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Climate of the Past Discussions

Interactive comment on "Persistent decadal-scale rainfall variability in the tropical South Pacific Convergence Zone through the past six centuries" *by* C. R. Maupin et al.

Anonymous Referee #1

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General comments

This study present new century-scale climate data derived from stalagmites from the Solomon Islands. Multi-century reconstructions of regional rainfall variability are provided as context for interpreting recent observed decadal and multi-decadal variability within the region and particularly shifts in climatology observed in the twentieth century. The stalagmite-derived reconstruction suggests that decadal-scale precipitation variations are a characteristic of internal climatic variability, but nonetheless important for regional natural resource management.

Overall, the study presents interesting new data as a context for understanding recent observed changes in the region. The data is well presented and the writing is clear. However, the link to resolving the mechanisms behind the observed shift in the late twentieth is somewhat tenuous and requires additional dynamical consideration. There are also some minor comments in regards to methods that need to be addressed before this manuscript is suitable for publication.

Specific comments

1. The motivation for the study is about understanding decadal-scale climatic shift such as that occurring in 1976/1977. However, this study focuses only on fairly qualitative process-based understandings from one small region alone. In order to elucidate regional variability, I would think either a basin-based approach is necessary, or a dynamical investigation Pacific ocean-atmosphere changes. There are very few references to modelling based studies, which would be useful for interpreting the climatic signals record in the stalagmite calcite. The inclusion of model-based approaches or more extensive reference to those utilized in previous studies would strengthen this study in terms of understanding internal decadal-scale variability.

2. 5595, 1 ff. It is confusing how the shift in the climate in 1976/77 is introduced. The changes in the SPCZ, PWC strength and tropical SST anomalies associated with IPO are discussed. Do these changes define these "distinct epochs"? I think you need to be clear about defining this terms, otherwise it seems like you are suggesting that a regime shift occurs during different IPO phases, but this is also an important impact of the regime shift.

3. 5596, 16 ff. The rainfall variability in the region is mirrored by local rainfall variability, but given that you are discussing large climatic shifts, is this necessarily always the case? You need to explicitly address potential non-stationarities over longer timescales. It seems it would be highly sensitive to boundary conditions that influence the WPWP boundary?

4. 5596, 22 ff. It is not clear how useful it is to describe the climatology of the area over this time period, given that you are discussing a shift occurring in 1976. Can you provide clearer comparisons of the observed climatologies before and after the shift, and perhaps figure demonstrating this?

5. 5596, 26. Can a figure showing seasonality of rainfall be provided?

6. 5598, 17. It is not clear how representative the two-week sampling period is of conditions on longer timescales. Is this useful data? Can this be discussed somewhere?

7. 5599, 20. Can a citation/reference be provided for this method of age-model determination?

8. 5600, 4. This paragraph does not seem to readily fit in as 'Age Model', can this be contained in a new section addressing the fidelity of the record?

9. 5600, 8 ff. Can definitions be provided of "margins" vs "centre" of the stalagmite? These seem somewhat arbitrary and subjective?

10. 5601, 4 ff. Given the acknowledged large offsets between typical stalagmite deposition temperatures in caves and temperature ranges in the laboratory, it's not clear what is being shown here. Is this a useful test? I would think the most meaningful assessment of the fidelity of calcite isotopic composition is the close match across stalagmites and across caves on these timescales.

11. 5601, 21. Is this correlation significant?

12. 5602, Section 2.5. This is a fairly superficial discussion of source effects. Is this 0.3 % (line 12) or per mil? There is little discussion of variability in source through time (instead of just modern setting, and no reference to other studies explicitly addressing source effects.

13. Section 3.1 (and 5603, line 13) I'm not sure the "Calibration" is an appropriate word to use in this section heading. Calibration implies that two measurements are

being compared against each other for the purpose of adjustment. As calcite isotopic composition integrates many, complex and mutable processes, it is not a clear case of calibration against rainfall amount. Perhaps "relationship" would be more appropriate?

14. 5602, 23 ff. This seems to be a statistical, rather than process based, understanding of the relationship between rainfall amount and calcite composition. Why is the annual rainfall amount being regressed across isotopic changes? Is this the timescale you expect to integrated into calcite signals?

15. 5603, 9 ff. The GNIP network is temporally and spatially sporadic, and the PNG site is located quite some distance from the Solomon Islands. Can this be discussed explicitly? Is this relevant? Can you incorporate some model-based studies in order to discuss the relationship to stalagmite composition to rainfall amount?

16. Section 3.2. It is difficult at this stage for the reader to interpret the significance of "large, abrupt" changes. I think this would be easier is figures of modern seasonal data were provided.

17. 4. Summary and conclusions. The influence of anthropogenic forcings on the regional climatology are not discussed until the final summary of the analysis. Although the anthropogenic forcings on the observed regional climatology is likely small, it would be worth discussing how relevant the modern setting (given this radiative forcing) is to reconstructing multi-century climatic records.

18. 5607, 27 ff. Only one external forcing (sunspot) has been considered, but it would be worth discussing, in the context of the wider literature, whether other forcings may impact the climatic record, or whether other forcings may be important climatically or whether multi-decadal oscillations are largely the result of unforced variability.

Technical corrections

1. Many of the symbols and units are displayed erroneously in the manuscript. For example, in terms of isotopic ratios, these are shown by sigma, rather than delta. The

degrees symbols for coordinates are also incorrect and there are many stray commas (ie. 5598, line 8) and instances where a space should precede the unit given.

2. Line 5606, 7. The definition of time period show ?? instead of a year.

Interactive comment on Clim. Past Discuss., 9, 5593, 2013.