Supplementary information to:

Probabilistic and Deterministic Seismic Hazard Assessments of the area comprised between west Gulf of Cádiz and east Alboran Sea

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Table S1. Denomination of the areal seismogenic sources and their seismicicity parameters extracted from ESHM20 source model (Danciu et al., 2021a, b, c), used for the construction of the seismogenic model with which the DSHA has been calculated in the study area. The average value MM_{avg}, standard deviation σMM, minimum $MM_{min,}$ and maximum MM_{max} truncation limits are parameters of the MM distribution funtion. MM — Maximum magnitude.

Areal Source	Source ID.	Predominant Rupture Mechanism	Depth (km)	MM distribution function			
				$< MM_{avg} >$	σMM	MM_{min}	MM_{max}
Shallow crust	**ESAS127**	Normal	22	7.4	-	7.1	7.7
	ESAS128	Normal	30	7.3	-	7.1	7.6
	ESAS129	Strike-slip	60	8.6	-	8.5	8.7
	ESAS132	Normal	22	7.4	-	7.1	7.7
	ESAS133	Normal	12	6.6	-	6.3	6.9
	ESAS134	Normal	22	7.4	-	7.1	7.7
	ESAS135	Normal	22	7.4	-	7.1	7.7
	ESAS136	Reverse	22	7.4	-	7.1	7.7
	ESAS137	Normal	22	7.4	-	7.1	7.7
	ESAS138	Normal	22	7.4	-	7.1	7.7
	ESAS139	Normal	22	7.4	-	7.1	7.7
	ESAS140	Reverse	22	7.4	-	7.1	7.7
	ESAS144	Normal	22	7.4	-	7.1	7.7
	ESAS152	Normal	20	6.6	-	6.3	6.9
	ESAS153	Normal	20	6.6	-	6.3	6.9
	ESAS154	Normal	20	6.6	-	6.3	6.9
	ESAS200	Reverse	20	6.6	-	6.3	6.9
	ESAS330	Reverse	20	7.4	-	7.1	7.7
	MAAS001	Reverse	20	6.8	-	6.5	7.1
	MAAS344	Reverse	60	8.6	-	8.5	8.7
	MAAS346	Strike-slip	20	7.4	-	7.1	7.7
	PTAS382	Reverse	20	6.8	-	6.5	7.1
	PTAS384	Strike-slip	30	8.6	-	8.5	8.7
	PTAS386	Normal	20	7.3	-	7	7.6
	PTAS387	Strike-slip	20	7.6	-	7.3	7.9
	PTAS389	Normal	20	7.4	-	7.1	7.7
	PTAS390	Strike-slip	60	8.7	-	8.6	8.8
	PTAS391	Strike-slip	60	8.6	-	8.5	8.7
	PTAS392	Normal	20	7.3	-	7.0	7.6
	PTAS393	Strike-slip	20	7.3	-	7.0	7.6
	GEM0228	Reverse	30	7.7	-	7.4	8.0
Deep seismicity	**ESIS001**	Reverse	150	7.3	-	7.0	7.6

Table S2. Denomination of the active faults sources and their seismicicity parameters extracted from ESHM20 source model (Danciu et al., 2021a, b, c), used for the construction of the seismogenic model with which the DSHA has been calculated in the study area. The average value MM_{avg}, standard deviation σMM, minimum MM_{min}, and maximum MM_{max} truncation limits are parameters of the MM distribution funtion. MM — Maximum magnitude.

