

Interactive comment on “Application of bias correction methods to improve the accuracy of quantitative radar rainfall in Korea” by J.-K. Lee et al.

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Received and published: 23 July 2015

Manuscript information

Title: Application of bias correction methods to improve the accuracy of quantitative radar rainfall in Korea Authors: Jae-Kyoung Lee, Ji-Hyeon Kim, and Mi-Kyung Suk

Comments for the Anonymous referee#2

The authors present a paper where they analyze the impact of different correction techniques on radar rainfall estimations. They analyze algorithms to correct the reflectivity factor, and rainfall correction techniques based on rain gauge measurements. The

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application of these techniques is carried out on a good number of test cases.

Question#1: Maybe I'm wrong, but are we sure that they are not talking about “errors” instead of “bias”? For example, why the Z-R should (always) lead to a bias and not to a generic error without a precise and constant sign? The Local Gauge Correction appears to be a generic error correction, but is presented in a section called “Rainfall bias correction method”. Moreover I guess the authors intended “methods” and not “method”.

Answer: We agreed your comments. In general, error includes systematic error and random error and we can define the systematic error as the bias. Maybe, in the Local Gauge Correction, word ‘error’ can confuse referee. In this paper, word ‘error’ means ‘bias’ because ‘error’ was systematically difference between observed value and estimated value. And I revised ‘method’ to ‘methods’

Question#2: Authors are often poorly concise and not very clear in the description and they cause confusion to the reader. Please revise the paper and be clearer, even, if necessary with simpler language and omitting not useful information. For example pgg 4016 line 20: the authors write: “In this paper four merging methods are available: : :” And then at pgg 4017 line 1 they says that in the paper only one method is applied. . .

Answer: In this part, we already revised as follows by referee#1:

Revised: “appropriate merging methods (the maximum value, average value, minimum value, distance weighting methods) must be conducted because the scan ranges of the radar sites overlap.”

Question#3: At which time scale are the authors working? At which time scale the various methods are applied, are they applied at hourly scale, at event scale..other? And similarly, the scores are derived comparing rainfall estimate and reference rainfall, but at what time scale?

Answer: We worked at hourly scale in every event. 10-minute scale radar data were

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converted to hourly scale to compare the hourly scale observed data easily. Therefore, we used time unit 'mm hr⁻¹' in this paper.

Question#4: In some case the definitions are lost. For example they start referring to AWS in the abstract and they continue in other sections, but AWS is never defined extensively (I suppose AWS is related to ground measurements).

Answer: We agreed with your comment. We revised the sentence as follows:

Before: "Observed rainfall data were collected from 642 rain gauges (321 rain gauges for the calibration and 321 rain gauges for the validation, respectively) located in the Korean Peninsula." After: "Observed rainfall data were collected from 642 ground rain gauges (called AWS, Automatic Weather Station) (321 rain gauges for the calibration and 321 rain gauges for the validation, respectively) located in the Korean Peninsula"

Question#5: Why using so strange enumerating approach for tabs? I see for example Table1a and Table2b?

Answer: We cannot understand your comment exactly.

Question#6: I suggest using even a score with "sign" for verification. For example BIAS or Percentage error?

Answer: We agreed your comment. However, in this paper, we focused on reducing the magnitudes of biases not the over or underestimation and radar rainfalls were generally underestimated. Moreover, the RMSE includes the bias and variance.

Question#7: Some sentences are really difficult to be understood. Example 1 (pgg 4015 line 5): "Horizontal and vertical reflectivity (ZH and ZV), differential reflectivity (ZDR), differential phase (Φ DP), specific differential phase (KDP), correlation coefficient (ρ_{HV}), and spectrum width (SW) with a scan range of the maximum 150 km and a gate size of 0.125 km." : : :this sentence has not a verb: : : Example 2 (pgg 4018 line 19): "Reflect the accumulated attenuation effects due to rainfall in the observed reflectivity (attenuation ratio less than 10%)." What does it mean exactly??

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Answer: We agreed your comment. We revised the sentence as follows:

Before: "Horizontal and vertical reflectivity (ZH and ZV), differential reflectivity (ZDR), differential phase (Φ DP), specific differential phase (KDP), correlation coefficient (HV), and spectrum width (SW) with a scan range of the maximum 150 km and a gate size of 0.125 km" After: "Horizontal and vertical reflectivity (ZH and ZV), differential reflectivity (ZDR), differential phase (Φ DP), specific differential phase (KDP), correlation coefficient (HV), and spectrum width (SW) are estimated with a gate size of 0.125 km."

Sentence "Reflect the accumulated attenuation effects due to rainfall in the observed reflectivity (attenuation ratio less than 10%)." means that we considered the attenuation effects to estimate the quantitative radar rainfall because the radar signals were attenuated.

Interactive comment on Atmos. Meas. Tech. Discuss., 8, 4011, 2015.

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