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Probabilistic Assessment of Slip Rates Over Time of OffshoreBuried Thrusts: A Case Study in the Central Adriatic Sea(Italy)

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Understanding the recent tectonic activity and seismotectonics of inaccessible buried faults requires the development of feasible and robust approaches. The foredeep deposits of the northern and central Apennines (an offshore area in the central Adriatic Sea, Italy) blanket the active buried frontal thrusts of the Apennines and the Dinarides orogens. Detecting recent-to-ongoing tectonic activity of these thrusts is particularly challenging because sedimentation rates easily exceed the very slow tectonic rates.
In this work, we combine seismic reflection profile interpretation, sediment decompaction, kinematic restoration and balancing to quantitatively analyse the Plio-Pleistocene tectonic activity of the Apennines and Dinarides buried thrusts in the central Adriatic Sea and calculate the slip rates of the major faults. The northern and central Apennines foredeep is filled by a thick Messinian to Quaternary sedimentary wedge, unconformably resting on a Meso- Cenozoic carbonatic and siliciclastic passive margin succession, which is in turn involved in the east-northeast propagation of the fold-and-thrust belt from onshore to offshore (Adriatic Sea). As suggested by previous studies, the region is in a substantial tectonic activity decrease, but local and qualitative observations on specific structures show evidence of recent tectonic activity. The frontal thrusts of both the Apennines and the Dinarides are active, as also demonstrated by the moderate seismic activity historically (few past centuries) recorded in the region and by the recent earthquakes, followed by rather rich aftershock sequences that occurred in this region and nearby (e.g. the Porto San Giorgio earthquake Ml 5.0 in 1987; the Jabuka earthquake Mw 5.5 in 2003, the Pesaro earthquake Ml 5.7 in 2022). We interpreted, depth converted, and restored two northeast-trending regional seismic reflection profiles, thus roughly orthogonal to the main strike of the buried thrusts. We then used the inverse trishear approach to determine the slip necessary to recover the residual tectonic deformation (after decompaction) of four stratigraphic horizons with well-constrained age determinations (Zanclean to Middle Pleistocene). We then calculated and reported the slip rates using probability density functions, considering the uncertainties associated with both horizon ages and the restoration process. All together, our results show a progressive reduction of slip rates over time, with a main slowdown around 1.5 Ma. Reporting slip rates with probabilistic distributions is useful for incorporating epistemic uncertainty on the total seismic moment release in earthquake hazard analyses.