



On the development of probabilistic climate reconstructions based on fossil pollen records

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Past climate reconstructions based on proxy data help to understand natural climate variability. It is essential that palaeoenvironmental transfer functions between climate and proxy variables take in to account the stochastic nature of the climate system. Especially pollen based reconstructions are a complex issue, since pollen counts do not show direct relation to climatological parameters, e.g. due to plant competition and/or land cultivation. The idea is to assess the background knowledge from classical, more empirically based methods in order to develop statistical transfer functions between vegetation and climate. Two popular concepts, the indicator taxa approach (or MCR) as well as the biomisation (BIOME/PFT), are translated into a statistical framework in order to reconstruct January and July temperatures as well as annual precipitation during the Holocene (10,000yrs BP). This involves the problem of multivariate random vectors with non-normally distributed marginals, which has been addressed by using copulas. The methods are applied to fossil pollen records of laminated sediments from the Eifel region in Germany. On the one hand, the reconstructions indicate that pollen based reconstructions show larger uncertainty ranges than expected by several classical approaches. On the other hand, the indicator taxa approach is robust to the lack of modern analogues, which is an advantage in highly anthropogenically influenced areas such as the Mediterranean or Central Europe.