Supplementary Material

High-Frequency Ground-Motion Simulation of the 2019 Ridgecrest Earthquake Using a k^{-2} Kinematic Source Model on a 3-D Non-Planar Fault and Empirical Green's Functions

Arpit Kumar Maurya, Simanchal Padhy

Department of Earth Sciences,
Indian Institute of Technology Roorkee,
Roorkee, Uttarakhand, India

This supplementary material provides additional figures and tables supporting the analyses presented in the main manuscript. Figure S1 shows the three-component acceleration time series of selected Empirical Green's function (EGF) events of Set 1. Table S1 documents the range of source parameters considered in generating the stochastic realizations. Figure S2 extends the comparison with GMM predictions, showing that the simulation-to-GMM ratios are generally consistent across the three models, while differences between EGF sets vary among stations. These differences can be attributed to EGF selection rather than changes in the source realization. Table S2 further examines the consistency of the residual–distance relationships across the three GMMs, showing a negative correlation at SRT for Set 1, while the remaining combinations have confidence intervals that include zero. Together, these supplementary results provide additional evidence of source-related variability, sensitivity to EGF selection, and the consistency of the findings across different reference GMMs.

List of figures:

Figure S1 – Time series of the Empirical Green's function events at stations CCC and GSC.

Figure S2 – Ratios of simulated RotD50 PGA to BSSA14, CB14, and CY14 median predictions for the different stations and EGF sets.

List of tables:

Table S1 – Simulation parameters for the 20 stochastic realizations.

Table S2 – Sensitivity of the residual–distance correlation to the selected ground-motion model.

