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Applying sea-level indicators to validate reconstructions of relative sea level during the last glacial termination phase

Milena Latinović (1,2), Volker Klemann (1), Maik Thomas (1,2), and Andrea Unger (1)
(1) GFZ German Research Centre for Geosciences, Potsdam, Germany, (2) Free University, Berlin Germany

Observations of sea-level variations allow the validation of numerical models used to reconstruct past and predict future sea-level change. Sea-level indicators (SLIs) are used as the main source for deriving relative sea level (RSL) variations during previous epochs for which tide-gauge and satellite measurements were yet not available. However, the levelling of an SLI relative to present sea level does not provide a direct measure of former RSL, but only an indication according to the conditions under which the sample was deposited. This information depends on the sample type and on its environment and has to be mapped to RSL by an appropriate transfer function. The respective data has to be extracted by an objective procedure from primary information usually provided in geological or palaeontological literature of different primary focus, quality and detailedness. In addition to the height information, also the precision of dating varies between different indicators and in case of radiocarbon-dated material, a further calibration of the dated age has to be applied.

In order to improve the reliability of the sea level indicators for sea-level reconstructions, the visualization framework SLIVISU is developed at GFZ-Potsdam. It allows access to a relational database system that contains compilations of sea level indicators obtained from the literature where the respective meta information is stored. First, the radiocarbon dated material is calibrated considering information from the sample's metadata. Then likelihood functions are derived incorporating the indicative meaning as available error information in order to evaluate model-based sea-level predictions against the respective SLI.

Depending on the statistical significance, the analysed SLIs will serve as validation data for the viscoelastic lithosphere and mantle model VILMA. The VILMA model is currently part of the German Paleo-Climate Modelling Initiative PalMod (https://www.palmod.de/en), serving as the solid-earth response in the earth-system models applied in this initiative. This study contributes to the validation of SLIs as proxy data for sea-level reconstructions during the last glacial cycle.