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Zoning surface rupture hazard along normal faults: Insight from L'Aquila, 2009 (Mw 6.3, Central Italy) and other global earthquakes

P. Boncio (1), P. Galli (2), G. Naso (2), and A. Pizzi (1)

(1) University of Chieti-Pescara, Chieti, Italy (pboncio@unich.it, +39 0871 3556454), (2) Dipartimento della Protezione Civile, Rome, Italy

Surface fault rupture hazard (SFRH) is a localized seismic hazard due to the breaching of the ground surface from slip along a fault during a large earthquake. This motion may offset, tilt, distort and damage buildings on or in the vicinity of the fault trace. Although SFRH should be one of the most easily detectable seismic hazards, due to the visibility of active fault traces, the April 6, 2009 L'Aquila earthquake in central Italy (Mw 6.3) demonstrates that there is much progress to be made in assessing the hazard. Indeed, the 2009 normal faulting surface ruptures occurred across populated areas, producing mild-to-moderate damages to infrastructure (e.g., pipelines, roads) and buildings, including structures less than a few years old.
Similar to other countries with SFRH, Italy does not have explicit and comprehensive codes and/or regulations concerning this important issue. Following the observation of surface faulting occurred during the 2009 earthquake, we propose general criteria for delineating zones of SFRH along active normal faults. Our proposal, which is explicitly inspired to the Californian Alquist-Priolo Earthquake Fault Zoning Act, compares the 2009 coseismic surficial faults to surface rupture data collected globally for several normal faulting earthquakes. We propose Earthquake Fault Zones (EFZ) and fault Setbacks (S) which are asymmetrically shaped around the fault trace. The zones are wider on the hanging wall, consistently with the observation of wider coseismic rupture zones in the hanging wall block compared to the footwall block. For faults mapped in detail, we suggest a 150 m-wide EFZ on the hanging wall and a 30 m-wide EFZ on the footwall. The suggested widths of the S on the hanging wall and footwall are 40 m and 15 m, respectively. Considering the data collected for the L'Aquila fault system and abroad, we are confident that our proposal is conservative enough for Apennine-like normal faults and, applicable to Italy and other areas with comparable seismotectonic setting and seismic hazard.