Sensitivity Analysis on the Impact of Input Parameters on Seismic Hazard Results: A Case Study of Central America

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Supplementary Material

Supplement A

Recurrence parameters calculated using RSB and UHR declustering method as well as bLS and bML fitting method.

Supplement B

Acceleration maps of GMM branches analyzed in this study. PGA – 475 yrs return period.

Supplement C

Procedure developed to obtain the weights in the logical tree for the declustering method and the recurrence parameter fitting method.

Supplement A

Below we show the recurrence parameters calculated for this study in the seismic zones proposed by Alvarado et al. (2017) using the declustering method of Reasenberg (1985) (RSB) and Uhrhammer (1986) (UHR), as well as the least squares fitting method (bLS) and maximum likelihood fitting method (bML) proposed by Aki (1965) with the improvement by Weichert (1980).

Table S1
Seismic parameters with RSB desclustering and bML fitting method

Zone name	Code	Min Depth (Km)	Max Depth (Km)	M1	M2	a	aσ	b	bσ	$\dot{N}(M_{min})$
Upper-plate zones										
Guatemala Pacific	G1	0.0	10.0	6.4	6.5	5.62	0.02	1.12	0.05	3.61
Guatemala-El Salvador forearc	G2-S2	0.0	20.0	6.5	6.9	6.28	0.02	1.30	0.02	2.79
Guatemala, Volcanic Arc W	G3	0.0	20.0	6.2	6.7	3.73	0.03	0.92	0.05	0.39
Guatemala, Volcanic Arc E	G4	0.0	20.0	6.9	7.4	4.08	0.02	0.86	0.02	1.68
Guatemala-El Salvador-Honduras, Central Depression	G5-S5-H1	0.0	25.0	7.2	7.4	6.47	0.02	1.31	0.05	3.78
Guatemala, Polochic-Motagua W	G6	0.0	25.0	7.7	8.0	5.29	0.02	1.08	0.04	2.86
Guatemala, Polochic-Motagua NE	G7	0.0	25.0	7.5	7.9	4.96	0.03	0.98	0.06	3.67
Guatemala, North (Peten-Belice)	G8	0.0	25.0	5.5	6.0	4.75	0.04	1.08	0.11	0.81
Guatemala North-West	G9	0.0	25.0	7.1	7.3	6.05	0.04	1.29	0.12	1.81
Honduras, Central Highlands	H2	0.0	25.0	6.4	6.6	7.65	0.03	1.59	0.12	3.09
Honduras-Nicaragua, Guayape fault system	H3-N11	0.0	25.0	7.3	7.5	7.05	0.04	1.49	0.12	2.21
North Coast Honduras	H4	0.0	25.0	5.7	6.8	1.73	0.07	0.43	0.21	0.60
El Salvador, Central Pacific	S1	0.0	10.0	6.0	6.5	6.90	0.02	1.49	0.04	1.57
El Salvador, Central Volcanic Arc	S3	0.0	20.0	7.2	7.5	3.70	0.01	0.84	0.02	0.81
El Salvador-Nicaragua, Volcanic Arc (Fonseca Gulf)	S4-N5	0.0	20.0	6.5	6.7	3.68	0.03	0.88	0.04	0.56
Nicaragua, Pacific West	N1	0.0	10.0	5.7	6.4	8.82	0.01	1.81	0.03	4.54
Nicaragua, Pacific South – Costa Rica, Papagayo Gulf	N2-C1	0.0	25.0	6.2	6.6	8.56	0.01	1.74	0.02	5.34
Nicaragua, forearc West	N3	0.0	20.0	6.1	6.5	4.89	0.02	1.05	0.03	1.44
Nicaragua, forearc East	N4	0.0	20.0	5.7	6.5	4.36	0.02	0.95	0.03	1.17
Nicaragua, Volcanic Arc West-Central	N6-N7	0.0	20.0	7.4	7.7	3.30	0.01	0.76	0.02	0.76
Nicaragua, Volcanic Arc SE	N8	0.0	20.0	6.3	6.9	1.90	0.04	0.56	0.05	0.24
Nicaragua Depression	N9-N10	0.0	20.0	7.1	7.3	3.01	0.03	0.76	0.03	0.38
Nicaragua, Caribe South	N12	0.0	18.0	5.3	5.9	5.49	0.04	1.29	0.08	0.50
Nicaragua, Caribe North	N13-N14	0.0	25.0	5.9	6.3	3.23	0.05	0.75	0.10	0.71
Costa Rica, forearc NW	C2	0.0	15.0	5.7	6.5	4.74	0.02	1.06	0.07	0.94
Costa Rica, forearc Pacific Central	C3	0.0	15.0	5.4	6.2	6.41	0.01	1.37	0.04	1.77
Panama-Costa, Burica peninsula	C4	0.0	10.0	6.5	6.8	6.79	0.02	1.41	0.05	2.79
Costa Rica, Guanacaste Volcanic Arc	C5	0.0	15.0	6.5	6.8	4.50	0.02	0.98	0.02	1.19
Costa Rica, Central Volcanic Range	C6	0.0	20.0	6.4	6.8	4.92	0.01	1.08	0.01	1.15
Costa Rica - Talamanca	C7	0.0	40.0	6.3	6.6	6.38	0.01	1.33	0.03	2.40
Costa Rica, Backarc North	C9	0.0	11.0	5.4	5.9	2.52	0.05	0.69	0.08	0.27
Costa Rica, Central Caribe Parismina	C10	0.0	20.0	6.0	6.2	5.05	0.03	1.18	0.06	0.55
Panama Fracture Zone	P1	0.0	25.0	6.8	7.4	5.90	0.01	1.04	0.03	17.22
Panama, Deformed Belt South of Panama	P2	0.0	25.0	6.0	6.4	6.42	0.03	1.39	0.08	1.45
Panama, Colombia forearc North	P3	0.0	15.0	5.9	6.3	2.26	0.03	0.54	0.04	0.65
Panama, West	P5	0.0	20.0	6.3	6.5	5.40	0.02	1.18	0.04	1.24
Panama, Central	P6	0.0	20.0	6.9	7.1	3.95	0.07	1.13	0.20	0.08
Panama, East-Darien	P7	0.0	20.0	7.3	7.5	3.63	0.03	0.81	0.03	0.96
Panama, North Panama Deformed Belt North East	P8	0.0	20.0	7.9	8.1	4.60	0.05	1.10	0.11	0.43
Panama – North Panama Deformed Belt Central	P9	0.0	30.0	5.2	5.5	3.29	0.08	0.88	0.28	0.21
Panama, North Panama Deformed Belt West	P10-C8	0.0	30.0	7.7	8.0	4.52	0.01	0.90	0.02	2.95
Interplate zones										
Guatemala, Interface	Gsi9	10.1	40.0	7.5	7.8	5.70	0.01	1.04	0.02	10.20
El Salvador, Interface	Ssi5	10.1	40.0	7.5	7.7	7.46	0.01	1.42	0.01	11.61
Nicaragua, Interface NW	Nsi15	10.1	40.0	6.3	6.7	8.57	0.01	1.70	0.03	8.10
Nicaragua, Interface SE	Nsi16	10.1	40.0	7.2	7.5	5.99	0.01	1.15	0.01	6.78
Costa Rica, Interface Nicoya	Csi11	12.1	35.0	7.7	7.9	4.35	0.01	0.88	0.02	2.50
Costa Rica, Interface Quepos	Csi12	15.1	30.0	7.3	7.5	4.78	0.01	0.94	0.01	3.47
Costa Rica, Interface Osa	Csi13	10.1	30.0	7.4	7.7	4.08	0.01	0.86	0.02	1.58
Panama, Interface South	Psi9	10.1	30.0	7.5	7.7	5.15	0.01	1.03	0.02	3.33
Panama, Interface San Blas, Darien, Choco	Psi10	20.1	100.0	6.5	7.0	4.00	0.03	0.86	0.06	1.41
Panama Southeast	Psi11	20.1	100.0	7.0	7.2	4.57	0.05	0.98	0.10	1.50
Inslab zones										
Guatemala	Gsp10	40.1	280.0	7.6	8.1	6.12	0.01	1.06	0.02	22.28
El Salvador	Ssp6	40.1	230.0	7.9	8.2	6.11	0.01	1.11	0.01	13.51
Nicaragua	Nsp17	40.1	230.0	7.4	7.8	5.72	0.01	1.03	0.01	12.37
Costa Rica NW	Csp14	35.1	230.0	7.0	7.2	5.07	0.01	1.09	0.02	1.47
Costa Rica Central	Csp15	30.1	135.0	7.0	7.3	5.47	0.01	1.18	0.02	1.38
Costa Rica SE	Csp16	30.1	80.0	5.5	5.9	4.93	0.02	1.25	0.05	0.21
Panama South	Psp11	30.1	70.0	6.0	6.2	3.81	0.05	1.02	0.12	0.17

M1 = Mmax observed from the regional seismic catalog.
M2 = Mmax expected defined by expert criteria.
$\dot{N}(M_{min})$ = Cummulative seismic rate for $M_w \geq 4.5$

