

Interactive comment on “Investigating uncertainties in global gridded datasets of climate extremes” by R. J. H. Dunn et al.

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Received and published: 21 August 2014

We thank the reviewer for their detailed comments and address each in turn below.

Reviewer

1. Throughout the manuscript, much of the numeric analysis and discussion focus on data after 1950 while global time-series plots start in 1900. However, many of the figures (also in the supplement) reveal tremendous differences in global trends, between the different experimental choices, before 1950. These differences clearly relate to situations when the global time series are based on few data in the beginning but more data later on. The authors do acknowledge this in their discussion, but it could be emphasized at relevant places more how tremendously sensitive several indices can

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be to changes in the station network.

Response

We have added extra comments throughout the manuscript highlighting indices where the behaviour at early times is much more uncertain to indicate which index time series are particularly sensitive to the reduced station network in the early part of the record.

Reviewer

2. The Taylor diagrams may be very useful, but they appear to have been thrown in in the very last minute with almost no explanation of how to interpret them and no discussion about what they show. If they are not needed for the conclusions, then they could be omitted. It seems better, though, to explain and discuss them more in detail. I suggest to add some discussion of all panels in Fig. 20, to point out differences and similarities and highlight what the main message is. I see no particular reason to put them in an appendix. They could rather be shown and discussed in section 5.

Response

We increased discussion of the Taylor Diagrams in later sub-sections of Section 5 and linked back to the differing behaviour observed in the global timeseries in earlier sections (also in light of comments by Reviewer 3).

Reviewer

Technical comments: p 2106, l 6: Change “or which” to something else

Response

Changed “which” to “that”.

Reviewer

p 2110, l 11: Change “normalised” to “anomalous”

Response

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Done.

Reviewer

p 2110, l 18. Explain better what is meant by “grid boxes with 90 % completeness”

Response

Explanation added.

Reviewer

p 2111, l 6: Insert “are” after “1960”

Response

Added.

Reviewer

p 2111, l 16: What kind of percentage is considered here? “60 per cent” of what?

Response

The completeness criteria are the fraction of years available out of the total possible 110 years. In this case, at least 66 years should be available for the grid box to be included. We have added a clause to this effect.

Reviewer

p 2113, l 19: Is it really likely that changes in individual grid box values are always expected to be “small”? Perhaps they are large?

Response

For this change (the number of stations within a DLS), if when matching the coverage between all the different versions results in identical global averages, it seems reasonable that there are no large changes in any of the individual grid boxes. Also, the ADW

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method gives the highest weight to the stations closest to the grid box centre, with a decay to more remote stations. Hence small effects would be expected, especially in areas with a dense network. We have added extra sentences in this section to highlight this point.

Reviewer

p 2114, l 8: Insert “larger” before “regions”

Response

Added.

Reviewer

p 2114, l 9: Indonesesia could be added here.

Response

Added.

Reviewer

p 2115, l 3: Unexpectedly “regional workshops” are mentioned here. Why? What is that?

Response

Foot note added explaining these. When constructing HadEX2 some data were gathered at regional workshops where the indices were calculated from daily data by participants from countries in the region (see also comment from Reviewer 4).

Reviewer

p 2116, l 2: In which indices do you have “high confidence” in the trends...? I don’t see the same thing in Fig 6b.

Response

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The red shading is darkest in these listed areas in Fig. 6b. Fractions of these have grid boxes highlighted indicating high confidence in a non-zero trend in HadEX2. However we have rephrased the sentence to more clearly indicate the patchy nature of non-zero trends and updated the list of regions.

Reviewer

p 2116, l 4-9: Do you talk about precipitation indices here?

Response

Yes – we have made this explicit and add a reference to Fig 6b

Reviewer

p 2116, l 21-22: I don't agree that there is "little" effect on the overall trend. Rather "quite large".

Response

We have separated the discussion of the earlier and later periods of the time series shown in Fig 7b. There is good agreement for CSDI for the later period, post ~1950, but there are changes prior to this date. Further changes also have been made in relation to Major point 1.

