Supplementary information for

Unveiling the potential source and underlying causes of the 1755 Lisbon earthquake and tsunami

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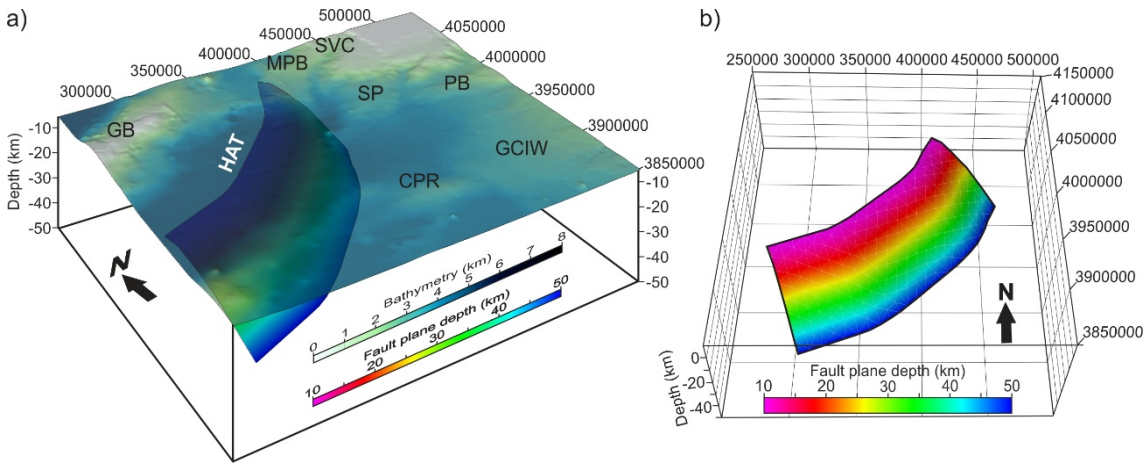
Supplementary Introduction

This supplementary information consists of a figure (Supplementary Figure 1) showing the HAT fault plane used as a source for tsunami simulations, and three tables including information on the focal parameters of the major instrumental earthquakes occurred off SW Iberia (Supplementary Table 1), and comparison of historically reported run-up (Supplementary Table 2) and tsunami arrival times (Supplementary Table 3) with results obtained from HAT tsunami simulation and previous works[1,2,3].



Supplementary Figure 1. 3-D HAT fault plane. a Fault plane used as source for tsunami simulations overlaid by regional bathymetric map for reference. **b** Fault plane used as source for tsunami simulate with the triangular mesh. CPR: Coral Patch Ridge; GB: Gorringe Bank; GCIW: Gulf of Cadiz Imbricated Wedge; HAT: Horseshoe Abyssal plain Thrust; MPB: Marquês de Pombal Block; PB: Portimão Bank; SP: Sagres Plato; SVC: São Vicente Canyon.

Supplementary Table 1. Focal parameters of the major instrumental earthquakes off SW Iberian margin

Date	Mw	Depth (km)	Strike/dip/rake (º)
28/02/1969	7.9	31	231/47/54
12/02/2007	6	40	245/55/50
17/12/2009	5.5	36	217/89/58

Supplementary Table 2. Comparison of historically reported tsunami run-up (m) with the maximum height (H_m) obtained from the HAT tsunami simulation and previous works[1,2,3]. Id 1 to 43 (yellow dots in Fig. 4): sites of historical tsunami run-up reports and sites with tsunami reports but no run-up reports (NRR). Id 44 to 49 (red dots in Fig. 4): sites that were populated in 1755 but did not report tsunami impact (NR).