Table S2
Seismic parameters with UHR desclustering and bML fitting method

Zone name	Code	Min Depth (Km)	Max Depth (Km)	M1	M2	a	aσ	b	bσ	Ṅ(M_{min})
Upper-plate zones										
Guatemala Pacific	G1	0.0	10.0	5.6	6.5	5.53	0.03	1.17	0.07	1.84
Guatemala-El Salvador forearc	G2-S2	0.0	20.0	6.5	6.9	5.23	0.02	1.14	0.03	1.28
Guatemala, Volcanic Arc W	G3	0.0	20.0	6.2	6.7	3.66	0.04	0.93	0.06	0.32
Guatemala, Volcanic Arc E	G4	0.0	20.0	7.1	7.4	3.99	0.02	0.87	0.03	1.17
Guatemala-El Salvador-Honduras, Central Depression	G5-S5-H1	0.0	25.0	7.2	7.4	6.35	0.02	1.30	0.05	3.28
Guatemala, Polochic-Motagua W	G6	0.0	25.0	7.7	8.0	5.37	0.02	1.11	0.05	2.39
Guatemala, Polochic-Motagua NE	G7	0.0	25.0	7.5	7.9	4.72	0.03	0.94	0.06	3.13
Guatemala, North (Peten-Belice)	G8	0.0	25.0	5.5	6.0	4.68	0.04	1.06	0.11	0.81
Guatemala North-West	G9	0.0	25.0	7.1	7.3	5.99	0.05	1.28	0.12	1.65
Honduras, Central Highlands	H2	0.0	25.0	6.4	6.6	7.71	0.04	1.61	0.12	2.86
Honduras-Nicaragua, Guayape fault system	H3-N11	0.0	25.0	7.3	7.5	6.94	0.04	1.47	0.13	2.11
North Coast Honduras	H4	0.0	25.0	5.7	6.8	1.27	0.07	0.34	0.22	0.54
El Salvador, Central Pacific	S1	0.0	10.0	5.6	6.5	6.36	0.02	1.40	0.04	1.12
El Salvador, Central Volcanic Arc	S3	0.0	20.0	7.2	7.5	3.21	0.01	0.76	0.03	0.62
El Salvador-Nicaragua, Volcanic Arc (Fonseca Gulf)	S4-N5	0.0	20.0	6.2	6.7	3.34	0.04	0.81	0.05	0.47
Nicaragua, Pacific West	N1	0.0	10.0	5.7	6.4	6.05	0.02	1.29	0.04	1.72
Nicaragua, Pacific South – Costa Rica, Papagayo Gulf	N2-C1	0.0	25.0	5.8	6.6	6.81	0.02	1.43	0.03	2.28
Nicaragua, forearc West	N3	0.0	20.0	6.1	6.5	3.17	0.03	0.72	0.04	0.83
Nicaragua, forearc East	N4	0.0	20.0	6.7	6.9	4.03	0.03	0.92	0.04	0.81
Nicaragua, Volcanic Arc West-Central	N6-N7	0.0	20.0	7.4	7.7	3.09	0.02	0.73	0.02	0.65
Nicaragua, Volcanic Arc SE	N8	0.0	20.0	6.3	6.9	1.78	0.05	0.54	0.05	0.24
Nicaragua Depression	N9-N10	0.0	20.0	7.1	7.3	3.09	0.03	0.78	0.03	0.39
Nicaragua, Caribe South	N12	0.0	18.0	5.3	5.9	5.10	0.04	1.20	0.08	0.49
Nicaragua, Caribe North	N13-N14	0.0	25.0	5.9	6.3	3.17	0.05	0.74	0.10	0.70
Costa Rica, forearc NW	C2	0.0	15.0	5.7	6.5	4.66	0.03	1.09	0.08	0.57
Costa Rica, forearc Pacific Central	C3	0.0	15.0	5.6	6.5	6.26	0.02	1.38	0.04	1.12
Panama-Costa, Burica peninsula	C4	0.0	10.0	6.5	6.8	6.35	0.02	1.35	0.06	1.85
Costa Rica, Guanacaste Volcanic Arc	C5	0.0	15.0	6.5	6.8	4.46	0.02	1.00	0.03	0.89
Costa Rica, Central Volcanic Range	C6	0.0	20.0	6.1	6.8	5.04	0.03	1.16	0.06	0.70
Costa Rica - Talamanca	C7	0.0	40.0	6.0	6.6	6.44	0.01	1.38	0.03	1.68
Costa Rica, Backarc North	C9	0.0	11.0	5.4	5.9	2.48	0.05	0.68	0.08	0.26
Costa Rica, Central Caribe Parismina	C10	0.0	20.0	6.0	6.2	5.12	0.03	1.21	0.07	0.46
Panama Fracture Zone	P1	0.0	25.0	6.8	7.4	5.63	0.02	1.00	0.03	13.61
Panama, Deformed Belt South of Panama	P2	0.0	25.0	6.0	6.4	6.29	0.03	1.38	0.08	1.22
Panama, Colombia forearc North	P3	0.0	15.0	5.8	6.3	2.17	0.03	0.54	0.04	0.54
Panama, West	P5	0.0	20.0	6.3	6.5	5.29	0.02	1.17	0.04	1.08
Panama, Central	P6	0.0	20.0	6.9	7.1	3.95	0.07	1.13	0.20	0.08
Panama, East-Darien	P7	0.0	20.0	7.3	7.5	3.65	0.03	0.83	0.03	0.82
Panama, North Panama Deformed Belt North East	P8	0.0	20.0	7.9	8.1	4.44	0.05	1.07	0.11	0.42
Panama – North Panama Deformed Belt Central	P9	0.0	30.0	4.7	5.5	3.29	0.08	0.89	0.29	0.20
Panama, North Panama Deformed Belt West	P10-C8	0.0	30.0	7.7	8.0	4.47	0.01	0.91	0.02	2.36
Interplate zones										
Guatemala, Interface	Gsi9	10.1	40.0	7.5	7.8	5.39	0.02	1.03	0.03	5.67
El Salvador, Interface	Ssi5	10.1	40.0	7.5	7.7	6.75	0.01	1.31	0.02	7.29
Nicaragua, Interface NW	Nsi15	10.1	40.0	6.3	6.7	6.29	0.02	1.29	0.05	2.96
Nicaragua, Interface SE	Nsi16	10.1	40.0	7.2	7.5	5.38	0.01	1.06	0.02	3.93
Costa Rica, Interface Nicoya	Csi11	12.1	35.0	7.7	7.9	4.03	0.02	0.83	0.02	1.99
Costa Rica, Interface Quepos	Csi12	15.1	30.0	7.3	7.5	4.27	0.01	0.87	0.02	2.37
Costa Rica, Interface Osa	Csi13	10.1	30.0	7.4	7.7	3.86	0.02	0.85	0.03	1.14
Panama, Interface South	Psi9	10.1	30.0	7.5	7.7	4.58	0.02	0.93	0.03	2.38
Panama, Interface San Blas, Darien, Choco	Psi10	20.1	100.0	6.5	7.0	3.99	0.03	0.86	0.06	1.33
Panama Southeast	Psi11	20.1	100.0	7.0	7.2	4.48	0.05	0.99	0.12	1.07
Inslab zones										
Guatemala	Gsp10	40.1	280.0	7.6	8.1	5.46	0.01	0.96	0.02	13.21
El Salvador	Ssp6	40.1	230.0	7.9	8.2	5.42	0.01	1.00	0.02	8.51
Nicaragua	Nsp17	40.1	230.0	7.4	7.8	5.26	0.01	0.96	0.01	8.43
Costa Rica NW	Csp14	35.1	230.0	7.0	7.2	5.04	0.01	1.10	0.02	1.18
Costa Rica Central	Csp15	30.1	135.0	7.0	7.3	5.41	0.01	1.20	0.02	1.01
Costa Rica SE	Csp16	30.1	80.0	5.5	5.9	4.87	0.02	1.25	0.06	0.17
Panama South	Psp11	30.1	70.0	6.0	6.2	3.41	0.06	0.95	0.14	0.14

M1 = Mmax observed from the regional seismic catalog.
M2 = Mmax expected defined by expert criteria.
Ṅ(M_{min}) = Cummulative seismic rate for $M_w \geq 4.5$