Source ID.	Fault type	Depth (km)		MM distribution function			
		Min	Max	MM_{avg}	σMM	MM_{min}	MM_{max}
ESCF000	Right-Lateral	2.5	25	7.7	-	7.3	8.3
ESCF001	Left-Lateral	1.5	18	7.3	-	6.9	7.6
ESCF002	Reverse	2	12.5	7.1	-	6.7	7.5
ESCF003	Left-Lateral	0	12	6.9	-	6.5	7.0
ESCF004	Left-Lateral	0	12	6.9	-	6.5	7.0
ESCF005	Left-Lateral	0	12	6.7	-	6.3	6.9
ESCF006	Left-Lateral	0	12	7.1	-	6.7	7.5
ESCF007	Left-Lateral	1	11	6.7	-	6.3	6.9
ESCF008	Left-Lateral	0.5	11	6.7	-	6.3	6.9
ESCF009	Left-Lateral	0	11	6.7	-	6.3	6.9
ESCF010	Normal	0	15	7.1	-	6.7	7.7
ESCF00E	Reverse	0	12	6.7	-	6.3	6.9
ESCF00F	Left-Lateral	0	12	6.7	-	6.3	6.9
ESCF00G	Reverse	1	12	6.7	-	6.3	6.9
ESCF00H	Reverse	1	12	6.5	-	6.1	6.8
ESCF00J	Reverse	1	12	6.9	-	6.5	7.0
ESCF00K	Reverse	0.5	15	7.1	-	6.7	7.5
ESCF00L	Left-Lateral	0	15	7.1	-	6.7	7.5
ESCF00M	Left-Lateral	0	11	6.7	-	6.3	6.9
ESCF00N	Left-Lateral	0	15	7.1	-	6.7	7.5
ESCF00Q	Reverse	0	10	6.7	-	6.3	6.9
ESCF00S	Reverse	0	15	7.1	-	6.7	7.5
ESCF00T	Normal	0	10	6.7	-	6.3	6.9
ESCF00U	Normal	0	15	7.5	-	7.1	8.1
ESCF00W	Normal	0	13.5	7.1	-	6.7	7.7
ESCF00X	Normal	0	15	6.9	-	6.7	7.5
ESCF01A	Normal	0	8	6.5	-	6.1	6.8
ESCF01D	Normal	0	10	6.5	-	6.1	6.8
ESCF01G	Normal	0	8	6.5	-	6.1	6.8
ESCF01H	Normal	0	8	6.5	-	6.1	6.8
ESCF01Q	Normal	0	11	6.5	-	6.1	6.8
ESCF01R	Normal	0	11	6.7	-	6.3	6.9
ESCF01T	Normal	0	11	6.7	-	6.3	6.9
ESCF01W	Left-Lateral	0	20	8.1	-	7.7	8.7
ESCF01X	Normal	1.5	15	7.5	-	7.1	8.1
ESCF020	Normal	1.5	15	7.3	-	6.7	7.9
ESCF021	Normal	1.5	15	7.3	-	6.9	7.9
ESCF022	Normal	1.5	15	7.1	-	6.7	7.7
ESCF023	Normal	1.5	15	7.5	-	7.1	8.1
ESCF024	Normal	1.5	15	6.9	-	6.5	7.5
ESCF025	Normal	1.5	15	7.1	-	6.7	7.7
ESCF026	Normal	1.5	15	7.3	-	6.9	7.9
ESCF027	Normal	1.5	15	6.9	-	6.5	7.5

