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The sources of sea-level rise in the Mediterranean Sea since 1960

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Sea-level change is geographically non-uniform, with regional departures that can reach several times the global average. Characterizing this spatial variability and understanding its causes is crucial to the design of adaptation strategies for sea-level rise. This, as it turns out, is no easy feat, primarily due to the sparseness of the observational sea-level record in time and space. Long tide gauge records are restricted to a few locations along the coast. Satellite altimetry offers a better spatial coverage but only since 1992. In the Mediterranean Sea, the tide gauge network is heavily biased towards the European shorelines, with only one record with at least 35 years of data on the African coasts. Past studies have attempted to address the difficulties related to this data sparseness in the Mediterranean Sea by combining the available tide gauge records with satellite altimetry observations. The vast majority of such studies represent sea level through a combination of altimetry-derived empirical orthogonal functions whose temporal amplitudes are then inferred from the tide gauge data. Such methods, however, have tremendous difficulty in separating trends and variability, make no distinction between relative and geocentric sea level, and tell us nothing about the causes of sea level changes. Here, we combine observational data from tide gauges and altimetry with sea-level fingerprints of land-mass changes through a Bayesian hierarchical model to quanify the sources of sea-level rise since 1960 at any arbitrary location in the Mediterranean Sea. We find that Mediterranean sea level rose at a relatively low rate from 1960 to 1990, primarily due to dynamic sea-level changes in the nearby Atlantic, at which point it started rising significantly faster with comparable contributions from dynamic sea level and land-mass changes.