Table S3

Seismic parameters with RSB desclustering and bLS fitting method

Zone name	Code	Min Depth (Km)	Max Depth (Km)	M1	M2	a	aσ	b	bσ	$\dot{N}(M_{min})$
Upper-plate zones										
Guatemala Pacific	G1	0.0	10.0	6.4	6.5	8.70	0.39	1.83	0.08	3.06
Guatemala-El Salvador forearc	G2-S2	0.0	20.0	6.5	6.9	6.24	0.21	1.30	0.04	2.46
Guatemala, Volcanic Arc W	G3	0.0	20.0	6.2	6.7	3.99	0.10	0.98	0.02	0.39
Guatemala, Volcanic Arc E	G4	0.0	20.0	6.9	7.4	4.44	0.11	0.95	0.02	1.43
Guatemala-El Salvador-Honduras, Central Depression	G5-S5-H1	0.0	25.0	7.2	7.4	6.80	0.16	1.38	0.03	3.74
Guatemala, Polochic-Motagua W	G6	0.0	25.0	7.7	8.0	4.68	0.19	0.95	0.04	2.44
Guatemala, Polochic-Motagua NE	G7	0.0	25.0	7.5	7.9	5.15	0.18	1.02	0.03	3.71
Guatemala, North (Peten-Belice)	G8	0.0	25.0	5.5	6.0	6.74	0.26	1.53	0.05	0.70
Guatemala North-West	G9	0.0	25.0	7.1	7.3	5.07	0.43	1.10	0.08	1.31
Honduras, Central Highlands	H2	0.0	25.0	6.4	6.6	7.11	0.64	1.49	0.13	2.60
Honduras-Nicaragua, Guayape fault system	H3-N11	0.0	25.0	7.3	7.5	4.58	0.60	1.01	0.11	1.07
North Coast Honduras	H4	0.0	25.0	5.7	6.8	4.50	0.51	1.02	0.10	0.79
El Salvador, Central Pacific	S1	0.0	10.0	6.0	6.5	7.56	0.23	1.64	0.05	1.48
El Salvador, Central Volcanic Arc	S3	0.0	20.0	7.2	7.5	3.49	0.15	0.81	0.03	0.71
El Salvador-Nicaragua, Volcanic Arc (Fonseca Gulf)	S4-N5	0.0	20.0	6.5	6.7	3.78	0.11	0.90	0.02	0.53
Nicaragua, Pacific West	N1	0.0	10.0	5.7	6.4	8.92	0.36	1.86	0.08	3.52
Nicaragua, Pacific South – Costa Rica, Papagayo Gulf	N2-C1	0.0	25.0	6.2	6.6	8.71	0.26	1.78	0.06	4.96
Nicaragua, forearc West	N3	0.0	20.0	6.1	6.5	5.36	0.13	1.15	0.03	1.47
Nicaragua, forearc East	N4	0.0	20.0	5.7	6.5	4.08	0.09	0.90	0.02	1.06
Nicaragua, Volcanic Arc West-Central	N6-N7	0.0	20.0	7.4	7.7	3.45	0.04	0.79	0.01	0.78
Nicaragua, Volcanic Arc SE	N8	0.0	20.0	6.3	6.9	1.92	0.07	0.57	0.02	0.22
Nicaragua Depression	N9-N10	0.0	20.0	7.1	7.3	2.71	0.07	0.71	0.02	0.34
Nicaragua, Caribe South	N12	0.0	18.0	5.3	5.9	5.39	0.22	1.27	0.05	0.47
Nicaragua, Caribe North	N13-N14	0.0	25.0	5.9	6.3	4.36	0.11	1.00	0.02	0.69
Costa Rica, forearc NW	C2	0.0	15.0	5.7	6.5	7.16	0.62	1.69	0.15	0.35
Costa Rica, forearc Pacific Central	C3	0.0	15.0	5.4	6.2	6.95	0.30	1.51	0.07	1.50
Panama-Costa, Burica peninsula	C4	0.0	10.0	6.5	6.8	6.41	0.35	1.33	0.07	2.53
Costa Rica, Guanacaste Volcanic Arc	C5	0.0	15.0	6.5	6.8	4.62	0.08	1.01	0.02	1.20
Costa Rica, Central Volcanic Range	C6	0.0	20.0	6.4	6.8	5.01	0.05	1.10	0.01	1.13
Costa Rica - Talamanca	C7	0.0	40.0	6.3	6.6	6.56	0.06	1.37	0.02	2.37
Costa Rica, Backarc North	C9	0.0	11.0	5.4	5.9	3.78	0.15	1.01	0.04	0.18
Costa Rica, Central Caribe Parismina	C10	0.0	20.0	6.0	6.2	5.19	0.17	1.21	0.04	0.54
Panama Fracture Zone	P1	0.0	25.0	6.8	7.4	7.51	0.32	1.35	0.06	27.28
Panama, Deformed Belt South of Panama	P2	0.0	25.0	6.0	6.4	6.38	0.20	1.39	0.04	1.37
Panama, Colombia forearc North	P3	0.0	15.0	5.9	6.3	2.77	0.07	0.70	0.02	0.44
Panama, West	P5	0.0	20.0	6.3	6.5	5.93	0.27	1.33	0.06	0.88
Panama, Central	P6	0.0	20.0	6.9	7.1	3.46	0.22	1.00	0.05	0.09
Panama, East-Darien	P7	0.0	20.0	7.3	7.5	3.79	0.08	0.84	0.02	1.02
Panama, North Panama Deformed Belt North East	P8	0.0	20.0	7.9	8.1	2.81	0.48	0.73	0.10	0.34
Panama – North Panama Deformed Belt Central	P9	0.0	30.0	5.2	5.5	5.94	0.45	1.50	0.10	0.15
Panama, North Panama Deformed Belt West	P10-C8	0.0	30.0	7.7	8.0	4.71	0.15	0.97	0.03	2.14
Interplate zones										
Guatemala, Interface	Gsi9	10.1	40.0	7.5	7.8	6.17	0.12	1.16	0.02	9.45
El Salvador, Interface	Ssi5	10.1	40.0	7.5	7.7	6.43	0.15	1.21	0.03	9.46
Nicaragua, Interface NW	Nsi15	10.1	40.0	6.3	6.7	7.91	0.14	1.57	0.03	7.32
Nicaragua, Interface SE	Nsi16	10.1	40.0	7.2	7.5	5.64	0.09	1.08	0.02	5.85
Costa Rica, Interface Nicoya	Csi11	12.1	35.0	7.7	7.9	4.16	0.15	0.86	0.03	2.03
Costa Rica, Interface Quepos	Csi12	15.1	30.0	7.3	7.5	4.75	0.07	0.95	0.01	3.48
Costa Rica, Interface Osa	Csi13	10.1	30.0	7.4	7.7	4.12	0.11	0.89	0.02	1.35
Panama, Interface South	Psi9	10.1	30.0	7.5	7.7	4.88	0.10	0.98	0.02	3.11
Panama, Interface San Blas, Darien, Choco	Psi10	20.1	100.0	6.5	7.0	4.62	0.12	0.99	0.02	1.41
Panama Southeast	Psi11	20.1	100.0	7.0	7.2	4.43	0.29	0.95	0.05	1.38
Inslab zones										
Guatemala	Gsp10	40.1	280.0	7.6	8.1	6.44	0.10	1.13	0.02	21.79
El Salvador	Ssp6	40.1	230.0	7.9	8.2	6.05	0.16	1.10	0.03	12.35
Nicaragua	Nsp17	40.1	230.0	7.4	7.8	6.00	0.11	1.09	0.02	12.60
Costa Rica NW	Csp14	35.1	230.0	7.0	7.2	5.09	0.08	1.09	0.02	1.48
Costa Rica Central	Csp15	30.1	135.0	7.0	7.3	4.87	0.17	1.05	0.04	1.48
Costa Rica SE	Csp16	30.1	80.0	5.5	5.9	4.31	0.24	1.09	0.06	0.25
Panama South	Psp11	30.1	70.0	6.0	6.2	3.70	0.24	0.99	0.06	0.18

M1 = Mmax observed from the regional seismic catalog.

M2 = Mmax expected defined by expert criteria.

