Active fault database for Iberia and its surroundings, including the Gulf of Cadiz and the Alboran Sea

José A. Álvarez-Gómez Universidad Complutense de Madrid

http://info.igme.es/qafi/



The **QAFI** is a community-based active faults database maintained and curated by the Geological Institute of Spain (IGME-CSIC).

Technical editors (ACCESS database):

Santiago Martín Alfageme (QAFI v.2) (IGME-CSIC) Julián García-Mayordomo (QAFI v.3 and 4) (IGME-CSIC)

Technical editors (Shapefiles):

Raquel Martín-Banda (IGME-CSIC) Julián García-Mayordomo (IGME-CSIC)

Web application:

Ángel Prieto Martín (IGME-CSIC)

Scientific editors of QAFI v.4:

Julián García-Mayordomo (IGME-CSIC) Raquel Martín-Banda (IGME-CSIC) Carolina Canora Catalán (U. Autónoma de Madrid) María Ortuño (U. de Barcelona) Héctor Perea (U. Complutense de Madrid) José J. Martínez-Díaz (U. Complutense de Madrid) Eulalia Masana (U. de Barcelona) Juan M. Insua-Arévalo (U. Complutense de Madrid) Octavi Gómez-Novell (U. de Barcelona) José A. Álvarez-Gómez (U. Complutense de Madrid)



Details of the fault AT004



×

Stongth Av



Geometry and kinematics			
Conventions			
		Her.	
	Variability Teur	20070	Brief communi
derange sinis $\langle T \rangle + 2 T$	+5	ш	Based on Machine Larintic et al (2018) map; alter Vanisha (2009) and Science et al. (2018).
Dec 20 - 14		1.0	Depth companying of a BEU profile (Zacilie) et al. 2021 2024)

Raine (*) - 10	+10	ы	Assessment pran remova
Second conversion in Fi		1.0	Displacement of effectance on anisotric data (Variation, 2029, Datain et al., 2028).
Longth (kes) - 68	**	ш	Baund an Martinez-Larmete et al (2018) reap, alter Vacarez (2029) and Datas et al. (2018). Towards the scalarit may measure with the language dimension Algorith Theorem (442) (Martinez-Larmete et al., 2018).
Min shyth (key) - 0		1.0	Variative, 2029; Orlena et al., 2010.
Max shyth (key) - 22	20.60	ш	Assumed same values as Harmoline halt (ATOR) and Eas Varenis Fault (are the trace Latents of al., 2018). Fault franchistic at contact latences very different seads. (continental anotherwising enhanced matchin) depth could be 2018 bes.
Weath (key) - 18-168		AK	
Long (See 7) - 3792.545		AR.	

Quaternary activity		STRUTE M
Vender	hylne lace	Biol summari
Quality and the public of the second second	offent Dastrey	arg Forrierons, Faldin, Jamihilakes accurriated, incitorio control or Xan Vicercie compar-
	1.0	Variative, 2009; Ordenia et al., 2010; Berna et al., 2010
Age of the youngest depends as landlares. 310–500 affected by the bask - y-DF	1.0	Appr of the load mass is seepart depend as unstated to the flad. We what it to the 1783 Linkser Bertinpade (Neurains, 2009, Dimon et al., 2019)
Sip rate		Accountry: Not rated

	VasiakilityTear Inserve Reinforcement		Enter automatic
. Vertical 35p Rate VSR $\left m(kp)>0.368\right.$	1.064	8.1	Reard on MCR profile as shown in large et al. (2020) Fig. 8 without 1.3s +8.08 (set)) or 110.6.8 +88 rs (M-1200 with +200) and age from unit is maker (3800 lept188).
Harisantal Silp Rate HSR (m/kg) - 0		8.1	Account year star-star
Net Silp Pate PDP (rwite) - 0.306	8.118	18. AR. Frank VIII, Dynami Role	
	Variability Teur	200.08	Brief conversed
Net ally per mont at the Barbare (re) :	Variability Teur	laure	Biol commoni Universes
Not algo per mont at the Barbara (m) : Namber of Reisenic Energy - L	VenaklityTeor	LS	Beat connext Debramen We choose a total of 2 successive reaso have aport depends associated to this toub (Connext, 2009, Databaset al., 2019)

Selamic parameters

	the second second second		
Maximum magnitude (Ma) - 8.1 Initiality A	80-83	1.0	Lowert al (2210)
Record control (general) - 2000 Relativity: Not out-of		1.0	Haused on the summage resources of summation rates interport depends associated in the Discours of Parellal Pauli (Naming, 2020). Discus et al., 2020).
Date of last major cariboastic (years)			University

Associated seismicity 1755 Lisbon earthquake

Name of the event : 1735 Linkon earloguine Defa: 11/1/1733 Heinstig and/armaphine. Novel Biel comment or selencess : Linkon-ever alther associated to Honsenber or Mangaes & Porelas Faults (Dalca et al., 2005, 20st) Biel comment or selencess :

