

Supplemental Material for

**Rupture Model of the 5 April 2024 Tewksbury, New Jersey Earthquake Based on
Regional Lg Wave Data**

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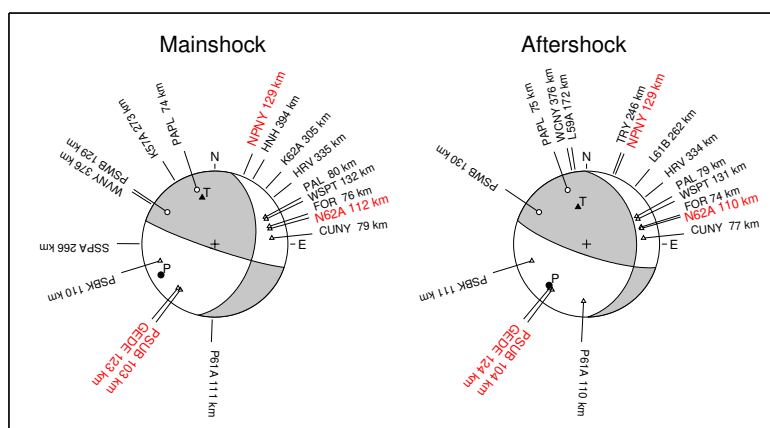
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Figures S1 to S4

(a)



(b)

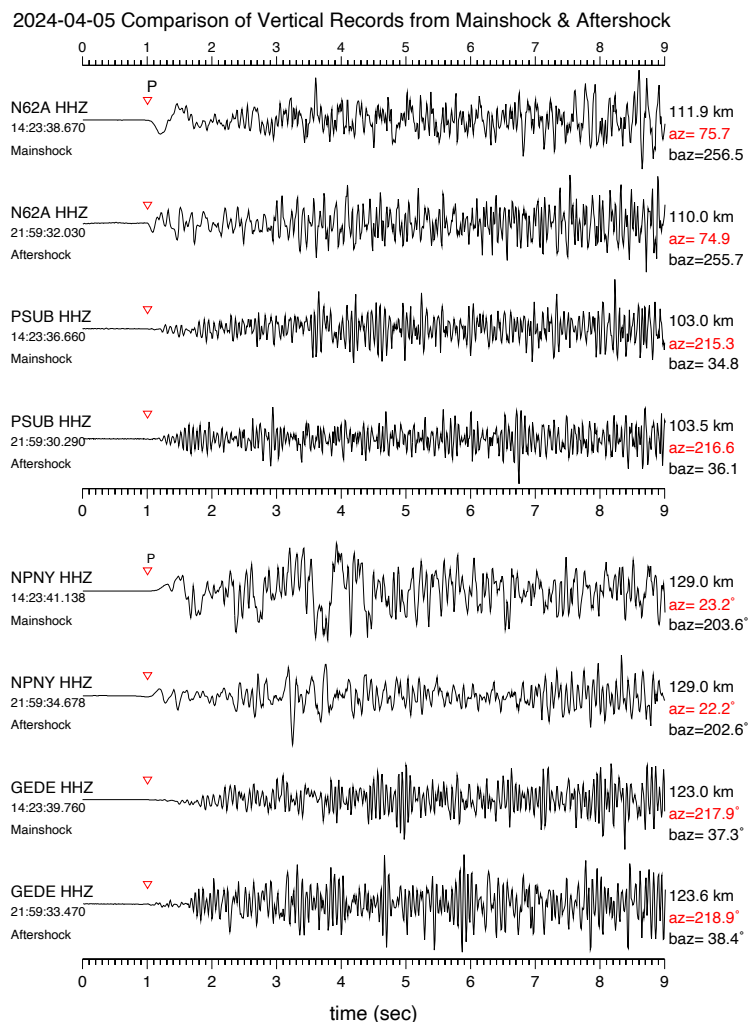


Figure S1. (a) Focal mechanisms of the mainshock and the largest aftershock (lower hemisphere projection) with compressional quadrants shaded. Station distribution is depicted, and station codes in red are those shown in (b). (b) Comparison of first 8 s of vertical records at four stations. In each station, the upper trace is from the mainshock,

and the lower trace is from the largest aftershock. Records start with *P* arrivals (red inverted triangle). In the upper frame, records from stations N62A ($\Delta=112$ km, $AZ=76^\circ$) and PSUB ($\Delta=103$ km, $AZ=215^\circ$) are compared, whereas stations NPNY (129 km, $AZ=23^\circ$) and GEDE (123 km, $AZ=218^\circ$) are compared in the bottom frame. Records from stations in the north-northeast show a strong *P* phase, whereas stations in the southwest show a very weak *P* phase and other phases.

