Response to reviewer Ceren Sozdinler

Major comments:

Comment #1: The most significant revision is needed for the idea of drawing of Euler Circle and defining the fault parameters accordingly. Since it is the basic of all this study, this part should be described more clearly and comprehensively.

Answer #1: In plate kinematics the relative motion between two plates can be described by rotation around an Euler pole. We draw the circle around the Euler pole according to the kinematic global kinematic plate model Nuvel-1A. We chose as fixed plate Africa and as moving plate Eurasia. We draw the circle at the proposed location of the candidate fault at 12.00 W, 35.00 N around the Euler pole at -20.61 W, 21.03 N. The global kinematic plate model computes a relative convergence rate of 3.8 mm per year.

We agree with the referee that more detailed explanation is necessary and adopt the corresponding sections in the manuscript accordingly.

The manuscript in section 2 now reads:
"Kinematic plate models (Argus et al., 1989; DeMets et al. 1999; Nocquet and Calais 2004; Fernandes et al., 2007) show low convergence rates 3 - 5 mm per year between African plates and Eurasia. We used the global kinematic plate model Nuvel-1A. This model is a recalibrated version of the precursor model Nuvel-1 that implements rigid plates and data from plate boundaries such as spreading rates, transform fault azimuths, and earthquake slip vectors (DeMets et al., 1990). The NUVEL 1A model predicts a relatively conservative convergence rate of 3.8 mm per year in the area close to the source area determined by Baptista et al. (2006) for the 1761 tsunami (Fig. 2).

Consequently, we consider a possible fault as an extension of the CPF closest to the area presented by Baptista et al. (2006). We draw the circle around the Euler pole at -20.61 w, 21.03 N according to the plate kinematic model Nuvel 1-A using Mirone suite (Luis 2007). To do this we chose Africa as fixed plate and Eurasia as moving plate and draw the circle at the center of the fault in figure 3. We compute the convergence rate (3.8 mm per year) and plot the tangent velocity vector along the circle (Fig. 3). For this fault, we test different earthquake fault parameters and compute the co-seismic deformation using the Mansinha and Smiley equations (Mansinha and Smiley, 1971). We assume that the initial sea surface elevation mimics the sea bottom deformation and we use it to initiate the tsunami propagation model."

Regarding the definition of the fault plane parameters the manuscript now reads in section 4.2:

"4.2 Testing the hypothesis

In the 20th century, two strong magnitude earthquakes occurred in the Gloria Fault (GF) area. Given this, we tested the compatibility of the tsunami observations in 1761 with the tsunamis produced by the earthquakes of the 25th November 1941 (Lynnes and Ruff, 1985; Baptista et al., 2016) and 26th May 1975 (Kaabouben et al., 2009). We use the fault plane parameters and rupture mechanism presented in Baptista et al. (2016) and Kaabouben et al. (2008) for the 1941 and 1975 events respectively. The fault dimensions and slip were made compatible with an 8.5 magnitude event using the scaling laws proposed by Wells and Coppersmith (1994), Manighetti et al. (2007) and Blaser et al. (2010).
These two events produce less than one-meter wave height in the North East Atlantic and were barely observed in the Caribbean Islands (Baptista et al., 2016; 2017). Moreover, the epicenters of the 25th November 1941 and 26th May 1975 are located outside the area

determined by Baptista et al. (2006). As expected, the TTTs do not agree with those reported in 1761; therefore, we excluded the GF as a candidate source for the 1761 event and do not consider their results for discussion.

The candidate fault area is centered at 12.00 W, 35.00 N to the west of the large NE/SW striking compressive structures (Martinez-Loriente et al., 2013) and 85 km northeast of the epicenter suggested by Baptista et al. (2006) (Fig. 3). Our tests considered the fact that the historical accounts indicate an earthquake and tsunami less violent than 1755. To account for this, we used the fault dimensions presented in table 2 corresponding to a magnitude 8.4-8.5 earthquake (Baptista et al., 2006); consequently, the wave heights in Lisbon and Cadiz are smaller than those observed in the 1755 tsunami (Baptista et al., 1998). The fault dimensions presented in table 2 are compatible with the scaling laws of Wells and Coppersmith (1994), Manighetti et al. (2007) and Blaser et al. (2010).

