

Geosci. Model Dev. Discuss., referee comment RC2
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Comment on gmd-2021-60

Anonymous Referee #2

Referee comment on "TopoCLIM: rapid topography-based downscaling of regional climate model output in complex terrain v1.1" by Joel Fiddes et al., Geosci. Model Dev. Discuss., <https://doi.org/10.5194/gmd-2021-60-RC2>, 2021

This is a well-written paper describing a downscaling and bias-adjustment method of potential great interest for the scientific community. I have mostly minor comments, outlined below.

General comments

As a general comment, this manuscript lacks a clear explanation of to what extent the method used is novel. The interest and aims of the method are clearly described, but its novelty and added-value (compared to Fiffes and Gruber, 2012, 2014, but also to previous similar downscaling and bias-adjustment methods) is not. A corollary comment is the fact that the method and results would benefit from being put into a larger context. For instance, results in section 5.3 should be compared to other studies of the impact of climate change on Alpine snow cover (which would also better fit with the current title of section 5.3 about "Alpine" snow cover, while currently only Swiss snow cover is discussed).

Useful references include (but are not limited to):

- Steger et al. (2013): <https://doi.org/10.1007/s00382-012-1545-3>
- Marty et al. (2017): <https://doi.org/10.5194/tc-11-517-2017>
- Frei et al. (2018): <https://doi.org/10.5194/tc-12-1-2018>
- Verfaillie et al. (2018): <https://doi.org/10.5194/tc-12-1249-2018>

Specific comments

- Several sentences lack commas, which would facilitate the reading, e.g. line 37 before "e.g.", line 43 before "which", line 109 before "e.g.", line 127 before "it does not", line 133 before "e.g.", line 152 before "i.e."
- Line 52: repetition of "the".
- Lines 47-58: to me, a key reference for quantile mapping that should be cited here somewhere is the pioneering work of Déqué et al. (2007): <https://doi.org/10.1016/j.gloplacha.2006.11.030>
- Line 92: the "required forcing variables" are not listed here. In fact, they are listed in Table 1, but Table 1 is never called in the text...
- Line 98: this sentence seems incomplete. Please edit.
- Line 104: "NWP" should be defined here.
- Line 116: "IMIS" should be defined here instead of line 203-204.
- Section 2.4: Am I correct in thinking that the quantile mapping method you employ is univariate (i.e. the different variables are corrected independently from each other)? If so, this should be stated here and its implications discussed in section 5. Indeed, if temperature and precipitation are corrected independently from each other, this could have potentially large impacts on snow cover estimates (important in mountainous areas and presented in section 5.3). Could you please explain if you found a way to circumvent this issue (in section 2.4) and the related uncertainties (in section 5)?
- Line 171 and elsewhere in the text: a distance value is always separated from its unit by a space, e.g. "44 km", "20 cm" (line 249), "100 m" (line 258), etc.
- Line 174: "the number of file downloads is large".
- Section 5.1, Figure 3 and Tables 3-4: please use a consistent naming convention for your experiments. I found conflicting occurrences of "QM", "QM_QM" and "QMAP", "QM_MONTH" and "QMAP_MONTH", and "T-MET" and "T-CLIM". At line 218, you could include the acronym "CLIM": "CORDEX ensemble mean (CLIM)".
- Line 225: there is a typo ("residual error").
- Line 227: Please remove the capital letter in "Percentage".
- Line 244 and caption of Figure 8: "time period".
- Line 245: "The shortest station record is 10 years, therefore the dataset nominally represents the period 1996-2018": I don't understand this statement...
- Line 275: I would split this sentence into two parts after "HIST".
- Line 279: please remove the capital letter in "Century".
- Line 308: I would also split this sentence after closing the parenthesis.
- Line 334: "historical reanalyses" (plural).
- Caption of Figure 4: "The coloured envelopes indicate".
- Caption of Figure 5: what does "WFJ2" stand for?
- Figure 6: please change the colour palette for this figure as it is not colour-blind friendly. Currently, the colours for HIST and RCP8.5 cannot be distinguished from each other by a colour-blind person. Why not use the same colours as in Figure 5?
- Figure 7: what do "Hist_1981_2010.1" and "Hist_1981_2010.2" stand for? Isn't there only one historical scenario used in this study? If so, why are the top left and top right panels slightly different? I don't think this is explained anywhere in the text or the figure caption.