ESCF02A	Normal	1.5	15	7.1	-	6.7	7.7
ESCF02B	Normal	1.5	15	7.1	-	6.7	7.7
ESCF02C	Normal	1.5	15	7.1	-	6.7	7.7
ESCF02E	Normal	1.5	15	7.3	-	6.7	7.6
ESCF02F	Normal	1.5	15	7.3	-	6.7	7.6
ESCF02G	Normal	1.5	15	7.5	-	6.7	7.6
ESCF02H	Normal	1.5	15	7.1	-	6.5	7.5
ESCF02J	Normal	1.5	15	7.3	-	6.9	7.9
ESCF02L	Normal	0	14	7.3	-	6.9	7.9
ESCF02M	Normal	0	14	7.5	-	7.1	8.1
ESCF02N	Normal	0	6	6.5	-	6.1	6.5
ESCF02O	Right-Lateral	1.5	8	6.3	-	6.1	6.6
ESCF02Q	Normal	0	8	6.5	-	6.1	6.8
ESCF02R	Normal	0	8	6.5	-	6.1	6.8
ESCF02U	Right-Lateral	0	11	6.9	-	6.5	7.0
ESCF02V	Normal	0	14	7.3	-	6.9	7.9
ESCF032	Normal	0	8	6.5	-	6.1	6.8
ESCF033	Normal	0	8	6.5	-	6.1	6.8
ESCF034	Normal	0	8	6.5	-	6.1	6.8
ESCF035	Reverse	0	8	6.5	-	6.1	6.8
ESCF036	Reverse	0	11	6.7	-	6.3	6.9
ESCF037	Reverse	0	10	6.7	-	6.3	6.9
ESCF03A	Reverse	0	12	6.9	-	6.5	7.0
ESCF03B	Reverse	0	12	6.9	-	6.5	7.0
ESCF03C	Normal	0	11	6.7	-	6.3	6.9
ESCF03E	Reverse	1	10	7.5	-	7.1	7.6
MACF001	Reverse	1	18	7.7	-	7.3	8.3
MACF007	Right-Lateral	3.5	21	7.9	-	7.3	8.5
PTCF00S	Reverse	4.5	17	8.1	-	7.7	8.5
PTCF00T	Reverse	5	13.5	7.5	-	7.1	8.3
PTCF00U	Reverse	4.5	20	7.7	-	7.3	8.4
PTCF00V	Right-Lateral	5	20	7.1	-	6.7	7.5
PTCF00W	Reverse	5	15	7.5	-	7.1	8.1
PTCF00X	Reverse	4.5	16.5	7.7	-	7.3	8.4
PTCF00Y	Reverse	1	17.5	7.5	-	7.3	7.6
PTCF011	Reverse	1	17.5	7.7	-	7.3	8.3
PTCF013	Reverse	1	17.5	7.5	-	7.1	7.6
PTCF014	Reverse	1	17.5	7.5	-	7.1	7.6
PTCF015	Reverse	1	18.5	7.5	-	7.1	7.6
PTCF016	Left-Lateral	1	18.5	7.5	-	7.1	7.6
PTCF017	Reverse	1	20.5	7.3	-	6.9	7.6
PTCF018	Normal	1	13	6.9	-	6.5	7.0
PTCF019	Reverse	1	18.5	7.5	-	7.1	7.6
PTCF01A	Normal	1	8	6.2	-	6.1	6.6
PTCF01B	Normal	1	20.5	7.1	-	6.7	7.5
PTCF01D	Left-Lateral	1	12	6.8	-	6.3	7.0
PTCF01E	Reverse	1	15	6.7	-	6.3	6.9
PTCF01F	Left-Lateral	1	10	6.5	-	6.1	6.8
PTCF01G	Reverse	1	20.5	7.3	-	6.9	7.6
PTCF01H	Reverse	1	20.5	7.1	-	6.7	7.5
PTCF01I	Normal	1	20.5	6.9	-	6.5	7.0
PTCF01J	Right-Lateral	1	20.5	7.3	-	6.9	7.6
PTCF01K	Right-Lateral	3	19.5	7.2	-	6.7	7.6

PTCF01L	Left-Lateral	0	18.5	7.7	-	7.3	8.3
PTCF01M	Left-Lateral	0	18.5	7.7	-	7.3	8.3
PTCF01N	Right-Lateral	4	18	6.9	-	6.5	7.0
PTCF01O	Reverse	5	13.5	7.1	-	6.7	7.5
PTCF01P	Reverse	3	20.5	7.4	-	6.9	7.6
UNCF01X	Right-Lateral	4	17.5	7.1	-	6.7	8.2
MACF000	Left-Lateral	1	18	7.7	-	7.3	8.3
MACF002	Reverse	1	18	7.7	-	7.3	8.3
MACF003	Reverse	1	15	7.5	-	7.1	7.6
MACF004	Left-Lateral	3	14	6.9	-	6.5	7.0
MACF005	Reverse	1	15	7.3	-	6.9	7.6
MACF006	Reverse	1	15	7.3	-	6.9	7.6
MACF008	Reverse	0.5	11	6.9	-	6.5	7.0
ESCF00V	Normal	0	15	7.3	-	6.9	7.9
ESCF00Z	Normal	0	15	7.1	-	6.7	7.7
DZCF000	Right-Lateral	2.5	25	7.9	-	7.5	8.0
DZCF001	Reverse	2	25	7.9	-	7.5	8.0
DZCF003	Reverse	3	25	7.9	-	7.5	8.0
DZCF004	Reverse	2.5	25	7.9	-	7.5	8.0
DZCF005	Right-Lateral	1	25	7.9	-	7.5	8.0
DZCF006	Right-Lateral	2.5	25	7.7	-	7.3	7.9
DZCF007	Reverse	1	18	7.5	-	7.1	7.8
DZCF008	Reverse	1	18	7.5	-	7.1	7.8
DZCF009	Reverse	1	18	7.7	-	7.3	7.9
DZCF00A	Reverse	1	18	7.5	-	7.1	7.8
DZCF00B	Reverse	1	18	7.7	-	7.3	7.9
DZCF00D	Right-Lateral	1	18	7.7	-	7.5	7.9

