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Bayesloc Multiple-Event Location Applied to a Global Data Set

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We extend the Bayesloc multiple-event location algorithm for application to global data sets. Bayesloc is a formulation of the joint probability function for multiple-event location parameters that includes hypocenters, travel time corrections, pick precision, and phase labels. Stochastic priors may be input for any of the Bayesloc parameters. Markov chain Monte Carlo sampling is used to draw samples from the joint probability distribution. The data set is selected from the LLNL database, which is a collection of bulletins, as well as over 100,000 LLNL picks. In this application events with the most picks are selected to produce an even geographic distribution. Data selection is done independently for a number of depth bins, each depth bin spaning 50 km. To this data set we add a number of explosion events, some with known origin times, and earthquakes that are accurately located with a local network. Preliminary relocation results without any prior constraints place epicenters within $\sim$8 km of known locations on average. Much of the improvement in location accuracy is attributed to dynamic assessment data precision, which factors into data weights. Location accuracy will improve when location priors are used. Of arrivals labeled P, Pn, and PcP, $\sim$93%, $\sim$90%, and 96% are properly labeled with probability > 0.9, respectively. Incorrect phase labels are frequently reassigned to another phase, but many arrivals are confidently determined to be erroneous. P and Pn residual standard deviation with respect to the ak135 model are dramatically reduced from 3.45 seconds to 1.01 seconds. Accurate locations, phase label reassignment that includes data culling, and overall data consistency make Bayesloc data sets ideal for tomographic studies. Prepared by LLNL under Contract DE-AC52-07NA27344, LLNL-ABS-422253.