Multi-Reference Relocation Technique

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Abstract

This investigation proposes a multi-reference relocation technique. The relocation technique compromises a system that minimizes the distance between the reference events and the relocated events. The distance between the master event and the station is the same as the velocity between a relocated event and a reference event.

Introduction

Numerous techniques are employed to accurately locate seismic events such as the absolute relocation, the master event relocation and the double difference relocation. Three different location techniques were applied to a group of industry blasts with known locations. Results have shown that relative and group location using a double difference relocation algorithm resulted in a significant improvement of the location of seismic events compared to absolute location. The absolute location technique has an accuracy ranging around 0.5 km (Cichowicz, 2014).

Multi-reference relocation method

Equation 4 contains the difference between the multi-reference relocation and the relative relocation method. With equation 6 only one master can be used because δTik is different for each master event however equation 5 overcomes this difficulty.

Testing software and method

Testing of software and method was carried out using a system of numerical tests. The network of eight stations was created and synthetic events were set in the middle of the network. The events were relocated using a multi-reference relocation technique (Nicholson et al., 2002) and the relocation used was calculated using synthetic seismic data. The network included a large number of synthetic events to emulate real seismic networks. Therefore the number of reference events for each master event was not constant because the same number of connections is not available for every reference event. The deviations are minimized with respect to the number of master events in the network.

Conclusions

The software was tested and performed according to design specifications. During development of the software a large number of synthetic tests were performed.

The newly developed software is successfully integrated with the Geoscience Information System.

Location improvement through the relocation process is obtained only when an event and the reference events are observed by at least seven stations (seven links). Less than five links gives an unpredictable result. The software was tested and performed according to design expectations.