Extended data and references

References : Garcia Centiana, J., Golcia, E., Vizcaino, A., Mangué, P., Old, C., Martinoz Rutz, F., Pilvan, E., Sarches-Catera, J., R. Yorkelem, J. J. (2006). Interfying instrumental with thirtical anti-gasize exercisis in the SPI between Wange assay STICH between Conference on Conference on Conference on Conference 10.1039/32004.02017. Golcia C.: Databethet, J.J. Venala, J. and FM403F4I, Team (2005). Maxetion active Faults of Intere-

SMI - Gasterney Astron Paulis Database of Berla 34 opti (Japan es

and the second se				
identification		Identification compilation		
Identification code : Fault name :	AT004 Margails de Pombal	Identification - compliation		
Geological and geographical set	Name geopryces memors Atlantic Dexar (Offahore Southwest Iberta)	Identification		
Compilation Name/s of the compilet/s :	Gracia, E., Bartislovel, R., Martinez, S. and Lo lacorea, C.	Identification and	47004	
Filation/s: Email:	Unitat de Tecnologia Matina - CSIC egracia@cmina.csic.es	Identification code	ATUU4	
Latest sports	2010-12-30	Fault name	Marques de Pombai	
	_	Identification method	Marine geophysical methods	
1		Geological and geographical set	Atlantic Ocean (Offshore Southwest Iberia)	
٩		Compilation		
		compliation		
		Name/s of the compiler/s :	Gràcia, E., Bartolomé, R., Martínez, S. and Lo lacono, G	5.
		Filiation/s :	Unitat de Tecnologia Marina - CSIC	
		E-mail :	egracia@cmima.csic.es	
[20m	Louis (Parenti ly Co.) (Contracting contains USE MAL	Latest update :	2010-12-30	
Geometry and knownatics				
Conventions	Augustation	Location		
The second second	1 - A			- le
	thread 1	+		A
	- V-	-		11
	VasiabilityTime Source Bort comment		1	
Average strike (*) - 23	1.1 D. Barrel in Gamma Carrier and (2010) resp. and Version (2010) and these in all (2010).	9	/	, 1
Der (*) - 24 Rate (*) - 10	11 El Aveandpar renne			1 Free
Second of responses (R	1.3 Deptember of effectives an activitie data (Naratice, 2009, Data et al., 2018)			
Longik (krs) - 64	6.6 E.J. Biased on Marinez-Lancete et al (2018) regulation Vession (2009) and Delate et al. (2018). Towards the analysis way contact a solit the Insurement Marineshoe Adapted Thread (402) (Marinez Lancete et al., 2018).		/	
Min-skepth-(ken) - O	1.0 Vacantes, 2009-Scheine et al., 2010.			
Max shysh (keq) - 22	20-68 E.J. Assumed source values an Housenhair back (MORT) and Dave Varente Faad (son Houseney Lonient et al., 2018). Faad Invested at source linear terms of different sources. () are dimensionly used in producting and access of another, depth candid for 40-50 fees.			
Windth (bere) - 11k 1101	AK .			
Long (100) - 3782 524				
Quaternary activity	Stingt 4		/	
Quality and dry and desire - Burlanning	genauter, of het Datemary Forward, full 5, Socialistics associated, instantic control on Dat Vicentin company			
Age of the youngest deposits or landforms 300 - 000	 Jape of the land rearest transport dispersit associated in the reads. No estate it to the 1708 Links Excilence Destination of Networks. 2019. 			
affected by the leaft - y #P				
sep fate	Accusery Rot taket			
Vectoral Map Rate VSR $[\mathrm{res}(kg) > 0.368$	E.O.M. R.J. Hannel on MCR profile as shown in large et al. (2003) Fig. 8. offset 1.35. s10.08 (set) or 110.6.0 etill re (Pr.1.500 evils 1200) and age from said in moders (2003 lipe1302).			
Harisantal Xip Rate HSR (m/lp) - 0 Mat Ne Rate NSR (m/lp) - 0	E2 Account pare signify a tax AK From VIII. Do and Folm			
Datum arthousies				
	VenightyTes: Server Bost converses			
Not algo per mont at the flucture (m) : Namine of Science Encoder - 4	Lidensen 1.3 Ver observer a total of 6 successive many tax spect departs asymptotic bio holds			
Enidem of antionic array 7	(Versiter, 2008; Educate et al., 2018). Universite			
Selamic parametera				
	WeakingTeen Invest References			
Maximum magnitude (Me) - 8.1 Initiality A	80-81 L2 Lineartial (2215).			
Record mean interval (years) - 2000 (Reliability: Not when	1.2 Hannel are for average remainment of manomatic reaso barragent depends avarabled to the Education de Pareled Pacel (Associate, 2023). Educe et al., 2023).			
Date of last major northquake (years) -	Universe			
Associated seismicity				
1755 Lisbon earthquake	1783 Lideo automia			
Date :	1/1/1/1755			
Information and day and and				

