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Seismic coupling and aseismic slip along the central section of the North Anatolian Fault

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The ever-increasing amount of geodetic observations worldwide allows detailed studies on the evolution of slip along active faults. Models predicting such observations reveal the spatial and temporal distribution of slip on faults during the interseismic phase. Some fault segments are locked, building up stress that will end up being released during future earthquakes, while other segments slip slowly (mm/yr to cm/yr), releasing stress aseismically. Detailed mapping of slip behavior is critical for understanding the relationship between locked and aseismic segments, thus providing insights into seismic hazard.

We analyze GNSS and InSAR data to study fault kinematic coupling along the central section of the North Anatolian Fault (Turkey) using a Bayesian framework. This section slips aseismically at least since the 1960s, with early evidence recognized in the vicinity of the small town of Ismetpasa. This segment also hosted large earthquakes, including the 1943 and 1944 M7+ earthquakes. We combine InSAR and GNSS data acquired over the last ten years to derive ground velocity fields over the last decade. We process SAR images (ALOS and Sentinel01) as well as continuous GPS to build maps of ground velocity, confirming the presence of a 100 km-long aseismic section, at rates of ~ 1 cm/yr. We then model these velocity fields to derive the Probability Density Function of slip, inferring probabilistic estimates of interseismic coupling. The quantified spatial slip variations are interpreted in terms of the fault mechanical behavior as well as compared with the historical events in the region.