

1 Supplemental Material for:
 2 **Constraining between-event variability of kinematic rupture scenarios by empirical**
 3 **ground-motion model: A case study in Central Italy**

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9 Table S1: Velocity models of (a) Norcia area west of the Sibillini Thrust, (b) Amatrice area,
 10 east of the Sibillini Thrust (Fig. 1a). The models are plotted in Fig. 1b.

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(a) Norcia area					
Top depth (km)	Vp(km/s)	Vs(km/s)	Rho(g/cm ³)	Qp	Qs
0	2.05	1.1	2.94	100	50
0.06	2.79	1.5	2.94	400	200
0.08	3.72	2.0	2.94	400	200
0.4	5.58	3.0	2.94	400	200
1	5.70	3.1	2.94	1000	500
2	5.76	3.1	2.94	2000	1000
5	6.51	3.5	3.15	2000	1000
27	7.00	3.8	3.26	2000	1000
42	7.80	4.2	3.50	2000	1000

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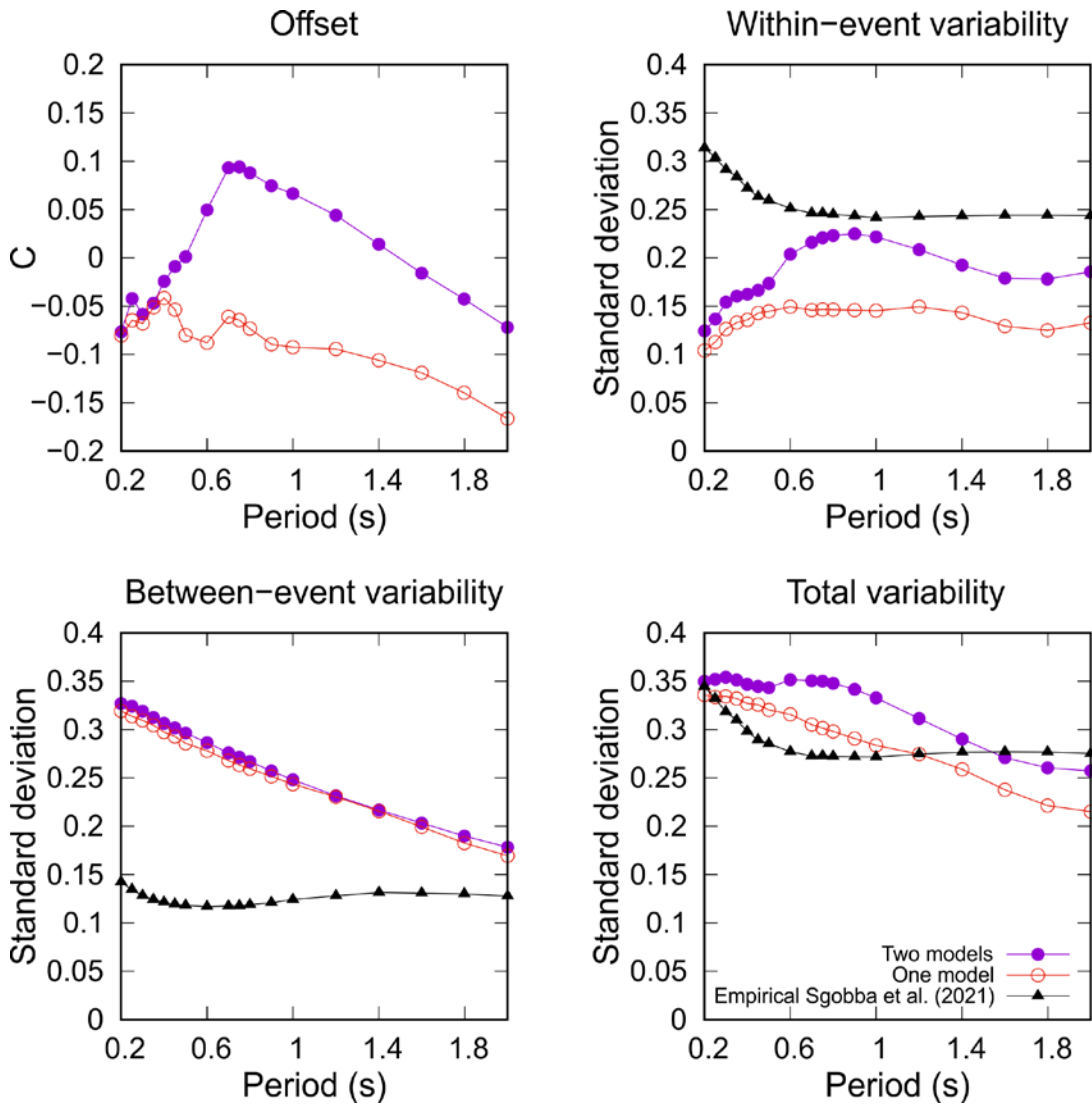
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(b) Amatrice area					
Top depth (km)	Vp(km/s)	Vs(km/s)	Rho(g/cm ³)	Qp	Qs
0.00	1.49	0.80	1.90	50	50
0.06	2.23	1.20	1.90	100	100
0.16	3.16	1.70	2.00	100	100
1.00	4.83	2.60	2.84	1000	500
2.00	5.76	3.10	2.94	2000	1000
5.00	6.51	3.50	3.15	2000	1000
27.00	7.00	3.80	3.26	2000	1000
42.00	7.80	4.20	3.50	2000	1000