Id	Locality	Historical record	This work		Barkan (Source 8)[3]		Gutscher (GCF)[2]		Baptista (MPF)[1]	
		Run-up (m)	$\widehat{H_m}$ (m)	Diff. (m)	H_m (m)	Diff. (m)	H_m (m)	Diff. (m)	H_m (m)	Diff. (m)
1	Bilbao(2)	NRR	0.48	-	-	-	-	-	-	-
2	Santander(2)	NRR	0.45	-	-	-	-	-	-	-
3	Vibeiro (Lugo) (2)	NRR	0.95	-	-	-	-	-	-	-
4	La Coruña(1)	<1	0.77	0.23	-	-	-	-	-	-
5	Baiona(2)	NRR	1.14	-	-	-	-	-	-	-
6	Porto(1)	1	0.81	0.19	0.9	0.1	0.7	0.3	-	-
7	Figueira da Foz(1)	NRR	1.87	-	-	-	0.5	-	-	-
8	Porto Novo(1)	NRR	7.31	-	-	-	-	-	-	-
9	**Lisboa (Oerias) (1)**	**6-15***	**6.78**	**0.78**	**1.7**	**4.3**	**2.2**	**3.8**	**10.0**	**4.0**
10	**Cabo Saõ Vicente(1)**	**>10**	**9.74**	**0.26**	**5.0**	**5.0**	**5.0**	**5.0**	**6.0**	**4.0**
11	Huelva (Vila Reial) (1)	NRR	3.97	-	-	-	2.6	-	-	-
12	**Cadiz(1,2)**	**5(2)-15(1)***	**6.26**	**1.26**	**3.0**	**2.0**	**5.5**	**0.5**	**5.0**	**0.0**
13	Gibraltar(1)	2	2.07	0.07	-	-	1.4	0.6	4.5	2.5
14	Marbella(2)	NRR	1.28	-	-	-	-	-	-	-
15	Ceuta(1)	2	0.91	1.09	-	-	-	-	-	-
16	Tangier(1)	15.2*	2.25	12.95	-	-	2.9	12.3	-	-
17	**Safi(1)**	**>6**	**6.09**	**0.09**	**1.5**	**4.5**	**1.2**	**4.8**	**2.0**	**4.0**
18	Canary Islands(1)	NRR	2.02	-	-	-	-	-	-	-
19	**Madeira(1)**	**4**	**3.35**	**0.65**	**3.0**	**1.0**	**3.0**	**1.0**	**1.5**	**2.5**
20	Porto Santo(1)	3	3.34	0.34	-	-	3.5	0.5	-	-
21	Angra (Azores) (1)	?-14.6*	5.97	8.63	3.1	11.5	-	-	-	-
22	Galway(3)	NRR	0.30	-	-	-	-	-	-	-
23	Kinsale(4)	NRR	0.50	-	-	-	-	-	-	-
24	Cork(5)	NRR	0.62	-	-	-	-	-	-	-
25	Cardiff(5)	NRR	0.18	-	-	-	-	-	-	-
26	Bristol(5)	NRR	0.17	-	-	-	-	-	-	-
27	Hartland(5)	NRR	0.94	-	-	-	-	-	-	-
28	Widemouth Bay(6)	NRR	0.93	-	-	-	-	-	-	-
29	Mount's Bay(6)	NRR	0.61	-	-	-	-	-	-	-
30	Penzance(1,5)	2-3.7	0.88	1.12	-	-	-	-	-	-
31	Newlyn(1)	NRR	0.97	-	-	-	-	-	-	-
32	Plymouth(1)	NRR	0.93	-	-	-	-	-	-	-
33	Cornwall(1,5,6)	2-3.7	0.69	1.31	0.3	1.7	-	-	-	-
34	Newfoundland(1)	NRR	1.35	-	0.4	-	-	-	-	-
35	Santiago de Cuba(1)	NRR	1.53	-	-	-	-	-	-	-
36	Samaná Bay(1)	NRR	0.82	-	-	-	-	-	-	-
37	St. Matin(1)	4.5	0.98	3.52	0.7	3.8	-	-	-	-
38	Saba(1)	6.4	1.88	4.52	0.4	6.0	-	-	-	-

39	Antigua[(1)]	3.6	0.79	2.81	0.5	3.1	-	-	-	-
40	Dominica[(1)]	3.6	0.76	2.84	0.6	3.0	-	-	-	-
41	Barbados[(1)]	1.5-1.8	0.74	0.76	-	-	-	-	-	-
42	Itamaraca[(1)]	NRR	0.35	-	-	-	-	-	-	-
43	Tamandare[(1)]	NRR	0.35	-	-	-	-	-	-	-
44	Boston[(1)]	NR	0.06	-	0.2	-	-	-	-	-
45	New York[(1)]	NR	0.05	-	0.2	-	-	-	-	-
46	Baltimore[(1)]	NR	0.00	-	0.3	-	-	-	-	-
47	Charleston[(1)]	NR	0.05	-	0.2	-	-	-	-	-
48	Virginia Key[(1)]	NR	0.03	-	0.5	-	-	-	-	-
49	Vigo[(1)]	NR	0.45	-	-	-	-	-	-	-
	RMS			**0.7**		**3.7**		**3.6**		**3.3**

(1) From Baptista et al.[1] and Barkan et al.[3]; (2) From Martínez-Solares[4]; (3) From Gupta and Gahalau[5]; (4) From Lyell[6]; (6) From Dawson and Stewart[7];
NRR=tsunami report but no run-up report.
NR=no tsunami report.
In bold information available in all simulations.
(*) Data not credible.

Supplementary Table 3. Comparison of historically reported tsunami arrival times (T_a) with calculated arrival times from HAT simulation and previous works[1,2,3].

