1086-62-123 **S. E. Tolwinski-Ward*** (tolwinski@math.arizona.edu), **M. P. Tingley**, **M. N. Evans** and **D. W. Nychka**. *Forward and inverse modeling of the nonlinear relationship between tree-ring width and climate.*

Natural proxy records are generally the result of lossy, nonlinear interactions between multivariate climate and the biological or physical recording process of the specific proxy archive. The width of tree rings depends on variations in temperature and moisture resources integrated over time. Yet regression-based climate reconstructions typically treat tree-ring width as information-preserving and linearly related to a single climate variable.

We present a simple yet biologically-motivated nonlinear forward model for tree-ring width as a function of monthly temperature and precipitation inputs. The validated model, called VS-Lite, is used to describe the climate-proxy relationship within a Bayesian hierarchical modeling solution to the inverse problem of reconstructing climate from ring width data. Like the real-world ring-width recording process,VS-Lite is not a one-to-one mapping between the space of climate histories and the space of modeled ring width series. The resulting nonidentifiability in our inverse statistical model is partly overcome when the model is combined with prior climatic information encoded in the Bayesian model. The rest is translated into a rigorous and realistic representation of uncertainty in the resulting estimates of climate. (Received July 25, 2012)