Inferring seismic hazards from a new 1:25,000 scale map of active and potentially-active continental faults in Chile

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Most of the seismic hazard along subduction zones is posed by great tsunamigenic earthquakes associated with the interplate megathrust fault. However, crustal faults are ubiquitous along overriding continental plates, some of which have been triggered during recent megathrust earthquakes. In Chile, the 2010 Maule earthquake (M8.8) triggered a shallow M7 earthquake on the Pichilemu fault, which had not been mapped and was unknown. In fact, M~7 earthquakes have recently occurred along unknown faults in California and New Zealand, emphasizing the need for better and more detailed mapping initiatives. A first step towards a synoptic assessment of seismic hazards posed by continental faults at the national level is mapping at a homogeneous scale to allow for a systematic comparison of faults and fault systems. Here, we present the first map of active and potentially-active faults in Chile at 1:25,000 scale, which includes published studies and newly-identified faults. All the published faults have been re-mapped using LiDAR and TanDEM-X topography, where available. Using different scaling relations, we estimate the seismic potential of all crustal faults in Chile. For specific faults where we have conducted paleoseismic and tectonic geomorphic field studies (e.g., Liquiñe-Ofqui, El Yolki, Mesamavida, and Pichilemu faults) we provide new estimates of slip rate, recurrence interval, and deformation style. We propose a segmentation model of continental faults systems in Chile, which are associated with distinct morphotectonic units and have predominant kinematics and relatively uniform slip rates. Using stress transfer models, we explore the potential feedbacks between upper-plate deformation and the megathrust seismic cycle.