Id	Locality	Historical record	This work		Barkan (Source 8)[3]		Gutscher (GCF)[2]		Baptista (MPF)[1]	
		T_a (min)	T_a (min)	Diff. (min)	T_a (min)	Diff. (min)	T_a (min)	Diff. (min)	T_a (min)	Diff. (min)
1	Bilbao(2)	-	144.6	-	-	-	-	-	-	-
2	Santander(2)	-	133.9	-	-	-	-	-	-	-
3	Vibeiro (Lugo)(2)	-	109.7	-	-	-	-	-	-	-
4	La Coruña(1)	-	106.0	-	-	-	-	-	-	-
5	Baiona(2)	-	76.7	-	-	-	-	-	-	-
6	Porto(1)	-	88.1	-	66-74	-	96.0	-	90.0	-
7	**Figueira da Foz(1)**	**45-50 (±10)**	**84.1**	**34.1**	**54-61**	**7.5**	**83.0**	**33.0**	**53.0**	**3.0**
8	Porto Novo(1)	75 (±25)	60.0	15.0	-	-	-	-	-	-
9	**Lisboa (Oerias)(1)**	**25 (±10)***	**42.0**	**17.0**	**38-43**	**15.5**	**51.0**	**26.0**	**28.0**	**3.0**
10	**Cabo Saõ Vivente(1)**	**16 (±7)**	**23.1**	**7.1**	**21-22**	**5.5**	**22.0**	**6.0**	**25.0**	**9.0**
11	**Huelva (Vila Reial)(1)**	**45 (±10)**	**55.0**	**10.0**	**45-51**	**3.0**	**52.0**	**7.0**	**80.0**	**35.0**
12	**Cadiz(1)**	**78 (±15)**	**69.9**	**8.1**	**50-56**	**25.0**	**36.0**	**42.0**	**70.0**	**8.0**
13	Gibraltar(1)	-	71.6	-	59-66	-	53.0	-	-	-
14	Marbella(2)	-	87.9	-	-	-	-	-	-	-
15	Ceuta(1)	-	76.8	-	-	-	-	-	-	-
16	Tangier(1)	-	62.3	-	54-61	-	54.0	-	-	-
17	**Safi(1)**	**26-34 (±20)***	**61.9**	**27.9**	**37-39**	**4.0**	**55.0**	**21.0**	**75.0**	**41.0**
18	Canary Islands(1)	-	89.0	-	-	-	-	-	-	-
19	**Madeira(1)**	**90 (±15)***	**63.2**	**26.8**	**49-52**	**39.5**	**72.0**	**18.0**	**78.0**	**12.0**
20	**Porto Santo(1)**	**60 (±15)**	**56.3**	**3.7**	**44-47**	**1405.0**	**59.0**	**1.0**	**68.0**	**8.0**
21	Angra (Azores)(1)	102*	136.3	34.3	-	-	-	-	-	-
22	Galway(3)	-	300.1	-	-	-	-	-	-	-
23	Kinsale(4)	-	251.9	-	-	-	-	-	-	-
24	Cork(5)	-	279.7	-	-	-	-	-	-	-
25	Cardiff(5)	-	467.0	-	-	-	-	-	-	-
26	Bristol(5)	-	512.4	-	-	-	-	-	-	-
27	Hartland(5)	-	349.2	-	-	-	-	-	-	-
28	Widemouth Bay(6)	-	341.8	-	-	-	-	-	-	-
29	Mount's Bay(6)	-	269.2	-	-	-	-	-	-	-
30	Penzance(1)	315*	262.6	52.4	-	-	-	-	-	-
31	Newlyn(1)	279	262.6	16.4	-	-	-	-	-	-
32	Plymouth(1)	390	312.3	77.7	-	-	-	-	-	-
33	Cornwall(1)	234	259.6	25.6	-	-	-	-	-	-
34	Newfoundland(1)	-	383.0	-	-	-	-	-	-	-
35	Santiago de Cuba(1)	-	523.1	-	-	-	-	-	-	-
36	Samaná Bay(1)	-	514.0	-	-	-	-	-	-	-
37	St. Matin(1)	-	457.8	-	-	-	-	-	-	-
38	Saba(1)	-	450.4	-	-	-	-	-	-	-
39	Antigua(1)	-	428.5	-	-	-	-	-	-	-

40	Dominica[(1)]	-	436.2	-	-	-	-	-	-	-
41	Barbados[(1)]	473	427.1	45.9	-	-	-	-	-	-
42	Itamaraca[(1)]	-	490.1	-	-	-	-	-	-	-
43	Tamandare[(1)]	-	487.6	-	-	-	-	-	-	-
44	Boston[(1)]	-	610.4	-	-	-	-	-	-	-
45	New York[(1)]	-	579.3	-	-	-	-	-	-	-
46	Baltimore[(1)]	-	725.2	-	-	-	-	-	-	-
47	Charleston[(1)]	-	673.9	-	-	-	-	-	-	-
48	Virginia Key[(1)]	-	605.0	-	-	-	-	-	-	-
49	Vigo[(1)]	-	91.8	-	-	-	-	-	-	-
	RMS			**19.9**		**18.5**		**23.4**		**20.2**

(1) From Baptista et al.[1] and Barkan et al.[3]; (2) From Martínez-Solares[4]; (3) From Gupta and Gahalau[5]; (4) From Lyell[6]; (6) From Dawson and Stewart[7].
In bold information available in all simulations
(*) Data not credible.

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