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# Bayesian estimation of kinematic earthquake source parameters through non-linear inversion of strong motion data

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We present a technique for imaging kinematic earthquake source parameters based on the inversion of strong motion data. We parametrize the rupture process by discretizing the fault surface into a set of regular subfaults and specifying rupture parameters, peak slip velocity, rake angle, rupture time and rise time, at subfaults' corners. Inside each subfault the parameters are then derived throug bilinear interpolation. Synthetic waveforms are calculated using a Discrete Wavenumber/ Finite Element method. Currently we assume an isosceles triangle as a source time function, but the method is not restricted to that choise.

We estimate the rupture parameters using a Bayesian approach. The calculation of the posterior probability density function is achieved in two steps. First, we explore the model space using an Evolutionary Algorithm for real-valued search spaces. The intrinsic parallel nature of the algorithm allows for a relatively easy parallelization, consequently saving computation time, particularly in case of the time consuming forward modelling calculations. Secondly, the ensemble of all the models produced during the search stage is used to estimate the posterior probability density function which in turn is used to perform uncertainty analysis on the inverted parameter.

We apply this technique to a synthetic rupture model characterized by heterogeneous slip and constant rupture velocity and rise time. We show how the algorithm is able to identify good data fitting regions of the model space and how the whole set of models can be used to estimate, for each parameter, the associated uncertainty through the calculation of the corresponding posterior marginal probability density function.