$\dot{N}(M_{min})$ = Cummulative seismic rate for $M_w \geq 4.5$

Table S4
Seismic parameters with UHR desclustering and bLS fitting method

Zone name	Code	Min Depth (Km)	Max Depth (Km)	M1	M2	a	aσ	b	bσ	$\dot{N}(M_{min})$
Upper-plate zones										
Guatemala Pacific	G1	0.0	10.0	5.6	6.5	7.52	0.30	1.62	0.06	1.69
Guatemala-El Salvador forearc	G2-S2	0.0	20.0	6.5	6.9	4.91	0.16	1.07	0.03	1.19
Guatemala, Volcanic Arc W	G3	0.0	20.0	6.2	6.7	3.72	0.11	0.93	0.03	0.33
Guatemala, Volcanic Arc E	G4	0.0	20.0	7.1	7.4	4.23	0.16	0.94	0.04	0.99
Guatemala-El Salvador-Honduras, Central Depression	G5-S5-H1	0.0	25.0	7.2	7.4	6.70	0.15	1.38	0.03	3.23
Guatemala, Polochic-Motagua W	G6	0.0	25.0	7.7	8.0	4.52	0.23	0.94	0.04	1.91
Guatemala, Polochic-Motagua NE	G7	0.0	25.0	7.5	7.9	4.97	0.17	0.99	0.03	3.28
Guatemala, North (Peten-Belice)	G8	0.0	25.0	5.5	6.0	6.71	0.26	1.53	0.06	0.70
Guatemala North-West	G9	0.0	25.0	7.1	7.3	4.92	0.42	1.08	0.08	1.17
Honduras, Central Highlands	H2	0.0	25.0	6.4	6.6	6.88	0.60	1.45	0.12	2.34
Honduras-Nicaragua, Guayape fault system	H3-N11	0.0	25.0	7.3	7.5	4.52	0.60	1.00	0.11	1.02
North Coast Honduras	H4	0.0	25.0	5.7	6.8	4.38	0.58	1.00	0.11	0.75
El Salvador, Central Pacific	S1	0.0	10.0	5.6	6.5	7.04	0.24	1.56	0.05	1.06
El Salvador, Central Volcanic Arc	S3	0.0	20.0	7.2	7.5	4.09	0.12	0.95	0.03	0.68
El Salvador-Nicaragua, Volcanic Arc (Fonseca Gulf)	S4-N5	0.0	20.0	6.2	6.7	3.40	0.11	0.84	0.02	0.44
Nicaragua, Pacific West	N1	0.0	10.0	5.7	6.4	7.08	0.25	1.52	0.05	1.68
Nicaragua, Pacific South – Costa Rica, Papagayo Gulf	N2-C1	0.0	25.0	5.8	6.6	8.87	0.26	1.87	0.06	2.96
Nicaragua, forearc West	N3	0.0	20.0	6.1	6.5	4.63	0.11	1.03	0.02	1.01
Nicaragua, forearc East	N4	0.0	20.0	6.7	6.9	3.89	0.08	0.89	0.02	0.76
Nicaragua, Volcanic Arc West-Central	N6-N7	0.0	20.0	7.4	7.7	3.29	0.05	0.77	0.01	0.68
Nicaragua, Volcanic Arc SE	N8	0.0	20.0	6.3	6.9	1.94	0.06	0.58	0.01	0.20
Nicaragua Depression	N9-N10	0.0	20.0	7.1	7.3	2.81	0.07	0.72	0.02	0.37
Nicaragua, Caribe South	N12	0.0	18.0	5.3	5.9	5.47	0.21	1.29	0.05	0.48
Nicaragua, Caribe North	N13-N14	0.0	25.0	5.9	6.3	4.20	0.10	0.97	0.02	0.68
Costa Rica, forearc NW	C2	0.0	15.0	5.7	6.5	7.15	0.55	1.73	0.13	0.24
Costa Rica, forearc Pacific Central	C3	0.0	15.0	5.6	6.5	6.64	0.18	1.47	0.04	1.01
Panama-Costa, Burica peninsula	C4	0.0	10.0	6.5	6.8	5.83	0.36	1.24	0.07	1.73
Costa Rica, Guanacaste Volcanic Arc	C5	0.0	15.0	6.5	6.8	4.38	0.08	0.98	0.02	0.94
Costa Rica, Central Volcanic Range	C6	0.0	20.0	6.1	6.8	5.02	0.06	1.15	0.01	0.71
Costa Rica - Talamanca	C7	0.0	40.0	6.0	6.6	6.51	0.11	1.40	0.02	1.72
Costa Rica, Backarc North	C9	0.0	11.0	5.4	5.9	3.70	0.14	0.99	0.03	0.17
Costa Rica, Central Caribe Parismina	C10	0.0	20.0	6.0	6.2	5.11	0.14	1.21	0.03	0.46
Panama Fracture Zone	P1	0.0	25.0	6.8	7.4	7.17	0.32	1.30	0.06	21.23
Panama, Deformed Belt South of Panama	P2	0.0	25.0	6.0	6.4	6.10	0.22	1.34	0.04	1.17
Panama, Colombia forearc North	P3	0.0	15.0	5.8	6.3	2.79	0.10	0.72	0.02	0.35
Panama, West	P5	0.0	20.0	6.3	6.5	5.82	0.32	1.32	0.07	0.75
Panama, Central	P6	0.0	20.0	6.9	7.1	3.46	0.22	1.00	0.05	0.09
Panama, East-Darien	P7	0.0	20.0	7.3	7.5	3.58	0.07	0.82	0.01	0.82
Panama, North Panama Deformed Belt North East	P8	0.0	20.0	7.9	8.1	2.77	0.47	0.72	0.09	0.33
Panama – North Panama Deformed Belt Central	P9	0.0	30.0	4.7	5.5	5.74	0.34	1.46	0.07	0.14
Panama, North Panama Deformed Belt West	P10-C8	0.0	30.0	7.7	8.0	4.51	0.17	0.95	0.03	1.68
Interplate zones										
Guatemala, Interface	Gsi9	10.1	40.0	7.5	7.8	5.79	0.11	1.12	0.02	5.58
El Salvador, Interface	Ssi5	10.1	40.0	7.5	7.7	5.68	0.12	1.09	0.02	6.17
Nicaragua, Interface NW	Nsi15	10.1	40.0	6.3	6.7	6.66	0.11	1.38	0.02	3.16
Nicaragua, Interface SE	Nsi16	10.1	40.0	7.2	7.5	4.90	0.08	0.98	0.02	3.16
Costa Rica, Interface Nicoya	Csi11	12.1	35.0	7.7	7.9	3.90	0.15	0.82	0.03	1.66
Costa Rica, Interface Quepos	Csi12	15.1	30.0	7.3	7.5	4.15	0.08	0.84	0.02	2.30
Costa Rica, Interface Osa	Csi13	10.1	30.0	7.4	7.7	3.79	0.12	0.84	0.02	1.01
Panama, Interface South	Psi9	10.1	30.0	7.5	7.7	4.53	0.07	0.93	0.01	2.25
Panama, Interface San Blas, Darien, Choco	Psi10	20.1	100.0	6.5	7.0	4.54	0.12	0.98	0.02	1.33
Panama Southeast	Psi11	20.1	100.0	7.0	7.2	3.96	0.18	0.89	0.03	0.95
Inslab zones										
Guatemala	Gsp10	40.1	280.0	7.6	8.1	5.89	0.11	1.06	0.02	13.46
El Salvador	Ssp6	40.1	230.0	7.9	8.2	5.50	0.14	1.02	0.03	7.92
Nicaragua	Nsp17	40.1	230.0	7.4	7.8	5.54	0.09	1.02	0.02	8.74
Costa Rica NW	Csp14	35.1	230.0	7.0	7.2	4.83	0.09	1.06	0.02	1.17
Costa Rica Central	Csp15	30.1	135.0	7.0	7.3	4.72	0.16	1.03	0.03	1.16
Costa Rica SE	Csp16	30.1	80.0	5.5	5.9	4.18	0.27	1.08	0.07	0.21
Panama South	Psp11	30.1	70.0	6.0	6.2	3.26	0.21	0.91	0.05	0.14

M1 = Mmax observed from the regional seismic catalog.
M2 = Mmax expected defined by expert criteria.
$\dot{N}(M_{min})$ = Cummulative seismic rate for $M_w \geq 4.5$

Supplement B

Below we show the acceleration maps of each GMM branch analyzed in the logic tree for this study. For the upper plate regime, we analyzed the GMM of Kanno et al. (2006), Atkinson and Boore (2011), Akkar et al. (2014), Boore et al. (2014) and Cauzzi et al. (2015). In the interface regime the models proposed by Youngs et al. (1997), Kanno et al. (2006), Zhao et al. (2006), Abrahamson et al. (2016) and Montalva et al. (2017). Lastly in the inslab regime, the models proposed by Youngs et al. (1997), Kanno et al. (2006), Abrahamson et al. (2016) and Montalva et al. (2017) were selected.

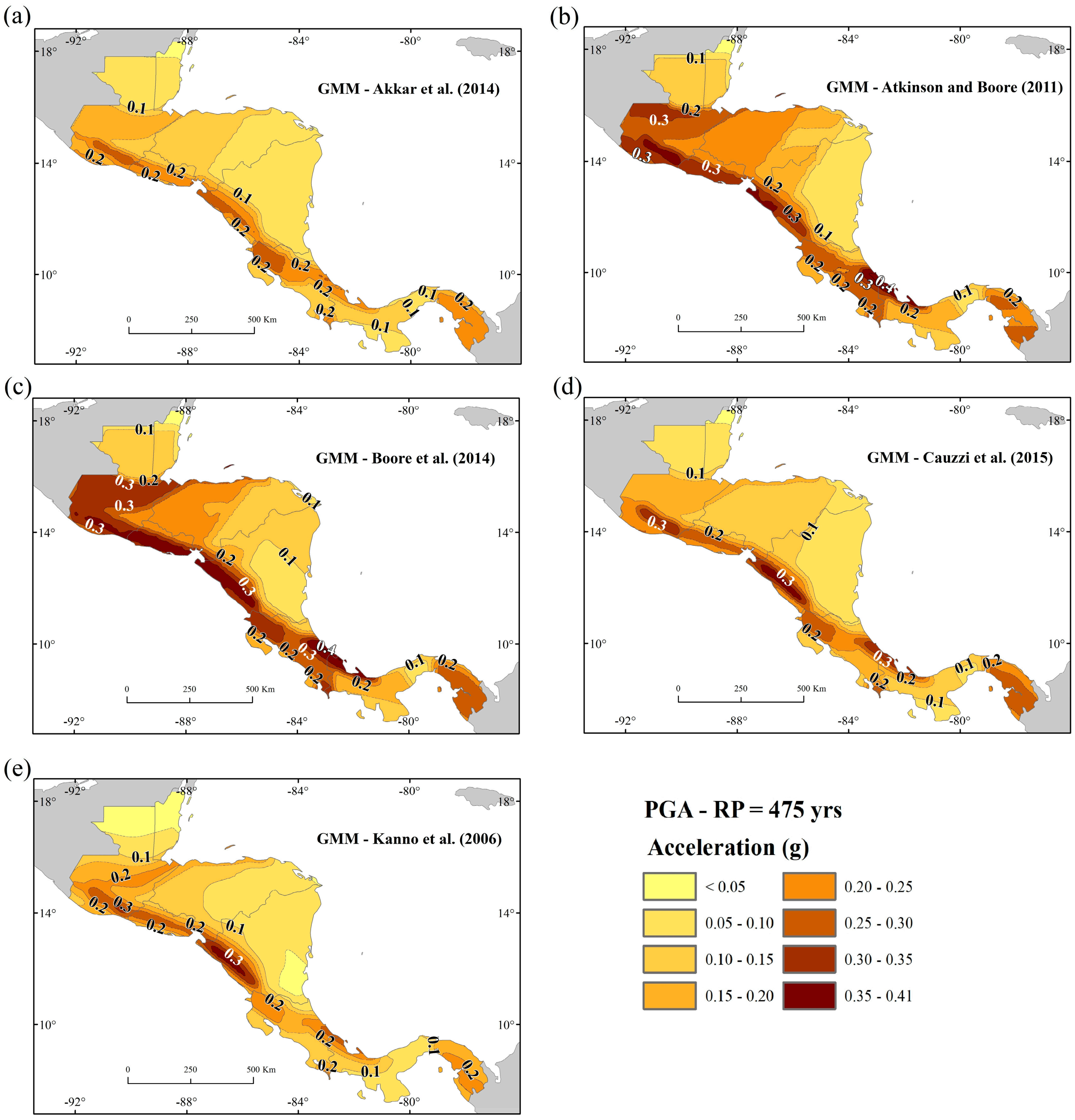


Figure S1 Acceleration maps in the upper plate regime for the GMM of (a) Akkar et al. (2014), (b) Atkinson and Boore (2011), (c) Boore et al. (2014), (d) Cauzzi et al. (2015) and (e) Kanno et al. (2006).

