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# of Full Moment Tensors, Including Uncertainties, For Earthquakes, Volcanic Events and Nuclear Explosions

A seismic moment tensor is a 3x3 symmetric matrix that provides a compact representation of seismic events within Earth's crust. We develop an algorithm to estimate moment tensors and their uncertainties from observed seismic data. The moment tensor uncertainties allow us to better discriminate among source types and to discuss physical processes for the events. For a given event, the algorithm performs a grid search over the six-dimensional space of moment tensors by generating synthetic waveforms at each grid point and then evaluating a misfit
function between the observed and synthetic waveforms. 'The' moment tensor M for the event is then the moment tensor with minimum misfit. To describe the uncertainty associated with M, we first convert the misfit function to a probability function. The uncertainty is estimated from a probability that the true moment tensor for the event lies within the neighborhood of M. We apply the method to data from events in different regions and tectonic settings: small (Mw < 2.5) events at Uturuncu volcano in Bolivia, moderate (Mw > 4) earthquakes in the southern Alaska subduction zone, and nuclear explosions at the Nevada Test Site.

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