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MAGNITUDE PDF MODEL ACCOUNTING FOR LINKING OF FAULT SEGMENTS FOR USE IN PSHA

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In probabilistic seismic hazard analyses, the distribution of earthquake magnitudes on faults is often modelled as a composite distribution with a characteristic part for large magnitudes and an exponential tail for small magnitudes such as the Youngs and Coppersmith (1985) model. The characteristic magnitude is based on full rupture of one or more segments of the fault. Recent studies, such as UCERF3, have allowed for linking of faults into larger ruptures. The available observations for individual fault systems are too sparse to provide constraints on the relative rates of linked ruptures. To provide a constraint on the rates of linked ruptures, the Hecker et al (2013) results that the coefficient of variation (CV) of slip at a point is less than 0.55 is used. A modified form of the Youngs and Coppermith magnitude pdf is developed which includes an exponential tail for magnitudes above the characteristic ruptures (above the boxcar). Using a relation between magnitude and surface slip, the CV of the slip at a point can be computed for a range of different b-values and rates of the upper tail. The combination of the b-value and the rate of the upper tail that lead to CV values less than the Hecker et al limit of 0.55 are considered to be allowable models. The constraint on the magnitude pdf provided by this slip-at-a-point CV depends on the correlation between the surface slip and magnitude: the stronger the correlation, the stronger the constraint. This method is applied to the Hosgri fault in central California, which could link with several other faults in the region. Using the CV constraint, the rates of earthquakes above the characteristic part of the magnitude pdf range from 8 to 50 times less than the rate of characteristic ruptures depending the the selected displacement-magnitude relation. The proposed approach provides a method to allow for lining for faults and fault segments and still provide constraints on the rates that can be used in probabilistic seismic hazard studies for faults.

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