Approaches to radar reflectivity bias correction to improve rainfall estimation in Korea.

March 28, 2016

Summary

This study addressed a major problem associated with weather radar data. Three methods are proposed for radar reflectivity bias correction. Three methods are proposed for reducing errors in single polarimetric radar (SPOL) reflectivity using either polarimetric radar (DPOL) and or DSD measurements. The DSD information is derived by a disdrometer located 9 km away from PSN. First method tries to correct the data using the reflectivities on the equidistance line between the two radar devices. The second approach using the overlapping area of the two radars for correction purposes. The third approach proposes correcting radar data by the reflectivity derived from the DSD observations of a disdrometer. Two events in 2014 and 2012 are selected to investigate the techniques. The validation is carried out by comparing the observations of 121 gauges and radar rainfall estimates. All the three methods improved the accuracy of estimated rainfall, except for a period when DSDs were not observed. This was explained by the fact that the disdrometer was not able to observe the entire rain event.

General comments

Although the content of the paper is relevant to the meteorological community, there are some concerns. The philosophical justification for each approach is not clear. The DPOL provide more accurate information than SPOL, but still suffers from errors. However, why should a source containing errors (DPOL) be used for correcting another source (SPOL). Even if the approach is justifiable, why should one correct a source where a better source of data exists. I mean, one can use directly DPOL data instead of taking the effort for correcting SPOL? Another point is that the DPOL device is an S-Band radar system. How about the other device? Because of the radar radius, I assume that the SPOL device should be an C-Band system, (Figure 4, left)? We know that S-Band has unique problems. How do you give explanation for using two different devices for correction? If my guess is not valid, the authors must provide a better explanation of the two devices. When it comes to using disdrometer data and the equidistance method, it is not clearly explained how it is extended to the rest of the area. A better description must be provided.

In general, I suggest to compare the methods with a common correction method for a better conclusion and investigation of the techniques. Furthermore, the validation must be more clear. What is the temporal resolution of the data being evaluated? How do you explain comparing radar data with point data. How do you justify using a constant parameter set for the Z-R relationship?

Specific comments

P1, L22 to L24: You talk about combining all the three methods. You must address a way how to combine them, and if you think it is better, you should add it to the paper as the fourth method.

P2, L6 to L8: How do you evaluate each method in these regards? Your reference data is uncertain!

P3: why don't you separate the two sections of "Data" and "Methodology". Each method should be described separately in a subsection. A better description of data must be provided.

P3, L9 to L13: You start the paragraph with "Data". What are you referring to? The entire paragraph is a bit unclear.

P3, L14: What is PSN? What is BSL? Explain the location of each radar device and the abbreviations.

P3, L30: You must give reasons for taking the equidistance line for correction. How do you use the correction for the rest of the study area? How reliable is the approach?

P5, L8: "reflectivity and Z_{DR}" **-** Either both symbols or both the entire word.

P5, L9: What is the "systematic bias"?

P6, L16 to L19: The events must be described in the "Data" section. You should explain a bit the types of the two events.

P6, L21: What are the "reflectivity biases"?

P7, L9: What is the "precipitation system"?

P8, S3.3: As already asked, it is not clear how you use this information for the rest of the study area. For example, for the points far away from the disdrometer.

P9, L1: Which one is "Fig. 16a)"?

P14: What are the circle? The legend must be provided including the scaling. What are BSL and PSN and AWAS? Those must be also described in the text.

P15: A similar question to the correction approach using disdrometer data. How do you use the information for the rest of the study area?

P17: What are the circles? The gray areas?

P18: You are averaging over 3 km × 3°. How do you then take the spatial bias into consideration?

P21: Following the y-intercept, the given equations are not going through the origin. How is it possible? Would it not result in a systematic error?

P22, and P23: A complete description of the figure must be provided.

Technical corrections

There are some parts with poor English. The ones I found:

P1: The last sentence in the abstract.

P2: L4-L5