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Double-difference relocation of earthquakes in South Iceland

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The objective of the Iceland Research Fund project '4D Seismic in the South Iceland Seismic Zone: A tool for strong earthquake forecasting' is to test the hypothesis whether pre-seismic velocity changes occur before large earthquakes in the South Iceland Seismic Zone (SISZ). The initial main source of data for this task are catalog earthquake locations and phase data of the Icelandic Meteorological Office (IMO). However, location uncertainties are too high for the significance level required for our purpose. To improve location accuracy, we have applied the relative earthquake location algorithm of Waldhauser and Ellsworth (2000) to the phase data. The algorithm minimizes measured and calculated travel time differences for pairs of closely spaced earthquakes observed at a series of recording stations. Each earthquake phase is paired with several other earthquake phases 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 method determines the relative distances between earthquakes with high accuracy, but also constrains the absolute locations. For this part of our project, we present a comparison of IMO catalog locations and DD relocations of earthquakes in South Iceland. We analyzed earthquakes prior to (from 1991) and following two moment magnitude 6.5 mainshocks that occurred in June 2000 in the SISZ. Our results show that the DD method produces significantly improved locations.