Separating temperature and precipitation signals in East Asian Monsoon climate reconstructions

Department: Earth Sciences
Research group: Organic Geochemistry
Supervisor: Dr. Francien Peterse
Email address: f.peterse@uu.nl

Project description

Monsoon systems are characterized by seasonally reversing winds and associated precipitation, driven by land-sea temperature contrasts. One of strongest systems is that of the East Asian Monsoon (EAM), which controls the water supply to over one-third of the world's population. Theoretically, ongoing global warming should strengthen the monsoon, but instrumental data indicate that the EAM has weakened since 1950. Indeed, climate models have difficulties simulating the EAM, which leads to low confidence in projections for future monsoon rainfall. Hence, long-term records of monsoon climate dynamics are needed to constrain the model outputs. However, currently available paleorecords reflect a combined signal of moisture and temperature, and thus cannot be used to assess the response of EAM rainfall to warming.

In this project, we are looking for a student who will generate independent, yet directly comparable records of temperature and precipitation using lipid biomarkers archived in Chinese loess. Samples are available from the Huining section on the northwestern edge of the Chinese Loess Plateau (CLP). This part of the CLP is characterized by very high deposition rates, which enables the reconstruction of very high-resolution climate records and study potential leads and lags between temperature and precipitation in great detail.

The project is primarily laboratory-based, and involves the extraction of lipid biomarkers (i.e., branched GDGTs and plant waxes) from the loess samples, and further separation using small column chromatography. The different biomarker fractions will be analyzed using gas chromatography and liquid chromatography-mass spectrometry. The student will work in the organic geochemistry research laboratories in Vening Meinesz B, and will have regular meetings with the supervisor (weekly, or whenever needed).

Job requirements

The student ideally has experience, or else a strong affinity with laboratory work.