

Changes in extreme precipitation patterns over the greater Caribbean and teleconnection with large-scale sea surface temperature

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Reply to reviewer #2

We sincerely thank reviewer #2 for his thorough review and insightful comments. Below are our responses to the comments. Responses are shown in blue, comments in black.

1. Line 20: Would you please clarify ‘a few large-scale SST index’: to my understand, SOI and NAO are originally represented by specific patterns derived from pressures instead of SST.

Thanks for the comment, indeed, SST indices should be specified i.e., whether they are derived from pressure variation or sea surface temperature. Since this line concerns the abstract, we wonder if these details should not be added in the methodology instead of in the abstract.

2. Line 28, I would suggest to rewrite sentence ‘In addition...’ I assume it means the positive correlation between them are found, however, ‘+SOI significantly increases with RR1...’ does not sounds the same meaning.

In fact, significant positive correlations were obtained. These positive correlations were also expressed in this sentence, which would mean that Caribbean Sea warming and the positive +SOI phase are associated with an increase in the indices (RR1, CWD). This increase is statistically significant, since a statistical test has been applied to this effect. This sentence will be rewritten to make it clearer.

3. In the text, at many place the names for regions/countries are mentioned, I strongly suggest to add names for major locations in Figure 1.

This correction will be considered in the revised version.

4. Line 64-65: would you clarify the details about what ‘climate extremes’ were found have been increased over the region? Which I think this information is essential for building up the initiation of this research.

Thanks, that's a very interesting question. We'll add these details in the revised version. Climate extremes are extreme rainfall, drought and wet spells.

5. Line 74: I would suggest delete 'in'. I would suggest checking the references with brackets or not in the text, for example in Line 76, the brackets is not necessary.

It's been noted and will be included in the revised version.

6. Line 75: would you clarify the meaning of AMO?

This precision will be added in the revised version.

7. Line 81: what kind of further research is needed, I would suggest to introduce the research gap more detailed, like to what aspect or what kind of index is needed to be involved, etc.

Thank you for your comment. These details will be added in the revised version.

8. Line84-86, 'In this context,...sea surface indices.' I would suggest rewriting this sentence to be clearer. Besides, here the term of 'sea surface indices' is used, instead of 'SST indices' (Line 20), would you please consider using consistent terms to avoid any confusions.

In fact, the term "sea surface index" does not include temperature. We will correct this to avoid any confusion.

9. Line 88: 'influence of SST indices on extreme precipitation', the indices are numbers used to represent the large scale climate phenomena, the impact should come from the phenomena, instead of the indices.

Thank you for your comment, but I didn't quite understand what you were suggesting.

10. Line 98, what does 'They' refer to?

Thanks, it's the climatology of monthly rainfall that's influenced....We'll make the correction in the revised version.

11. Line 99: Fig 1b shows the average annual rainfall, so it will not give any information on monthly maximum.

Thank you, there was an error; the reference is in the figures (sup.fig 1b) in the supplementary file.

12. Line 99: The reference to figures is not correct. There is a lack in serial number for the sub plots in suppl.Fig2b, and this figure is seasonal decadal SST anomaly, not seasonal rainfall.

Thanks, indeed, the reference is rather suppl.Fig1b.

13. Line 104, 'because of topography' I would suggest to describe the mechanism with more details.

More details will be added in the revised version.

14. Line 122: would you please clarify about the ‘best result’? what kind of result, and best compared to what?

This line presents the results of a study in which a better performance of the Chrips satellite product was used to reproduce in situ data.

15. Line 124: would you please clarify ‘heavy precipitation’, does it refer to high intensity or large volume?

Heavy rainfall was defined on the basis of a relative threshold (percentile) over a given period.

16. Line 133: I would suggest to rewrite the first sentence about the aim of developing extreme climate indices.

Noted. This correction will be added in the revised version.

17. In Methodology, I suggest describing the calculation process of the indices, I wonder is it based on each grid or on regional average precipitation data.

Table 1 of precipitation indices is not sufficient for this question. In this table, a definition has been associated with each index.

18. Line 138: I would suggest delete ‘(6)’.

Noted.

19. Table 1: would you describe the definition of indices with more detail? For example, it is unclear to define PRCPTOT with ‘Annual total rainfall $\geq 1\text{mm}$ ’.

Thank you, more details will be added in the revised version.

20. Line 166, I would suggest to delete ‘that is, whether the two variables are really correlated or not,’ just want to clarify that 0,05 is a level of significance, threshold less than 0,05 means higher confidence in significant level.

Thank you, noted. This correction will be added in the revised version.

21. Please clarify the meaning of n in equation 3.

Noted. This correction will be added in the revised version.

22. Line 174: misspelling PRCPTOT.

Noted. This correction will be added in the revised version.

23. Line 177: Could you please clarify why ‘a decline in total annual precipitation in the first decade’ is concluded? I assume that the bar plot shows annual mean anomaly of extreme precipitation indices, and I would suggest to apply a trend analysis to see if it exists any increase/decrease.

An initial explanation for this drop could be based on the number of rainy days and average rainfall intensity over the year. This is consistent with the fact that total annual precipitation depends on the number of rainy days and average rainfall intensity respectively. This explanation is given in the text (line 190).

24. Line 185: I would suggest use ‘percentage’ instead of %. Please consider giving each subplot a number to make it easier and clearer to indicate to specific ones. In Figure 3, I personally have curious in the change not only between decade 1-2 and decade 2-3, but also 1-3. Moreover, there seems no discussion in text about the difference between each decade, I would suggest to reconsider the methodology and data visualization of this figure.

Thank you for your suggestions. Regarding the suggested numbers, letters have been assigned to each figure group. For the difference between the decades, in the revised version, we'll be adding a lot more discussion.

25. Line 204, To my understanding in this study there is no calculations in difference phase of climate indices (the correlation analysis should be done with continues climate indices instead of separating them into different phases), if so, please rewrite the sentence. Similar statement can be found in Line 243, ‘positive phase of +NAO...’, also in Discussion section, eg, Line 262, Line 266. Please check an example of analysing the different phase of climate indices:

To be more explicit, we looked at whether there is a link between precipitation and SST indices, in other words, whether an increase (decrease) in one SST index leads to an increase in the other (if we refer to the definition of a link between two variables). To calculate this correlation, we used the data anomalies of the two variables. For this purpose, we used the term phase to refer to the signs of anomalies.

26. Line 211: the * and ** symbol needs to be defined better, for example, * could be used to represent the regions with less than 50% of the area significant, if larger, than marked as **.

Thank you for this suggestion, it will be considered in the revised version.

27. In supplement Table 1, should be INDEX-NAO, Haitu should be Haiti?

Thank you, we will make this correction in the revised version.

28. Line 224: there exists no Suppl. Table 2.

Thank you, there was an error. It's Suppl. Table 1, this correction will be added in the revised version.

29. Line 254: the effect of sea surface anomalies. I would suggest to consider using the term ‘impactor influence’ other than ‘effect’.

Noted. This correction added in the revised version.

30. Line 317: ‘...and cooling in the eastern Pacific (La Niña) have positive and significant effects on extreme precipitation indices.’ Would you please clarify the basis/evidence for this conclusion?

This clarification will be added in the revised version.