Final comments on the manuscript

A new bias-correction method for precipitation over complex terrain suitable for different climate states: a case study using WRF (version 3.8.1)

by Patricio Velasquez et al.

for publication in Geoscientific Model Development

General:

The authors addressed in a concise and comprehensive manner the points raised in the former evaluation and implemented suggestions to improve and extend their manuscript. Moreover, results of the last Glacial Maximum simulation are included in the new version. I also would like to emphasize the very detailed answers to the points raised in the former evaluation, especially to clarify some potential misunderstandings.

Below I list some minor comments and suggestions that might be helpful to prepare the final version of the manuscript for final publication.

Minor comments and suggestions:

Abstract:

p.1 l.4 please add […human occupation and *according migration routes*].

1 Introduction:

p.2 l.20 please change: [… these tools provide *physically consistent* and spatially gridded three dimensional information on various meteorological variables.]

p.3 l.15 please add that also temperature thresholds are important as absolute values (e.g. limiting factor for vegetation coverage, freezing of water, snowfall vs. liquid precipitation)

p.3 l.21 please reformulate: [If the method is applied to ….]

p.4 l 4 please reformulate: […that can ameliorate the stationarity assumption…]

2 Models and Data:

p.5 l. 20 please add in the text which kind of convection scheme you are using for the convection-permitting simulations (with reference to Table 2)

3 Bias correction:

p.7 l.24 I suggest to put the formulas for Q_SIM* and Q_OBS into dedicated lines with numbering of formulas for a quicker reference for the reader

4.1 Biases of WRF and their seasonality:

p.9 ll.3 ff I suggest to include the scatter diagrams as separate figures or subfigures into the figure section

p.10 l.3 I was wondering whether the vast glaciation of the LGM over the alpine region has an impact on near-surface condensation processes, i.e. freezing of near-surface moisture on the surface of the ice and whether those processes are addressed in the WRF model. This might be listed as another source of uncertainty that can only hardly be quantified, but might play a role when bias correcting results for LGM-type of climates.

4.2 Influence of different orographic characteristics on the performance of the bias-correction method:

p.11 l.14 A second issue explaining the somewhat better performance of the 100 m interval relates to the better fit of the transfer function in the respective height interval – in complex alpine regions a vertical difference of 400 m can be climatologically quite large compared to the one using only 100 m.

4.3 Application of the bias-correction method and cross-validation under present-day conditions:

p.11 l.25 please re-formulate: [We consider… → A priori, this comparison is based on different prerequisites, as…]

p.12 l.4 please replace “works” by “is appropriate”

p.12 l.24 ff In this context, 15 years in each sub-period might not cover the full range of the internal climate variability. I assume that longer validation/verification intervals ameliorate this effect [as the authors indirectly state on p. 13 l.2.] An alternative is for instance to apply a one-leave-out type of method to hold back most of the years for calibration. In this context in my opinion, a qualitative statement would be enough as additional background information for the reader.

4.4 Application of bias-correction methods on the simulated LGM climate:

p.16 l.6 please change “safer” to “is better suited”

5 Summary and conclusions:

One might also put the method into context of future climate change: the current example is on LGM with a potentially reduced complexity in terrain due to vast glaciers. In future scenarios this might be the opposite, especially over areas with presently still extensive glaciated areas like the Himalayas Mountains. In those areas increased melting of glaciers increases the complexity of the terrain and hence the application of according bias correction methods might become important.

Figures:

General: If possible, please indicate in each Figure caption the main conclusion of the Figure(s) as immediate summary for the reader

Fig. 1: In Fig. 1b the lat/lon information is missing. Also for Fig. 1c it would be desirable to diplay separately the map including lat/lon information and the legend

Fig. 3, caption: I suggest keeping the formulation “Empirical Quantile Mapping (EQM)”