

Interactive comment on “Earth System Model Evaluation Tool (ESMValTool) v2.0 – diagnostics for extreme events, regional and impact evaluation and analysis of Earth system models in CMIP” by Katja Weigel et al.

Anonymous Referee #1

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Overall: This is an overview of what looks like a very useful tool for climate model data analysis. I am not involved in CMIP, but I think this tool is going to be useful beyond CMIP. A paper discussing what the tool is about what would be helpful is making awareness of the tool's availability.

I have mostly minor comments and some additional comments about how the tool can be improved.

Comments:

C1

Line 142: “The linear model (lm) function of R is used to calculate trends.” One possible alternative is to use Generalised Linear Model (GLM; Nelder and Wedderburn 1972) of R (function glm) instead as GLMs are more flexible (with standard linear regression being part of this approach). The fitting of indices that their values do not follow normal distribution would be made more flexible and easier. It should be a fairly straightforward change to the R code as all R regression modules more or less follow the same standard.

Section 3.3.3: I would think another related metric would be the annual temperature range (warm season Tmax vs cold season Tmin) could be quite useful along with DTR. If annual temperature range is widening, it may also imply energy use be expected to increase (akin to DTR getting larger).

Lines 353-354: Are the CORDEX regions included part of this package? I think doing so will make them more useful to compare with regional climate model results.

Section 3.5: More a general comment – this will be a very useful tool in the future to just to avoid data and information overload, considering the volume of multi-model and multi-ensemble data will be involved in future MIPs.

Technical comments:

Line 162: May be better to say “Meteorological droughts are negative anomalies in precipitation.” instead.

Line 173: “. . . which makes SPI incompatible with the concept of hydrological droughts.”

Line 179: “This allows the estimation of surface water retention.”

Line 181: “Evapotranspiration is typically not calculated by climate models.” Climate model does output them as part of the land surface model output, but how that is computed are simplistic as in being diagnosed from the variables the authors are mentioning (i.e. surface T and wind). Hence, I am not sure “calculate” is the right word here. Perhaps, “is not prognostic” “is diagnosed simplistically” would be more appropriate.

C2

Lines 224-225: It may be advisable to drop the “computationally demanding” from the sentence as a few hours or days are still short comparing to the wall clock time needed to run the CMIP models.

Figure 6, values near year 2000: The ensemble spread around year 2000 is outside of the ensemble mean. Please check what causes this.

Figure 7, lines 241: For the sake clarity and easy viewing of the figure, indicate which of the 3 indices are for precipitation (the top 3 ones).

Lines 256-261: Can you be more specific what the extreme temperature biases are? Do you mean non-bias corrected data has a lot more temperature extremes than in observations (which would be consistent what mortality rates estimates are too high)? If yes, state so directly.

Figure 9: The font size of the titles for each panel are small, and one can tell the dpi of the image is quite low (which makes the titles even harder to read). I think the dpi issue can be addressed by outputting the figure as a png (or other reasonable lossless format) or pdf.

References:

Nelder JA, Wedderburn RWM (1972) Generalized Linear Models. *Journal of the Royal Statistical Society Series A (General)* 135:370–384. <https://doi.org/10.2307/2344614>

Interactive comment on Geosci. Model Dev. Discuss., <https://doi.org/10.5194/gmd-2020-244>, 2020.