Supplementary Material for SRL-D-20-00335R2

**New Insights into the Lake Erie Fault System from the 2019 ML4.0 Ohio Earthquake Sequence**

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**List of Supplemental Table Captions**

**Table S1:** 1D velocity model for synthetic seismograms

**Table S2**: A list of earthquake templates

**Table S3**: Detected earthquake catalog

**Table S4**: Location results from HYPOINVERSE

**Table S5**: Relative location results from HypoDD

**Table S2-S5** are uploaded separately.

**List of Supplemental Figure Captions**

**Figure S1**. Remaining stations for focal plane solution of the 2019 Ohio mainshock. Black and red are observed ground velocity and synthetic seismogram, respectively. Station name (with epicentral distance in km/constant shift in second) and time shift in seconds and cross-correlation coefficient (%) of individual waveforms are labeled.

**Figure S2**. Magnitude distribution for all detected events. The standard deviation of the measured magnitude for each event across all used stations is shown with gray vertical bar. The bold black curve marks the cumulative number of events.

**Figure S3**. Three component waveform envelope function (log scale) in the first 12000s since the mainshock (red filled triangle). Black and red vertical dashed lines indicate all detected events and verified earthquakes with visible S arrivals, respectively. Black filled circles are M2.0+ EQs.

**Figure S4**. Top panel: magnitude-time distribution for nearby seismicity (20 km radius). Bottom panel: Spatial distribution of nearby seismicity. Two large circles have a radius of 5 km and 10 km, respectively. Events since 2019 are labeled as red circles.

**Figure S5**. Frequency-magnitude distribution of seismicity. Red and blue symbols and dashed lines correspond to both all detected events and verified earthquakes. b-values are also labeled.

Text, letter

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Chart

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Chart

Description automatically generated

Figure S3. Three component waveform envelope function (log scale) in the first 12000s since the mainshock (red filled triangle). Black and red vertical dashed lines indicate all detected events and verified earthquakes with visible S arrivals, respectively. Black filled circles are M2.0+ EQs.

Diagram

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Figure S4. Top panel: magnitude-time distribution for nearby seismicity (20 km radius). Bottom panel: Spatial distribution of nearby seismicity. Two large circles have a radius of 5 km and 10 km, respectively. Events since 2019 are labeled as red circles.

Chart

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Figure S5. Frequency-magnitude distribution of seismicity. Red and blue symbols and dashed lines correspond to both all detected events and verified earthquakes. b-values are also labeled.

TableS1: 1D velocity model used for synthetic seismograms (CUS model)

|  |  |  |
| --- | --- | --- |
| H(km)  Thickness | Vp (km/s)  P velocity | Vs (km/s)  S velocity |
| 1.0 | 5.00 | 2.89 |
| 9.0 | 6.10 | 3.52 |
| 10.0 | 6.40 | 3.70 |
| 20.0 | 6.70 | 3.87 |
| 0.0 | 8.15 | 4.70 |

Note: last layer corresponds to the bottom half space model (set as a thickness of 0)