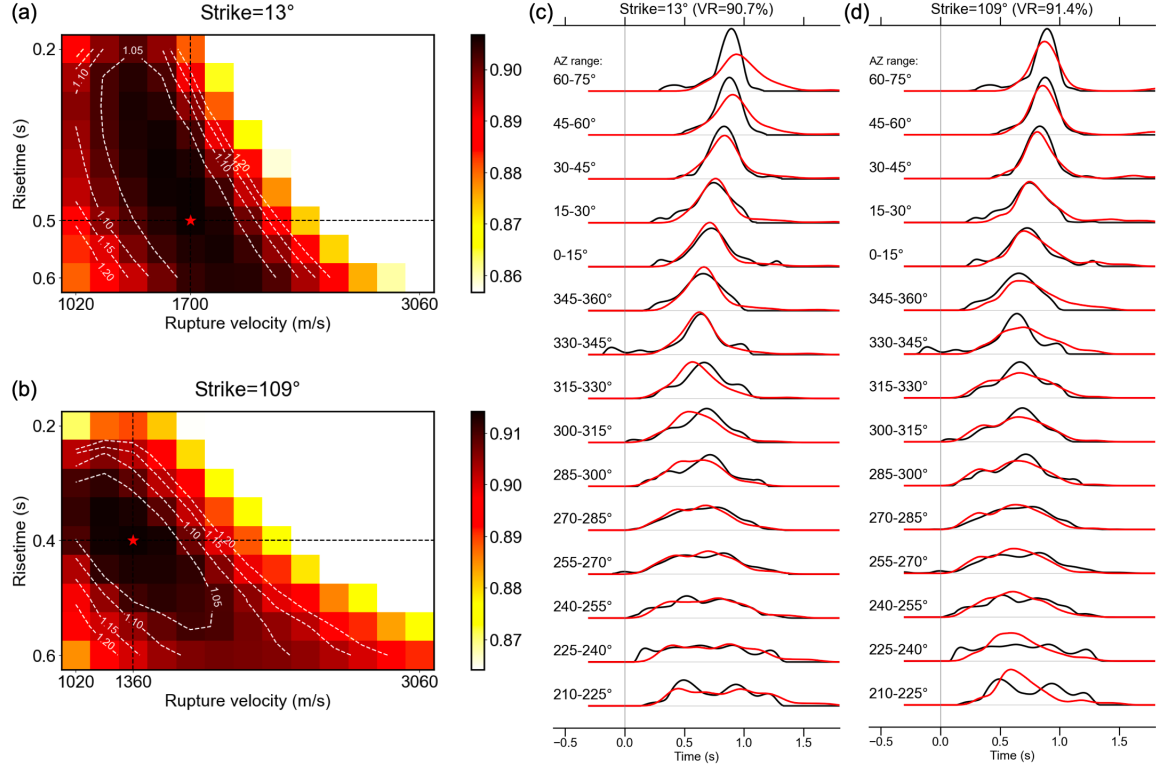


Figure S2. 1D fault slip inversion results for strike directions of two nodal planes. Variance reductions (VRs) for the strike directions of (a) 13° (nodal plane 1, NP1) and (b) 109° (nodal plane 2, NP2) in searching for the optimal rupture velocity and risetime are shown. Optimal rupture velocities and risetime, which maximize VR are indicated by red stars. Comparison between the *Lg* RSTFs (black) and synthetic RSTFs (red) calculated by forward modeling of the 1D inversion result for the strike directions of (c) 13° and (b) 109° are shown.