Service and warging using a United International Chronology Carophys. Hen. Lett., 35 (24), 124601.000 10.1059/32006.1205417. Grida E. Darlobetta, J.J. Versele, J. and FMRSFAL Team (2005). Machine active faults of fahrer

SAM - Quality way dotton Fundis Databases of Borris 24 sptf: Japane on



0.011 - Qualementry Anton Paulin Databaser at Bornia 34 opti-Jupene es

Details of the fault AT004 X						
Marquês de Pombal: AT004	Margu	iês de Pombal [.] AT004				
Identification - compliation	Indiaryo					
Identification						
Identification code : AT004 Fault name : Marquis de Pombal	Identificatio	on - compliation				
Identification method : Marine geophysical methods Geological and geographical set : Attactic Down (Diffacer Southwest Ilonta)	Identification					
Completion						
Namey's of the complexits: Gracia E, Earlistone, R., Martinez, S. and Lo lacons, C. Filladion/a: Unitst de Tecnologia Martina - CSIC Engel: complexity of the complexity of th		Identification code : AT004				
Latent update: 2810-13-00		Fault name : Marquês de Pombal				
Location		Identification method : Marine geophysical	Pothodo			
-		Geological and geographical set : Atlantic Ocean (Offs	Geometry	and	kinematics	
	Compilation		Convention			
		Name/s of the compiler/s : Gràcia, E., Bartolomé,		/	(right-hand rule)	
	l r	•		_	STRIKE	
		Ouaternary activity			Strength: A+	
20m Lote Parentiples (Experimentary contacts CEE MAA		,				
Geometry and kinematics		v	ariability/Error	Source	Brief comment	
Convertions	Location	Quaternary activity evidence : Surface expre	ssion, offset Qu	uaterna	ry horizons, folds, landslides associated, tectonic control on San Vicente canyon	
New York Control of the second						
	+			LD	Vizcaino, 2009; Grácia et al., 2010; Serra et al., 2020	
		Age of the youngest deposits or landforms 300 - 560		I D	Age of the last mass transport deposit associated to the fault. We relate it to the 1755	
Venality Two for convert		affected by the fault : vr BP			Lisbon Earthquake (Vizcaino, 2009; Gràcia et al., 2010)	B) map, after Vizcaino (2009) and Gràcia et al.
Armage while (P): 23 at 12 Manual and Galaxies and a 12 Phil resp. and Values (2007) and there is a (2017).	Q	,,,				
Faller (%) 110 411 FAL Annual from the second state of the second		Clip rate			Anournous Not roted	ellini et al., 2001; 2004)
Sinnes of wavements (F L3 Displacement of or Enters on second data (Variano, 2009, Solicia et al., 2018).		Silprate			Accuracy: Not rated	
Children (1997) 1987 1997 1997 1997 1997 1997 1997 1997		v	ariability/Error	Source	Brief comment	
Mite skepsh (ben): 0 1.0 Vennine, 2029; Gelesin et al., 2010. Mite skepsh (ben): 10 2016 EJ Answere values on Hennesher havit (MOBIT) and Exer Vennin Frank (see		Vertical Slip Pote VSP (m/ku) - 0.269	0.064	E I	Record on MCS profile as shown in Serre at al. (2020) Fig. 8: offset 1.2s ±0.05 (twitt) =>	data (Vizcaino, 2009; Gràcia et al., 2010).
Hard transf. Control or al, 2010, Final hundred at contrast interacts were applied by the contrast interacts of the set o		ventical silp nate von (m/ky) : 0.500	0.004	LU	1105.0 ±50 m (V=1700 m/s ±200) and age from unit Ia marker (3000 ky±500).	
Long (party - 2772 MM AR				F 1	Account of a construction of the	b) map, after vizcaino (2009) and Gracia et al.
Quaternary activity Storgtk Ar		Horizontal Slip Rate HSR (m/ky) : 0		EJ	Assumed pure dip-slip	,
Visiolity Tour Tourne Birl comment Quatemary sciency existing existence : Sortice expression, arbeit Quatemary Forcers, (eds.). Socialities accurated, instants control on Xon Viserie compar-		Net Slip Rate NSR (m/ky) : 0.906	0.156	AR	From VSR, Dip and Rake	
1.3 Venting 2019 Grinter et al., 2010, Breas et al., 2011						
Age of the youngest depends to leaderers 20: 500 1.0 Age of the land must a surgest dependent to make A solution 1700 albeided by the land : y 87 London Dethyoute (Annoine, 2005), Dation et al. (2015)		Paleoearthquakes				fault (AT005) and San Vicente Fault (see
Stip rate Accuracy Not rated		r alcocal triquakes				antle), depth could be 40-50 km.
Vestight There Increase Reef connected Vestight There Increase Reef connected Vestight Table 2008 (vestight - 0.000 Increase Incr		v	ariability/Error	Source	Brief comment	
Hankanshal Xing Padri MXR (yu lig) i D KJ Annamend yaar oliyooliy		Net slip per event at the Surface (m) :			Unknown	
Nex Stop Pales (RSR (ex lig) - 0.103 E 118 APC From VIP), Explored Role						
Weaking States and States an		Number of Seismic Events : 4		LD	We observe a total of 4 successive mass transport deposits associated to this fault	
Bei slip per ennel al ike Barbaro (nel) bioseau.					(Vizcaino, 2009; Gracia et al., 2010).	
(Unitariant 2020) Education of an ACOCO		Evidence of aseismic creep? :			Unknown	
Salamic narrowing						
Veniality Tex: Source Revieweest		Seismic parameters				
Maximum mappinda (Mar) 8.1 8.04.0 1.2 Linux et al. (2003) (Britality A)						
Recar reveal inferred (years) (200) 1.2 Named as the samings remains our of scattering in the special dependence of the Recard of Parallel (Recarding 2008) Edition in al. (2018).		v	ariability/Error	Source	Brief comment	
Date of last explor northquile (ynen) - Listenson		Maximum magnitude (Mw) : 8.1	8.0-8.5	LD	Lima et al. (2010).	
Associated avianticity 1755 Linke exthansis		Reliability: A	_/			
Name of the event : 1755 Linkon surfrequele						
Date: 1/1101755 Internaty and/or reagabled: : Nor-8 Pair commuter or effective : Linker over either associated to Hersenberg or Managers in Denty (Fector Associated 1999) Weller		Recurrence interval (years) : 2000		LD	Based on the average recurrence of successive mass transport deposits associated to	
et al. 2004.		Reliability: Not rated			the marques de Fombal Fault (Vizcalno, 2009; Gracia et al., 2010).	
Extended data and references		Date of last major earthquake (years)			Unknown	
vermendors: Sumo Jonessa, J., Sumon, E., Witchin, A., Konson, K., Vini, V., Karris, Ruis, F., Pifers, E., Sanche- Cabaza, J.A. Scheinstein, J. (2006). Identifying instrumental and interview entry lack records in the SW berlan Margin using 216Ph turkidite chronology. Geophys. Res. Lett., 35 (24), L24607, doi:	L	Date of last major cartinquake (jouro).				
10.1629;32066.028417. Grida E., Dafabetela, J.J., Venale, J., and FARGFAL Team. (2002). Maxima active faults of fahree						

