Geophysical Research Abstracts
Vol. 20, EGU2018-11615, 2018
EGU General Assembly 2018

Joint proxy inversion to improve paleoclimate reconstructions

Gabriel Bowen and Brenden Fisher-Femal
University of Utah, Geology and Geophysics, Salt Lake City, UT, United States (gabe.bowen@utah.edu)

The paleoclimatologist's toolbox is deep but filled with blunt instruments. Although we have a wide variety of proxies at our disposal, none of them provides the level of specificity or precision we desire. The bluntness of our tools stems from both practical and fundamental limitations; most fundamentally, however, we are confronted with the fact that no proxy reflects a single, unique, environmental variable of interest.

The complexity of our proxies and their response to multiple environmental factors can be viewed as a source of 'noise' in paleoclimate reconstructions, but also offers a potential pathway to a deeper, more highly resolved reconstruction. By combining multiple, complimentary, proxies in the context of formal statistical inversion analysis, suites of environmental variables can be reconstructed that are consistent with our proxy records. The "joint proxy inversion" can capitalize on complex signals in proxies that share overlapping environmental influences to provide more highly constrained interpretations of our data or even extract signals not apparent in traditional univariate data analysis approaches. The method requires development of proxy models linking measured data to multiple environmental variables, and is sensitive to omissions in these models as well as uncertainties in the temporal representativeness of multiple proxies; these factors can be considered in error analysis, however.

We illustrate the joint proxy inversion approach using the pedogenic carbonate system. We will present an overview of the proxy models developed for this system, results from synthetic proxy records illustrating the properties of the method, and a case study from the Paleocene-Eocene boundary that demonstrates the ability of joint inversion to constrain otherwise ambiguous environmental signals documenting real-world environmental perturbations in continental environments. Through these examples we hope to illustrate the general and broad utility of the approach across systems and timescales.