Supplementary information to "A dense microearthquake catalog reveals the complex rupture of the extremely shallow M5.1 Sparta, North Carolina Earthquake"

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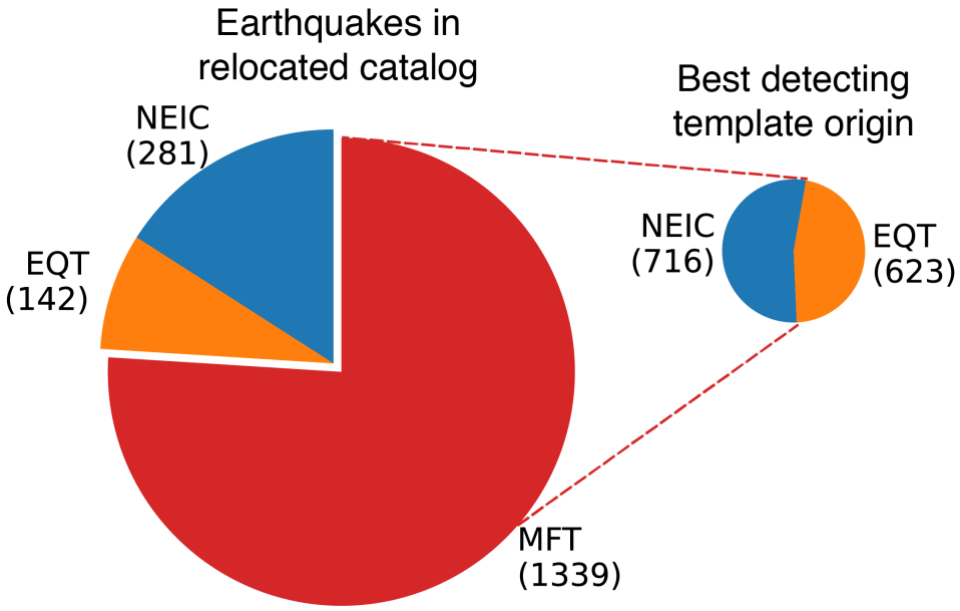
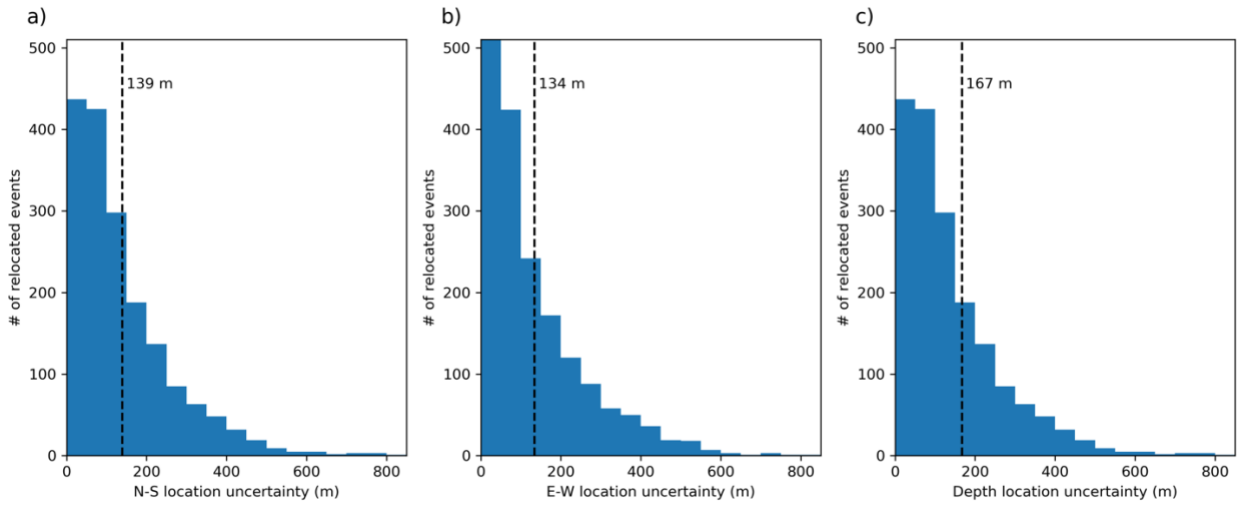
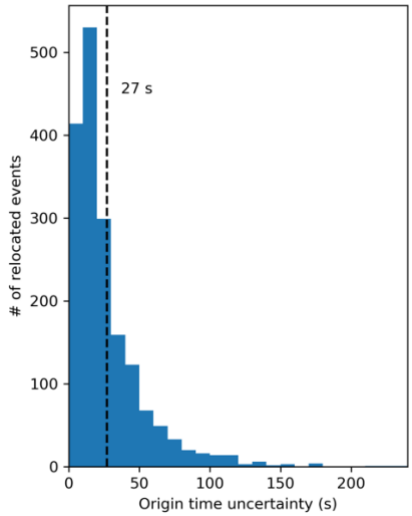


