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Seismic state equation and scaling relations for earthquake parameters

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Two alternative formulations of the apparent stress, representing homogeneous crack and triangle pulse rupture models, are tested. They are termed seismic state equations and express the apparent stress, τ_a, as a function of respectively two or three other earthquake parameters: seismic moment, M_0, rupture area, A, and, in the latter case, mean slip acceleration, g. The number of parameters is the key difference between the two models. A variety of possible $\tau_a - M_0$ scalings is obtained by substitution of different moment-area relations, $M_0 - A$, into the seismic state equations, $\tau_a(M_0, A, g)$. Both seismic state equations enable us to explain the observed $\tau_a - M_0$ global trend. However, the triangle pulse solution fits the empirical trend with much higher correlation coefficient. Also the trends obtained for regional data sets are more consistent with the pulse model than with the crack one.