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Constraining coastal change: A morpho-sedimentological concept to infer sea-level oscillation

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One of the responders to Milankovitch-scale climate changes is sea level which, in turn, is a driver of coastal change. In literature, the sedimentary sequences representing the coastal change are often linked to high sea-level stands, to intermediate sea-level positions or to regressive shorelines. We note apparent contradictions that indicate a lack of concept and inconsistent usage of sea level-related terms. To overcome this, we combine an integrated morpho-sedimentological concept for microtidal, mid-latitudinal coasts with chronologies based on Bayesian statistics. The concept regards the coastal sedimentary system as a depositional complex consisting of shallow-marine, aeolian and alluvial facies. These facies are in juxtaposition and respond simultaneously to external forcing. Bayesian statistics constrains the timing of the sequence based on optical or radiocarbon ages.
Here, we present the site Hergla located on the North African coast of the central Mediterranean Sea as a case study to illustrate how the approach helps eliminating contradictions. The site has been cited frequently for confirming the hypothesis of a global two peak sea-level highstand during the last interglacial (MIS 5e). The ∼2 km cliff exposure at Hergla was surveyed, mapped, logged and sampled for further describing the sediments and their depositional environment through thin section and Bayesian modelling of optical ages. Using our concept based on sequence stratigraphy tools, the section is interpreted as representing a coastal barrier with two bounding surfaces in the succession. Both surfaces mark the falling sea level of, first, MIS 5e and, second, MIS 5a and hence bound the falling stage system tract of a forced regression. Part of the deposits between the two surfaces are pulled up onto the shoulder of a small rising horst and the associated tectonic event coincided with the MIS 5a sea-level rise enhancing locally the accommodation space for a second foreshore environment.
Our presentation will provide theoretical background of the concept and critically discuss the global dataset for last interglacial sea-level oscillations using both the stratigraphic record and age distributions.