Geophysical Research Abstracts, Vol. 9, 06392, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-06392


# Methodological approach towards the effective use of geological data in defining seismic source zones in seismic hazard analysis practice

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The first step in any seismic hazard analysis (SHA) is the identification and characterization of seismic sources. Modern SHA often considers two different types of sources: Zones and Major Faults. Seismic zones are usually define based on the relations found by the analyst between epicentre distribution and arbitrary geological units, this method has been shown to be very subjective and has lead to proposal of zone-less models or the combined use of different zonings in a logic tree scheme. Nevertheless, the consideration of geological data and geologically based criteria can provide more objective and reliable seismic zonings in SHA purposes, particularly in their identification, delineation, and assessment of maximum credible earthquakes. In probabilistic hazard calculations seismic occurrence within a seismic zone is considered Poissonian in time and space –i.e., earthquakes are fully independent events. Furthermore, seismic occurrence is equally likely within the whole volume and the size of the earthquakes follow an exponential distribution –i.e., a Gutenberg-Richter law. These statements are the base of the methodology hereby presented, which is supported by the following assumptions: 1) A seismic zone is a volume of crust with a homogeneous deformation behaviour, and 2) elastic deformation within the volume is distributed along the internal fracture system. In other words, a seismic zone represents a volume of fractured crust with a distinct rheological structure. Hence, the identification and delineation of seismic zones has to be based in the identification of crustal volumes with contrasting structures, compositions and thermal states, the construction of rheological profiles being a very useful tool. In fact, several rheological parameters show a good correlation with seismic occurrence: strength of the upper crust, thermal gradient, and depth of the fragile-ductile transition (F-D); e.g., hot, weak and shallow F-D crusts present higher activity rates, shallow focal depths and higher b-

values. On the other hand, maximum credible earthquake –i.e., the upper threshold of the Gutenberg-Richter law, can be evaluated considering that elastic deformation distributes along the internal fracture network of the zone. Maximum potential seismic moment release is thereby controlled by the size of the faults. To assess this value a statistical approach based on morphotectonic observations can provide an estimation, and making use of empirical and/or analytical equations draw a mean value and measure of uncertainty. The methodology proposed has already been applied in Southeast Spain.