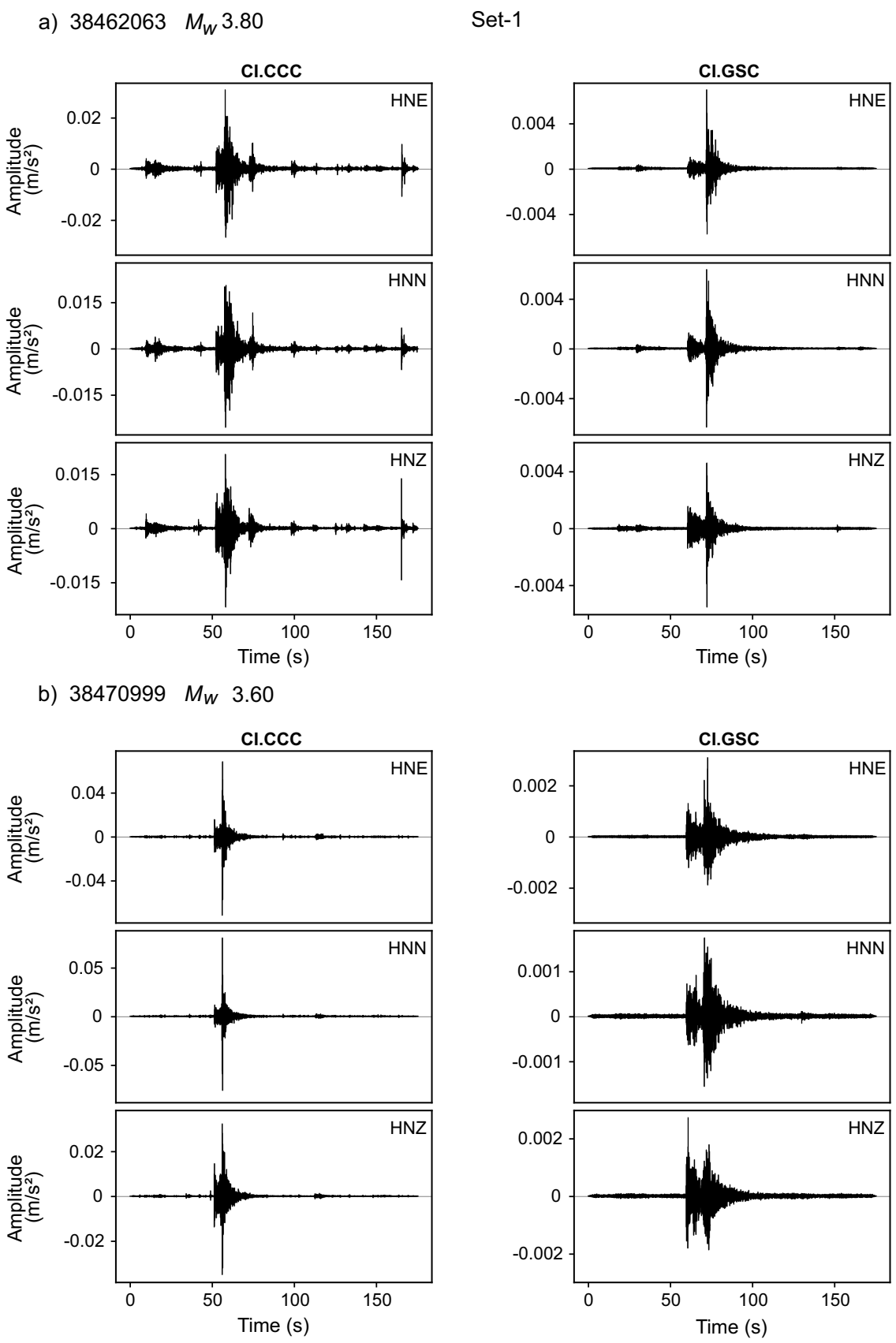


Figure S1: Time series of the two EGFs used: the 38462063 event of magnitude Mw 3.80 (a) and the 38470999 event of magnitude Mw 3.60(b). Time series are represented for the CCC soft rock site (left) and GSC hard rock site (right).

Table S1: Simulation parameters for the 20 stochastic realizations.

Simulation	L (km)	W (km)	f_c (Hz)	SD (MPa)	D_m (m)	V_r (m/s)
1	52.24	19.52	0.050	1.27	1.486	2796.5
2	45.12	16.88	0.056	1.81	1.989	2718.1
3	44.88	16.72	0.052	1.40	2.019	2477.4
4	49.28	18.40	0.054	1.61	1.671	2855.1
5	42.80	16.00	0.054	1.56	2.212	2451.2
6	42.32	15.84	0.060	2.18	2.260	2708.9
7	48.24	18.00	0.058	1.92	1.745	2963.3
8	50.64	18.96	0.049	1.22	1.578	2673.1
9	50.56	18.88	0.049	1.18	1.587	2640.6
10	49.36	18.40	0.056	1.74	1.668	2930.8
11	52.00	19.44	0.053	1.47	1.499	2922.4
12	48.00	17.92	0.050	1.23	1.761	2542.0
13	44.08	16.48	0.056	1.76	2.085	2628.7
14	46.00	17.20	0.059	2.06	1.915	2889.4
15	47.44	17.68	0.050	1.24	1.806	2518.1
16	53.68	20.08	0.045	0.93	1.405	2586.0
17	46.48	17.36	0.052	1.42	1.878	2580.7
18	39.44	14.72	0.067	3.03	2.610	2818.7
19	55.44	20.72	0.046	1.00	1.319	2739.9
20	58.64	21.92	0.044	0.88	1.178	2778.4

