Hydrol. Earth Syst. Sci. Discuss., 12, C2203–C2207, 2015
www.hydrol-earth-syst-sci-discuss.net/12/C2203/2015/

Hydrology and Earth System Sciences
Open Access
Discussions

Interactive comment on "Climatological characteristics of raindrop size distributions within a topographically complex area" *by* S.-H. Suh et al.

Anonymous Referee #2

Received and published: 23 June 2015

Summary: This manuscript presents a detailed analysis of a 4-year drop size distribution (DSD) dataset as obtained from a POSS disdrometer. This works presents both the general distribution of the parameters of a normalized DSD as well as the different rainfall integral variables. Furthermore, the authors show the impact of wind direction, daytime vs. nightime and summer vs. winter on the characteristics of the DSD.

Overall quality: Scientific research on the topographical variations of the DSD are very interesting. These variations result from different meteorological forcing mechanisms. Understanding these processes is important both from a scientific point of view as well as from a societal perspective (as it may lead to improved precipitation estimates. The

current work presents analyses of a long term (4 year) disdrometer dataset observed in South Korea. The work presented here is very interesting. However, it fails to provide an in depth analysis on the processes leading to these variations in South Korea. Therefore, the manuscripts currently still has a number of concerns that should be addressed before it can be accepted for publication in HESS. Below you'll find a detailed overview of these concerns.

Major concerns: 1) Page 4007, line 23-25 states: "The raindrop size distribution of stratiform rainfall observed at the ground is larger than that of convective rainfall, due to the resistance of ice particles to break-up mechanisms". This statement might be true for maritime precipitation as e.g. observed by Tokay and Short, 1996. However, for continental precipitation it is really dependent on the type of precip around the zero-degree isotherm (snow vs. ice) whether the average diameter is smaller or larger for stratiform precipitation in comparison to convective rainfall. See for an in depth discussion on this issue Hazenberg et al. 2011.

2) Page 4011 line 21: "(vi) The DSD tends to be overestimated when D_m < 0.5 mm." This line is unclear and should be rephrased.

3) Page 4014-4015, lines 23-3 "The value of mu . . . in the negative mu range". These sentences are not very clear and should be rephrased. From what I understand, the authors state that in the current work, the values of mu are generally smaller for convective rainfall, which is in contrast to other previous studies. The authors note that a larger value of mu for convective precipitation is to be expected, because of the fact that due to break-up mechanisms the number of larger drops decreases, while the number of larger drops decreases. I only partially agree with the authors on this. A decrease of the number of larger drop would indicate an increase in the slope parameter of the gamma distribution (which is the combined value -(4+mu)/D_m value). Furthermore, mu generally tends to be heavily influenced by the number of small droplets. For South Korea these apparently observed quite frequent for convective precipitation and result in small values of mu (mu<0). This is in contrast with other maritime studies where the

HESSD
12, C2203–C2207, 2015

number of small droplets decrease due to below cloud evaporation.

4) Page 4015, lines 10-12 “Generally, stratiform . . . of raindrops.” See previous comment 1 above.

5) Page 4015, line 23 “The PDF . . . (Fig. 4d and e)” This is to be expected since LWC is related to the third moment of the DSD while R is related to about the 3.67 moment of the DSD.

6) Page 4016, lines 12 “The method . . . in Busan.” Since the work of Gamache and Houze Jr. (1982) many different type of algorithms have been developed to identify convective precipitation in a radar image. In e.g. the work by Steiner et al. (1995) a step wise approach was taken where all precipitation with Z>42 dBZ is identified as convective, while for lower reflectivity values, horizontal variabilities are taken into account. As such, the statement by the authors is a bit dated and can be removed.

7) Page 4017, lines 3-4 “Based on . . . (Table 2).”: It is not clear to me why a comparison is made to observed DSD in Finland. Such a motivation is also not provided in the Introduction or Section 2. In case the authors wish to provide comparisons to other locations, it would be nice if the authors could add a number of extra sites for which these parameters were estimated.

8) Page 4019 line 8 “A larger . . . in DT.” Please motivate this statement.

9) Page 4019 lines 19-21: “In accordance . . . convective system.” For me this statement is quite counter intuitive, since convective events usually occur during daytime under influence of boundary layer processes influence by solar energy flux. It would be nice if the authors could elaborate on the type of processes that result in convective precipitation at night time.

10) Page 4019, line 28 “In the . . . are similar.” See comment 5) above.

11) Fig. 10: In order to improve comparison between panel a) and b). Please add both histograms into one figure with summer and winter bars next to each other.

HESSD

12, C2203–C2207, 2015

12) Fig. 11. See previous comment 11.

13) Please combine Fig. 12 and 13 into one figure to improve comparison.

14) Please combine Fig. 14 and 15 in a joint 4 panel figure to improve comparison.

15) In section 3.3.2 the authors show differences in the DSD characteristics between summer and winter, and between daytime and night time. These results show that there is both an impact of season and of the period of the day on the DSD. However, the authors do not provide any additional information on the meteorological characteristics that cause these differences. As such, the authors currently only present the results and fail to provide any in depth understanding/hypotheses. I would suggest to add an extra discussion section that addresses this issue.

Minor concerns:

1) Please remove “within a topographically complex area” from the title as this paper does not deal with that. Instead just state “as observed in South Korea.”

2) Page 4010, line 6 should be: “the ratio between the standard deviation (SD) of D_m and D_m.

3) Page 4010, eq. 9: rho_w should be v(D)

4) Fig. 2: Please add an x- and y-axis or some kind of distance scale to the lower panel

5) Fig 4: Legend should be “(h) A_h and (i) K_dp”

6) Table 3: Change “Entire rainfall” with “All rainfall”. Does this table provide rainfall rate (as mentioned in the legend) or do the number show the total number of minutes observed?

7) Fig 5 change “with respect to stratiform rainfall” into “for stratiform rainfall”. Furthermore, what does the dashed line in this figure indicate? For panel b) would be nice if the authors could zoom in on the D_m 1-2 mm range.

HESSD

12, C2203–C2207, 2015

8) Table 4 please rephrase “Type” for “Period”

References:

Hazenberg P., N. Yu, B. Boudevillain, G. Delrieu and R Uijlenhoet, 2011, Scaling of raindrop size distributions and classification of radar reflectivity–rain rate relations in intense Mediterranean precipitation, J. Hydrol., 402, 179-192.

Steiner M., R. A. Houze Jr. and S. E. Yuter, 1995, Climatological characterization of three-dimensional storm structure from operational radar and raingauge data, J. Appl. Meteorol., 34, 1978-2007

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 12, 4005, 2015.