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Network Geometry Optimization Using a Fully Automated Stochastic Method

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One of the most important goals of any seismic network, is the ability to locate more accurately seismic events. Accordingly, accurate stations distribution, plays an important role for achieving that goal. In this study, we present a fully automated stochastic method for calculating the optimal station distribution inside a permanent/temporary seismic network. Using fuzzy self-tuned particle-swarm-optimization technique, we can do a complete search on the entire area inside the network to find the best plausible station coordinates by generating synthesized earthquakes and relocating them in a forward-inverse manner. The new stations distribution could be completely far (designing a new network) or relatively close to the current seismic network (optimizing current network). In either cases the final network pattern represents increases the accuracy of the relocated events.
We evaluated the proposed method on a data-set comprising 1562 earthquakes in Iran region (recorded by Iranian-broadband-seismic-network (BIN)) with magnitudes Mw>4.0, during 2010-2020. The maximum displacement of 25 km for each station from its initial location was considered, then the program starts to find the best coordinates. The final results showed that using the optimized seismic network, the accuracy of relocated events (based on the Hypo71 event-accuracy criteria) could be increased up to 15%.

Promotional text

Increasing the accuracy (efficiency) of seismic events (networks) has always been one of the most important goal of the CTBTO in a broad context. Here we present a fully automated stochastic-method for calculating the optimal stations distribution inside a seismic network.

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