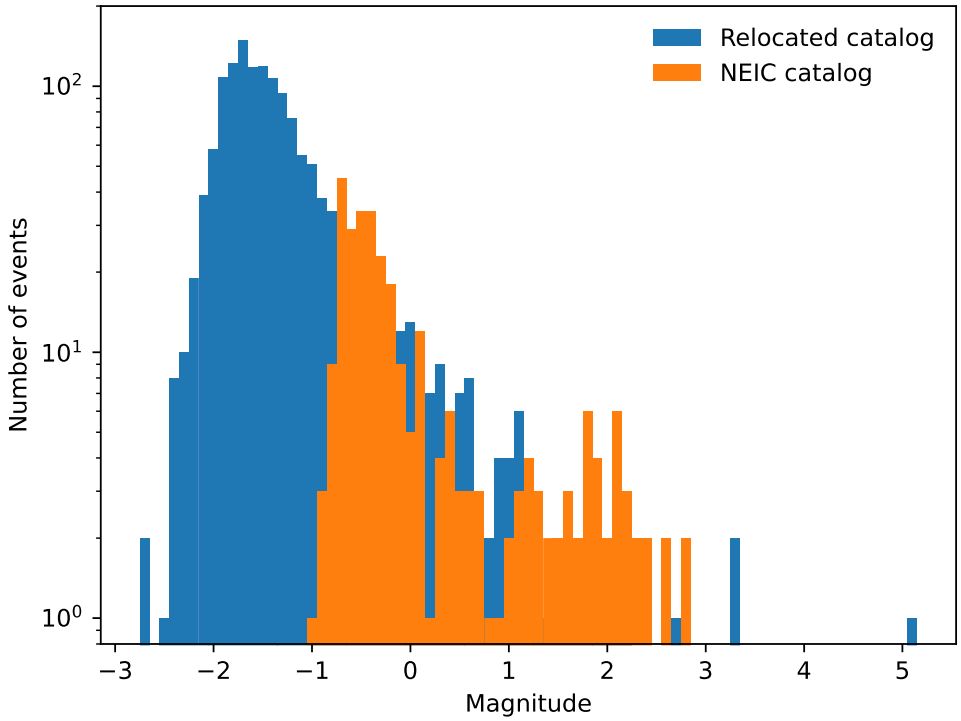
Supplementary Figure 1: Detection origin of the earthquakes in the final relocated earthquake catalog.



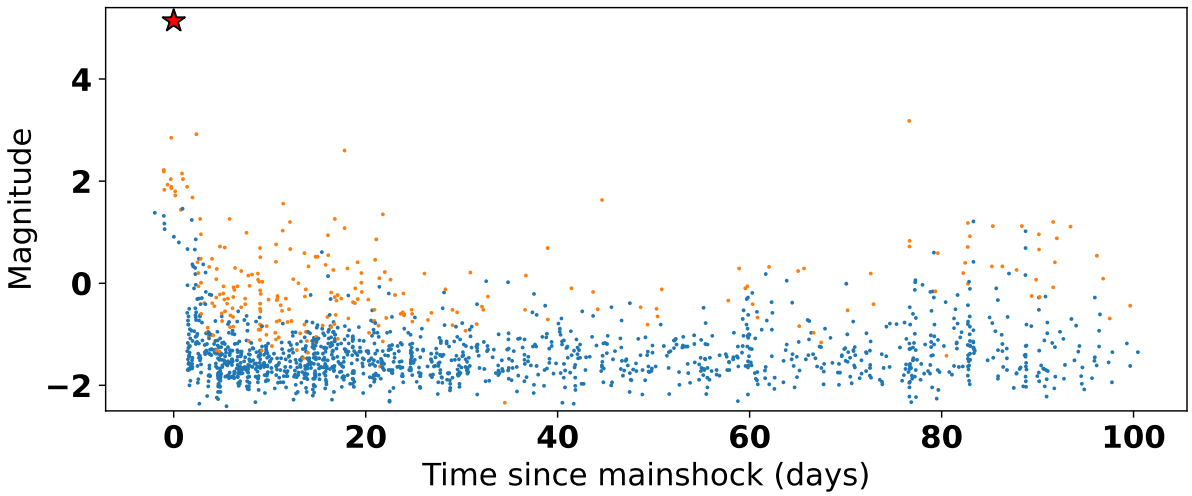
Supplementary Figure 2: Relative location error estimates. a) and b) show horizontal errors and c) depth. Black lines denote the average error of all relocated events. Uncertainties are binned in 50 m width bins.