Reviewer

p 2119, l 9: Insert "parts of" before "South America"

Response

Added

Reviewer

p 2119, l 9-11: The sentence is incomplete.

Response

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Sentence has been clarified

Reviewer

p 2120, l 7 (and other related places): Why are not all curves in Fig. 11 forced to pass through the point (0,1)? Physically, the correlation is definitely expected to be 1 and distance 0. The only curve that is close to the observations when the correlations have dropped to $1/e$ is the blue (exp+off). All others have a very poor fit. I can accept that the different curve-fitting approaches has a usefulness just to study how sensitive the results are to different ways to estimate DLS, but it is clear that some choices are physically unrealistic and give much too large DLS values (for the case shown in Fig. 11). This should be commented upon. Also, as Referee #1 pointed out, the polynomial fit is very unrealistic at long distances. I assume it has to be used here because it was used in HadEX2, but a motivation and discussion about its usefulness could be added for clarity.

Response

The reason the curves were not forced to go through (0,1) is that this is the method used by HadEX2. We have added the panel for TN90p to show how similar the fits are for some of the temperature based indices. As can be seen there, although physically the correlation is expected to be 1 at distance 0, and a data point at this location has been included for this reason, the decay curve for all other distances is not consistent with this (assuming a simple exponential form). We also refer to the comment by Reviewer 4, who points out a “nugget” effect relating to siting and instrumental uncertainty, and hence perfect correlation at zero distance would not be expected. We decided not to use more complex algorithms in this study, or vary which functional forms were to be fitted to each index.

Yes, the polynomial fit was used in this analysis as it is used in HadEX2, and so is required to compare against. We have expanded this section to discuss in more detail the differences between fitting models and the indices.

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Reviewer

p 2121, l 1: What is meant by “only the level differs”? I see no difference in mean level in Fig. 12b.

Response

The “level” referred to was the value of the global average in one of the peaks/troughs. Specifically for Fig 12b, the Exp curve (red) stands out higher than the HadEX2 curve (black). We have clarified this sentence.

Reviewer

p 2123, l 23-27: The assumption that “issues with the quality and inhomogeneity are minor” is a bit dangerous. I don’t think every single station record has been sufficiently “carefully checked” yet to allow this assumption. Consider a more “careful” statement.

Response

Section has been expanded upon and “carefully checked” has been removed (see also comments by Reviewer 4).

Reviewer

p 2124, l 26-27. The sentence here would be more true if “relatively good” is changed to “relatively poor”. This is one example where the authors tend to paint a too rosy picture. There are BIG differences in trends between different methodological approaches in some cases when the entire period is considered.

p 2125, l 1: It is good when short timescale variations occur at the same time and in the same direction, but from a climate-change viewpoint it is even more important that long-term trends are about the same. This is another case where a too rosy picture is painted.

p 2125, l 6-8: I would like to see a more expanded discussion on when and where the

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match with HadEX2 is “reasonably well” and when it is not so well and also why it is not so well in those cases.

Response

We have dealt with these three comments all together as they refer to the same section. We have increased the discussion of this section to include all the indices as the gridding method has one of the largest effects on the global time series. We had focussed just on the later period, but have also included extra material about changes in the early period of the time series. For the long term trends (for the last 60 years of the dataset), these are discussed in reference to Table 1 in Section 5.4

Reviewer

p 2125, l 14: You probably mean “grid box values” rather than “grid boxes”.

Response

Agreed. Sentence amended

Reviewer

p 2126, l 17-19: But if you include pre-1920 data, very different trends may result randomly depending on how the jack-knifing is realised.

Response

We have expanded this section. For indices with very strong long-term global trends, then the jackknifing runs do not change these by much. But for indices which have no strong trend, or a non-linear behaviour, there can be large changes from run to run. Our focus was on the most recent period because of the issue of data availability and coverage – this has been dealt with in the first point.