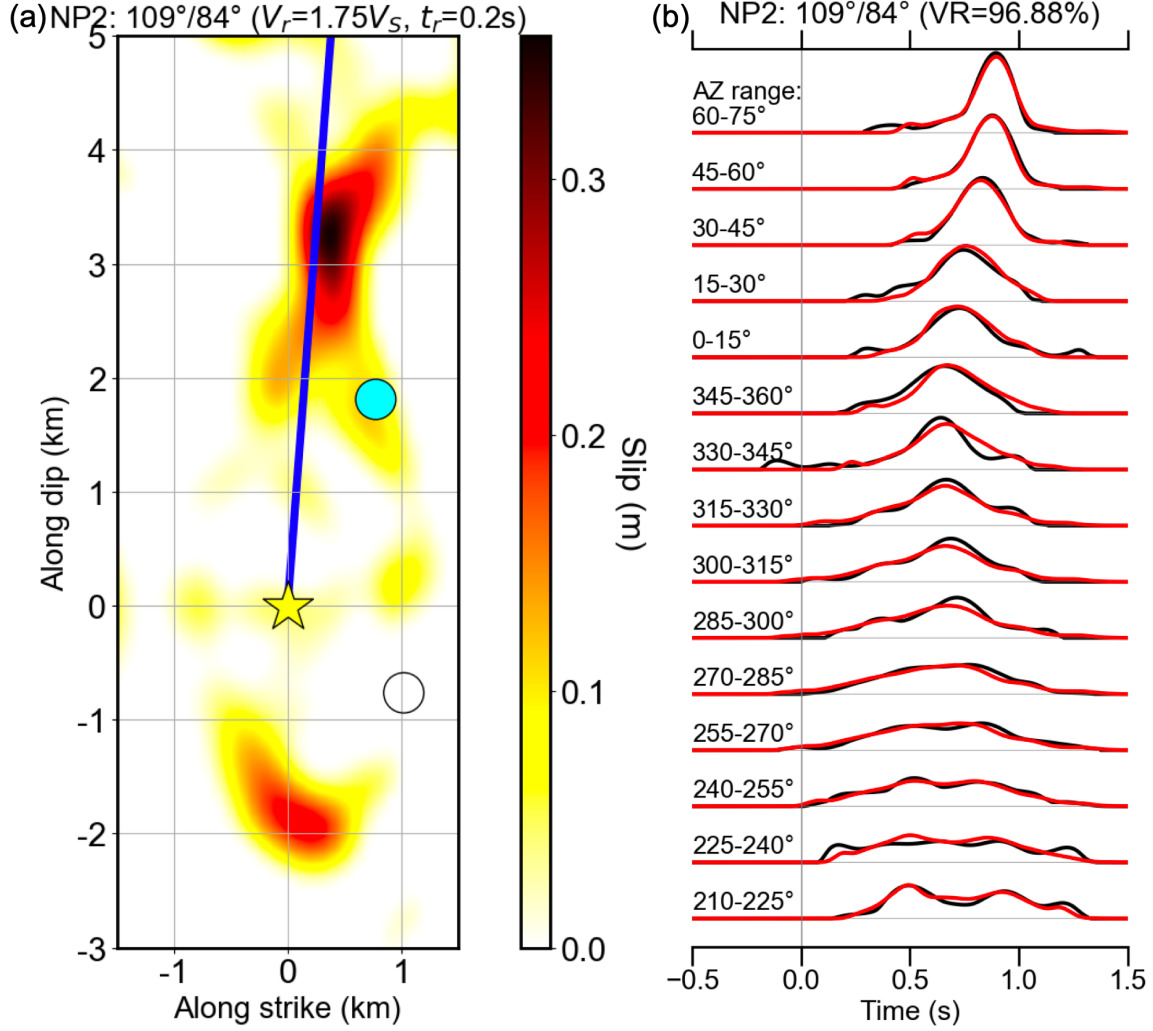


Figure S3. 2D fault slip inversion result for the nodal plane 2 (NP2) of which strike and dip directions are 109° and 84°, respectively. (a) Slip distribution on NP2 when the rupture velocity (V_r) is $1.75 \times V_s$ at risetime (t_r) of 0.2 s. A blue solid line represents the rupture direction and its extent retrieved from the 1D inversion result. The plotting scheme is the same as that shown in Fig. 4a. (b) Comparison between the L_g RSTFs (black) and synthetics (red) calculated by the forward modeling of slip distributions on the fault plane.