Marquês de Pombal: AT004

Ouaternary activity

Slip rate

Paleoearthquakes

Maximum magnitude (M

Recurrence interval (years

Date of last major earthquake (year

Reliability: Not rat

Reliabilit

Extended data and references References : García-Orellana, J., Gràcia, E., Vizcaino, A., Masqué, P., Olid, C., Martínez Ruiz, F., Piñero, E., Sánchez-Cabeza, J.A. Dañobeitia, J.J. (2006). Identifying instrumental and historical earthquake records in the Identification code : ATO SW Iberian Margin using 210Pb turbidite chronology, Geophys, Res. Lett., 33 (24), L24601, doi: Fault name : Marc 10.1029/2006GL028417. Identification method : Mar Gràcia, E., Dañobeitia, J.J., Vergés, J., and PARSIFAL Team (2003). Mapping active faults offshore Geological and geographical set : Atlar Portugal (38°N-36°N): Implications for seismic hazard assessment along the southwest liberian Margin. Geology, 31, 83-86. Gràcia, E., Vizcaino, A., Escutia, C., Asioli, A., Rodés, A., Pallàs, R., García Orellana, J., Lebreiro, S., Goldfinger, C (2010), Holocene earthquake record offshore Portugal (SW Iberia); Testing turbidite Name/s of the compiler/s : Gracia paleoseismology in a slow-convergence margin. Quaternary Science Reviews, 29, 1156-1172. Gràcia, E., Bartolomé, R., Lo Jacono, C., Moreno, X., Martínez-Loriente, S., Perea, H., Masana, E., Pallàs, R., Diez, S., Dañobeitia, J.J., Terrinha, P., Zitellini, N. (2010). Characterizing active faults and associated mass transport deposits in the South Iberian Margin (Alboran Sea and Gulf of Cadiz); On-fault and offfault paleoseismic evidence. En: Contribución de la Geología al Análisis de la Peligrosidad Sísmica **Ouaternary activity evidence** (J.M. Insúa v F.Martín-González, eds.), pp. 163-166, IBERFAULT, Sigüenza (Guadalajara), 27-29 Octubre 2010. Geissler et al., 2010. Focal mechanisms for sub-crustal earthquakes in the Gulf of Cadiz from a dense Age of the youngest deposits or landform OBS deployment, Geophys, Res. Lett., 37, L18309. affected by the fau Martínez-Loriente, S., Gràcia, E., Bartolome, R., Perea, H., Klaeschen, D., Dañobeitia, J. J., Zitellini, N., Wynn, R. B., & Masson, D. G. (2018), Morphostructure, tectono-sedimentary evolution and seismic potential of the Horseshoe Fault, SW Iberian Margin, Basin Research, 30, 382-400, https:// doi.org/10.1111/bre.12225 Serra, C.S. Martínez-Loriente, S., E. Gràcia, Urgeles, R., Vizcaino, A., Perea, H., Bartolome, R., Pallàs, R., Lo lacono, C., Diez, S., Dañobeitia, J.J., Terrinha, P., Zitellini, N. (2020) Tectonic evolution. Vertical Slip Rate VSR (m/ky geomorphology and influence of bottom currents along a large submarine canyon system: The São Vicente Canvon (SW Iberian margin), Marine Geology, 426, https://doi.org/10.1016/ Horizontal Slip Rate HSR (m/ky j.margeo.2020.106219. Stich, D., Mancilla, F., Morales, J., 2005. Crust-mantle coupling in the Gulf of Cadiz (SW Iberia). Net Slip Rate NSR (m/ky Geophys. Res. Lett., 32, L13306, doi:10.1029/2005GL023098. Stich et al., 2010. Moment tensor inversion for Iberia-Maghreb earthquakes 2005-2008 Tectonophysics, 483, 390-398. Lima,V.V. J. M. Miranda , M. A. Baptista, J. Catalao, M. Gonzalez, L. Otero, M. Olabarrieta, J. A. Alvarez-Gomez, and E. Carreño (2010): Impact of a 1755-like tsunami in Huelva, Spain. Natural Hazards and Net slip per event at the Surface (m Earth System Science, 10: 1-10. Number of Seismic Event Martínez-Loriente, S., Gràcia, E., Bartolome, R., Perea, H., Klaeschen, D., Dañobeitia, J. J., Zitellini, N., Wynn, R. B., & Masson, D. G. (2018). Morphostructure, tectono-sedimentary evolution and seismic potential of the Horseshoe Fault, SW Iberian Margin, Basin Research, 30, 382-400. https:// Evidence of aseismic creer doi.org/10.1111/bre.12225 Vizcaino, A., Gràcia, E., Pallàs, R., García-Orellana, J., Escutia, C., CASAS, D., WILLMOTT, V., Díez, S., AND Seismic parameters Dañobeitia, J.J. (2006). Sedimentology, physical properties and ages of mass-transport deposits associated to the Marquês de Pombal Fault, Southwest Portuguese Margin. Norwegian Journal of