Reviewer

p 2126, l 22: Insert “in particular” before “in the 25 % runs”

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Response

We have added “particularly” in this location

Reviewer

p 2128, l 3-5: Mathematically, I don't agree with the statement in this sentence. A strong correlation can be obtained even in the absence of a trend. Take for example an arbitrary time series with no trend, and a copy of the same time series but with 10 times larger amplitude. The correlation between these two series is 1, but the RMS is large. Modify your explanation on what the Taylor diagram shows.

Response

Thank you for pointing this out – we have attempted to improve our explanation of the Taylor Diagram and what it shows.

Reviewer

p 2128, l 12: Delete “that” after “stipulates”

Response

Done

Reviewer

p 2128, l 22: Delete “is” after “grid box”

Response

Done

Reviewer

p 2130, l 12-13: Change “almost all the choices fall within the statistical trend of HadEX2” to something like “the trends of HadEX2 fall within the envelopes of trends for almost all the choices”. I guess this is what you really mean.

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Response

We have explained what we meant with this sentence and kept its original form. We were trying to indicate that an estimate of the statistical range in linear trends is in many (most) cases larger than the range in trends obtained when using the different methodological choices. Hence the structural and parametric uncertainties are in many (most) cases lower than the uncertainties in the trends themselves. We hope this has clarified our meaning sufficiently for this sentence to remain. We note that a linear trend is not necessarily the best description for the long-term changes in the indices over the entire data period.

Reviewer

p 2130, l 15: Can you somehow quantify what you mean with “only slightly less robust”?

Response

We have explained our intention here more clearly. In the precipitation indices, the HadEX2 trends more often fall outside of the envelope set by the methodological choices.

Reviewer

p 2131, l 3: Delete one “s” in “ass” at the end of this line.

Response

Done

Reviewer

p 2131, l 17: The fact that the quality of the station data has not been investigated could be highlighted more clearly in relevant places. Why hiding this information?

Response

We did not intentionally hide this information, but we have made it more clear that this

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has not been attempted and given reasons as to why – not all the daily data is available to us to perform QC or assess its quality and homogeneity. Also the data quality is not a methodological choice in the construction of HadEX2.

Reviewer

p 2132, l 8-9: This sentence is ridiculous. Delete it.

Response

Done

Reviewer

p 2132, l 12: I can see several instances in the supplement when changes in methods introduce a strong trend or a drastic change in variability! Be more honest and clear about this. Don't hide where there are problems, but do point out where there is robustness.

Response

We were trying to reach a balance between giving example indices which were robust and others which showed disagreement, without overwhelming the reader or making the paper too long. However we have added additional paragraphs for each choice more clearly outlining other features present in other indices than those shown in the main manuscript.

Reviewer

p 2133, l 6-7: Similar comment as above for p 2130, l 12-13.

Response

See our response to p2130, l 12-13, but we have also attempted to clarify our meaning in this sentence.

Reviewer

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p 2133, l 7-8: The very last sentence is an overstatement that does not strictly follow from the previous one. Be more careful when trying to summarize your main findings. What is robust? What is not robust?

Response

We have expanded this sentence to be clearer with what parts of HadEX2 are robust.

Reviewer

p 2133, l 11. As I pointed out above in my second point: Expand the discussion on Taylor diagrams and consider move it to Sect. 5.

Response

Done

Reviewer

p 2137. Caption to Table 1. Change “Sen (1968), Lanzante (1996)” to “(Sen, 1968; Lanzante, 1996)”

Response

Done

Reviewer

p 2137. Delete the second “temperature” in the definition of TNn

Response

Done

Reviewer

p 2138. The name of SDII should probably not be “Simple daily index index”

Response

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Done

Reviewer

p 2140. Caption to Fig. 1. I cannot remember that you have define how you exactly define e_{RMS} and σ^2 anywhere. Have you?

Response

We have added a paragraph explaining how these were calculated.

Reviewer

p 2148. Caption to Fig. 8. Change “stations per grid box choices” to “choices of stations per grid box”.

Response

Done

Interactive comment on Clim. Past Discuss., 10, 2105, 2014.

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