CDI from DYFI, 04/05/2024 New Jersey Earthquake

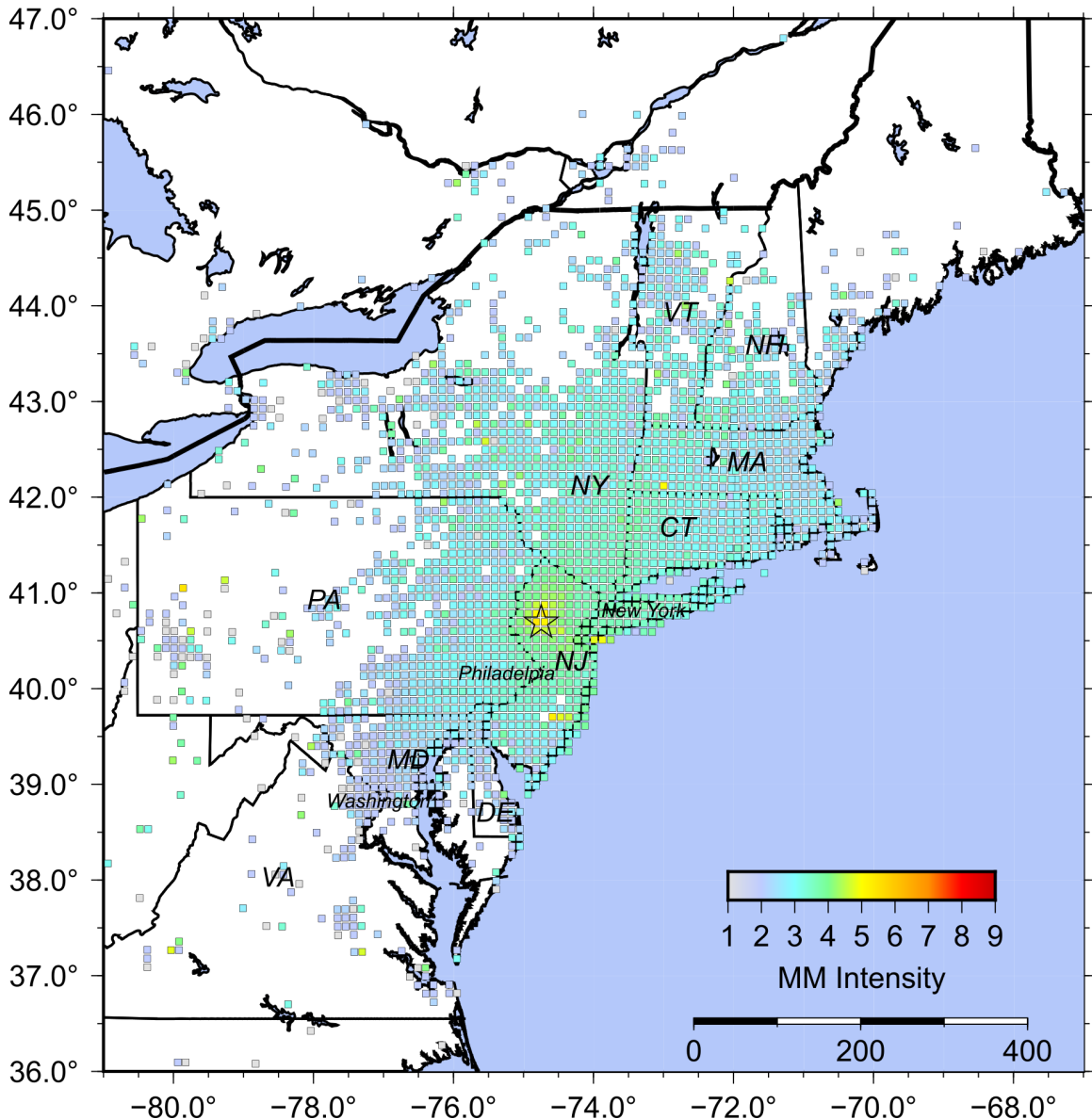


Figure S4. Community Decimal Intensity (CDI) values at each 10 km by 10 km cell are color-coded as the inset legend. Epicenter and the surrounding area have an average MM intensity *V* (green blocks) – an area of 30 km (EW) by 40 km (NS) but never reached intensity *VI*. There were only six reported intensity *VI* values out of over 5,300 intensity *V* reports. Obviously, there is a lack of felt strong motion reports near the epicenter. However, areas with reported intensity *IV* (blue) are extensive; it goes well over 100 km from the epicenter in the eastern half of the region. The distribution map of the CDI values may have been biased due to population density, but absolute intensity values at each 10 by 10 km cell may be close to true values.