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Modeling sea-level curve signatures on staircase sequences of marine terraces

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Sequences of uplifted erosional coastal landforms are widespread and contain essential clues on multi-scale climatic and tectonic processes. Here we explore the influence of both synthetic and published Quaternary sea-level curves on the geometry of a marine terrace sequence using a numerical model of cliff erosion. The morphology of the modelled sequence is particularly sensitive to timing and elevation of sea-level highstands, and the duration and amplitude of sea-level rise. Modelling the rapidly ($\sim$1.5 mm/yr) uplifting <240 ka marine terraces in the Gulf of Corinth, our test site, we find that sea-level curves based on dated coral reef terraces generally best reproduce the observed topography. Contrarily, based on Quaternary time-scale (2.6 Ma), low uplift rate (0.2 mm/yr) modelling we find that ice-sheet or hydraulic model-based curves may be more appropriate on time-scales extending through the Mid-Pleistocene climatic transition. Our study demonstrates how modelling the geometry of terrace sequences can be used as a tool to test the suitability of different sea-level curves, and simultaneously evaluate the governing parameters of marine terrace formation. We propose that extending this approach globally, to well-dated sequences with a well-constrained geometry, can potentially enhance our understanding of Quaternary climatic and tectonic variations.