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# Pseudo-dynamic source modeling with 1-point and 2-point statistics of earthquake source parameters

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Dynamic rupture modeling considers physical processes during fault rupture, by incorporating conservation laws of continuum mechanics, the constitutive behavior of rocks on the fault plane, and the state of stress in the Earth crust. This approach has been successfully adopted for physics-based source and ground motion simulations in the last couple of decades. However, dynamic rupture calculations are still computationally expensive, especially for large events. Moreover, the required input parameters of stress and frictional properties are generally not well constrained. Therefore, pseudo-dynamic source modeling has been introduced (Guatteri et al, 2004), by combining strengths from both dynamic and kinematic modeling approaches i.e. keeping computational efficiency with kinematic source modeling, but trying to emulate the physics of the source process inferred from rupture dynamics and data observations. Song and Somerville (2010) propose a pseudo-dynamic source modeling method based on cross-correlation structures between kinematic source parameters, including both zero- and nonzero-offset correlations, which thus define a 2-point statistics of source parameters. In this study, we extend previous studies in the following ways: 1) The concept of 1-point statistics is included in both source characterization and modeling, 2) A new stochastic source modeling tool, based on the Cholesky factorization, is implemented, in addition to the previously proposed sequential Gaussian simulation with kriging method, 3) Ground motions are computed using both full- and pseudo-dynamic modeling methods, and then compared quantitatively. Our preliminary source and ground motion modeling results show that we can successfully capture the main characteristics of dynamic rupture models by applying 1-point and 2-point statistics, and hence also reproduce the main characteristics of ground motions generated by full dynamic rupture modeling.