed and the interpretation of the observations; presently there are several repetitions which is confusing.

The figures should be more focused. Some figures can be omitted, some should be merged. See below for details.

I suggest adding a table with instrument acronyms and main characteristics (wavelength, resolution, power, pulse repetition frequency etc.).

Please check the numbering of the figures; the numbers are presently not in order in the text.

Page 30951, line 5: Please write “Simultaneously with the lidar observations, radar measurements were performed from the same site”. . . or similar.

Page 30951, line 5: What do you mean with “among others”? I suggest that you delete references to dates in the abstract which are anyway not discussed in the present manuscript.

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Page 30952, line 2: Please change to “snowflakes change into raindrops” or similar.

Page 30952, line 5ff: How about other radar bands, especially C and X band?

Page 30952, line 14: Please change to “partly melted” or similar.

Page 30952, line 20: Please explain what you mean by “reaches its plateau”.

Page 30953, section 2: I think it would be worth noting that there have been four additional COPS supersites with similar instrumentation.

Page 30953, line 14: Here references to other publications using BASIL measurements during COPS could be added.

Page 30954, line 3: Please write “During COPS, BASIL was collocated with...” or similar.

Page 30955: Why do you focus on the case of 23 July 2007? Are there meteorological reasons? Can you tell whether this case is special or common?

Page 30955, line 14: Please write “. . . from clouds above the lidar and radar site”.

Page 30955, line 22ff: Here a reference to the temperature profile (Fig. 7) should be added. Or you show the temperature profile also together with the time-height plots of the lidar and radar data.

Page 30955, line 24: Please quantify “smaller”.

Page 30955, line 26: Please delete “but the lidar dark band presumably continues. . .” This is pure speculation.

Page 30955, last paragraph of section 3.1: I suggest that you delete this paragraph and the related figure 8. The determination of fall velocities from such fall streaks seen in vertical data is prone to errors because of horizontal heterogeneities in the structure of the precipitation. The Doppler radar data provide measurements with much higher accuracy.

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Page 30955, line 28: Please add brackets around the reference.

Page 30959, line 1: Please rewrite “myriad” and omit “actually”.

Page 30959, line 5: Is the simulation for a radius of 1.5 mm or independent of the particle radius? Please clarify.

Page 30959, line 19: Especially the measured profile of the particle backscatter coefficient at 355 nm (green line in the middle panel of Fig. 7) looks not quite similar to Fig. 9 but the particle backscatter coefficient at 1064 nm does. Can you explain this? I strongly recommend that you extend the discussion of the differences seen for the different laser wavelengths. It is a specialty of this study that observations are available at three lidar wavelengths simultaneously (as pointed out correctly, e.g., in the summary).

Page 30960, section 3.3: This section is quite lengthy and the number of figures not in proportion. Please focus on what is relevant for the interpretation of the bright and dark band phenomena. Please introduce all measurements first (both in-situ and remote sensing data) and discuss the interpretation afterwards.

Page 30961, line 1: What was the direction between location of the aircraft and remote sensing observations? It is probably important to use information about the orography below the aircraft for the joint interpretation of the data.

Page 30963, first paragraph; Fig. 18: Because the disdrometer data are 2 h after the lidar observations, their discussion should be omitted here. One cannot expect any support in the interpretation of the bright and dark band phenomena.

Page 30970, Fig. 1: I suggest that you use gray for marking the lidar dark band because this color is not used for the data. Altitudes above 6000 m or so are not relevant because the lidar beam does not go much beyond the cloud bottom anyway; I suggest that you restrict the plot to this height.

Page 30970 ff, Fig. 1 to 6: Please use the same height and time scale (not necessarily range) for all these plots so that they are better comparable. I suggest that you join all

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these data in one figure with different panels.

Page 30976, Fig. 7: The text in this figure is difficult to read. It is sufficient to mention date and time in the figure caption, I think. I suggest that you mark bright and dark bands without labels and omit the distances. The colors used for the lidar backscatter coefficients could follow the wavelengths (red for 1064 nm, green for 532 nm, blue for 355 nm).

Page 30978 & 30980, Fig. 7 & 11: These two figures should be merged.

Page 30982 to 30985, Fig. 13 to 16: Please focus on what is relevant for the topic (see above). Please add in the caption that these are aircraft in-situ data.

Interactive comment on Atmos. Chem. Phys. Discuss., 11, 30949, 2011.

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