

FINAL REPORT
JHD RELOCATION OF NEW MADRID SEISMIC ZONE EVENTS RECORDED
BY THE CENTRAL MISSISSIPPI VALLEY SEISMIC NETWORK

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Objective

The main objective of this research was to relocate events from the central New Madrid seismic zone recorded by the Central Mississippi Valley Seismic Network (CMVSN, operated by Saint Louis University) over the last 20 years. To constrain the event locations, a number of events simultaneously recorded by the CMVSN and by CERI's portable network (PANDA) were used. The PANDA stations were deployed in the central New Madrid seismic zone during October 1989 - August 1992.

Summary

A subset of 1961 events recorded during 1976-1993 by stations of the Central Mississippi Valley Seismic Network (CMVSN) was relocated using the JHD technique with constraints. These constraints were derived from the analysis of a subset of 246 events recorded simultaneously by the CMVSN and CERI's portable network (PANDA) in 1989-1992. Because the PANDA stations targeted events in the central arm of the New Madrid seismic zone, only CMVSN events that occurred in this area were relocated. In addition, the stations used to relocate the events were those either within the embayment or outside it but close to its edge. The one-dimensional velocity model used in the relocation of the events includes a low-velocity layer corresponding to the embayment sediments. The constrained relocation has two major steps. The first one involved the joint location of the CMVSN/PANDA subset, with PANDA event locations and station corrections fixed. The second step involved the joint location of the CMVSN subset with some event locations and some station corrections fixed (as determined in the first step). To reduce the errors in the event locations, only those events with maximum azimuthal gaps of less than 180° and final RMS residuals of 0.3 s or less in the last iteration were relocated. This decreased the number of events to 1015. To estimate the errors affecting the relocated events, those having fixed locations (90 events) were relocated using a single-event location program and the station corrections generated in the second step. Comparison of the new and original locations show average differences (in absolute value) in epicenter and depth of 0.6 and 1.0 km, respectively. Comparison of the JHD locations with the original catalog locations shows that, on average, the absolute values of the differences in epicenters and

depths are equal to 0.9 and 1.7 km, respectively. Although the new locations represent a substantial improvement over the original ones, particularly in depth, the former do not have the same quality as the PANDA JHD locations. An important result of our study is that the JHD technique detected the presence of arrival times corresponding to S-to-P converted waves that were misidentified as direct S-waves. This conversion is documented by comparison of PANDA and CMVSN seismograms for common events. The JHD S-wave station corrections compensated for this misidentification.