

Interactive comment on “Global trends in extreme precipitation: climate models vs. observations” by B. Asadieh and N. Y. Krakauer

Anonymous Referee #1

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I recommend that the paper "Global trends in extreme precipitation: climate models vs. observations" be accepted subject to revisions.

This paper compares trends in annual-maximum daily precipitation in observations (over land) with similar trends from climate models. The authors have subsampled the model output to the locations and years for which the observations are available. The results are valuable because this kind of model-observations comparison hasn't been made before, but work is needed to improve the description of the statistics and the presentation of results more generally.

Specific comments:

1) First paragraph of section 3: The authors should specify the method used to calcu-

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late statistical significance of the trends. Do they use one of the two methods in the appendix or another method?

2) The Q_{median} statistic seems to be misinterpreted in the paper. As defined in appendix A2, it is an estimate of the trend, but page 11377 (line 19) says it is a "confidence level", page 11382 says it is a "slope of trend", and table 1 presents it as not having any units (the units are presumably mm/day/yr). In table 1, Q_{median} and the ordinary least squares slope ("b") agree for the observations (0.0504 versus 0.0521) but not so well for the models (0.0230 versus 0.0314). This discrepancy should be commented on.

3) Some of the observational results are similar to those of Westra et al, J. Climate, 2013. For example, Westra et al show the percentage change in annual maximum precipitation per K of global warming at each latitude, similar to Fig 5d. I think this paper should include a few sentences regarding the differences in methodology and any differences in results. Both Westra et al and this paper show a higher rate of change per K at some lower latitudes - could this be related to the higher rate of change per K found for tropical extremes by O’Gorman, Nat. Geo. 2012, or is the analysis too uncertain?

4) The figures are generally difficult to read. The fonts are too small, and the titles given above panels are too long and have many unexplained abbreviations. In Figure 3, the marker sizes have meaning but they are too small for this to be of use to the reader.

5) page 11380 lines 12-14: It is stated that "extreme precipitations and flooding" seem to be underestimated by climate models, but this is not supported by the results presented: a) this paper doesn’t analyze flooding, b) according to page 11376, the lower values in the models are because of the different scales for models and observations and are therefore not truly an underestimation, and c) this paper doesn’t provide error bars for the observational trends and so it is not possible to conclude that the trends are underestimated in models. (It seems unlikely that the difference of 10%/K versus

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8.3%/K mentioned in the conclusions is statistically significant.)

6) Caption of figure 3: Model disagreement for the trends is quantified at the gridbox level and is said to be a measure of the discrepancy between the climate models. However, these differences could easily be due to the influence of non-forced variability (which will be different in different simulations), rather than any differences between the models. The maps are also said to show the underestimation of the trends by the models, but both more positive and more negative trends are apparent depending on location. (The absolute magnitudes of the gridbox trends are expected to be smaller compared to observations because an average is taken across independent model simulations with their own variability in each case.)

7) More care is needed to distinguish between the global average of relative trends and the relative trend in the global average. For example, the abstract says that "The global average of observational annual-maximum daily precipitation has increased ... 8.5% in relative terms". I think this number refers to the global average of the relative trend at each location, but it is not clear. Similarly ambiguous statements are made in the conclusions.

8) The appendix should be referred to in the paper.

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