Hypotheses A and A-MS:

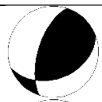
We use a strike angle compatible with the study by Martinez-Loriente et al., (2013) that follows the morphology of the Coral Patch seamount (Fig. 1). The velocity vector predicted by NUVEL 1A (Fig. 3) together with the short periods (4-12 minutes) reported in 1761 (table 1) are in line with the mean dip angle of 40 degrees suggested by Martinez-Loriente et al. (2013) (table 2). We approximate the rake angle according to the difference between the convergence arrow given by the circle around the Euler Pole and the fault plane (Fig. 3).

The wave period in Lisbon produced by this candidate source is close to 30 minutes. This value is not compatible with the observations (Table 1). To solve this problem, we implemented a multi-segment fault here called A-MS. This multi-segment solution consists of four segments each 50 km. The four segments are placed adjacent to each other, and the rupture mechanism is equal for each segment as in hypothesis A with a mean slip of 11m (Table 2). The slip of each segment is presented in table 2. The synthetic waveforms are presented in figure 5 and discussed in sections 5 and 6.

Hypothesis B:

Finally, we test an alternative hypothesis B with a larger strike-slip component compared to hypothesis A. This also results in larger fault length and a steeper dip angle. Here, we consider a rupture along a fault plane rotated about 180° when compared to hypothesis A. To do this, we selected compatible strike and rake angles that results in a sinistral inverse lateral rupture (table 2). The synthetic waveforms are presented in figure 7 and discussed in sections 5 and 6.”

Table 2. The fault dimensions and parameters used herein to investigate candidate sources of 1761 event. We describe hypotheses (Hyp.) A-MS, A and B by the fault parameters length (L), width (W), strike, dip, rake, slip and depth. The slip values for hypothesis A-MS are listed for each segment from west to east. Additionally, we present the moment magnitude (Mag.), the assumed shear modulus (μ) and the focal mechanism.

Scenario	L [km]	W [km]	Strike [°]	Dip [°]	Rake [°]	Slip [m]	Depth [km]	Mag.	μ [Pa]	Focal mechanism
Hyp. A-MS	4 x 50	50	76	40	135	7/15/15/8	10	8.4	$4*10^{10}$	
Hyp. A	200	50	76	40	135	11	10	8.4	$4*10^{10}$	
Hyp. B	280	50	254.5	70	45	15	10	8.5	$4*10^{10}$	

”

Comment #2: The second revision should be for further description of backward ray tracing contours.

This part is not clear to me; further details are needed for the meaning of these contours.

Answer #2: In section 3, paragraph 3 we describe how we obtain the contours in figure 2 and 3. The contours show a tsunami travel time of 7 and 7.5 hours respectively (Fig. 2 and 3). The prosed fault is located within these contours. Baptista et al. (2006) used macro seismic analysis and backward ray tracing and conclude a source area delimited by the orange contours in figure 2. Once the 7 hours contour falls within their proposed area and the observed tsunami travel time was 7 – 8 hours we propose a source in between the 7 h and 7.5 h contours.

We changed the corresponding paragraph in section 3.

The manuscript now reads:
"We assume as in Baptista et al. (1998a, b) that all times are solar time and we re-evaluate the Tsunami Travel Time (TTT) for Barbados. For Barbados, documents report a tsunami arrival at a 4 pm local time. Baptista et al. (2006) concluded for the unreliability of this observation and did not use it for the simulations to locate the source. In this study, we use 3.5 hours solar time difference between Lisbon and Barbados. Using 4 pm local time as stated in Borlase (1762) for the arrival of the tsunami and the 3.5 h solar time difference between Lisbon and Barbados, we conclude a TTT of 7-7.5 h. We place a point source at Barbados and use backward ray tracing and find that the 7 h contour falls within the area presented by Baptista et al. (2006) close to their suggested location (Fig. 1 and 2) at 34.50 N 13.00 W."

Comment #3: The other important revision is necessary for the comparison of observed data with the calculated results. The summary of results for 2 selected hypotheses are given in Tables 3 and 4 but there is no information for the observed wave heights at these locations. Instead, these values are given in Table 1. Table 1 may stay as it is but Table 3 and 4 should also include the observed values in a column for better comparison.

Answer #3: We agree with the referee and changed the tables accordingly.

