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Hydrology and Earth System Sciences
Discussions

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

Anonymous Referee #1

Received and published: 12 May 2015

This paper reports the results of four years of drop size distribution observations from Busan, Korea. The paper is mostly descriptive and does not report particularly novel scientific findings; however it is generally well written and reports the results clearly. With some significant revisions, the paper may be publishable.

General comments:

A clear shortcoming of the paper is the treatment of the radar parameters, which seem to have been added to the paper as something of an afterthought. There are two glaring omissions: First, as far as I can see, the authors do not mention anywhere in

the paper what frequency is assumed for the radar calculations. While the definition of reflectivity in Eq. (11) is frequency independent, the other radar parameters such as Z_dr and K_dp certainly are not! Second, neither the abstract nor the title mention that the paper reports any radar-related analysis.

The choice of Jarvenpaa as a comparison to Busan also seems a bit arbitrary. Why compare the Busan results to that place in particular? The authors have cited several other papers dealing with DSDs in different regions. As the typical rain intensities and dominant cloud types around the world are highly variable, there will surely be differences between the DSDs as well. As a minimum, I'd suggest adding, if possible, to Table 2 the mean values from the Darwin measurements that the authors have already referenced. With Darwin near the equator, Busan around 35 deg latitude, and Jarvenpaa around 60 deg, these three would already give a decent comparison in terms of latitude coverage.

I found the reported results on the differences between the daytime and nighttime DSDs interesting. A nice way to improve the paper would be to put a bit more effort on this analysis. Specifically, the daytime and nighttime should be separated by the actual sunset and sunrise times (see my specific comments above). The authors speculate that the day-night difference is due to a change in the prevailing winds (continental vs. maritime). This hypothesis could also be tested by separating the observations according the actual measured wind direction. The authors already have this data from the local AWS station so doing this analysis should not be overly difficult.

Specific comments:

Title: Since this is a paper dealing with the climate of a particular region, I think that the region (Busan, Korea) should be mentioned in the title.

Page 4006:

Abstract: not mentioning radar simulations, see above. Line 12: The variable D_m is

not described.

Page 4007:

Lines 18-19: How is the microphysical structure more complicated in the high latitudes? Certainly deep convection, which might be regarded as "more complicated", is more common at lower latitudes. Lines 28-29: This is true when the rain rate is held constant, however, convective rain tends to be more intense. Since rain rate correlates strongly with drop size, on average convective rain tends to have larger drop size.

Page 4008:

Line 8: The comment above is supported by this reference from Bringi et al., where large drop size is clearly one of the criteria for classifying rain as convective. Line 15: Are not sea breezes generally associated with mornings rather than evenings?

Page 4009:

Line 12: is D defined here as the volume-equivalent diameter?

Page 4010:

Eq. (9): The factor 3.6/10ˆ3 is apparently here for a unit conversion, but you don't say which unit R is supposed to have. I would consider it preferable to make the equations independent of the units wherever possible and only give the units where needed (for example, for empirical relations such as Eq. (10)).

Line 4011:

Line 7: What frequency was used? What are the channels? Please expand the explanation of the instrument. Line 13: How were snow events detected? How about hail or graupel? Lines 14-16: The sentence after (ii) is unclear. I don't understand what "DSD spectra was smaller than five consecutive channels" means. Line 16: Criterion (iii) effectively introduces a minimum size for the DSD, what is this? Line 19: How common were cases with R > 200 mm/h? Line 21: The threshold below which the DSD is over-

estimated depends on the disdrometer. Leinonen et al. (2012) used a different type of disdrometer. Line 29: Please describe the results of the POSS-AWS comparison here.

Page 4012:

Line 3: What T-matrix implementation was used? Eq (11): This equation holds for the Rayleigh scattering regime; since you have omitted the radar wavelength, I cannot evaluate if it is applicable to your calculations.

Page 4013:

Line 11: Please give the units (mm hˆ{-1}) for the SD as well. Lines 20-24: Here, you seem to acknowledge that the sunrise/sunset times vary considerably and then say that you used fixed times regardless. Since analysis of the diurnal cycle is among the key points of your paper, surely you could use the actual sunset/sunrise times instead, in order to eliminate a known source of error?

Page 4014:

Lines 6-8: The description of Changma should be moved somewhere before first mention of it on the previous page. I suggest moving it to the introduction and expanding it to a paragraph giving a short introduction to the local climate and geography to readers who are not familiar with those aspects of the Korean peninsula.

Page 4015:

Line 24: This occurs in many places in the paper but I will just remark on it here: you cannot use a logarithm like this! If you take log(R), the result will be unitless - but will depend on the unit of R. Therefore you cannot say that log(R) = 2 mm hˆ{-1}. All the occurrences of this should be fixed.

Page 4016:

Line 7: "frequencies" should be "reflectivities"?

Page 4017:

Line 24: Eq. (15) is not linear.

Page 4018:

Line 15: In which direction is the coastline? Lines 19-21: I am not sure that any conclusions can be drawn about peaks in mu, the data in Fig. 8 mostly looks like noise. Line 22: While I agree that there is clearly a drop in D_m, 0.1 mm is hardly "dramatic". Line 24: Fig. 5a clearly seems to show an inverse relationship. Between D_m and mu.

Page 4019:

Line 8: "A larger number of smaller and larger raindrops": this sentence makes no sense. Lines 9-11: Since you are already separating stratiform and convective precipitation, it would be interesting to see if there are larger differences between day and night if you also differentiate between convective and stratiform. (In particular: is the daytime convective DSD different from that at nighttime?) Line 24: KST for non-Korean regions?

Page 4020:

Lines 2-4: What does Fig. 9f say about the relationship between Z and R? All it seems to do is report the distribution of Z.

Page 4012:

Line 8: The inverse behavior of D_m in summer vs. winter is an interesting result. This might be a topic for another study, but do you have any guesses as to why this is happening?

Figure 8: are these the 1-hour averages of these parameters?

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