

Interactive comment on “A Combined Statistical Bias Correction and Stochastic Downscaling Method for Precipitation” by Claudia Volosciuk et al.

Anonymous Referee #3

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The authors present a new approach to bias correct and downscale precipitation from free running GCM/RCM simulations. The authors use the ERA interim nested KNMI RACMO2 RCM, the gridded E-OBS field and E-OBS station data to test their method. The evaluation is focussing on each modelling step (i.e., bias correction and downscaling separately as well as both combined). Overall, the evaluation is very comprehensive and the study is a welcome contribution to the highly relevant field of climate impact analysis. Also the motivation and description of the method is nicely described and easy to understand. However, the manuscript is imbalanced with respect to usage of figures and text in the results section, with too little text for too many figures. Also, the conclusions are too a large extent a summary of the results and provide only little

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discussion (I only found p.15 l. 2-5) and conclusion. The result of this is that the paper reads very much like a technical report. The authors should have more discussions on the results with references in the results part. This discussion should include the following points.

Major Comments

The presented method of VGLM + QM corrected RCM is not able to outperform the low resolution data (i.e. the raw RCM data or the QM corrected data) everywhere. See for example Figure 10, where the RCM (triangle) and QM (circles) is present for most locations. How can it be that a statistical post-processing is decreasing the performance? It should at least be as good as the gridded data. This indicates to me that precipitation is to a large extent not following a gamma distribution as used in the VGLM and that the linear predictor-predictand relationship (eq. 6) is implausible. The authors should provide an explanation on this point and also relate their findings to that of previous studies such as Wong et al. 2014 or Eden et al. 2014.

Additionally, there are some contradictions that must be resolved. For example, the authors state on p. 14 l. 26ff, that E-OBS might be unreliable in France and eastern Europe due to low station density that implies a misrepresentation of gridded precipitation in this region. But on p. 12 l. 4, that in Scandinavia E-OBS has a high station density and is of good quality, but the VGLM is still performing poorly. This indicates to me that the quality of E-OBS cannot be identified as the source of bad performance for the VGLM.

The results for the different European regions (e.g., Figure 5) should also be related to previous research as tremendous research has used this classification.

Minor comment

The authors should include an appendix shortly summarising the approach by Wong et al. or include this in the methods part as it is important for the reader to understand

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the difference between the method by Wong et al. and the one presented here.

The ordering of Figures should follow the order they are referred to in the text.

p. 4, l.14ff: "We have...", I do not understand this sentence. Please rephrase.

p. 6. l.4f: Assuming that precipitation is in every case heavy tailed seems like a strong assumption. Could this assumption not also lead to overestimation of extremes as seen for the VGLM in Figure 12?

p.7 l.28: The author should give more details for the cross-validation setup. I assume it is in time, but I am not sure which periods have been used for calibration/validation.

p.11 l. 6: I think that Figure 10d) shows that the model is strongly underestimating the occurrence of heavy precipitation events by almost 50% in most locations.

p.12 l.21ff: How is the correlogram calculated for the 100 VGLM realizations. Are the realizations first averaged and is the correlation calculated afterwards or the other way around? Please add this also in the text.

p.13 l.9ff: The improvement of the "drizzle effect", "location bias" has not been shown in this study but in previous work. The references should be added to avoid misunderstanding.

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