

Relative Sea-Level Changes since the Last Glacial Maximum: Integration of Seismic Stratigraphy, Benthic Foraminifera, and Calcareous Nannofossils in the Sant'Eufemia Gulf (Offshore Calabria, Italy)

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A relative sea level (RSL) curve represents the variation in sea level at a specific location and sedimentary basin scale over time. RSL changes are influenced by global eustatic sea-level fluctuation and local factors such as tectonic uplift or subsidence, sediment loading, and glacial isostatic adjustment (GIA). Although relative sea-level curves were proposed for 30 sites along the Italian coast since the Last Glacial Maximum (LGM), these early models faced limitations due to insufficient age markers. This research aims to present a comprehensive curve of relative sea-level variations for the southern Tyrrhenian region, constrained by coastal features, paleoenvironmental data, and age markers across various time intervals from the LGM to the Holocene. We address this study specifically on the Sant'Eufemia Gulf in the southeastern Tyrrhenian Sea. The site was chosen due to its relatively stable tectonic setting, which allows us to isolate and analyze the effects of eustatic sea-level changes on coastal evolution. The study employed an integrated approach, combining multiple methodologies. High-resolution, multichannel seismic profiles were used to reconstruct the architecture and depth of coastal features (e.g. infralittoral prograding wedges and wave-cut platforms). Sedimentological analyses and high-resolution micropaleontological studies of benthic foraminifera and calcareous nannofossils assemblages, complemented by calibrated radiocarbon ages, were used to calibrate the seismic profiles, constrain sedimentation rates, and reconstruct the paleoenvironmental evolution of the study area since the LGM. The proposed RSL curve is robustly constrained by multiple geological markers across a timescale spanning thousands of years. The curve displays a non-linear trend in sea level rise, characterized by several step-like geometries that indicate phases of sea level rise interrupted by periods of stillstand or lowering. The curve presented in this work was compared with RSL curves proposed by previous studies. The latter – first adjusted using the GIA models – include the ICE-X curves proposed by the Peltier research group (e.g. Roy & Peltier, 2017), the ANU curves by Lambeck et al. (2014) and Lambeck & Purcell (2005), and the PaleoMIST curve by Gowan et al. (2021). The comparison indicates that the curve presented here exhibits greater sea level depths during the 17-21 ka interval. From about 17 ka onward, the curve aligns well with the other curves in terms of depth values within the error bar, with the exception of the PaleoMIST curve. However, the proposed curve reveals higher frequency sea level variations, highlighting a more detailed depiction of the RSL path modelled in this work. Accurate reconstructions of past relative sea-level variations are crucial for developing tectonic and paleoenvironmental models, improving predictive modeling capabilities, and elucidating the implications of climate change.

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