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Modelling the vertical motions of the Alboran Sea since the Messinian salinity crisis: Topographic reconstruction and glacial-isostatic sea-level effects

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The Messinian Salinity Crisis (MSC) was caused and terminated by changes in the Atlantic-Mediterranean connectivity in the western end of the Alboran Basin, a complex tectonic area affected by the Iberia-Africa collision and the presence of a subducted lithospheric slab beneath the Betic-Rif orogen.

The isostatic, tectonic and erosional effects on surface topography work on different spatial and temporal scales, and their relative contributions to the changes in connectivity and subsequent evaporite deposition and sea-level drop are difficult to constrain.

We perform 2D-planform flexural isostatic modeling using the Messinian Erosion Surface imaged in the Alboran Basin to reconstruct the topography and vertical motions of this region since the end of the MSC. The results constrain the original depth of the Messinian erosional features to test their consistency against the various models proposed for Mediterranean sea-level changes during the MSC.

We apply Glacial Isostatic Adjustment theory to quantify the time response of these vertical motions to the large MSC-related mass shifts (salinification, evaporite deposition and a kilometer-scale sea-level drop), and their gravitational effects on sea-level in the Mediterranean. In particular, models for the Strait of Gibraltar allow us to identify the potential role of these effects as feedback mechanisms influencing the rates and duration of changes in the Atlantic-Mediterranean connectivity at the straits. We will explore the possible implications of these for the timing of the closure of the last Atlantic-Mediterranean seaway.