Geology, 86, 173-182

Vizcaino, A., 2009. "Processos sedimentaris d'edat Holocena al marge sud-oest de la Península Ibèrica: Aplicació a la paleosismologia marina". Tesis Doctoral, Universitat de Barcelona, 281 pp.

Zitellini, N., Mendes, L., Córdoba, D., Dañobeitia, J.J., Nicolich, R., Pellis, G., Ribeiro, A., Sartori, R., Torelli, L., and BIGSETS TEAM (2001). Source of the 1755 Lisbon Earthquake and Tsunami Investigated. EOS, Transactions of AGU, Vol 82 (26), p. 285-290-291.

rust

Zitellini, N., Rovere, M., Terrinha, P., Chierici, F., Matias, L., and BIGSETS Team, 2004. Neogene through Quaternary tectonic reactivation of SW Iberian Passive Margin. Pure Appl. Geophys., 161, 565-587.

The **QAFI** is a community-based active fa maintained and curated by the Geologica Spain (IGME-CSIC).

Filter faults and legend

11.000 vrs to Present)

(the last 125,000 yrs)

Fault activity reaches Holocene (from the last

Fault activity at least reaches Upper Pleistocene

 Fault activity is Quaternary (the last 2.6 ma), although activity during Upper Pleistocene or

Holocene times has not been demonstrated yet.

Fault activity

Technical editors (ACCESS database):

Santiago Martín Alfageme (QAFI v.2) (IGME-CSIC) Julián García-Mayordomo (QAFI v.3 and 4) (IGME-CSIC)

Technical editors (Shapefiles):

Raquel Martín-Banda (IGME-CSIC) Julián García-Mayordomo (IGME-CSIC)

Web application:

Ángel Prieto Martín (IGME-CSIC)

Scientific editors of QAFI v.4:

Julián García-Mayordomo (IGME-CSIC) Raquel Martín-Banda (IGME-CSIC) Carolina Canora Catalán (U. Autónoma de Madrid) María Ortuño (U. de Barcelona) Héctor Perea (U. Complutense de Madrid) José J. Martínez-Díaz (U. Complutense de Madrid) Eulalia Masana (U. de Barcelona) Juan M. Insua-Arévalo (U. Complutense de Madrid) Octavi Gómez-Novell (U. de Barcelona) José A. Álvarez-Gómez (U. Complutense de Madrid)

The Iberian active fault and palaeoseismology research community is composed of geologists, geophysicists and geodesists. This community is articulated through specific sessions in several congresses as well as the Iberfault congresses held every 4 years.

