EGU2020-3224
https://doi.org/10.5194/egusphere-egu2020-3224
EGU General Assembly 2020

Fast acquisition of focal mechanism based on statistical analysis

Marisol Monterrubio-Velasco, José Carlos Carrasco-Jimenez, Otilio Rojas, Juan Esteban Rodríguez, and Josep de la Puente
Barcelona Supercomputing Center, CASE, Barcelona, Spain (marisol.monterrubio@bsc.es)

Earthquake and tsunami early warning systems and post-event urgent computing simulations require of fast and accurate quantification of earthquake parameters such as magnitude, location and Focal Mechanism (FM). Methodologies to estimate earthquake location and magnitude are well-established and in place. However, automatic solutions of FMs are not always provided by operational institutions and are, in some cases, available only after a time-consuming inversion of the wave-forms needed to determine the moment tensor components. This precludes urgent seismic simulations, which aim at providing ground shaking maps with severe time constraints. We propose a new strategy for fast (<60 s) determination of FM based on historical data sets, tested it at five different active seismic regions, Japan, New Zealand, California, Iceland, and Italy. The methodology includes the k-nearest neighbor's algorithm in a spatial dimension domain to search the most similar FMs between the data set. In our research, we focus on moderate to large earthquakes. The comparison algorithm includes the four closest events, and also a hypothetical event building by the median values of strike, dip, and rake of the k-neighbors. The validation stage includes the minimum rotated angle measure to compute the similitude between a pair of FMs. We find three model parameters, such as the minimum number of neighbors, the threshold radius that defines the neighboring sphere, and the magnitude threshold, that could improve the statistical similitude results. Our fast methodology has a 75%-90% agreement with traditional inversion mechanisms, depending on the particular tectonic region and dataset size. Our work is a key component of an urgent computing workflow, where the FM information will be used as input for ground motion simulations. Future work will assess the sensitivity of FM uncertainty in the resulting ground-shaking maps.