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Climate of the Past Discussions

Interactive comment on "Holocene climate variability in the winter rainfall zone of South Africa" *by* S. Weldeab et al.

C. Stager (Referee)

cstager@paulsmiths.edu

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This article presents interesting and useful new information regarding Holocene climatic changes in the winter rainfall zone of southern Africa, offering marine-based information in support of existing terrestrial records.

The methods appear to be sound and the multi-proxy approach helps to support the conclusions made in the article, most of which I find convincing. However, this approach also presents the risk of confusing readers such as myself who are not as accustomed to working with these paleo indicators as the authors are. This is especially important when each proxy can have multiple environmental interpretations (grain size = source area and/or wind strength, 18C = salinity and/or temperature, 13C = upwelling and/or river discharge, etc.). I therefore recommend including a simple

summary paragraph or table of what each proxy is taken to mean (13C, 18O, K/Al, Ti/Al, etc.) along with the presumed condition of each environmental system (position of westerlies, humdity, upwelling strength, SST, etc.) to help guide the reader while evaluating the text and the data.

On page 2294, for example, the authors explain that reduced delta-13C means stronger upwelling (lines 23-24) and/or reduced river input (lines 14-15), which presumably would be expected under drier climatic conditions associated with poleward drift of the westerlies. This seems to suggest a negative correlation between upwelling and humidity. On page 2298, however, aridification is linked to weakening of the BUS (lines 7-8), suggesting a positive correlation, and on page 2301 (lines 20-25), stronger upwelling is linked to more humid conditions and equatorward drift of the westerlies. After multiple readings I am still having trouble keeping it all straight - probably due in part to my own limitations, but still reasonable grounds for a reader to request more clarification.

One unresolved point in particular is the climatic interpretation of nssCa in Antarctic ice cores. In most of the article, higher nssCa is taken to represent poleward retreat of the westerlies, which makes intuitive sense if the dust-bearing westerlies move closer to the site of deposition. However, in our cited Verlorenvlei paper (Stager et al., 2012) we found rising nssCa at Siple Dome associated with rising precipitation in the WRZ during the last 600 years or so. We hypothesized that this indicated more dust delivery to Siple Dome as a result of EQUATORWARD drift of the westerlies, which would bring more winter rain to the WRZ and also reach more landmass in the southern hemisphere from which dust could be transported. The authors are therefore left in the unenviable position of dealing with multiple interpretations of this particular proxy as well. However, if the ice core records are to be used in the figures, then these opposing interpretations need to be addressed somehow in the text. One possible key to resolving this is the complexity of atmospheric circulation over Antarctica; for example, the Siple Dome snow chemistry doesn't necessarily have to vary in lockstep with that from the EPICA

CPD
8, C715–C717, 2012

coring site.

I was also a bit confused by some aspects of the LIA history. To my eye, it seems as though delta-13C declined during the 500-300 BP interval, and on Figure 7 this indicates stronger upwelling as well as southward drift of the westerlies (Fig 7A). However, southward drift would apparently be contradicted by the Verlorenvlei evidence of wetting (Fig 7K), the abstract links stronger upwelling to wetter climates and equatorward drift of the westerlies, and on page 2301 (lines 9-10) the text says that upwelling declined during that time period. Please clarify?

In addition, on page 2299, lines 10-11, the Tyson et al citation of dry climate seems to contradict the interpretation of wetter conditions, but without explanation.

Some other minor suggestions:

1. I would avoid the term "amelioration" when referring to climatic changes, as it is based on undefined human preferences and can have multiple interpretations. If it became drier or warmer, for example, then better to simply say that it became drier or warmer.

2. A map of the mudbelt might be useful, though not absolutely necessary.

3. Typo on page 2285, line 20 (Drakensberg)

4. Additional editing for English usage suggested

I look forward to the published version of this paper, which represents a potentially important contribution to our understanding of the climatic history of the southern hemisphere.

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