

**Manuscript:** Trend-preserving bias adjustment and statistical downscaling with ISIMIP3BASD (v1.0)

## Major remarks

The author presents a documentation about an improved bias correction technique that separates bias correction and statistical downscaling. The manuscript provides an useful overview on the bias correction method that is supposed to be used in the third phase of the Inter-Sectoral Impact Model Intercomparison Project (ISIMIP). The paper is generally written well, and the describe formalisms are necessary but not too overloaded with equations. I have only a few remarks that should be addressed.

1. Section structures should be indicated in the beginning of a section. Currently, in several cases, a description is given where information is missing. The missing information is then provided in the one of the next paragraphs, but in the beginning there was no indication that this is being done. One example for this is sect. 3.2.2., where the detailed description starts on p.11 – line 32 after 5 paragraphs of general description of the downscaling method.
2. Observations used for bias correction are usually available on a fine, regular grid while the coarse GCM grids are usually not regular (e.g. often a Gaussian grid is used). Thus, the usage of the downscaling technique must be clarified for this common case where the fine grid does not fit into the coarse grid. In this respect I was really wondering why it is written on p. 11 – line 7-11 that ‘It requires that the coarse grid of the climate simulation data and the fine grid of the climate observation data are compatible ...’
3. Even though the manuscript is a documentation on the technical method of the ISIMIP3 bias correction, it should not be concealed that the bias correction cannot compensate for several types of GCM errors, e.g. erroneous shifts of storm tracks in the GCM. In such cases, bias correction may even lead to erroneous climate change signals. With respect to this topic, I suggest pointing towards Maraun, D., T. Shepherd, M. Widmann, G. Zappa, D. Walton, J.M. Gutiérrez, S. Hagemann, I. Richter, P. Soares, A. Hall and L. Mearns (2017). Towards process-informed bias correction of climate change simulations. *Nature Clim. Change* 7: 764-773, doi: 10.1038/nclimate3418.

In summary, I suggest accepting the paper for publication after minor revisions are conducted.

## Minor remarks

In the following suggestions for editorial corrections are marked in *Italic*.

p.3 – line 2

It is written:

‘... these data are bilinearly interpolated...’

Does ‘these data’ refers to the original GCM data or to the data interpolated on the 2° grid?

I guess you mean the original data as otherwise the bilinear interpolation would not make so much sense as the 0.5° data fit to the 2° data.

p.3 – line 8

As the EWEMBI refers to a published dataset, but not peer-reviewed publication, I suggest including more information about the data, variables (and their respective source) and bias-correction. This may also be done in an appendix.

p.5 – Table 2

In table or the associated text, the difference between bounds and threshold should be clearly described.

In addition, it should be noted where the different types of trend preservation are prescribed (see also major remark 1).

p.9 – line 6

Is this the threshold listed in Table 2?

p.9 – line 7-13

The definitions and differences of  $a$  and  $\alpha$  as well as  $b$  and  $\beta$  are unclear. Please clarify!

p.10 – eq. 10-14

I am not familiar with the logit function, and I assume other readers many not either. Please explain what this function is doing.

Or is this just the function you define in eq. 15?

This must be indicated when the logit term is used for the first time.

p.11 – line 3

It is written:

‘Since the resulting data can be considered bias-free ...’

The uninformed user may understand this misleading statement wrongly. See also major remark 3.

p.12 – line 8-10

Sentence “This is done ...” is too long and difficult to read. Please separate into two sentences.

p.15 – line 11

The first column is set to  $W$ . What about the other columns?

p.17 – line 5 and 8

Replace ‘is to represent’ by ‘represents’.

p.19 – Fig. 7 (also Fig. 8, 9, 10)

Some of the bluish and greenish colours are difficult to separate. Please improve colour setting.