Determination of focal mechanism solution using simulated annealing

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Many seismologists have determined focal mechanism solutions using grid search (e.g. Nakamura and Mochizuki, 1988, QJS) or genetic algorithms (e.g. Kobayashi and Nakanishi, 1994, GRL). However, simulated annealing (SA) that is known as one of the efficient methods for global optimization has never been used to determination of this solution, although it allows for getting an optimal solution by jumping out of local minimum. In this study, we apply the SA to determination of focal mechanism solution. When we express the null, pressure and tension axes using a set of Euler angles (e.g. Nakamura and Mochizuki, 1988), the optimal set of Euler angles is determined by minimizing difference between synthetic and observed polarity of P-wave first motion. To investigate the feasibility of the application, we determine focal mechanism solution of the 14 March 2014 Iyo-Nada intermediate-depth earthquake (M_{JMA} 6.2). The computation of SA method is then about the 1278 time faster than the grid search method. Strike, dip and rake angles calculated by the optimal set of Euler angles is nearly identical to focal mechanism reported by the Japan Meteorological Agency (JMA).
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Keywords: focal mechanism solution, simulated annealing, grid search

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