Geophysical Research Abstracts
Vol. 14, EGU2012-7676, 2012
EGU General Assembly 2012

The problem of calibration: A possible way to overcome the drawbacks of age models

B. Goswami, J. Heitzig, K. Rehfeld, N. Marwan, and J. Kurths
Potsdam Institute of Climate Impact Research, Potsdam, Germany (goswami@pik-potsdam.de)

Constructing a meaningful age model from a set of radiocarbon age-depth measurements made on a palaeoclimatic archive is the crucial backbone of all proxy-based research carried out thereafter. Significant progress in the development of Monte Carlo based interpolation techniques and Bayesian methods has been made recently, targeting the uncertainties of radiocarbon dating, which then reflect meaningfully as time domain errors in the proxy vs. time relationship. However, one primary limitation of these approaches is the debatable assumption of Gaussianity of the errors in calibrated ages as calibration often results in highly irregular and non-trivial probability distributions of the age for every measurement. Here, we present a method that circumvents this limitation by focussing on the construction of the proxy vs. time relationship rather than emphasising on the estimation of an age-depth relation as the intermediary step. Our method is based on a simple analysis of the involved probabilistic uncertainties and the use of (preferably non-parametric) regression methods that give an estimate of the uncertainty of regression at every point as well. With the appropriate use of Bayes' Theorem we then provide a regression-based estimator for the proxy measurements and compute the respective distribution parameters (such as mean and variance) that quantify the uncertainties of the proxy in the time domain. We verify this method with the help of an artificial data set involving the accumulation history of a simulated core and noisy radiocarbon dating and proxy measurements made on it. To our best knowledge, this is the first method that manages to overcome the fundamental problem of irregular distributions induced by calibration of radiocarbon ages. We feel that this approach shall enable us to look at the problem of dating uncertainties in a new light and open up newer possibilities for studying not only speleothem proxies but, more generally, from other palaeoclimatic archives as well