Recent Seismicity in Ozark-Illinois Basin Boundary: Results from the EarthScope OIINK Flexible Array Experiment

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We examined 316 days' continuous seismic records, from July 29, 2011 through June 8, 2012, based on stations in a study area encompassing eastern Ozark Dome and southern Illinois Basin. The records came from a composite network including 23 Flexible-Array stations of the OIINK (Ozark, Illinois, INdiana and Kentucky) network, 38 transportable array stations of USArray, 8 New Madrid array stations, and 1 GSN station. Artificial events or blasts from active quarries and coalmines dominate the preliminary catalog. We discriminated the blasts/explosions visually by the relatively large amplitude, high frequency Rg waves compared to those of unambiguous earthquakes. By this way the preliminary catalog was reduced to include only natural earthquakes. Most of the blasts happened during the local daytime period approximately from16:00 to 23:00 UTC. For earthquake Frequency-Magnitude Distribution analysis, we generally ignored events happened during this time window. Our results showed that the estimated depths of earthquakes happened in the Ozark-Illinois Basin Boundary (OIBB) region are generally larger than those of the earthquakes happened in NMSZ. This correlates with the different tectonic characteristic in the two regions. The composite OIINK network extended the earthquake detection limit in OIBB from M_L2.1 to about M_L1.8. This means that we have the ability to detect 3 times more earthquakes in OIBB than NM network does in the same time period. The focal mechanisms reflect the difference of the regional stresses in OIBB and NMSZ. In conclusion, the character of seismicity varies across the study area, and that the transitional boundary between Ozark Dome and the Illinois Basin, which has served as a significant tectonic boundary throughout the Phanerozoic, remains active. The composite OIINK network lowered the detection threshold in OIBB and caught more earthquakes in this region. This is significant for understanding the earthquake hazard in southern Illinois Basin area.

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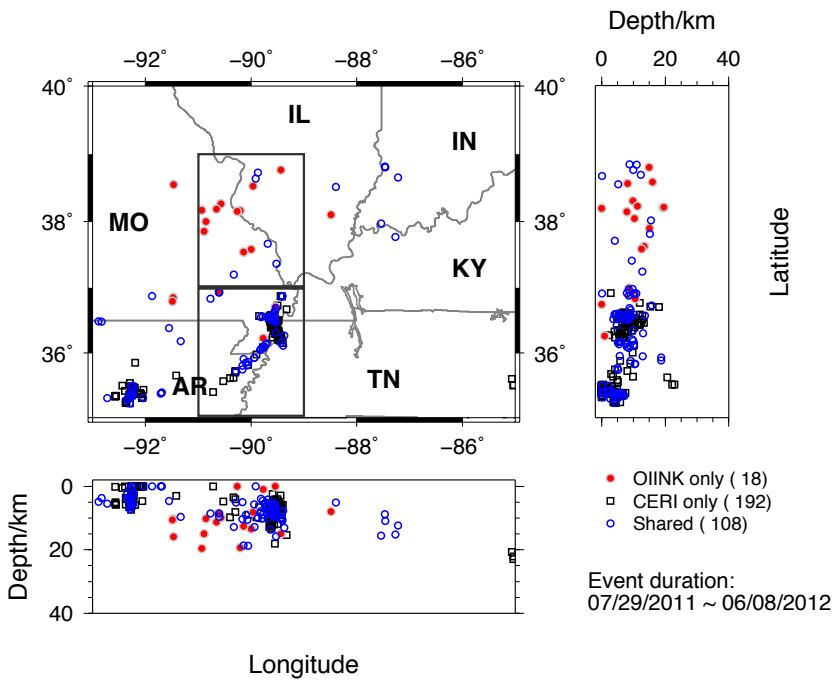

Figure 1. Epicenter map for earthquakes happened during July 29, 2011 and June 8, 2012
Red dots are epicenters of earthquakes detected only by OIINK network; Squares are epicenters of earthquakes detected only by CERI; Blue circles are epicenters of earthquakes detected by both OIINK and CERI. State names and borders are included.

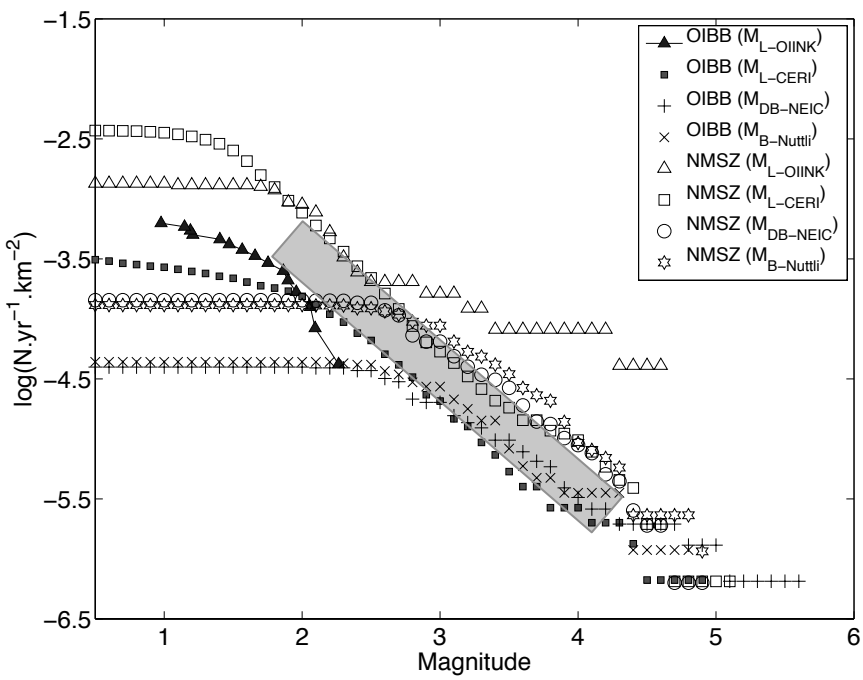

Figure 2. Earthquake frequency-magnitude distribution from multiple catalogs: OIINK, CERI, NEIC, and Nuttli's catalog. The magnitude was binned by ΔM=0.1 for CERI, NEIC and Nuttli's catalog. For OIINK catalog, the same bin width was used only for NMSZ. Since the sample size of OIINK catalog in OIBB is small, 15 earthquakes, we used the unbinned magnitudes. Each black triangle from OIINK catalog for OIBB stands for one earthquake data point. In OIBB, MC_{OIINK}=1.8, MC_{CERI}=2.1. In NMSZ, MC_{OIINK}=2.0, MC_{CERI}=1.6.