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A non-linear multi-proxy approach for climate reconstruction based on archaeological shells

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In accordance with the trends seen in previous years, also 2007 hit some temperature records. We just lived the warmest winter and the warmest spring since the beginning of all temperature measurements. To properly understand present day and future changes it also is important to gain insight into temperature evolutions for the period preceding the era of instrumental observation. To know more about it we need high quality proxy-archives reflecting clear seasonal and longer term trends and a tool for proper interpretation of the signal and to reconstruct the environmental condition.

Several years of biogeochemical research on bivalve shells yielded in clear proxy-records carrying potential for reconstruction of paleoclimate trends in coastal environments. However, the interpretation of the proxy signals is still often problematic. Classical linear transfer functions relating proxy to environmental parameter fail for most proxies, and in situations where they seem to work (e.g. relating δ^{18}Oshell to SST) the uncertainty on the reconstructed temperature is often too large (mostly because of poor knowledge of the d18Owater value, or paleosalinity) to make clear interpretations about temperature trends.

In an attempt to circumvene this problem we developed a non-linear multi-proxy model based on trace element and isotope records in modern bivalve shells. This approach consists in the construction of a model in a multi-dimensional space, as a first

step, from which in a second step a temperature reconstruction is obtained. At this moment two types of models are used to describe the chemical signature ; (1) a spline model and (2) a polynomial model. Both models describe the variations in the trace element and isotope signature of the shell during a full year cycle. The shortest distance from any other data point (from a fossil shell for instance) to the model will give a time point estimation in the annual cycle, which can then be linked to environmental parameters. At present our model approach achieves quite accurate SST reconstructions (up to ±0.35ºC) and results will be shown for two bivalve species *(Mytilus edulis* and *Ruditapes philippinarum*) from two estuarine environments: the Scheldt estuary and le golfe du Morbihan.