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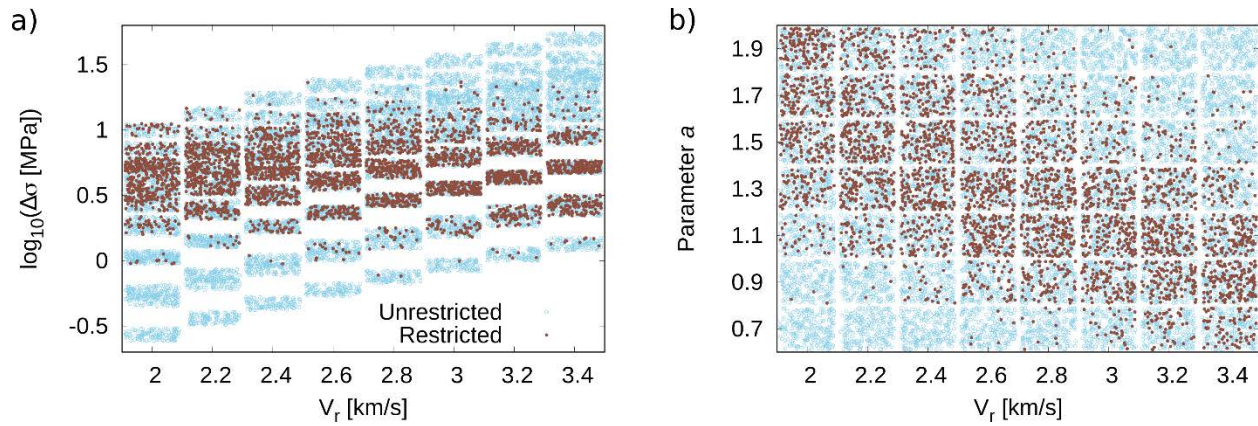
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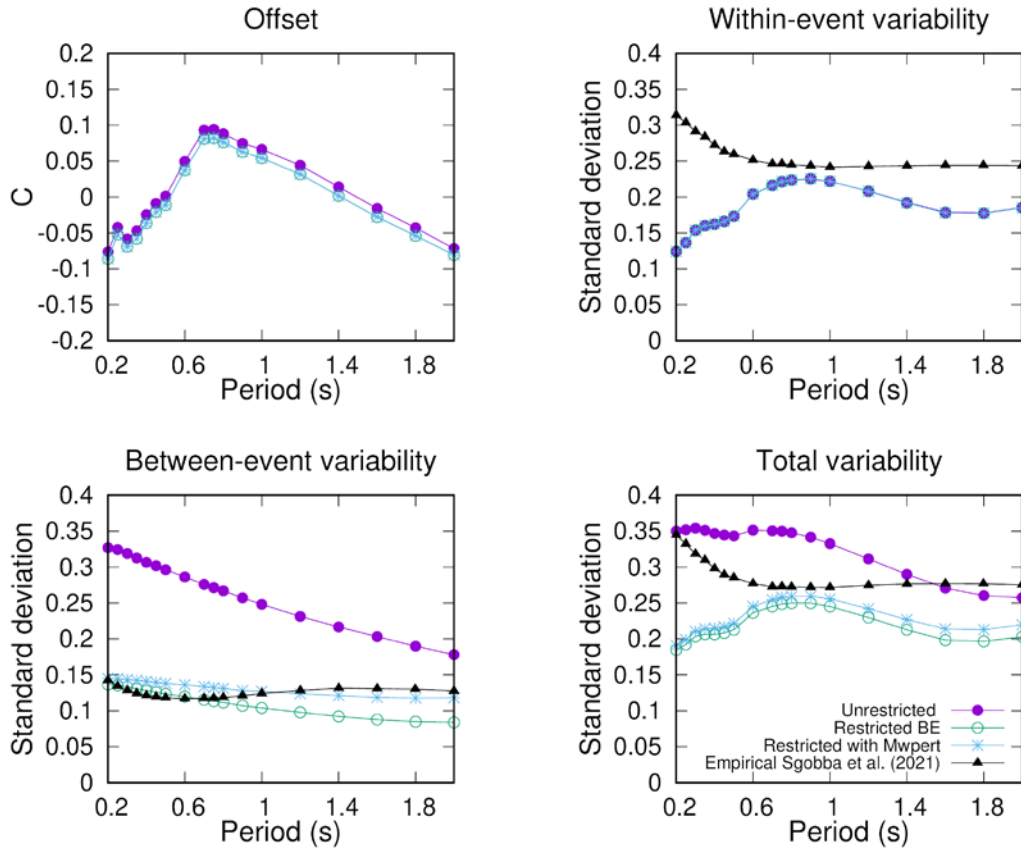
Figure S1: Effect of using only one crustal model on the GMM residuals compared to two regional crustal models: Offset, W-E, B-E and total variability (in log 10) of the GMM residuals when using two regional crustal models (violet line with full circles), or only one crustal model of the Amatrice area in the whole domain (red line with red circles). The black line shows the corresponding empirical values of GMM by Sgobba et al. (2021).



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28 Figure S2: Distribution of source parameters in the restricted (brown) and unrestricted
 29 (blue) database: a) Stress parameter with respect to rupture velocity v_r , b) parameter a
 30 with respect to rupture velocity. For better graphical representations of the model counts,
 31 the gridded values are spread to clouds by randomly perturbing their values. The figure
 32 demonstrates that the stress parameter in the restricted database attains narrower
 33 distribution independent of v_r by anticorrelating v_r and a , which is not prescribed in the
 34 original unrestricted database.

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38 Figure S3: Experiment with adding random error in Mw (pretending uncertain real-data
39 estimate) and its effect on the SA residuals: Offset, W-E, B-E, and total standard deviation
40 (in log10) of the unrestricted (violet), restricted (green) and perturbed restricted (blue)
41 database. The black lines show the respective empirical values of GMM by Sgobba et al.
42 (2021). The perturbed SA residuals were generated from restricted database by perturbing
43 the Mw value of 6.2 of each scenario using normal distribution with standard deviation of
44 0.1. The test demonstrates that the effect on the B-E variability is more pronounced on
45 longer periods, where it brings the synthetic B-E standard deviation of the restricted
46 database closer to its empirical value.