APPARENT STRESS OF RIDGECREST EARTHQUAKES 4.0 $\leq$ M$_W$ $\leq$ 5.4: A TIME DOMAIN ANALYSIS

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We use strong motion records from Southern California Seismic Network (CI) to estimate the apparent stress (σ_a) of 42 Ridgecrest, California earthquakes in the magnitude range $4.0 \leq M_w \leq 5.4$. The dense CI network allows us to use only those stations within an epicentral distance of 50 km thereby minimizing complex path and attenuation effects. We estimate the seismic radiated energy using the time integral of squared S wave ground motion velocity (Kanamori et al., 1993). We correct for crustal attenuation and site amplification by simultaneously inverting for the attenuation curve $q(r)$ and a station terms (s_j). We obtain $q(r) = r^{-1}\exp[(k_1 + k_2 M_w)r], r^2 = \Delta^2 + h^2$ with $k_1 = 0.043$, $k_2 = -0.0026$ where h is the centroid depth and Δ is epicentral distance. For these earthquakes the centroid depth varies between 3.5 km and 12 km. For epicentral distances $10 \leq \Delta \leq 50$ km, $q(r) \propto r^{-1.6}$. Relative to the hard-rock station CLC (China Lake), other strong motion stations in the studied region amplify the seismic radiated energy by a factor of 5.9 on average with a log10 standard deviation of 0.25. With the data corrected for path attenuation and the station term we invert for the apparent stress. Although σ_a has a geometric mean of 0.86 MPa for the 42 earthquakes, σ_a increases with depth and magnitude: $\log_{10}(\sigma_a) = 0.104h + 0.240M_w - 1.882$.The apparent stress σ_a increases by more than a factor of four when centroid depth increases from ~ 4 km to ~ 10 km. We find that the strong depth dependence of σ_a cannot be accounted by depth-dependent attenuation without adversely affecting the fit to the data.