Expected characteristics of near fault magnitude 8 ground motions

by Paul Somerville

We only have one recording close to a magnitude ~8 earthquake - the Pump Station 10 recording of the Denali, Alaska earthquake - so we do not know much about such ground motions. From a theoretical point of view, we would not expect the largest recordings of smaller earthquakes to have the same characteristics as median near-fault ground motion levels of a magnitude 8 earthquake. Specifically, we would expect the median response spectral ordinates of magnitude 8 earthquakes to be much stronger than even the largest recordings of smaller earthquakes at periods longer than about 5 seconds. We expect the flat-in-acceleration region of the M 8 near-fault response spectrum to extend well beyond 5 seconds out to a period of 10 seconds or more. We expect the average displacement on the fault to be about 5 to 10 meters, so near the fault, each side of the fault would have a permanent displacement of 2.5 to 5 meters. The median ground motion level from a magnitude 8 earthquake occurs in San Francisco once every few hundred years, so it is not a rare ground motion.