Tables 3 and 4 now read:

"

Table 3. Results of the VTGs for hypothesis A-MS

Local		VTG coordinates & depth			TTT	Wave height [m]				Polarity	Period
		Lon. [°]	Lat. [°]	d [m]		First	max.	Green's Law	Obs.		
Lisbon		-9.136	38.706	3	~ 1 h 10 min	1.6 m	1.8 m	nesting	1.2 – 1.8 m	D	< 30 min
Cadiz		-6.291	36.524	4	~ 1 h	-0.6 m	2.4 m	nesting	-	D	~ 30 min
Scilly Islands		-06.383	49.85	50	~ 4 h	0.4 m	0.4 m	0.7 m	0.6 – 1.2 m	U	~ 15 min
Mount´s Bay		-05.48	50.08	26	~ 4 h 30 min	0.4 m	0.5 m	0.8 m	1.2 – 1.8 m	U	~ 15 min
Kinsale		-08.500	51.653	28	~ 4 h 15 min	0.1 m	0.5 m	0.8 m	0.6 m	U	< 15 min
Dungarvan		-07.479	51.949	50	~ 5 h	0.1 m	0.3 m	0.5 m	-	U	< 15 min
Madeira	**E**	-16.666	32.750	51	~ 30 min	0.3 m	0.8 m	1.4 m	-	U	~ 30 min
Madeira	**S**	-16.926	32.619	51	~ 40 min	0.2 m	0.4 m	0.7 m	-	U	~ 30 min
Azores		-27.150	38.800	53	~ 2 h	0.5 m	0.7 m	1.3 m	-	U	~ 15 min
Barbados		-59.566	13.033	50	~ 7 h	0.1 m	0.2 m	0.4 m	0.45 – 0.6 m	U	~ 30 min

Table 4. Results of the VTGs for hypothesis B

Local	VTG coordinates & depth			TTT	Wave height [m]				Polarity	Period
	Lon. [°]	Lat. [°]	d [m]		First	max.	Green's Law	Obs.		
Lisbon	-9.136	38.706	3	~ 1 h 15 min	0.9 m	2.2 m	nesting	1.2 – 1.8 m	D	> 30 min
Cadiz	-6.291	36.524	4	~ 1 h	-0.4 m	2.6 m	nesting	-	D	~ 30 min
Scilly Islands	-06.383	49.85	50	< 4 h min	0.4 m	0.5 m	0.9 m	0.6 – 1.2 m	U	~ 15 min

Mount´s Bay		-05.48	50.08	26	~ 4 h 30 min	0.4 m	0.7 m	1 m	1.2 – 1.8 m	U	~ 15 min
Kinsale		-08.500	51.653	28	~ 4 h 15 min	0.2 m	0.6 m	1 m	0.6 m	U	< 15 min
Dungarvan		-07.479	51.949	50	~ 5 h	0.1 m	0.4 m	0.7 m	-	U	< 15 min
Madeira	**E**	-16.666	32.750	51	~ 30 min	0.9 m	1.4 m	2.5 m	-	U	~ 30 min
	S	-16.926	32.619	51	~ 40 min	0.3 m	1.1 m	2.1 m	-	U	~ 30 min
Azores		-27.150	38.800	53	~ 1 h 45 min	0.5 m	2.4 m	4.2 m	-	U	~ 15 min
Barbados		-59.566	13.033	50	~ 7 h	0.1 m	0.6 m	1.1 m	0.45 – 0.6 m	U	~ 30 min

“

Comment #4: Another revision is recommended for giving further details regarding Paleo DEM mentioned on Page 8 very shortly. Since the modeling results may be affected due to such data, it is necessary to make further explanation on how you prepared/used this data and also its difference from the current DEM data.

Answer #4: We agree with the referee and changed the manuscript accordingly.

The manuscript in section 4.1, paragraph 3 now reads:
“In Cadiz, we use the soundings and coastline of historical nautical charts from the 18th century (Bellin, 1762 and Rocque, 1762) to compute a Paleo Digital Elevation Model (PDEM) (Wronna et al., 2017). To do this, we geo-referenced the old nautical charts and use the modern-day DEM (UG-ICN, 2009) to implement the information from the ancient charts. According to Wronna et al. (2017) we systematically remodel the bathymetry and the coastline. “

Minor comments:

Comment #5: - Page 1 Line 14: the phrase “...from Cadiz not used before” is not clear.

