

# ***Interactive comment on “Applicability of the VisiSize D30 shadowgraph system for cloud microphysical measurements” by Jakub L. Nowak et al.***

## **Anonymous Referee #2**

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The authors of this study test, characterize and apply a commercial shadowgraph system, which has been originally designed to characterize industrial and agricultural sprays, for measuring cloud microphysical properties, such as droplet size distribution and number concentration in atmospheric clouds. Due to laboratory investigations, among others, the authors improved estimations of droplet number concentration and size distribution as well as verified the sizing accuracy. Then, the system was tested in a real atmospheric cloud. They finally conclude that the shadowgraph system can be applied for cloud microphysical measurements if certain features of the system are considered, such as the droplet size-dependent measuring volume.

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The study is very important for the atmospheric cloud community as it presents an additional instrument option for obtaining cloud microphysical properties such as cloud size distribution and its number concentration. I recommend publication after the following comments have been addressed.

General comments:

Would it be possible to use the shadowgraph system to obtain some 3D information about the position of the cloud droplets?

Could you give any estimate for the largest detectable number concentration? In case of large number concentrations, for example, it might be possible that droplets “hide” one after the other.

Concerning the application of the shadowgraph system in the atmospheric cloud (Section 5): Has there been any other cloud probe which measured the size distribution at the same time as the shadowgraph system? If so, could you present a comparison of the obtained droplet size distributions and its moments, respectively? If not, I would suggest, for a future study, to have a comparison to another cloud probe.

Specific comments:

Page 7, line 145-146: Looking on Fig. 1, I would think that the direction of the droplet flow was vertically aligned.

Fig. 5c: For diameters larger than  $30\mu\text{m}$ ,  $z_{\text{max}}$  deviates significantly from the analytical approximation  $z_{95}$ . Do you have any explanation for that?

Fig. 7 and Fig. 15 and the corresponding text: In Fig. 7 only DSDs applying methods “def” and “ind” are shown, for given reasons. However, later in Fig. 15, DSDs for “def”, “cor” and “ind” are shown. Wouldn’t it make more sense, to show DSDs for methods “def”, “cor” and “ind” in Fig. 7 and explain that there are only small differences between methods “cor” and “ind” and then only show DSDs for “def” and “ind” in Fig. 15?

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Page 14, line 280: This gradual decrease from the center to the sides is obvious for  $x_1$ , but not really for  $x_2$  and  $x_4$ . Could you please comment on that?

Page 14, line 284-291: I think the speculation given here is reasonable. However, could this also be true for  $x_2$  and  $x_4$ ? But here more (smaller) droplets are detected, both in a smaller FOV compared to  $x_1$  which compensates this feature?

Page 15, Line 318: Could you please provide a size range where you would not use  $x_1$ . As later said,  $x_1$  makes sense for larger droplets in the drizzle and rain size range. Please make clearer under which circumstances you would avoid using  $x_1$ , and vice versa.

Fig. 9 and respective text: Does the discrepancy in the first and second z-bin has any consequences on the calculation of the DSD and DNC?

Minor comments:

Page 2, Line 50: I would suggest to write either “shadowgraphy” or “the shadowgraph technique”.

Page 3, line 70: Please add “the” at the beginning of the sentence: “The two main parts [...]”.

Page 6, line 120: Since “z” is a parameter it should be given in italic type font.

Page 7, line 137: Please write “[...] inverting Eqs. (1) and (2)”.

Page 7, line 142: It should read “[...] in the range of 2 -20  $\mu\text{m}$  [...]”.

Page 7, line 143-144: I would suggest to write: “Care was taken to fill [...]”.

Page 8, line 169: Please add “DOF” in the brackets behind “(depth of field)”.

Fig. 14: I would suggest to increase the size of the symbols in the figures here.

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