Contribución de la Geología al Análisis de la Peligrosidad Sísmica

Primera Reunión Ibérica sobre Fallas Activas y Paleosismología Primeira Reunião Ibérica sobre Falhas Activas e Paleossismologia First Iberian Meeting on Active Faults and Paleoseismology Sigüenza (Guadalajara, España) 27, 28 y 29 de Octubre de 2010

Registros de la Base de Datos de Fallas Activas en el Cuaternario de Iberia

Quaternary Active Faults Data Base of Iberia

BRIEF REPORT

QAFDBI v.1.1 (2011)

QAFI v.2.0 (2012)

UTM Projection ETRS-1989

Kilometers

QAFI v.3.0 (2015)

· •

Quaternary Faults Database of Ib × +

C ▲ No es seguro | info.igme.es/gafi/

4 \rightarrow + Mapa - OpenStreetMap Instituto Geológico MINISTERIO DE CIENCIA v Minero de España O Mapa - ESRI Streets _ Toulo Mapa - Base IGN **Ouaternary Active Faults** A Coruña Asturias Santander Bilbao Database of Iberia v.3 O Mapa - Ráster IGN folame Asturies Tugo 9 Vitoria-Gasterz O Mapa - ESRI Topographic List of faults | Downloads | Links | About | Disclaimer de Compostela O Satélite - ESRI Imagery Click on **QAFI Faults** to get detailed information León Ourense O Satélite - Ortofotos del PNOA Palencia CAFI Faults Zaragoza ated Faults Faults from the Neotectonic Map of Spain Braga Valladolid Nat. Hazards Earth Syst. Sci., 17, 1447-1459, 2017 Natural Hazards § aults from the Neotectonic Map of Spain https://doi.org/10.5194/nhess-17-1447-2017 EGU and Earth System Porto Barcelona Q Author(s) 2017. This work is distributed under Sciences the Creative Commons Attribution 3.0 License. cene / Possibly Quaternary Salamanca Madrid Nat. Hazards Earth Syst. Sci., 24, 3945-3976, 2024 Natural Hazards & https://doi.org/10.5194/nhess-24-3945-2024 España and Earth System C Author(s) 2024. This work is distributed under Toledo Active fault databases: building a bridge between Sciences the Creative Commons Attribution 4.0 License. Ciceres a Mancha . earthquake geologists and seismic hazard Ciudad practitioners, the case of the QAFI v.3 database Real Mérida Albacete Julián García-Mayordomo^{1,2}, Raquel Martín-Banda^{1,2}, Juan M. Insua-Arévalo², José A. Álvarez-Gómez², Badajoz José J. Martínez-Díaz², and João Cabral³ The European Fault-Source Model 2020 (EFSM20): geologic ¹Instituto Geológico y Minero de España, 28003 Madrid, Spain ²Department of Geodynamics, Geology Faculty, Complutense University, 28040 Madrid, Spain ³Department of Geology, Science Faculty, Lisboa University, 179-016 Lisbon, Portugal Córdoba

Sevilla

Marbella

Gibraltar

Tétouan

HEE.LE

تطوان

Al Hoce

Nado

I.E:Q Ilider

Taza 4: ¥

Béjaïa

@X.5#X

M'Sila EOEN.

تحاية

10

Alger AX.5+O

الحزائر

Leaflet | Powered by Esri | OpenStreetMap contributors

AELU:00.0.

عين وسارة 🗧

Chief GH+H Ain Oussara

الشلف

Tiaret

Oran U. DO%

مهران

Saïda

Tlemcen

+.N. . . .

Oujda UIA.

Constan

ZOSESI. a

Rickra J.C

Huelva

Cádiz

Larache

NHO.SC

العرائش

Rabat OO.E

Correspondence to: Julián García-Mayordomo (julian.garcia@igme.es)

Received: 31 March 2017 - Discussion started: 18 April 2017 Revised: 7 July 2017 - Accepted: 14 July 2017 - Published: 30 August 2017

Abstract. Active fault databases are a very powerful and 1 Introduction useful tool in seismic hazard assessment, particularly when singular faults are considered seismogenic sources. Active fault databases are also a very relevant source of information for earth scientists, earthquake engineers and even teachers or journalists. Hence, active fault databases should be updated and thoroughly reviewed on a regular basis in order to keep a standard quality and uniformed criteria. Desirably active fault databases should somehow indicate the quality of the geological data and, particularly, the reliability attributed to crucial fault-seismic parameters, such as maximum magnitude and recurrence interval. In this paper we explain how we tackled these issues during the process of updating and reviewing the Quaternary Active Fault Database of Iberia (QAFI) to its current version 3. We devote particular attention to describing the scheme devised for classifying the quality and representativeness of the geological evidence of Ouaternary activity and the accuracy of the slip rate estimation in the database. Subsequently, we use this information as input for a straightforward rating of the level of reliability of maximum magnitude and recurrence interval fault seismic parameters. We conclude that QAFI v.3 is a much better database than version 2 either for proper use in seismic hazard applications or as an informative source for non-specialized users. However, we already envision new improvements for a future update

Published by Copernicus Publications on behalf of the European Geosciences Union.

