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Geoscientific Model Development Discussions

Interactive comment on "Changes in regional climate extremes as a function of global mean temperature: an interactive plotting framework" *by* Richard Wartenburger et al.

Anonymous Referee #2

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The paper describes a very useful tool to assess regional changes in extreme indices in term s of global mean temperature change. The paper is clearly written und should be punblished with minor modifications addressing the issues and questions below.

Main point:

The relationship between ensemble mean changes in extreme indicators in term so global mean temperature change may partly been due to changes in the ensemble itself as not all of the simulation reach the same level of warming. It is possible to illustrate this by showing the number of data points in the individual samples as a histogram to the x-axis of the plots?

Minor points:

It is quite relevant that the data is not only visualized but also available for download. That seems to be the case as mentioned only at the end of the manuscript. It should be highlighted earlier in the text. The data associated with the ensemble plots should also contain the information about each individual model run.

P2, L21: "the probability of exceeding a given temperature threshold" instead of "exceedance of a given temperature threshold"

P5, L1: "Derivation of the relationship between changes in regional climate indices and global mean temperature" instead of "Derivation of regional global temperature dependency relationships"?

P5, L5: Throughout the manuscript "predict" or "prediction" should be replaced by "project" or "projection".

P5, L13: Throughout the manuscript "global temperature" should be replaced by "global mean temperature" and "dependency relationship" could be replaced by "(functional) relationship". In this case I would suggest to write "To test the significance of the relationship between global mean temperature change and the regionally averaged. . ."

P5, L16: I think it is more precise to say "The number of models for which the slope of the regression line is significantly different from zero. . ."

P5, L19-21: I do not think that this is true. A scaling coefficient that is significantly different from zero does not imply that the relationship can really be explained by a linear model. That is an assumption made when fitting the data. The approach only tests whether the scaling coefficient is significantly different from zero assuming that the data follow the underlying linear model.

P5, L22: Are the decadal averages not actually calculated to allow for the averaging?

P7, L5: I would suggest do name it "Functional form of the relationship" (see comment

above)

P7, L9: I think it is “to” instead of “than”.

P7, L10-11: “Moreover, the relationship of these indices involves the least uncertainties. . .” How is that measured?

P7, L15-16: Similarly, “The largest departures from the identity line. . .” How is that measured?

P7, L18: “The ensemble mean changes. . . still show a significant linear scaling. . .”. How is that tested? In the method section that is only described for individual runs while the entire ensemble has a more complex structure where e.g. results from different scenarios but one climate models cannot be considered as independent. Even if it is tested in this simple way it should be described in the method section and the limitations should be mentioned.

P7, L27: Delete “in”. P7, L29-30: How is that derived? It should be explained as it seems to be part of the plot shown in Figure 2.

P8, L13-14: This description should be moved to section 2.3. Is the test only applied to individual scenarios, i.e. a sample where containing one element per climate model, or also across the four scenarios, i.e. a larger sample with up to four data point per model? In the latter case the elements of the sample cannot be considered independent. How is that addressed?

P8, L31: Change “an” to “one”.

P3, Figure 1: The Caption should include the definition of TXx.

P16, Figure 2: Could the different uncertainty ranges be shown in transparent colors that one of them does not hide the other one? Would be nice to add a histogram to illustrate the number of data points behind the lines (see first comment). It has to be explained how the CO2 budgets are derived. That should be described in the main

text. In the caption the term “CO2 emissions” should be adjusted. It is not precise enough.

P17, Figure 3: The caption should include a reference to Table 2 where the indices are described. Why does the shaded area extent beyond the line of the ensemble mean?

P20, Figure 5: The caption should also say that the cetral line of the box plot is represents the median.

P22, Figure 7: Could the different uncertainty ranges be shown in transparent colors? Here, it would also be good to add the information about the number of data points (or models) included in the samples to get a better idea whether non-linearities in mean response could also be due to changes in the underlying samples.

P23, Figure 8: Why does the shaded area extent beyond the line of the ensemble mean?

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