

Interactive comment on “Documentary-derived chronologies of rainfall variability in Antigua, Lesser Antilles, 1770–1890” by A. J. Berland et al.

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Received and published: 26 May 2013

Dear Professor Guiot,

On behalf of myself and my co-authors, I would like to thank you for managing the review process and for your constructive suggestions on our original manuscript. Below I include a comprehensive overview of all revisions that have been made to the paper in the light of reviewers' comments.

Yours sincerely,

Alex Jorge Berland

H. Diaz

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Main comment: "...it is sometimes difficult to associate specific periods or years of wet/dry conditions to large scales modes of climatic variability such as ENSO or NAO. For example, one particular period – 1769-1771 is highlighted as having been a rather low rainfall period [Page 1552, lines 16-22], but their connection to ENSO is for the most part inconsistent."

Additional comments: The reviewer provides a link to the findings of an ENSO chronology compiled by Garcia-Herrera et al. (2008), which - like the chronology of Ortlieb (2000), already cited by us - contains no evidence of an El Niño event in the period 1769 to 1771.

Response: The reviewer's main comment does not in fact contradict what we argue in our manuscript. In the final paragraph of Section 6, we acknowledge that there is no El Niño recorded at that time in the South American chronology of Ortlieb (2000), but simply speculate that concurrent drought in Antigua, Jamaica, Mexico and India could be the mark of El Niño's global teleconnections.

Revision made: We have added a citation to the ENSO reconstruction of Garcia-Herrera et al. (2008) to page 1552, line 22. Lines 19-22 on that page have been re-worded to emphasise: (1) that it was Chenoweth (2003) who originally stated that concurrent drought in Jamaica, Mexico and India at this time could be indicative of an El Niño event; and (2) that although relatively dry conditions in Antigua certainly do not detract from the aforementioned assertion made by Chenoweth (2003), chronologies based on South American documents do not record an El Niño at this time.

Anonymous Referee #2

Comments:

1. A smoothing filter could be added to figure 2b in order to facilitate the identification of drought episodes.
2. An alternative presentation style is advised for figure 3a. The reviewer suggests

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adding a smoothing filter or pooling data into multi-year groupings.

3. Orthographic errors highlighted on pages 1539, 1546 and 1562.

Summary of responses:

1. We agree.

2. We acknowledge that figure 3a is rather complex, but feel that it is important to provide readers with a means of discerning our rain-year classifications at an annual resolution. This data is not available in any other section of the paper and including it in a single figure avoids making further additions to an already lengthy paper. As the clarity of this figure was not highlighted as an issue by other reviewers, one solution might be to position the figure landscape format across the full length of the page to make the fine details as clear as possible. However, we understand that this will be at the discretion of the type-setter.

3. The necessary corrections will be made.

Revisions made:

-Page 1539, line 14: “meteorological” changed to “meteorological”.

-Page 1546, line 11: “excefsive” changed to “excessive”.

-Page 1562, Figure 4a annotation: “Instrumnetal” changed to “Instrumental”.

-Figure 2b: a 5-year moving average has been added.

D. Nash

Comments:

1. An alternative referencing system for rain-years (e.g. 1770-71, 1771-72 and 1772-73 instead of 1770-1771, 1771-1772 and 1772-1773) would be clearer.

2. Could the ‘confidence rating’ (CR) system of Kelso and Vogel (2007) be applied to

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provide an insight into the security of individual rain-year/seasonal classifications?

3. Blue books were mentioned in Table 1, but not discussed in the text of Section 3.

4. “Do the authors have any indication about the homogeneity of these instrumental datasets from their archival research? For example, is there any indication as to whether the instrument has always been in the same place?”

5. The work of Rudolf Brazil and Christian Pfister should be cited when discussing the limitations of documentary-derived climate evidence (Page 1543, lines 3-6).

6. Some basic statistical analysis of the comparison between the island-wide and central-eastern Antigua chronologies (described verbally on page 1552, lines 15-16) would improve the rigour of the investigation.