The acceleration maps for the upper plate regime indicate that the highest accelerations occur with the models of Boore et al. (2014) and Atkinson and Boore (2011), while the models of Akkar et al. (2014) tend to produce relatively lower accelerations and Kanno et al. (2006) tends to produce a little high acceleration in volcanic arc compared to the other GMMs. Conversely, the Cauzzi et al. (2015) model shows moderate accelerations compared to all the GMMs. These maps complement the sensitivity analysis conducted on the GMMs through acceleration profiles (refer to the manuscript of this study). The analysis highlights that the Cauzzi et al. (2015) model maintains stable accelerations across most of the analyzed seismic zones, while the Akkar et al. (2014) and Boore et al. (2014) models can be considered *"extreme models"*, as they yield the minimum and maximum accelerations in this study. As a result, these models were included in the logic tree to prevent overestimations or underestimations of accelerations in the Central.

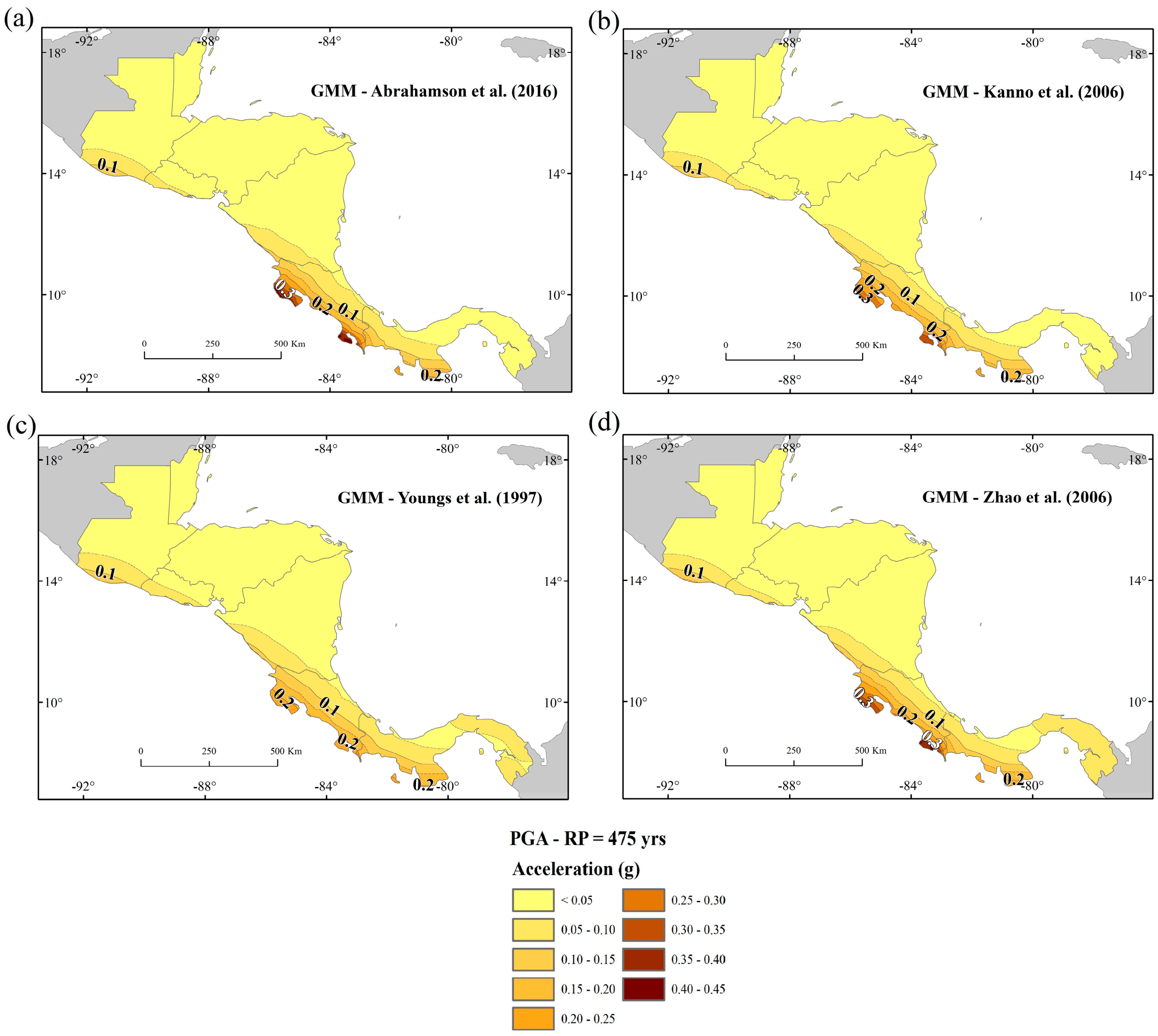


Figure S2. Acceleration maps in the interface regime for the GMM of (a) Abrahamson et al. (2016), (b) Kanno et al. (2006), (c) Youngs et al. (1997) and (d) Zhao et al. (2006).

The acceleration maps for the interface regime demonstrate the low impact of GMM in the region. Accelerations influenced primarily the Pacific coasts of Central America. Furthermore, no single GMM shows predominance over the others, as illustrated by the acceleration profiles for this regime where all remain close to the mean (refer to the manuscript of this study). Consequently, all analyzed GMM were selected and assigned equal weighting in the final logic tree.

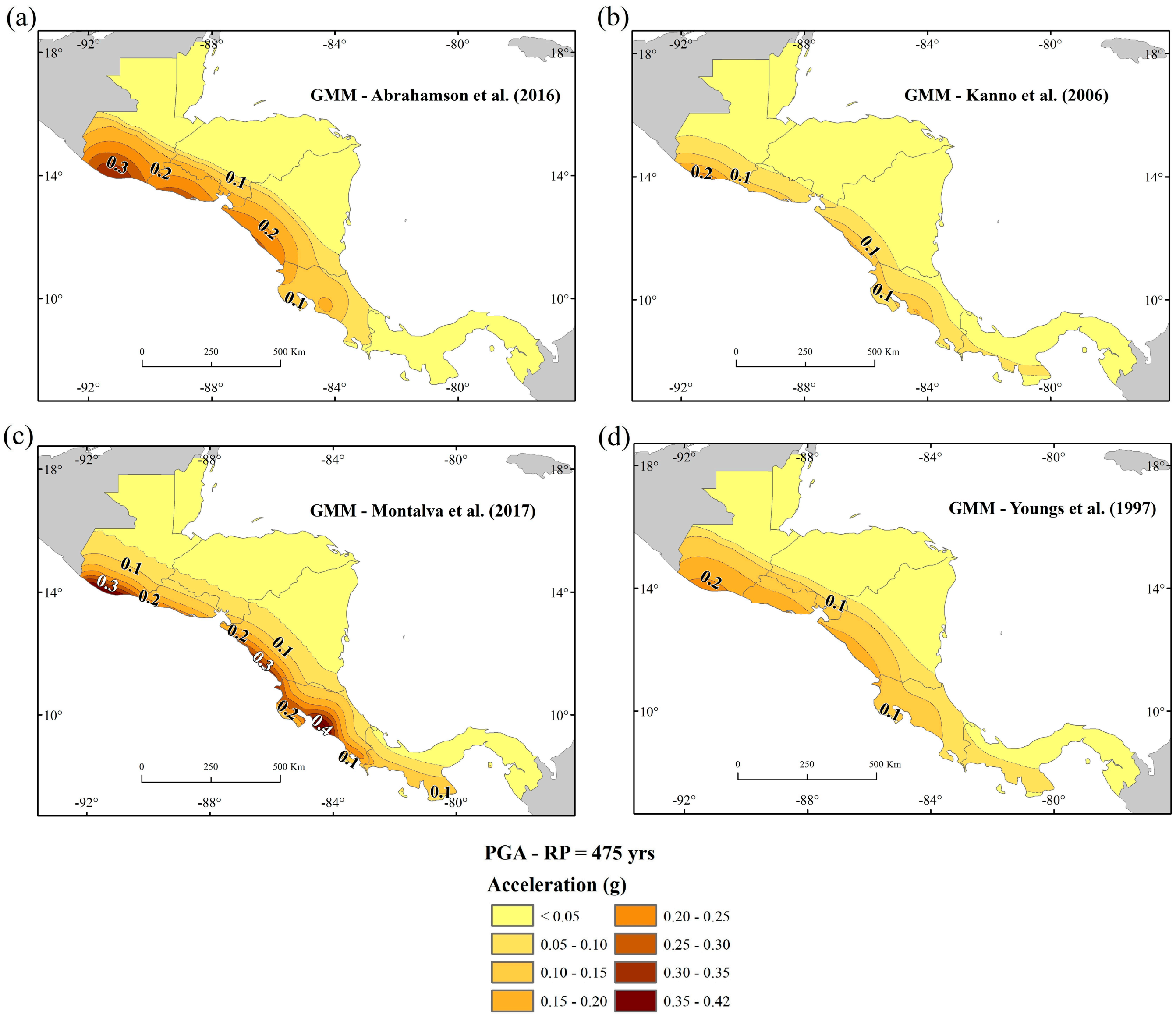


Figure S3. Acceleration maps in the inslab regime for the GMM of (a) Abrahamson et al. (2016), (b) Kanno et al. (2006), (c) Montalva et al. (2017) and (d) Youngs et al. (1997).

Accelerations in the inslab regime have a greater impact on the region compared to those in the interface regime. Additionally, the Montalva et al. (2017) model produces the highest accelerations among the others. For this reason, this model was excluded from the final logic tree, as it may overestimate accelerations in the region. Its significant impact is evident in the acceleration profile for this regime (refer to the manuscript of this study). Consequently, the models of Abrahamson et al. (2016), Kanno et al. (2006), and Youngs et al. (1997) were selected, with a higher weighting assigned to Abrahamson et al. (2016) due to its relatively close alignment with the mean accelerations of all the GMM analyzed for the inslab regime.

