Importance of surface ruptures and fault damage zones in assessment of earthquake hazards

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Most of the accumulated stresses along active faults are released through big earthquakes. Big earthquakes (generally > M 6) produce ***surface ruptures*** as well as ground motion. The length of surface rupture and offset produced by an earthquake depends on fault type and magnitude of the earthquake. Because rupturing stress along a rupture related with large earthquakes is enormous and quickly released during a short time of earthquake, any building can hardly survive. This type of earthquake hazard could produce very serious damages, even though it is concentrated along a very narrow zone. Therefore, it is very important to trace active faults around important sites such as nuclear facility sites.
Fault damage zones are now well known structures developed around faults, which are important to understand fault geometry and kinematics. Furthermore, in the point of earthquake hazard, they are very important to predict hazardous areas. Although we generally can consider ***respect distance*** to assess earthquake hazards around active faults, damages around faults or earthquake ruptures are not symmetric along the faults or ruptures. They are depending on *fault type*, *slip sense*, and *location* along the fault. Therefore, we should understand and consider not only respect distance but also fault damage zones and their characteristics to select proper sites for important facilities.
Several damages associated with big earthquakes show the importance of surface ruptures and fault damage zones. Although reported earthquake hazards along the surface ruptures and fault damage zones are very serious, the damages in several tens of meters away from the ruptures are generally not so serious (for strike-slip fault cases). Also, fault damage zones are important to understand locations for aftershock clustering, defining fault and earthquake segmentation, and triggering and termination of earthquakes.

Keywords: Surface ruptures, Fault damage zones, Respect distance