7. Orthographic errors on pages 1539, 1546, 1551, 1552 (two of which already noted in a previous review).

Summary of responses:

1. We agree.

2. In the case of the island-wide chronology, it is possible to assign confidence ratings to the rain-years that received definitive classifications (i.e. very wet, wet, normal, dry or very dry). Of the 85 rain-years of this type, 73 would be awarded the highest CR value of 3, while the remaining 12 would be given the moderate CR of 2. The assignment of ‘assumed normal’ classifications or leaving rain-years unclassified when available evidence was not conclusive eliminates the need for any CRs of 1 (the lowest confidence level). Kelso and Vogel’s CR system is not strictly applicable to the central-eastern Antigua dataset, as most classifications in this reconstruction were assigned on the basis of descriptions of the progression weather conditions or climate events over intervals of several weeks or months within each season, rather than annual/seasonal summaries. The use of statistics of the availability of data points and sources (Figures 3b and 5b) thus seems a preferable means of indicating classification confidence,

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as it can be applied in a consistent manner to both the island-wide and centraleastern Antiguan reconstructions.

3. A sentence about the Blue Books was mistakenly edited out previously and can be re-inserted.

4. In short, we have been able to obtain very limited information affording an insight into the homogeneity of the data, despite thorough searches of the archives. In the cases of both Auchinleck's dataset, and that obtained from archival sources for St. John's, little more was provided than the rainfall values themselves.

5. We agree.

6. We agree.

7. The necessary corrections will be made.

Revisions made:

1. All references to rain-years throughout the paper have been reformatted in the suggested manner.

2. A footnote has been added to page 1544, line 11 noting the CR ratings that would be assigned to classified rain-years in the island-wide chronology and briefly explaining why this has not been done for the central eastern reconstruction.

3. A sentence describing the Blue Books and their content has been added to paragraph 4 in section 3 (Page 1539, line 25-page 1540 line 5).

4. We have expanded on the final paragraph of setion 4.1 (page 1542, lines 1-16), to specify more clearly what information we do and do not have regarding the instrumental data series in question.

5. We have added the citations suggested in Professor Nash's review to Page 1543, lines 3-6).

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6. On page 1552, lines 15-16, we now note in brackets the Kendall's Tau statistic of the correlation between island-wide rain-year classifications and wets season classifications in the central-eastern Antiguan chronology.

7. Page 1552, line 26, "documnetary" changed to "documentary". Page 1552, line 17, "collocated" changed to "co-located".

L. Ortlieb

Comments:

1. Regarding the following statement "Antigua experiences considerable interannual precipitation variability, which is known to be driven by the El Niño Southern Oscillation (ENSO) and North Atlantic Oscillation (NAO)" made in section 2 (Page 1538, lines 17-19), the reviewer suggests the usage of more precise wording. He asserts that, currently, the phrasing suggests that there is no question over the combined impacts of the ENSO and NAO. Furthermore, no citation is given for this assertion, which may also seem to contradict our conclusions made later (Page 1553, lines 1-3).

2. An alternative referencing system for rain-years (e.g. 1770-71, 1771-72 and 1772-73 instead of 1770-1771, 1771-1772 and 1772-1773) would be clearer.

Responses:

1. We agree that some rewording is needed.
2. See response to D. Nash's review (point 1).

Revision made:

We have altered the wording of the final paragraph in section 2 (Page 1538, lines 7-25) to make it clear that NAO and ENSO are two climatic modes that operate independently and have their own influence over interannual precipitation levels in the Caribbean at large. We have included another citation to the work of Gianni et al. (2001a) to make the foundation of this information clear.

Additional revisions

1. While re-examining our data since review, we have noticed that in the island-wide reconstruction the rain-years 1774-75 and 1887-88 were mistakenly recorded as having 'normal' classifications, but should have been assigned "assumed normal". Similarly, rain-year 1808-09 was previously documented as "assumed normal", but should in fact be receive the classification "wet". These corrections have been made to all figures displaying classifications for these rain-years and the statistics displayed in Table 3 have accordingly been updated. These changes do not, however, have any implications for the remainder of the paper.

2. We have expressed our appreciation of the constructive comments made by reviewers in the 'acknowledgements' section.

Interactive comment on Clim. Past Discuss., 9, 1535, 2013.

CPD

9, C906–C912, 2013

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