

Interactive comment on “Does a proxy measure up?: A framework to assess and convey proxy reliability” by F. Garrett Boudinot and Joseph Wilson

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The manuscript by Boudinot and Wilson represents a substantial contribution to paleoclimate research by describing a new system for presenting proxy data that explicitly identifies potential inaccuracies. By addressing how scientist reconstruct ancient climates, the manuscript is appropriate for "Climates of the Past." The topic of proxy reliability is something all paleoclimatologists are aware of and wrestle with, but not something for which we have a universal language. A universal framework for reporting proxy reliability is necessary as we try to synthesize the large mass of data collected into coherent datasets for making global conclusions. The differences in the

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same types of paleoclimate data and their uncertainties are reported forces scientists into comparing apples and oranges. The text lays out an example of this in the paragraph beginning on line 272. Without the ability to compare similar datasets, such as temperatures produced from TEX-86 analysis, we are limited in the breadth of our conclusions. More critically, this issue prevents us from independently assessing the reproducibility of conclusions.

The manuscript is difficult to review for Scientific Quality since it is not a traditional analysis of original data nor a review paper. The text does contain a logical breakdown of what makes proxies unreliable: variation based on context. The manuscript also presents many new terms (confounding causal factors or CCFs, observation-constrained proxy, inference-constrained proxy, correlation-constrained proxy) that need explicit definitions to be clear. I suggest use of a glossary. The evaluation framework presented does not assess the magnitude of influence of different CCFs on the proxy interpretations. For example, air temperature may influence the seawater temperature recorded by foram oxygen isotopic composition, but not beyond the analytical error of the oxygen isotopic measurement. If this is the case, then does the lack of calibration for air temperature mean that the seawater temperature is more poorly constrained? The text is also missing a detailed consideration of how geologic age influences proxy reliability. The issue is mentioned (ln 138-142), but not explored as a significant CCF. Reliability with geologic age may not be possible to integrate into a calibration. My reading of the manuscript indicates that the authors assume that CCFs may always be known, which isn't possible. Determining if this proxy-assessment framework is useful can really only be determined by applying the framework to other proxies, which is beyond the scope of this paper.

The presentation of the manuscript is clear for an abstract subject. The title reflects the contents of the paper, the language is fluent, the document is well structured, and the conclusions are well referenced. The abstract is missing an explanation of CCFs, which are the critical subject of the rest of the paper. Figure three does need some

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clarification. The y-axis of figure 3b needs to be defined - low uncertainty to high uncertainty or absolute values of uncertainty. Also, the sizes of the boxes seem to contradict the text as In 270 states that potential uncertainty should always be higher than reported uncertainty, but then the blue "reported uncertainty" box is larger than the potential uncertainty box. Figure 3b is critical for understanding the framework but currently very unclear.

I've included a PDF of the manuscript with my comments for further investigation.

Please also note the supplement to this comment:

<https://www.clim-past-discuss.net/cp-2020-12/cp-2020-12-RC2-supplement.pdf>

Interactive comment on Clim. Past Discuss., <https://doi.org/10.5194/cp-2020-12>, 2020.