

Review of:

Application of bias correction methods to improve the accuracy of quantitative radar rainfall in Korea

This work is basically an application of well-known methods to compensate bias errors on weather radar rainfall estimations. Consequently the main cause of interest for this work is given by the test of such methods on the site represented by Korean radar network; this is particularly interesting for the LGC method, employed in the USA national mosaic. Paper structure is well done and complete, especially regards tables and figures included, and correctly Authors indicate this work relies on important assumptions that impact on the study results and require further investigations; one of this assumptions is that only one (cumulative?) reflectivity measurement bias is considered. Nevertheless this work requires an important revision. The most concerning point is represented by results analysis, not as conclusive as declared by Authors, especially Z Bias method results, indeed quite arguable. Moreover some sections are not adequately developed and lack of clearness, English grammar and readability have to be improved in the whole paper, and also references requires some improvements. Follow more specific comments.

- Title: in my advice “quantitative radar rainfall” should be substituted with something more specific.
- Abstract: in my opinion has to be fully re-written. It lack of auto consistency, it is of very hard reading and does not adequately declare the purposes of this work, its development and results.
- Sections: I suggest Authors to include a small introduction at the beginning of each primary section (see 11433 between lines 1 and 2, 11435 between lines 14 and 15, 11441 between lines 5 and 6). Moreover I have noticed that in section 2.3 a fourth section level is used: I invite Authors to evaluate removing section 2.3 as title and promote 2.3.1 to 2.3 and 2.3.2 to 2.4
- References: quite good and complete in my advice even if someone more could be included (more details in the following points). In particular I invite Authors to suggest references from AMT, if possible, and books. I have found several works not used in the paper, i.e. [Kim et al., 2006], [KMA, 2012a], [McMillian et al., 2011], [Moulin et al., 2009], [Oh et al., 2003], [Villarini, 2008], [Villarini and Krajewski, 2010], [Villarini et al., 2008], [Yoo et al., 2011]; on the other hand, [Goudenhoofd and Delobbe, 2009] is not indicated. Works of [Morin and Gabella, 2007] and [Woodley et al., 1975] are misspelled in the text (respectively 11432:2 and 11431:7). Finally I have noticed a general misalignment between text and references, in terms of subject and/or date, when reports from KMA or WRC are cited.
- Tables: in table 1 should be indicated acronym for Bislan (BSL ?), because referenced in table 2. Table 2 should be modified to indicate the reference radar once: see KWK and KSN, that are indicated as reference radar twice, I suggest a single row KWK → IIA, GDK and KSN → KWK, JNI.
- Figures: Figure 2 is interesting but too small and dense, so it should be modified; my suggestion is to indicate only coastlines, radars location (by radar acronym) and coverage, eventually using different colors. In figure 3 caption indicate RAR acronym. Figures 5 and 6 are not so clear and should be

improved. In figure 7 GNG is calibrated by KWK and not by GDK as in table 2: which is wrong? In figures 11 and 12 OBC have to be substituted by Z_bias.

- Section 1: I suggest authors to include a book reference in line 11431:7, because weather radar errors is a point debated by a very long time and well consolidated in its principles. For similar reason I suggest to indicate [Chumchean et al., 2006] as an example. I have some problems to understand the logic behind the citation of the works indicated at 11431:15 and following lines in the economy of this work, so Authors should improve this part.
- Section 2.1: I would like to have some more details on the indicated radars, so I suggest Authors to include references; nevertheless elevations of the reference radar should be indicated in the text. Lines 11433:14-18 are not clear: the reference radar is still Bislan and accuracy is evaluated respect rain gauges? Nevertheless the algorithm used to produce the indicated rainfall estimations has to be at least referenced.
- Section 2.2: Z_{eT} , R_T and f in eq. 1, 2 should be explicitly declared.
- Section 2.3.1a: It is not clear which is the “reference radar” compared to the Bislan one, indicated in 11436:3. In 11436:20 the second ϕ_{DP_CALC} has to be substituted with ϕ_{DP_OBS} . In 11436:21 the “b” parameter should be a bit described. In 11436:9, which theoretical DSDs are used? Some more details is necessary.
- Section 2.3.1b: in my opinion this section is quite clear and referenced on KMA reports, but some more details could be useful.
- Section 2.3.2a: MFBC method has to be referenced in some extent.
- Section 2.3.2b: IDW method (11439:2) has to be referenced. LGC method description is not completely clear and should be improved. In particular, θ_j has to be defined as $\theta_j = r_j - g_j$ (modifying lines 11439:16,17), n (eq 10) has to be defined, further details on b determination should be given. Also quality control procedure description (11440:13-25) should be improved for sake of clarity. Finally, I suppose that at 11440:7 is referenced eq. 6.
- Section 3.1: I suppose that at 11441:11 is indicated eq. 3. Values in 11441:25 should be written in a different manner, to distinguish RMSEs from correlations. In 11442:1-3 I have noticed that the numbers in the two cases indicated are the same (7.36 and 7.43): it is correct? Calibration has been performed over a well-defined rain gauges network and time-period, so it could be interesting to have a feedback on the stability over time of the computed biases; on the other hand, it is necessary to given some more details on how fig. 8 and relative RMSEs/correlations are been obtained. Results analysis is my opinion quite arguable: it is true that overall RMSE and correlation improve, but as we can see by fig. 8, we have several cases where performances are worse, including also changma fronts. Also the justification that changma fronts are nationwide while typhoons are local is not so convincing. Briefly, performances of the Z_bias algorithm require further investigations and more cases. In this respect it could be interesting an analysis on cases 8, 11 and 17. Finally, why case 12 has been chosen for fig. 9 has to be explained.
- Section 3.2: In 11442:21, I suppose that the 18 cases are the same of Tab. 1 and the same used in section 3.1 for verification. In 11443:28, I suppose fig. 11a is indicated. Performances of Z_bias_LGC are quite obvious, at least for the considered cases; it could be interesting an analysis of the algorithm on a longer period.