Supplement C

Below we show the approach developed by Gurjar & Basu (2022) to obtain the weights in the logical tree for the declustering method (RSB and UHR) and the recurrence parameter fitting method (bML and bLS).

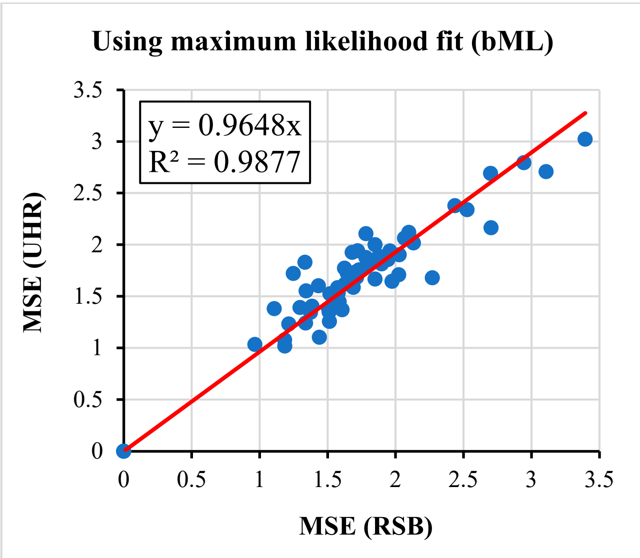
We estimated the observed seismic rates [$\dot{N}(m)_{obs}$] over the complete period for each magnitude bin Mw using the RSB and UHB declustering methods, respectively, and also we estimated the predicted seismic rates [$\dot{N}(m)_{pred}$] using the fit method of maximum likelihood (bML) and least square (bLS). Finally, we calculated the mean squared error (MSE) and the root mean squared error (RMSE) of the observed and predicted data starting from the completeness magnitude (Mc).

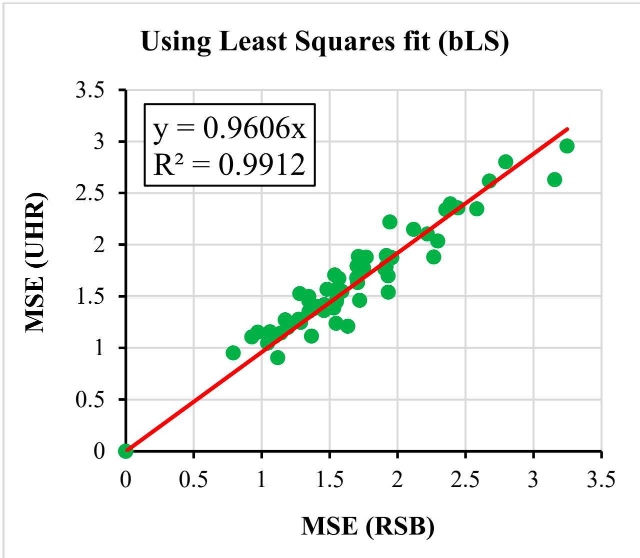
Weights associated with each method for the logic tree approach are proposed to be inversely proportional to mean squared error over all the source zones (Gurjar & Basu, 2022). This mean that the mean square error (MSE) of both methods can be compared, and the best-fit linear relation is constructed with a constraint of zero intercept, i.e., $MSE_y = \theta \times MSE_x$, where θ is the slope of the zero-intercept best-fit straight-line, MSE_y is the means square error in the ordinate axis and MSE_x is the mean square error in the abscissa axis.

Applied this approach in our data, the results of the weights in the logic tree are as follows:

- **<u>For all the seismic zones</u>**

Weights for declustering methods:





$$W_{RSB} = \frac{1/MSE_{RSB}}{(1/MSE_{RSB} + 1/MSE_{UHR})} = \frac{\theta}{\theta + 1}$$

$$W_{RSB} = \frac{0.9648}{0.9648 + 1} = \mathbf{0.49}$$

$$W_{UHR} = \frac{1/MSE_{UHR}}{(1/MSE_{RSB} + 1/MSE_{UHR})} = \frac{1}{\theta + 1}$$

$$W_{UHR} = \frac{1}{0.9648 + 1} = \mathbf{0.51}$$

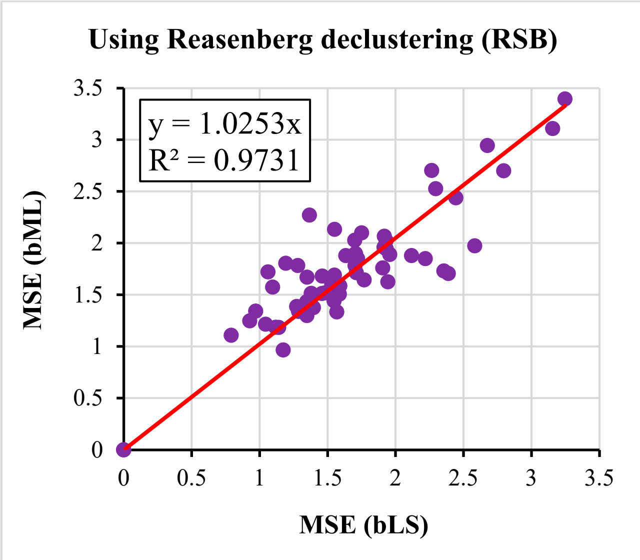
$$W_{RSB} = \frac{1/MSE_{RSB}}{(1/MSE_{RSB} + 1/MSE_{UHR})} = \frac{\theta}{\theta + 1}$$

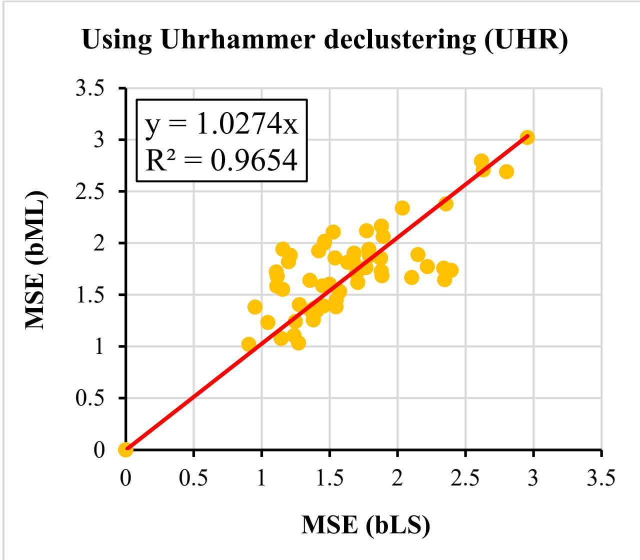
$$W_{RSB} = \frac{0.9606}{0.9606 + 1} = \mathbf{0.49}$$

$$W_{UHR} = \frac{1/MSE_{UHR}}{(1/MSE_{RSB} + 1/MSE_{UHR})} = \frac{1}{\theta + 1}$$

$$W_{UHR} = \frac{1}{0.9606 + 1} = \mathbf{0.51}$$

Weights of fitting methods:





$$W_{bLS} = \frac{1/MSE_{bLS}}{(1/MSE_{bLS} + 1/MSE_{bML})} = \frac{\theta}{\theta + 1}$$

$$W_{bLS} = \frac{1.0253}{1.0253 + 1} = \mathbf{0.51}$$

$$W_{bML} = \frac{1/MSE_{bML}}{(1/MSE_{bLS} + 1/MSE_{bML})} = \frac{1}{\theta + 1}$$

$$W_{bML} = \frac{1}{1.0253 + 1} = \mathbf{0.49}$$

$$W_{bLS} = \frac{1/MSE_{bLS}}{(1/MSE_{bLS} + 1/MSE_{bML})} = \frac{\theta}{\theta + 1}$$

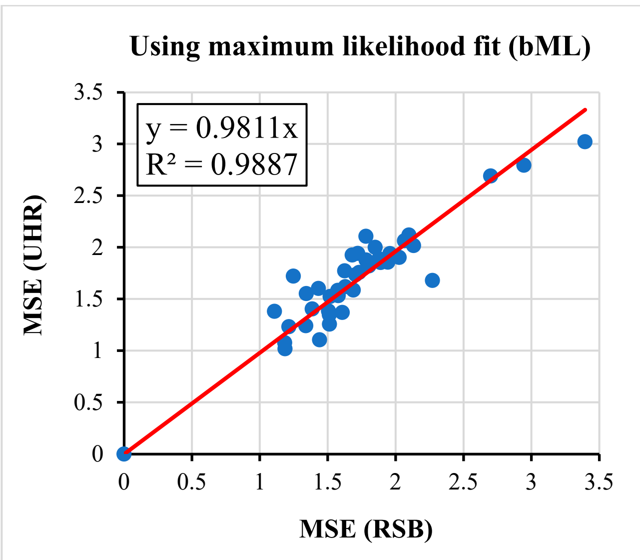
$$W_{bLS} = \frac{1.0274}{1.0274 + 1} = \mathbf{0.51}$$

