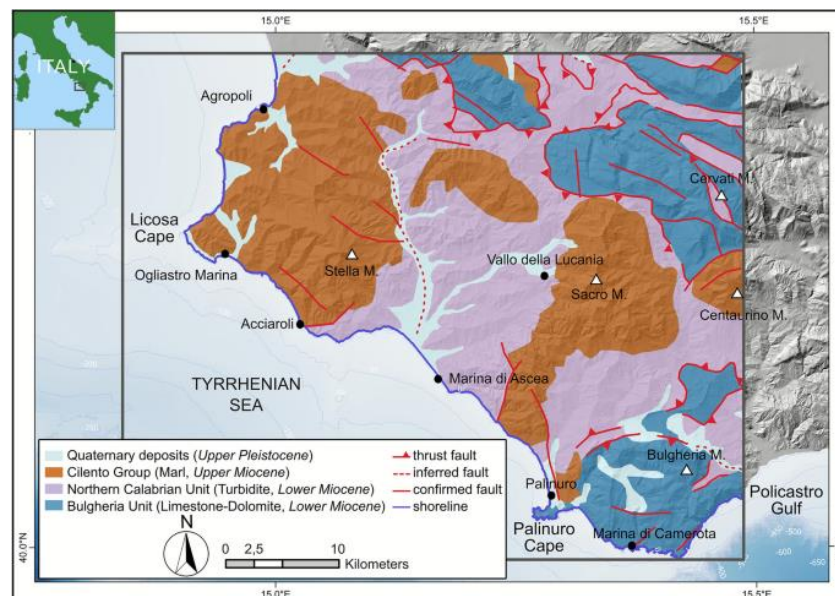


Reconstructing Late Quaternary coastal landscapes by a machine-learning framework

Summary

Coastal landforms, particularly sea cliffs and associated wave-cut platforms, preserve key evidence of past sea-level fluctuations, tectonic activity, and paleoclimate variability. In this study, we implement a supervised machine learning approach, trained on an original, expert-labeled geomorphological dataset, to detect and classify inherited and active coastal features - such as paleo-sea cliffs and polycyclic sea cliffs - along the south-Tyrrhenian. Using DTM and morphometric indicators, our model, based on a RandomForestClassifier trained on expert-based cartography and independently validated, accurately identifies the spatial signatures of Quaternary coastal evolution. These results are cross validated against independent geomorphological mapping and sea-level reconstruction datasets. The integration of geomorphological classification with sea level markers enables us to reconstruct coastal morphogenesis in relation to the last interglacial cycle. Our findings highlight the potential of machine learning to automate the identification of coastal paleo-landscapes, providing insight into the imprint of climatic forcing on their morphology. This approach offers a scalable framework for investigating past climate–landscape interactions and for supporting future coastal hazard assessments under changing climate conditions.



Geological sketch of the study area

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