

PROBLEMS IN ESTIMATING THE RESPONSE FUNCTIONS OF NATURAL CLIMATIC
RECORDING SYSTEMS

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Abstract

- High-resolution proxy records of climate, such as varves, ice cores, and tree-rings, provide the opportunity for reconstructing climate on a year-by-year basis. In order to do so it is necessary to approximate the complex nonlinear response function of the natural recording system using linear statistical models. Three problems with this approach were discussed, and possible solutions were suggested. Examples were given from a reconstruction of Santa Barbara precipitation based on tree-ring records from Santa Barbara County.

First, natural recording systems will frequently exhibit a degree of persistence which is not present in the climatic variable. This problem can often be minimized by modeling the proxy record as an autoregressive process and using the residuals in the reconstruction.

Second, the response function is often nonlinear in mean and variance. This problem can be addressed by transforming the variables, but it implies that some aspects of the reconstruction are likely to be more accurate than others. In the precipitation reconstruction, for example, dry years are estimated more accurately than wet ones.

Third, estimates of skill derived from data used to calibrate the proxy record to climate will be optimistically biased when applied to the reconstruction. Cross-validation provides a means for reducing this bias.