

## ***Interactive comment on “Measuring Droplet Fall Speed with a High-Speed Camera: Indoor Accuracy and Potential Outdoor Applications” by C.-K. Yu et al.***

**Anonymous Referee #2**

Received and published: 3 February 2016

### General comments

Paper describes most of all results of indoor experiments concerning measurements of droplet fall speed with a High-Speed Camera (HSC) and their accuracy. At the end results obtained for outdoor conditions are also reported and discussed. However presented results for outdoor experiments are limited to 29 drops only collected during 2 storm events. For sure the motivation of study is clear and formulated in following sentence: “The acquisition of accurate rain drop fall speed measurements outdoors in natural rain represents a long-standing and challenging issue in the meteorological community.” Despite the rapid progress in electronics and optoelectronics this is still rather a goal to be met than a reality. I would only add that: “Acquisition of accurate

C1

rain drop fall speed measurements outdoors in natural rain by means of moderate cost and easy to use devices represents a long-standing and challenging issue in the meteorological community.” I have to also admit that in general the manuscript is well constructed and clearly written. However after manuscript reading I have to raise the fundamental question concerning the novelty of presented study. The detailed literature review of droplet fall speed (DFS) is summarized by the following sentence: “However, none of these previous published works has addressed the possible application of the HSC to the investigation of atmospheric DFSs (page 5, line 13)” I have a doubt concerning the accuracy of this particular statement having in mind references used in manuscript and some other scientific communications. First of all, video disdrometers based on single camera (1 DVD) and double cameras (2 DVD) are already in use and commercially available at JOANNEUM RESEARCH Forschungsgesellschaft mbH. It could be only discussed if this advanced and costly equipment is affordable for all meteorological community. Problems reported in manuscript are already solved in this kind equipment or could be considered as minor in contrast to the issues of fast recorded frames processing, reduction of splash and turbulent wind effects on orifice of devices and supporting optimal cameras and light arrangement for in field measurements. Nevertheless fall velocity, front and side view of every single particle could be acquired by the 2 DVD. Having in mind the journal to which manuscript was submitted I would also suggest to refer to following paper: Garrett, T. J., Fallgatter, C., Shkurko, K., and Howlett, D.: Fall speed measurement and high-resolution multi-angle photography of hydrometeors in free fall, *Atmos. Meas. Tech.*, 5, 2625-2633, doi:10.5194/amt-5-2625-2012, 2012. This particular paper is focused on snowflakes measurements but MASC is based on the idea of HSC image processing, it is capable to measure also other types of hydrometeors and finally some studies of device accuracy are presented. Finally note that in both devices: MASC and 2DVD use of multiple cameras, mounted at different angles solves the problem of focal zone discussed on page 16 and presented in fig. 9.

Specific comments

C2

Page 9, lines 17-19. Why the size error is equal to +/- 0.040-0.045 mm? Should it not be a product of multiplying 2 (or 4, ie. 2 pixels for upper and 2 pixels for bottom droplet edges) by 0.028 mm?

Page 10, lines 15-16. Please check, most probably should be: 0.00056-0.01064 mm and 0.002-0.038 m/s

Page 14, lines 8-12. Most probably instead magnitudes of the  $V_e$  - magnitudes of  $V_e$  percentile should be used.

Page 16, lines 14-15 – Why not to compare to 2DVD (as claimed by manufacturer: vertical velocity accuracy better than 4

Page 16, lines 16-18 page 15 lines 6-8. Why only larger drops were studied? Parsivel records droplets of diameter smaller than 1.75 mm up to about 0.2 mm.

Page 16, lines 8-11. Does it mean that threshold values could vary between day and night and over the day due to solar radiation differences? If so, this should be commented as another severe complication of outdoor applications.

Page 18 lines 6-8. This sentence is not clear. Note that several drops namely 9 drops were collected simultaneously on 25 June 2014 at 15:13:03 UTC. The question is how many drops simultaneous could we examine especially if a view frame is 29x29 mm<sup>2</sup>? Could we expect some saturation problems at higher rainfall rates? How much time do we need to process the frames? Is it possible to process them on-line?

Page 18 lines 9-10. Most probably too optimistic having in mind 2 DVD and MASC devices.

Tab. 1. How the rainrate R was estimated? Was it a reading from Parsivel? Please, comment row 9 where you report droplet parameters for rainrate R equal to 0.

Technical corrections

Page 14 line 13 most probably bonds instead bond

C3

Page 15 line 21 most probably allowed instead allow

---

Interactive comment on Atmos. Meas. Tech. Discuss., doi:10.5194/amt-2015-396, 2016.