Relative earthquake location in Southern Iceland.

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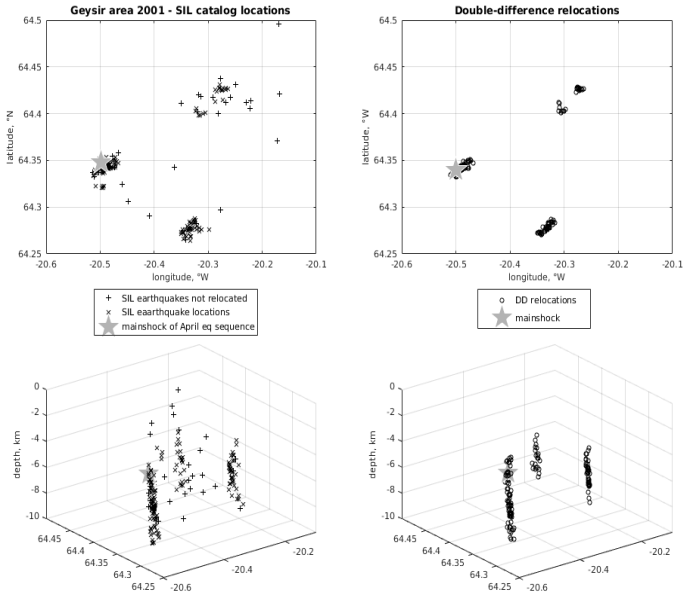

The project, 4D Seismic in the South Iceland Seismic Zone: A tool for strong earthquake forecasting, is supported by the Iceland Research Fund. The hypothesis whether in situ temporal changes exist before significant earthquakes in Southern Iceland is tested, and also whether these changes can be used for earthquake prediction purposes. Our intention is to constrain in situ changes in seismic velocity at ~0.5 % significance level and with a relatively high spatial resolution of ~10x10x3 km3, using the local earthquake data recorded by the Icelandic Meteorology Office (IMO).

The better constrained earthquakes in the SIL earthquake catalog of the IMO (~1/3 of total) tend to have location uncertainties of ~1.0 km, which is too high for the significance level required.. To improve location accuracy of the IMO catalog, the relative earthquake location algorithm of Waldhauser and Ellsworth (2000) (W&E) is being applied. The algorithm minimizes measured and calculated travel time differences for pairs of closely spaced earthquakes observed at a series of recording stations. Each earthquake is paired with several other earthquakes and the best fitting distances between them as a group are determined. Methods based on this kind of minimization are called double-difference (DD) earthquake location algorithms.

The observed travel time differences already mentioned can either be obtained from absolute times of measured (picked) phase arrivals (logged in earthquake catalogs) or as relative times between phases measured with cross-correlation (CC) of waveforms. CC between closely spaced earthquakes can give highly accurate relative time differences between phases, and can correct bad picks from seismic analysis. The time accuracy is usually an order of magnitude higher than the routinely measured phase arrival times, offering the possibility of measuring the relative distance between earthquakes with high accuracy. However, at the beginning we will use the picked phase arrivals from the SIL catalog, since W&E have shown that applying DD to good quality catalog data tend to improve earthquake locations significantly.

Our first step is to test the algorithm on a small subset of 215 earthquakes in year 2001, as reported in the SIL catalog, the earthquakes being located in and around the Geysir region in Southern Iceland. Three small areas were active during the year of 2001, although only one of them was recorded to be active as an earthquake sequence (western cluster; main shock mag. ~3.0 and aftershocks). The DD relocation gives tighter clustering of earthquakes in all three areas, and the strike of a fault segment, unclear in the catalog data, becomes clearly visible after relocation. Relocation shifts the centroids of the clusters by ~300 m from catalog locations, but relative distances between clusters do not change significantly. Our next step is to extend the analysis to other areas of South Iceland.