FAULT DAMAGE ZONES IN CARBONATES: FORMATION, DISTRIBUTION AND ROLE IN THE SEISMIC CYCLE (ITALIAN CENTRAL APENNINES)

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Fault zones include one or more fault cores sandwiched by up to hundreds of meter thick damage zones. In carbonates rocks, damage zones are characterized by the presence of in situ shattered rocks (ISRs). Despite their abundance, it remains unclear how damage zones form and how their presence affects the propagation of individual seismic ruptures and associated near field ground motions. In the Italian Central Apennines, seismogenic faults may have damage zones with varying thickness from few meters (e.g., Campo Felice Fault zone) up to 1000m thick (e.g., Monte Marine fault associated with the Abruzzo Mw 6.7, 1703 earthquake). Moreover, along the fault strike, the thickness of the damage zone increases in the presence of geometrical complexities, such as fault step-overs and intersections. By integrating field surveys, data analysis, and numerical modelling, we aim to refine our understanding of the formation of these zones, the factors controlling their spatial distribution (along strike and with depth), and their impact on the seismic cycle. As a first step toward this goal, we present 3D dynamic rupture simulations including off-fault Drucker-Prager plasticity for a 25 km long NW-SE striking extensional fault as representative of the seismic sources in the Central Apennines. Through a suite of Mw 6.0-6.5 dynamic rupture scenarios, we investigate the formation and evolution of damage zones under various geological (lithology, fault geometry, topography), mechanical and loading conditions. This work enable us to clarify on the mechanisms driving ISR formation and distribution and the key factors influencing earthquake rupture propagation. Furthermore, this study will contribute to the assessment of seismic hazard in the Italian central Apennines.