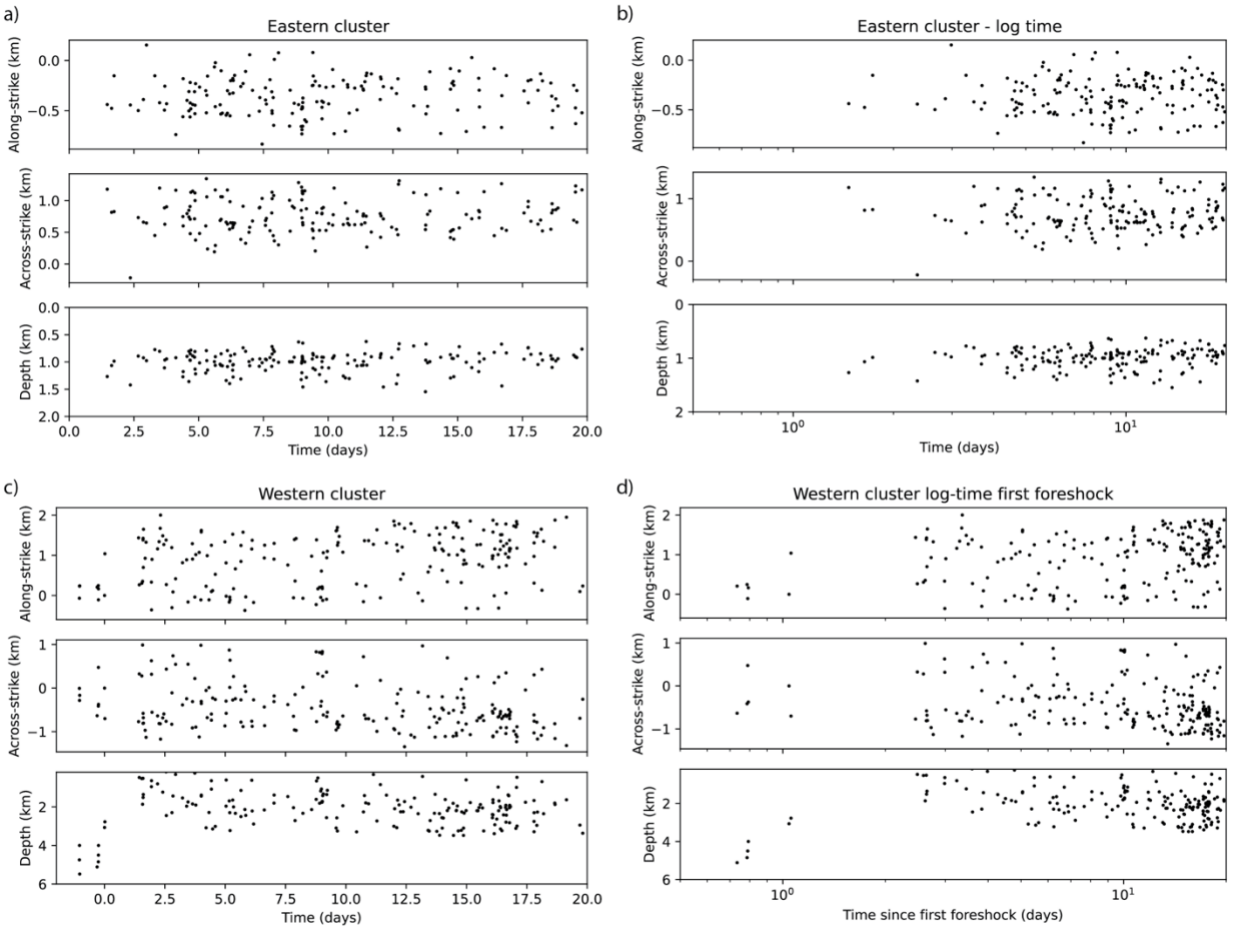
Supplementary Figure 3: Origin time error resulting from the relocation procedure. Black line denotes the average error of all relocated events. Uncertainties are binned in 10 s width bins.



