ADDRESSING THE STATISTICAL CHALLENGES OF ESTIMATING PAST CLIMATE FROM POLLEN SOURCES

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Quantitative reconstructions of past climate have an intrinsic value as a source of insight into the Earth's climate history, including the timescales involved in abrupt changes in climate. Such reconstructions also provide a potentially valuable tool for evaluating the performance of general circulation models (GCMs), which are used to explore the potential future climatic consequences of anthropogenic changes to the Earth system.

In this talk we focus on inferring past climate from fossil pollen data, a "noisy" source of climate information obtained from lake bed sediment cores, and identify the statistical challenges which need to be overcome to harness pollen as a climate proxy. These are multiple in nature - the present day model training dataset, consisting of highly multivariate, zero-inflated compositional counts for vegetation, as well as measurements on several climate covariates including temperature and precipitation, presents numerous challenges of model choice and inference. In particular, we present a framework for modelling compositional count data subject to an excess of both zeroes and N's, a feature introduced to our pollen responses by the imposition of hierarchical structures. We also illustrate the drawbacks of omitting influential climate covariates in models, and the resulting impact on climate predictions. We conclude by providing historical climate predictions for a number of European locations, and attempt to evaluate the accuracy of these estimates.

Keywords: Statistical climatology, Zero and N-inflated compositional data, Inverse regression problems.

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