technische universität dortmund

fakultät statistik

Juniorprofessur Environmetrics

A Bayesian model for reconstructing climate from pollen assemblages

Bachelor or Masterthesis
Supervision: JProf. Dr. Nils Weitzel, Environmetrics group
12.01.2026

Short description

Pollen-climate transfer functions are statistical links between pollen count data from sediment samples and climate conditions governing the vegetation composition. These are trained with modern data from over a large spatial and climate range, and then applied to reconstruct climate thousands of years back in time. This application involves several assumptions and the risk of overfitting when these are not fulfilled. Using Bayesian statistics for climate reconstructions can create models that invert the causal link from climate to vegetation and incorporate several sources of uncertainty. Tipton et al. (2019) have developed a promising latent Gaussian process model for univariate climate reconstructions from compositional data that can model species specific responses to climate changes but also interactions between species. The aim of this project are to comprehensively evaluate and expand the method from Tipton et al. (2019). Potential thesis topics include

- Comprehensive evaluation of the Tipton et al. model with a hemispheric-scale training and reconstruction dataset
- Comparing the results with previously developed methods for pollen-based climate reconstructions
- Extending the model to reconstruct multivariate climate states

Key concepts/prerequisites

- Experience with Bayesian statistics
- Experience with Gaussian processes
- Programming skills in R
- Interest in working with environmental datasets

Key reference

- Tipton, J. R., Hooten, M. B., Nolan, C., Booth, R. K., and McLachlan, J.: Predicting paleoclimate from compositional data using multivariate Gaussian process inverse prediction, Ann. Appl. Stat., 13, https://doi.org/10.1214/19-AOAS1281, 2019.