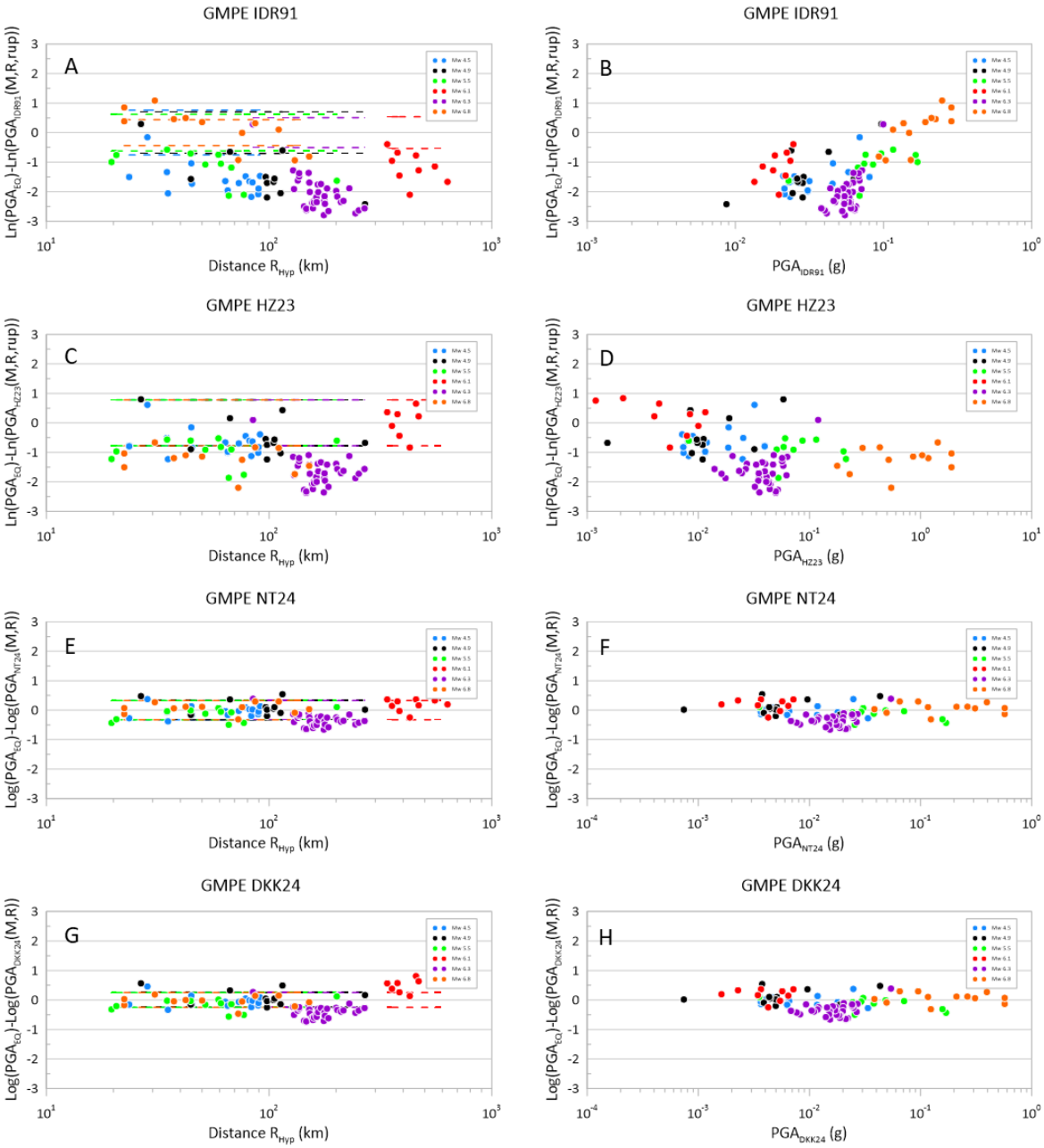

Figure S1. Residual plots on Log PGA of the goodness of fit for the predicted values by the selected GMPEs — IDR91 (A and B), HZ23 (C and D), NT24 (E and F), and DKK24 (G and H) — against the registered data in the earthquakes used for diagnosis.

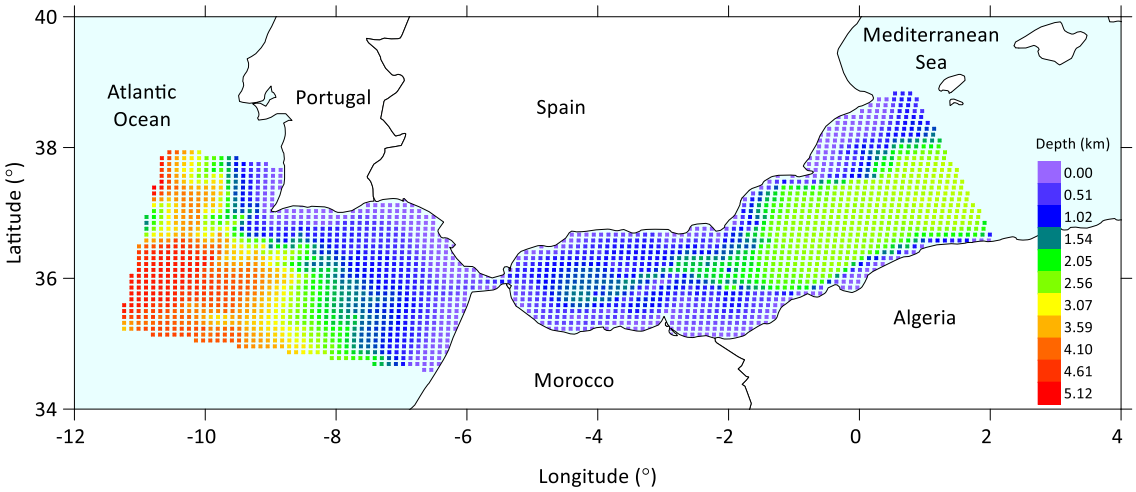

Figure S2. Computational grid for seismic hazard calculation of this study. The grid points are equally spaced at 0.1 to 0.1 degrees. The total number of computational sites, colored according to DTM depth, is 3,854.

References:

Danciu L., Nandan S., Reyes C., Basili R., Weatherill G., Beauval C., Rovida A., Vilanova S., Sesetyan K., Bard P-Y., Cotton F., Wiemer S., Giardini D. (2021a) - The 2020 update of the European Seismic Hazard Model: Model Overview. EFEHR Technical Report 001, v1.0.0, https://doi.org/10.12686/a15

Danciu, L., Nandan, S., Reyes, C., Basili, R., Weatherill, G., Beauval, C., Rovida, A., Vilanova, S., Sesetyan, K., Bard, P.-Y., Cotton, F., Wiemer, S., & Giardini, D. (2021b). Main Datasets of the 2020 Update of the European Seismic Hazard Model (ESHM20) [Data set]. EFEHR European Facilities of Earthquake Hazard and Risk. https://doi.org/10.12686/ESHM20-MAIN-DATASETS

Danciu, L., Nandan, S., Reyes, C., Wiemer, S., & Giardini, D. (2021c). OpenQuake Input Files for the 2020 Update of the European Seismic Hazard Model (ESHM20) [Data set]. EFEHR European Facilities of Earthquake Hazard and Risk. https://doi.org/10.12686/ESHM20-OQ-INPUT