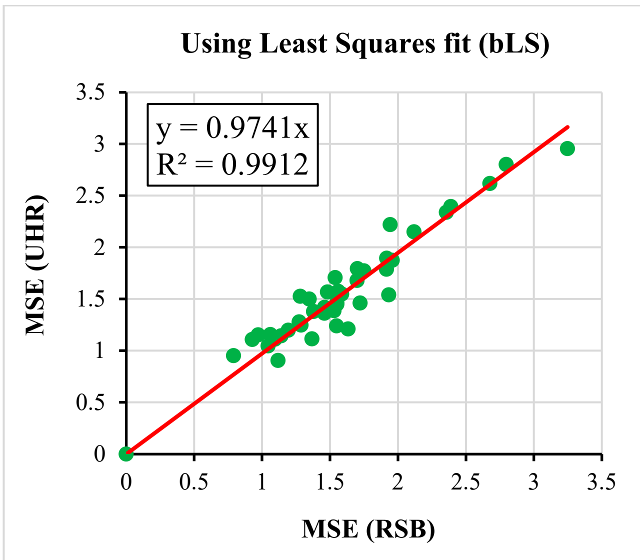
$$W_{bML} = \frac{1/MSE_{bML}}{(1/MSE_{bLS} + 1/MSE_{bML})} = \frac{1}{\theta + 1}$$

$$W_{bML} = \frac{1}{1.0274 + 1} = \mathbf{0.49}$$

- **<u>For upper-plate seismic zones</u>**

Weights for declustering methods:





$$W_{RSB} = \frac{1/MSE_{RSB}}{(1/MSE_{RSB} + 1/MSE_{UHR})} = \frac{\theta}{\theta + 1}$$

$$W_{RSB} = \frac{0.9811}{0.9811 + 1} = \mathbf{0.50}$$

$$W_{UHR} = \frac{1/MSE_{UHR}}{(1/MSE_{RSB} + 1/MSE_{UHR})} = \frac{1}{\theta + 1}$$

$$W_{UHR} = \frac{1}{0.9811 + 1} = \mathbf{0.50}$$

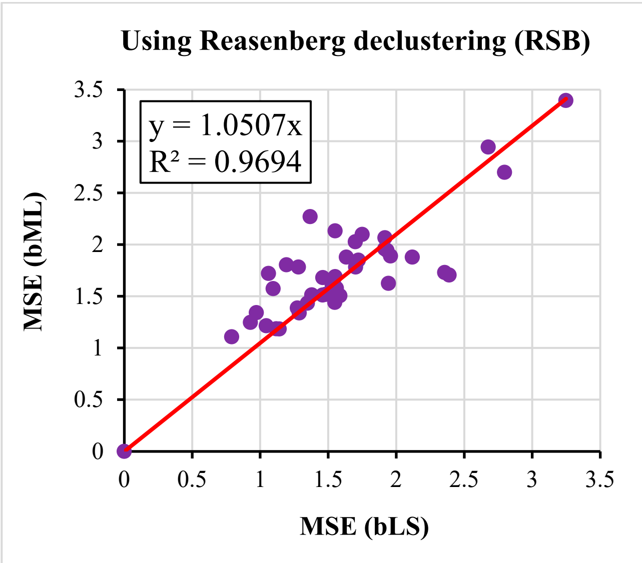
$$W_{RSB} = \frac{1/MSE_{RSB}}{(1/MSE_{RSB} + 1/MSE_{UHR})} = \frac{\theta}{\theta + 1}$$

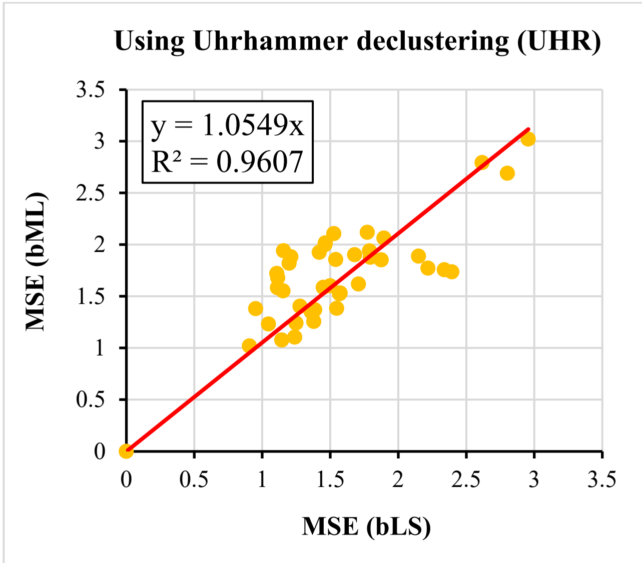
$$W_{RSB} = \frac{0.9741}{0.9741 + 1} = \mathbf{0.49}$$

$$W_{UHR} = \frac{1/MSE_{UHR}}{(1/MSE_{RSB} + 1/MSE_{UHR})} = \frac{1}{\theta + 1}$$

$$W_{UHR} = \frac{1}{0.9741 + 1} = \mathbf{0.51}$$

Weights of fitting methods:





$$W_{bLS} = \frac{1/MSE_{bLS}}{(1/MSE_{bLS} + 1/MSE_{bML})} = \frac{\theta}{\theta + 1}$$

$$W_{bLS} = \frac{1.0507}{1.0507 + 1} = \mathbf{0.51}$$

$$W_{bML} = \frac{1/MSE_{bML}}{(1/MSE_{bLS} + 1/MSE_{bML})} = \frac{1}{\theta + 1}$$

$$W_{bML} = \frac{1}{1.0507 + 1} = \mathbf{0.49}$$

$$W_{bLS} = \frac{1/MSE_{bLS}}{(1/MSE_{bLS} + 1/MSE_{bML})} = \frac{\theta}{\theta + 1}$$

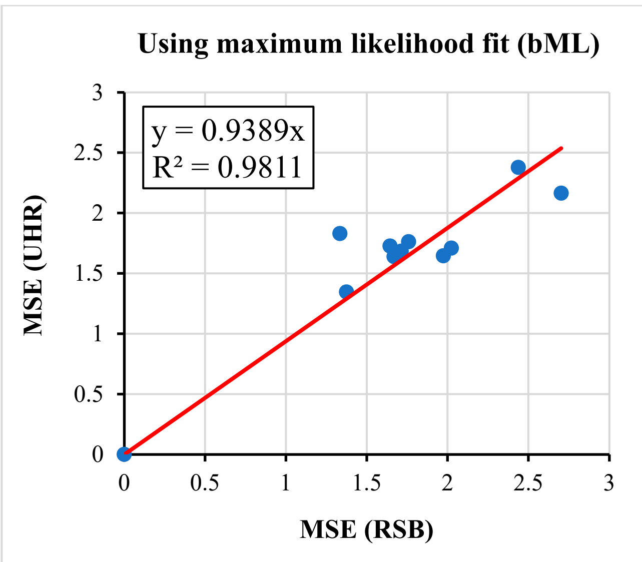
$$W_{bLS} = \frac{1.0549}{1.0549 + 1} = \mathbf{0.51}$$

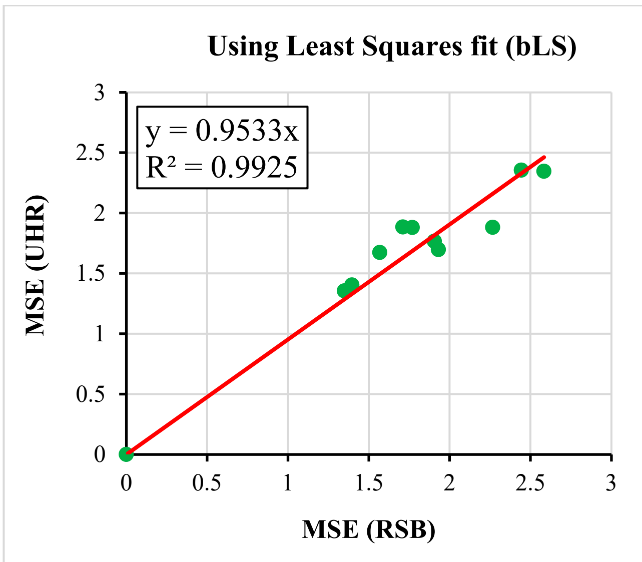
$$W_{bML} = \frac{1/MSE_{bML}}{(1/MSE_{bLS} + 1/MSE_{bML})} = \frac{1}{\theta + 1}$$

$$W_{bML} = \frac{1}{1.0549 + 1} = \mathbf{0.49}$$

- **<u>For interplate seismic zones</u>**

Weights for declustering methods:





$$W_{RSB} = \frac{1/MSE_{RSB}}{(1/MSE_{RSB} + 1/MSE_{UHR})} = \frac{\theta}{\theta + 1}$$

$$W_{RSB} = \frac{0.9389}{0.9389 + 1} = \mathbf{0.48}$$

$$W_{UHR} = \frac{1/MSE_{UHR}}{(1/MSE_{RSB} + 1/MSE_{UHR})} = \frac{1}{\theta + 1}$$

$$W_{UHR} = \frac{1}{0.9389 + 1} = \mathbf{0.52}$$

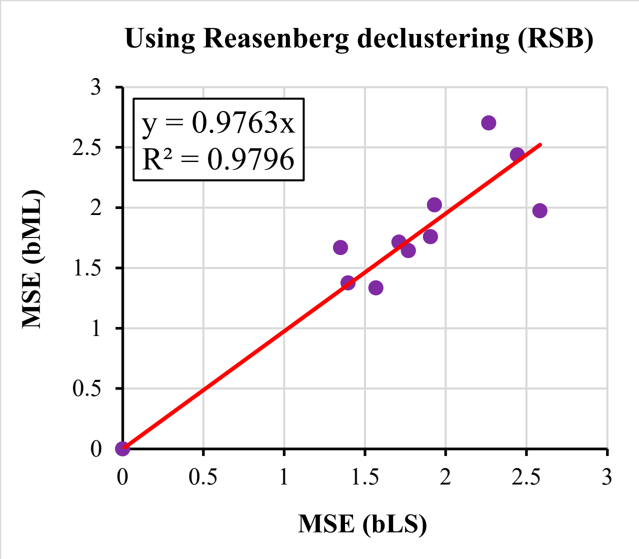
$$W_{RSB} = \frac{1/MSE_{RSB}}{(1/MSE_{RSB} + 1/MSE_{UHR})} = \frac{\theta}{\theta + 1}$$