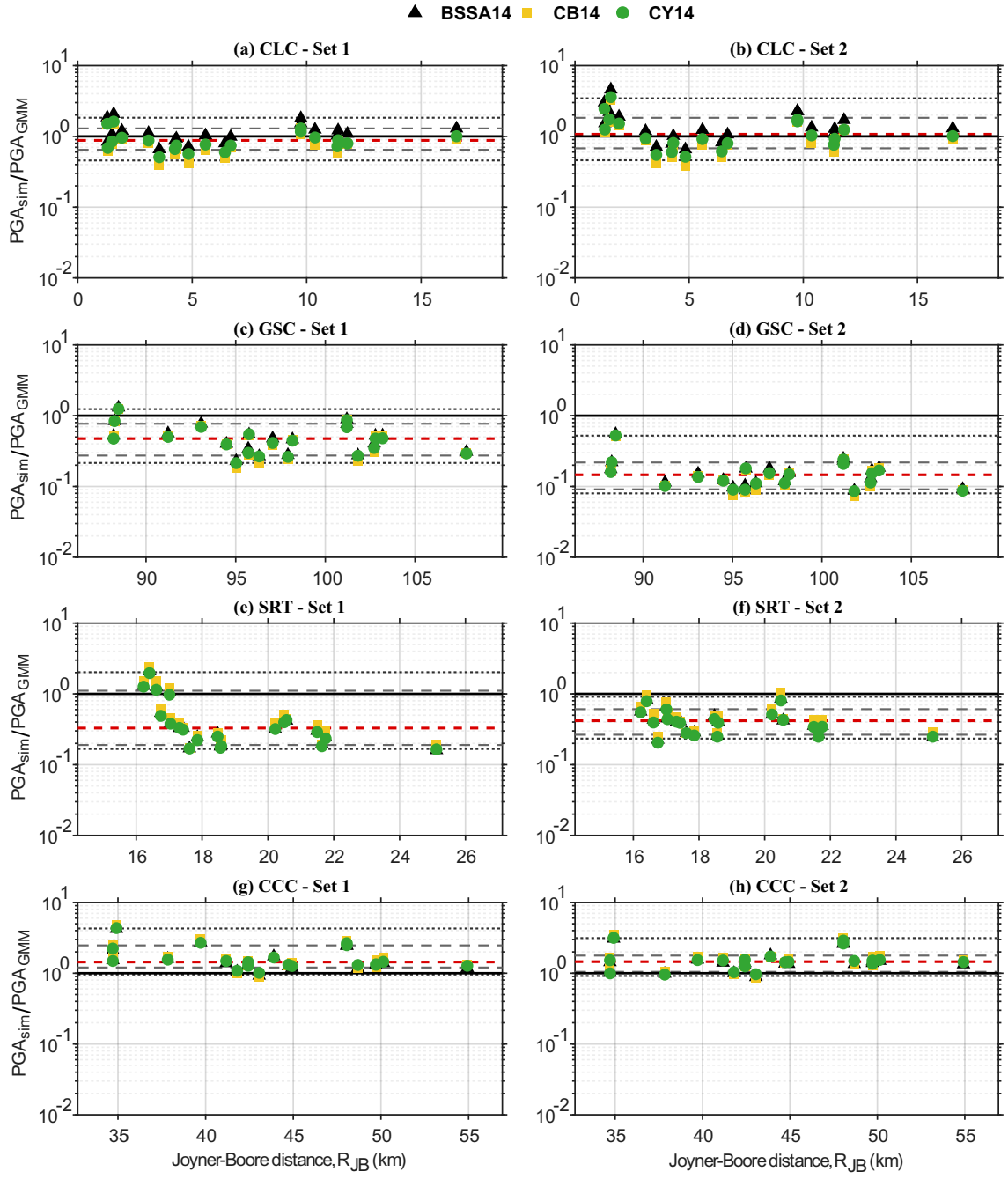


Figure S2: Ratios of simulated RotD50 PGA to the BSSA14, CB14, and CY14 median predictions as a function of Joyner–Boore distance (R_{JB}), shown separately for each station and EGF set. The solid black line denotes unity. The red dashed line indicates the median of the pooled ratios shown in each panel, and the gray dashed and black dotted lines denote the 16th–84th and 2.5th–97.5th percentile ranges, respectively. For each source realization, one ratio is shown for each of the three GMMs.

Table S2: Sensitivity of the residual–distance correlation to the selected ground-motion model. Pearson correlation was calculated between $\log_{10}(R_{\mathrm{JB}})$ and the natural-log residual, whereas Spearman's coefficient was calculated from the corresponding ranks of R_{JB} and the residual. Brackets indicate percentile 95% bootstrap confidence intervals based on 20 000 resamples. Each station–EGF set combination contains $N = 20$ realizations.

Station	EGF set	GMM	Pearson r_{P} [95% CI]	Spearman ρ_{S} [95% CI]
CLC	Set 1	BSSA14	−0.03 [−0.46, 0.54]	+0.12 [−0.37, 0.61]
		CB14	−0.12 [−0.52, 0.42]	+0.01 [−0.45, 0.51]
		CY14	−0.13 [−0.53, 0.46]	+0.05 [−0.42, 0.54]
CLC	Set 2	BSSA14	−0.35 [−0.64, 0.18]	−0.16 [−0.57, 0.38]
		CB14	−0.37 [−0.67, 0.15]	−0.21 [−0.61, 0.34]
		CY14	−0.40 [−0.68, 0.12]	−0.27 [−0.65, 0.27]
GSC	Set 1	BSSA14	−0.38 [−0.69, 0.10]	−0.27 [−0.65, 0.20]
		CB14	−0.34 [−0.67, 0.12]	−0.22 [−0.61, 0.26]
		CY14	−0.39 [−0.71, 0.10]	−0.28 [−0.65, 0.20]
GSC	Set 2	BSSA14	−0.35 [−0.66, 0.27]	−0.14 [−0.56, 0.38]
		CB14	−0.32 [−0.65, 0.26]	−0.16 [−0.58, 0.35]
		CY14	−0.36 [−0.67, 0.26]	−0.20 [−0.61, 0.32]
SRT	Set 1	BSSA14	−0.60 [−0.78, −0.32]	−0.69 [−0.92, −0.26]
		CB14	−0.57 [−0.76, −0.27]	−0.66 [−0.91, −0.21]
		CY14	−0.59 [−0.77, −0.31]	−0.68 [−0.92, −0.23]
SRT	Set 2	BSSA14	−0.30 [−0.68, 0.22]	−0.38 [−0.78, 0.14]
		CB14	−0.26 [−0.64, 0.24]	−0.35 [−0.76, 0.16]
		CY14	−0.26 [−0.65, 0.25]	−0.34 [−0.74, 0.17]
CCC	Set 1	BSSA14	−0.40 [−0.70, 0.08]	−0.37 [−0.71, 0.09]
		CB14	−0.39 [−0.70, 0.09]	−0.38 [−0.72, 0.09]
		CY14	−0.38 [−0.70, 0.13]	−0.37 [−0.70, 0.10]
CCC	Set 2	BSSA14	+0.10 [−0.40, 0.59]	+0.12 [−0.36, 0.54]
		CB14	+0.06 [−0.41, 0.52]	+0.15 [−0.33, 0.57]
		CY14	+0.13 [−0.38, 0.63]	+0.10 [−0.38, 0.54]