The effect of species selection on SST reconstructions based on planktonic foraminifera assemblages.

Lukas Jonkers and Michal Kucera

MARUM Center for Marine Environmental Science, University of Bremen, Germany

Planktonic foraminifera assemblages in modern sediments are well predicted by sea surface temperature and their fossil assemblages provide an important source of information about past sea surface temperature. However, the effect of the presence of uninformative or even nuisance species on temperature reconstructions has not been rigorously assessed. Here we investigate the effect of species selection on planktonic foraminifera transfer functions. We rank species according to their importance for transfer function models using a random forest technique and evaluate the performance models with the number of species increasing according to their importance ranking.

Irrespective of using models that use the entire training set (weighted averaging) or models that use only a subset of the training set (modern analogue technique), we find that the majority of foraminifera species does not carry useful information for temperature prediction. In general, less than one third of the species in the training set is required to provide a temperature estimate with an error comparable to a transfer function that uses all species in the training set. This means that from a single record of assemblage change (sediment core) many different reconstructions of sea surface temperature with the same error are possible. By reanalysing the MARGO last glacial maximum dataset and downcore assemblages, we find that largest differences between traditional reconstructions using all species and reconstructions using trimmed training sets are related to poor analogue situations, likely associated with bioturbative mixing across abrupt transitions in the downcore assemblages. The possibility of obtaining multiple different reconstructions from a single sediment record without a direct means to assess their validity, presents a previously unrecognised source of uncertainty for sea surface temperature estimates based on planktonic foraminifera assemblages.