Active fault databases are both an important ma for seismic hazard assessment as well as a conveni displaying and sharing scientific information of ac Knowledge about the location and activity degree crucial for seismic hazard and risk assessment, r for critical facilities such as nuclear power plant tive waste storages and chemical plants, but also ning anthropic activities that may involve changir ural stress state in the crust: water reservoirs, u gas storage, fracking, etc. The importance of activ a matter of concern in modern seismic code prov example in Eurocode-8, in which official docume by competent national authorities are referred to fo tification of such faults (e.g. Eurocode-8: Part 5: Cl Active fault databases are also key for tsunami haz ments (e.g. Álvarez-Gómez et al., 2011) as well a warning systems, which are largely based on protsunamigenic faulting scenarios derived from info such databases (e.g. Gailler et al., 2013).

Since the Quaternary Active Faults Database (QAFI v.2) was released in February 2012 Mayordomo et al., 2012a), an increasing number have made use of it. The most relevant use so far ha the creation of the new seismic hazard map of Si UPM, 2013), performed considering the foresee of Eurocode-8 throughout 2017. OAFI faults we ered to be complementary information for designing

¹Istituto Nazionale di Geofisica e Vulcanologia, 00143 Rome, Italy

input data for the European Seismic Hazard Model 2020

Roberto Basili¹, Laurentiu Danciu², Céline Beauval³, Karin Sesetyan⁴, Susana Pires Vilanova⁵, Shota Adamia⁶, Pierre Arroucau7, Jure Atanackov8, Stéphane Baize9, Carolina Canora10, Riccardo Caputo11, Michele Matteo Cosimo Carafa¹, Edward Marc Cushing⁹, Susana Custódio¹², Mine Betul Demircioglu Tumsa¹³ João C, Duarte¹², Athanassios Ganas¹⁴, Julián García-Mavordomo¹⁵, Laura Gómez de la Peña¹⁶, Eulàlia Gràcia¹⁶, Petra Jamšek Rupnik⁸, Hervé Jomard⁹, Vanja Kastelic¹, Francesco Emanuele Maesano¹, Raquel Martín-Banda¹⁵, Sara Martínez-Loriente16, Marta Neres17.12, Hector Perea16, Barbara Šket Motnikar18, Mara Monica Tiberti1, Nino Tsereteli⁶, Varvara Tsironi¹⁴, Roberto Vallone¹, Kris Vanneste¹⁹, Polona Zupančič¹⁸, and Domenico Giardini²⁰

²Swiss Seismological Service, ETH Zurich, Zurich, Switzerland ³ISTerre, IRD, Univ. Grenoble Alpes, Univ. Savoje Mont Blanc, CNRS, Univ. Gustave Eiffel, Grenoble, France ⁴Boğazici University, Kandilli Observatory and Earthquake Research Institute, Department of Earthquake Engineering, 34684 Istanbul, Türkiye ⁵Instituto Superior Tecnico, Universidade de Lisboa, Lisbon, Portuga ⁶Institute of Geophysics, Ivane Javakhishvili Tbilisi State University, Tbilisi, Georgia 7 Electricité de France, TEGG, Aix-en-Provence, France 8 Geological Survey of Slovenia, Ljubliana, Slovenia ⁹Institut de Radioprotection et de Sûreté Nucléaire, Fontenay-aux-Roses, France ¹⁰Universidad Autónoma de Madrid, Facultad de Ciencias, Dnto, Geología y Geoquímica, 28049 Madrid, Snain 11 Department of Physics and Earth Sciences, University of Ferrara, Ferrara, Italy 12 Instituto Dom Luiz (IDL), Faculdade de Ciências, Universidade de Lisboa, 1749-016 Lisbon, Portugal 13 Turkish Earthquake Foundation, Istanbul, Türkiye 14National Observatory of Athens (NOA), Athens, Greece 15 Instituto Geológico y Minero de España (IGME-CSIC), 28760 Madrid, Spain 16 Institut de Ciències del Mar-CSIC, Barcelona, Spain 17 Instituto Português do Mar e da Atmosfera, 1749-077 Lisboa, Portugal 18 Slovenian Environment Agency, Ljubljana, Slovenia 19 Royal Observatory of Belgium, Brussels, Belgium 20 Institute of Geophysics, Department of Earth Sciences, ETH Zurich, Zurich, Switzerland Correspondence: Roberto Basili (roberto.basili@ingv.it)

Received: 17 July 2023 - Discussion started: 11 September 2023

Revised: 16 July 2024 - Accepted: 2 September 2024 - Published: 19 November 2024

Abstract. Earthquake hazard analyses rely on seismogenic source models. These are designed in various fashions, such as point sources or area sources, but the most effective is the three-dimensional representation of geological faults. We here refer to such models as fault sources. This study presents

leased European Seismic Hazard Model 2020. The EFSM20 compilation was entirely based on reusable data from existing active fault regional compilations that were first blended and harmonized and then augmented by a set of derived parameters. These additional parameters were devised to en-

QAFI v.4.0 (2022)

Fault2SHA ESC-Working group. Laboratory on the Eastern Betics Shear Zone

> TALLER SOBRE MODELADO DE FALLAS EN PSHA

EASTERN BETICS SHEAR ZONE LAB

ALICANTE - 30 DE JUNIO Y 1 DE JULIO DE 2022

2022 (Alicante). Workshop on fault modelling in PSHA.