Supplementary Figure 4: Frequency magnitude distribution of the new relocated catalog (blue) and the initial NEIC catalog (orange).



Supplementary Figure 5: Earthquake magnitudes with time for events in our new relocated catalog. Events also included in the original NEIC catalog are denoted in orange and new detections in blue. Red star denotes the mainshock.



Supplementary Figure 6: Location of earthquakes in our new catalog along- and across-strike, and with depth for each cluster. a) Earthquakes in the Eastern cluster. b) Same as (a) but with log-time scale. c) Earthquakes in the Western cluster. d) Same as (c) but with log-time scale starting at the first identified foreshock. We do not observe any clear migration in the Eastern cluster. In the Western cluster we identify a potential across and along-strike expansion in relation to the first foreshock. Though the limited number of earthquakes in the foreshock period and in the day following the mainshock, when noise levels are higher and we rely only on regional stations, preclude us from making clear observations.

Supplementary Figure 7: Repository file supplementary_figure7_3d_earthquakes_plot.html (https://figshare.com/s/55793e7d1b17ecfcd7d7). Interactive 3D plot of earthquakes in our catalog and the best fitting planes to the three identified seismicity cluster.

Supplementary Figure 8: Repository file supplementary_figure8_3d_earthquakes_planes_plot .html (https://figshare.com/s/55793e7d1b17ecfcd7d7). Interactive 3D plot of earthquakes in our catalog and the best fitting planes to the three identified seismicity cluster.

Supplementary Figure 9: Repository file supplementary_figure9_3d_faultplanes_plot.html (https://figshare.com/s/55793e7d1b17ecfcd7d7). Interactive 3D plot of best fitting planes to the three identified seismicity cluster and mainshock hypocenter.

Supplementary Table 1. Table listing estimated corner frequencies and uncertainties estimated for 4 of the largest events in the catalog.

Catalog number	M_W	f_c (Hz)	f_c 95% confidence interval (Hz)	σ_{Brune} (MPa)	$\sigma_{K\&S}$ (MPa)	$\sigma_{Madariaga}$ (MPa)
77	5.14	1.07	[1.04; 1.10]	16.3	47.1	89.3
6187	3.19	4.00	[3.82; 4.21]	1.0	2.9	5.5
68	2.85	5.06	[4.88; 5.23]	0.6	1.8	3.5
3954	2.60	5.74	[5.47; 5.99]	0.4	1.1	2.1

Supplementary Data 1: supplementary_data1_relocated_catalog_sparta.txt (https://figshare.com/s/55793e7d1b17ecfcd7d7).

Earthquake relocated catalog for the 2020 Sparta earthquake sequence.

File format: ID YYYY MM dd hh mm ss.sss lat lon depth mag ex ey ez et rms

ID: event identifier

YYYY: year of earthquake origin time

MM: month

dd: day

hh: hour

mm: minute

ss.sss: seconds

lat: latitude(degrees)

lon: longitude(degrees)

depth: depth in km

mag: earthquake magnitude

ex: North-South uncertainty estimated from bootstrapping (m)

ey: East-West uncertainty estimated from bootstrapping (m)

ez: depth uncertainty estimated from bootstrapping (m)

et: origin time uncertainty estimated from bootstrapping (s)

rms: root-mean-square of the differential times

Supplementary Data 2: supplementary_data2_polarity_focal_mechanism_catalog.txt (https://figshare.com/s/55793e7d1b17ecfcd7d7).

First motion polarity derived focal mechanism catalog.

File format: ID YYYY MM dd hh mm ss.sss mag lat lon depth st dip rk ep eap np misfit qual prob

stratio nsp sp_misf

ID: event identifier

YYYY: year of earthquake origin time

MM: month

dd: day

hh: hour

mm: minute

ss.sss: seconds

mag: earthquake magnitude

st: focal mechanism strike

dip: focal mechanism dip

rk: focal mechanism rake

ep: fault plane uncertainty

eap: auxiliary fault plane uncertainty

np: number of P first motion polarities

misfit: weighted percent misfit of first motions

qual: focal mechanism quality: A-F

prob: probability mechanism close to solution

stratio: 100*(station distribution ratio)

nsp: number of S/P ratios

sp_misf: 100*(average log10(S/P)) misfit