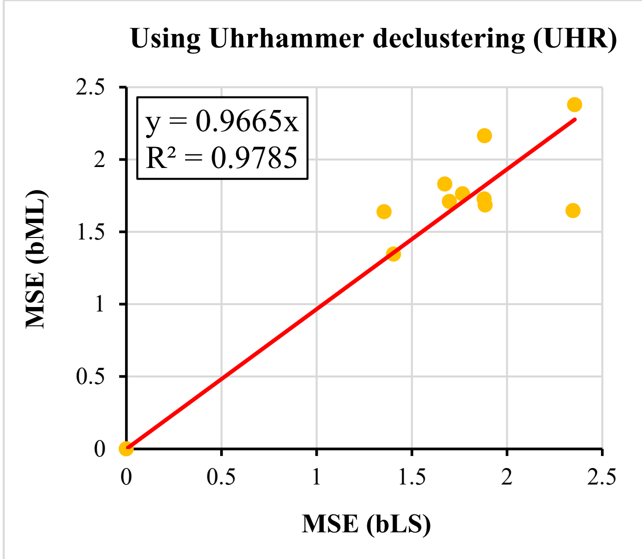
$$W_{RSB} = \frac{0.9533}{0.9533 + 1} = \mathbf{0.49}$$

$$W_{UHR} = \frac{1/MSE_{UHR}}{(1/MSE_{RSB} + 1/MSE_{UHR})} = \frac{1}{\theta + 1}$$

$$W_{UHR} = \frac{1}{0.9533 + 1} = \mathbf{0.51}$$

Weights of fitting methods:





$$W_{bLS} = \frac{1/MSE_{bLS}}{(1/MSE_{bLS} + 1/MSE_{bML})} = \frac{\theta}{\theta + 1}$$

$$W_{bLS} = \frac{0.9763}{0.9763 + 1} = \mathbf{0.49}$$

$$W_{bML} = \frac{1/MSE_{bML}}{(1/MSE_{bLS} + 1/MSE_{bML})} = \frac{1}{\theta + 1}$$

$$W_{bML} = \frac{1}{0.9763 + 1} = \mathbf{0.51}$$

$$W_{bLS} = \frac{1/MSE_{bLS}}{(1/MSE_{bLS} + 1/MSE_{bML})} = \frac{\theta}{\theta + 1}$$

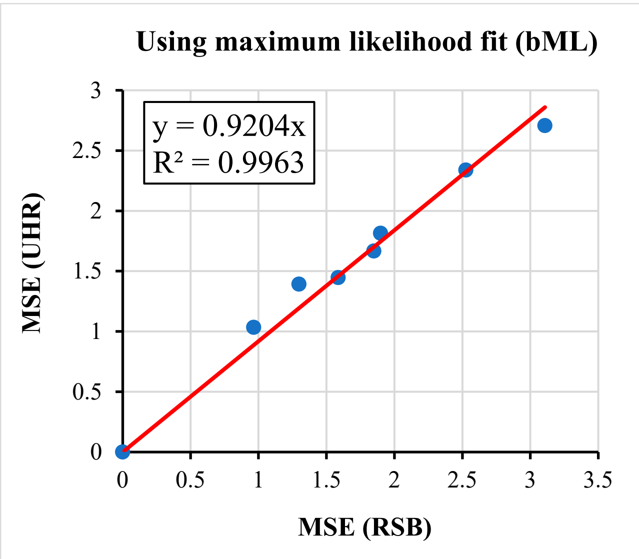
$$W_{bLS} = \frac{0.9665}{0.9665 + 1} = \mathbf{0.49}$$

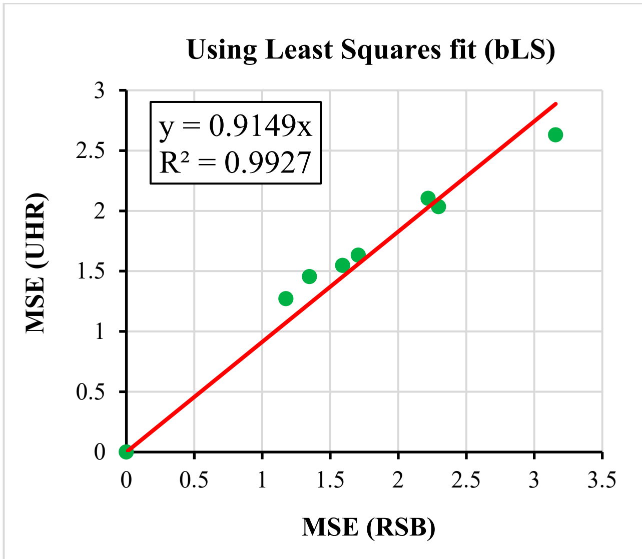
$$W_{bML} = \frac{1/MSE_{bML}}{(1/MSE_{bLS} + 1/MSE_{bML})} = \frac{1}{\theta + 1}$$

$$W_{bML} = \frac{1}{0.9665 + 1} = \mathbf{0.51}$$

- **For inslab seismic zones**

Weights for declustering methods:





$$W_{RSB} = \frac{1/MSE_{RSB}}{(1/MSE_{RSB} + 1/MSE_{UHR})} = \frac{\theta}{\theta + 1}$$

$$W_{RSB} = \frac{0.9204}{0.9204 + 1} = \mathbf{0.48}$$

$$W_{UHR} = \frac{1/MSE_{UHR}}{(1/MSE_{RSB} + 1/MSE_{UHR})} = \frac{1}{\theta + 1}$$

$$W_{UHR} = \frac{1}{0.9204 + 1} = \mathbf{0.52}$$

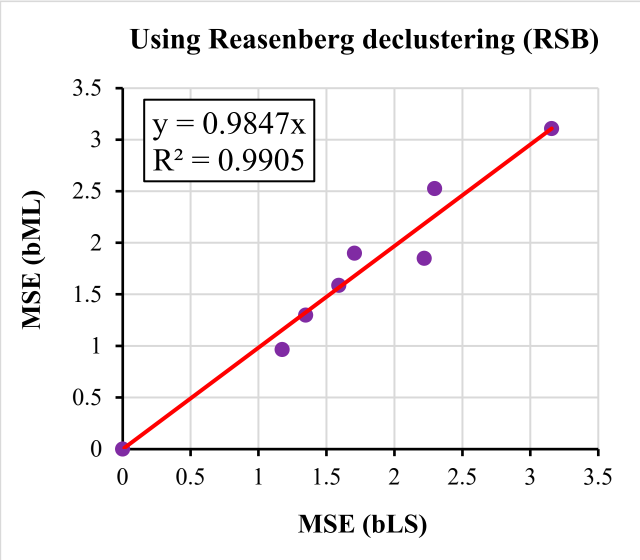
$$W_{RSB} = \frac{1/MSE_{RSB}}{(1/MSE_{RSB} + 1/MSE_{UHR})} = \frac{\theta}{\theta + 1}$$

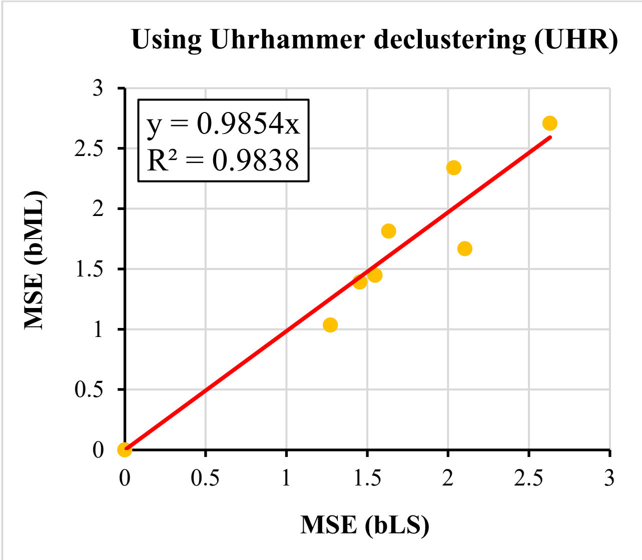
$$W_{RSB} = \frac{0.9149}{0.9149 + 1} = \mathbf{0.48}$$

$$W_{UHR} = \frac{1/MSE_{UHR}}{(1/MSE_{RSB} + 1/MSE_{UHR})} = \frac{1}{\theta + 1}$$

$$W_{UHR} = \frac{1}{0.9149 + 1} = \mathbf{0.52}$$

Weights of fitting methods:





$$W_{bLS} = \frac{1/MSE_{bLS}}{(1/MSE_{bLS} + 1/MSE_{bML})} = \frac{\theta}{\theta + 1}$$

$$W_{bLS} = \frac{0.9847}{0.9847 + 1} = \mathbf{0.50}$$

$$W_{bML} = \frac{1/MSE_{bML}}{(1/MSE_{bLS} + 1/MSE_{bML})} = \frac{1}{\theta + 1}$$

$$W_{bML} = \frac{1}{0.9847 + 1} = \mathbf{0.50}$$

$$W_{bLS} = \frac{1/MSE_{bLS}}{(1/MSE_{bLS} + 1/MSE_{bML})} = \frac{\theta}{\theta + 1}$$

$$W_{bLS} = \frac{0.9854}{0.9854 + 1} = \mathbf{0.50}$$

$$W_{bML} = \frac{1/MSE_{bML}}{(1/MSE_{bLS} + 1/MSE_{bML})} = \frac{1}{\theta + 1}$$

$$W_{bML} = \frac{1}{0.9854 + 1} = \mathbf{0.50}$$