2023 (Madrid). Seminar and workshop on the incorporation of Active Faults into seismoresistant codes. Antecedentes: El Junes 18 de septiembre de 16:00 a 20:00 horas tuvo lagar un ciclo de conferencios: sobre "Pelipositado de desplazamiento en superficio por terremotos. Aplicación en la normas de consucción superioristeristar "en la faciada de facensa Geológicas (UCM). Al da siguiente, en el ICML, CSC (MARIA) de 50:0 a 13:00 horas, se celebrá la "Annola de Trabajo der la consideración portenziar terregoria de mano anos subanes:sistemente españa la der la consideración de fallos extoras en en propreto de mano anos subanes:sistemente españa la dera de la consideración de fallos extoras en españar portención en españa en españa españa de fallos extoras en españar españa españa de la consideración de fallos estoras en españar españa españa de la defallo estoras en españar españa españa de la defallo estoras en españar españa de la defallo estoras en españa españa de la defallo estoras en españar españa de la defallo estoras en españa españa de la defallo estoras en españar españa de la defallo estoras en españa españa defallo estoras en españa españa de la d

El presente documento, a fecha de 18 de Octubre de 2023, muestra las conclusiones más importantes que se akanzaron en ambas actividades por el grupo de trabajo formado od hoc en el proceso de inscripción a la Jornada de Trabajo en el IGME, y una serie de acciones propuestas para seguir trabajando en el tema en el corto y medio plazo.

CONCLUSIONES (Resumer

- La Jornada ha cumplido las expectativas en el sentido de haber sido capaz de abordar los temas más importantes y alcanzar un consenso general en las cuestiones más
- criticas. Si bien es evidente que es necesario seguir trabajando sobre diferentes aspecto concretos, para lo cual se han creado Grupos de Trabajo (ver punto 2 del documento).
- La base de datos QAFI es un excelente punto de partida para crear un catálogo de fallas activas según NCSR-23. Sin embargo, necesita un trabajo de corrección, actualización y transcripción.
- Sería muy recomendable editar una Guía Técnica o unas Recomendaciones para el uso del mencionado catálogo de fallas activas, así como para la aplicación de determinado: preceptos de la norma (ej, medida de distancias, ...).
- 4. En particular, se considera a priori buena práctica considerar hasta una distancia horizontal de 400 m a la traza de la falla en superficie (o su proyección) como definición de "cercanía" a la falla para el propósito de evitar deformaciones permanentes del terreno (rotura en superficie).
- 5. Se considera a priori que la escala de trabajo de la QAFI (aprox 1:100.000) es suficiente para medir distancias de precisión de klômetro (5, 10 y 15 km) para la consideración de efectos de cercania de fuente (e), annjo 2 puentes). Se propone que esta distancia se mida a la proyección en superficie del plano de falla.
- No se concluye por el momento cuando puede considerarse que la recurrencia del

The QAFI V.5 is now being developed:

- Transformation/adaptation to an official **active fault database** to be used on the **seismoresistant national code**.
- **Comprehensive updating** of known active faults by means of work groups by region.
- Estimation of buffer distances for Fault
 Displacement Hazard.
- **Updating** of the estimations on **recurrence intervals** harmonizing with coherent return periods.

2023 (Madrid). Seminar and workshop on the incorporation of Active Faults into seismoresistant codes.

The QAFI V.5 is now being developed:

- Transformation/adaptation to an official **active fault database** to be used on the **seismoresistant national code**.
- **Comprehensive updating** of known active faults by means of work groups by region.
- Estimation of buffer distances for Fault
 Displacement Hazard.
- **Updating** of the estimations on **recurrence intervals** harmonizing with coherent return periods.

2023 (Madrid). Seminar and workshop on the incorporation of Active Faults into seismoresistant codes.

What about tsunamis and submarine faults?

Gulf of Cadiz sources

Gulf of Cadiz sources

Gulf of Cadiz sources

Alboran Sea sources

Alboran Sea sources

Alboran Sea sources

Limitations of the tsunamigenic seismic sources on the QAFI database

- Not all the potential seismic sources are included in the database → Epistemologic uncertainty. We think that the most important ones are included
- Fault trace uncertain due to technical limitations *enough for tsunami models?*
- Lack of outcrop data → Uncertainties on kinematics (rupture type) key for tsunamis
 → Uncertainties on slip rate
- Lack of geodetic data \rightarrow Uncertainties on slip rate key for PTHA
- Seismogenic potential biased \rightarrow No multi-segment rupture considered key for max. Mw
- 3D structure unknown → Real fault dimensions, seismogenic potential and dip uncertain key for surface deformation

Ongoing and forthcoming research projects

