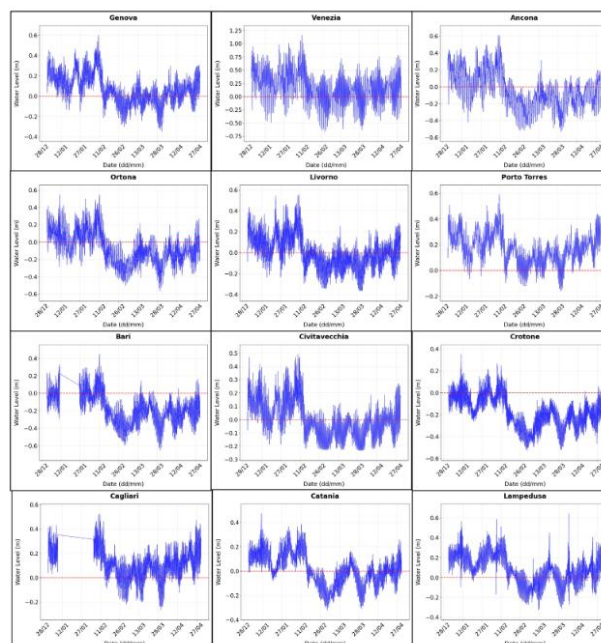


Extreme low tides: coastal evidence from the Mediterranean Sea

Summary

Climate change profoundly impacts coastal systems by altering their natural equilibrium. These systems are primarily influenced by medium to long-term processes, including sea-level rise, intensifying storm events, vertical land movements (both natural and anthropogenic subsidence), and human activities that lead to resource overexploitation and structural overloads. However, short-term atmospheric anomalies can also induce significant coastal responses. This study examines the coastal impacts of positive pressure anomalies that affected the Mediterranean region in recent years. During these events, tidal records indicated a relative sea-level lowering, ranging from -0.2 m to -0.6 m, resulting in seaward shoreline migration of several meters along the Adriatic and Tyrrhenian coasts of Italy and in Greece. Additionally, channels and piers experienced drying, as documented in Venice and Pozzuoli (Naples). These pressure anomalies influenced large regional areas, as documented during the February-March 2021 extreme low tides. After the end of the pressure anomalies, we observed a rapid adaptive response of mobile coastal systems, with complete restoration of initial conditions following each event. This temporary adaptive response contrasts with permanent coastal changes driven by sea-level rise and sustained anthropogenic pressures.



Time-series of sea level extracted from the tide gauges considered in this study for February-April 2021; dashed red line indicates the zero-reference level.

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