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How Reliable is Our Existing "Seismic Hazard Analysis"?

Major earthquakes in recent years repeatedly reveal that our existing seismic hazard maps have been unable to reliably estimate seismic hazard. For example, the seismic risk due to dynamic rupture of the Nojima fault has been underestimated before the 1995 Kobe earthquake in Japan, not much attention was paid to Chelungpu fault before the 1999 Chi-Chi earthquake in Taiwan, and potential seismic risk induced by Longmenshan fault has been ignored before the 2008 Wenchuan earthquake in Sichuan. For example, the estimated hazard level of PGA is only 0.1g (at least exceeding once in 475 years) at Yingxiu and Beichuan while the 2008 Wenchuan earthquake actually induced shaking of 0.6g to 1g in these two areas (Wen et al. 2010). We have to ask ourselves how reliable our existing hazard analysis is. The original Cornell's method assumes earthquake occurrence as a Poisson process (i.e. all earthquakes are independent of one another), and common sense tells us that this is clearly untrue. We rely heavily on the past records to establish the probability of earthquake occurrence which is used in hazard analysis, but with our limited data in earthquake catalogue in geological history our estimation of earthquake probability is inevitably to be inaccurate. For example, the maximum historical earthquake (within the last 2000 years) occurred in Longmenshan fault is only 6.2, and because of this the seismic hazard has been severely underestimated. Therefore, the 2008 Wenchuan of Ms 8.0 (Mw 7.9) is to the surprise of many seismologists. We desperately need a better method of "hazard analysis".

Reference:

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