

Interactive comment on “Technical Note: Bias correcting climate model simulated daily temperature extremes with quantile mapping” by B. L. Thrasher et al.

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1 Summary

This technical note investigates the performance of quantile-mapping (QM) for the bias-correction of daily minimum (Tmin) and maximum (Tmax) temperature as well as the diurnal temperature range (DTR). The bias-correction is applied to general circulation model (GCM) data of the CMIP3 database. The study shows that i) quantile-mapping leads to physical inconsistencies (i.e. $T_{\min} > T_{\max}$) when applied to Tmin and Tmax

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directly, ii) applying QM to Tmin and DTR and inferring Tmax improves the physical consistency but deteriorates the validation performance of Tmax and iii) applying QM to Tmax and DTR and inferring Tmin has the same advantage as the approach in ii) while the validation performance of Tmin remains on a similar level as in the approach in i). As a reason for the physical inconsistencies in i), the authors speculate on a relation to the bias of the snow-albedo feedback in the GCMs.

2 General comments

The topic of the technical note is clearly relevant for the scientific community as QM is frequently used to post-process climate model data. The point that QM fails to correct Tmin and Tmax in a physical consistent way is made very clearly. Also, the proposed alternative approaches are presented and evaluated very clearly. The text is well-structured and well-written. While reading the text, I would have liked to know more about the reasons for the problem. The authors refer to ongoing investigations and it is understood that a technical note cannot give an in-depth analysis. However, I guess it might be interesting to the readers and users of QM to get some more information about the failures of QM. I suggest acceptance of the manuscript after some minor comments have been taken into account and I am looking forward to the full scientific paper about the topic once the in-depth analysis has been accomplished.

3 Specific comments

Page 5517, line 18: Reference to Quintana Segui et al. (2010). When reading this reference, I expected to learn something about Tmin and Tmax in an application of the quantile-mapping. However, Quintana Segui et al. (2010) do not specifically state that the relation between Tmin and Tmax is unrealistic. They generally state that the diurnal

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cycles are unrealistic but they do not pin-point that to the bias-correction of Tmin and Tmax. The unrealistic diurnal cycles are probably more related to the fact that Quintana Segui et al. (2010) use a climatological diurnal cycle to reconstruct hourly data from daily data resulting from the quantile-mapping. Please put the reference in a correct context.

Page 5519, line 15: It is not clear to me why GCM biases in the mean and variance explain physical inconsistencies in Tmin and Tmax. Please explain a bit further. I learned that QM is able to correct for biases in the mean and the variance, but not for biases in the serial correlation.

Page 5519, lines 18-23: Also related to the comment above. It is unclear to me how a bias in the snow-albedo feedback leads to occurrences of $T_{min} > T_{max}$ in the bias-corrected data. Could you please provide some more explanations? For me, it would be very illustrative to see a particular case where this happens. I suggest showing the quantile distributions for Tmin and Tmax for a particular grid cell where $T_{min} > T_{max}$ occurs and explain how Tmin and Tmax of the SCE period are mapped in an inconsistent way. A different way would be to construct a synthetic case with some clear assumptions that lead to occurrences of $T_{min} > T_{max}$ when quantile-mapping is applied. These further explanations might be helpful to readers that are not so familiar with quantile statistics but still want to know more about the possible traps when applying quantile-mapping.

Caption Fig. 2: April instead of Aril

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