Answer #5: We changed the abstract.

The abstract now reads:
“The segment of the Africa-Eurasia plate boundary between the Gloria fault and the Strait of Gibraltar has been the set of significant tsunamigenic earthquakes. However, their precise location and rupture mechanism remains poorly understood. The investigation of each event contributes to a better understanding of the structure of this diffuse plate boundary and ultimately leads to a better evaluation of the seismic and tsunami hazard. The 31st March 1761 event is one of the few known transatlantic tsunamis. Macroseismic data and tsunami travel times were used in previous studies to assess its source area. However, no one discussed the geological source of this event. In this study, we present a reappraisal of tsunami data to show that the observations dataset is compatible with a geological source close to Coral Patch and Ampere seamounts. We constrain the rupture mechanism with plate kinematics and the tectonic setting of the area. This study favors the hypothesis that the 1761 event occurred southwest of the likely location of the 1st November 1755.”

Comment #6: - Page 2 Line 12: what does “we revisit the source...” mean?

Answer #6: We revisit the source of the 1761 earthquake by summarizing the results of earlier studies and include new findings. However, we believe that the manuscript needs some alterations.

We changed this paragraph of the manuscript.

The paragraph on page 2, line 10 now reads:
“In this study, we investigate the geological source of the 1761 transatlantic tsunami. To do this, we start with a reappraisal of previous research on TTT, we analyze the tectonic setting of the area and draw a source compatible with plate kinematics. From this source we compute

the initial sea surface displacement. To propagate the tsunami, we build a bathymetric dataset based on GEBCO (2014) data to compute wave heights offshore the observations points presented in table 1. We also compute inundation using high resolution digital elevations models in Lisbon and Cadiz to compare the results with the observations. Finally, we use Cadiz and Lisbon observations in 1755 and 1761 to compare the size of the events. “

Comment #7: - Page 2 Line 15: Better to say “compared with” instead of “checked against”

Answer #7: Please see **answer #6**.

Comment #8: - Page 6 Line 2: It should be “...did not use it in the simulations...”. “in” is missing.

Answer #8: We corrected the mistake.

The manuscript now reads:
“We use solar times at each observation point as in Baptista et al. (1998). Baptista et al. (2006) concluded for the unreliability of this observation and did not use it in the simulations to locate the source.”

Comment #9: - Page 6 Line 15: Please rephrase the sentence “In a summary by Borlase (1762) summary describes...”

Answer #9: We rephrased the entire section 3.

Section 3, paragraph 5 now reads:
“For Lisbon, the reports state abnormal motion of the sea about 1 hour and 15 minutes after the earthquakes. Two sources (Unknown, 1761 and Molloy, 1761) describe a flowing and ebbing of 8 feet of about six minutes while Borlase (1762) reports only three to four feet. All three reports agree that the agitation lasted until the evening. “

Comment #10: - Page 6 Line 19: better to write 6 pm in numbers

Answer #10: We agree and changed the manuscript accordingly.

The manuscript now reads in section 3, paragraph 7:
“At Scilly Islands, the report states that the sea rose four feet and that the agitation lasted about 2 hours. In Kinsale, the Annual Register (1761) states that at 6 p.m. at low water, ….”

Comment #11: - Page 6 Line 31: In which region are these river estuaries located?

Answer #11: Borlase summary states uncommon motions in the river Sure in Carrick and Waterford and in the river Barrow in Ross. All sites are located in Ireland. However, we delete the sentence because it is not relevant in our study.

Comment #12: - Page 8 Line 8: “...observation points..” instead of “...observations points...”

Answer #12: We corrected the mistake.

Comment #13: - Page 8 Line 25: The message of this sentence is not clear. Further explanation and clarification are needed.

Answer #13: We agree and rephrased the sentence.

The sentence now reads:
“We considered the fact that the historical accounts indicate an earthquake and tsunami less violent than the 1755.”

Comment #14: - Page 9: The first paragraph is a bit irrelevant with the previous and following ones. Better to link this paragraph with the previous one.

> **Answer #14:** We believe it is worth to explain in the beginning of the results section how the section is structured and maintain the paragraph in the manuscript.

Comment #15: - Page 9 Line 11: Better to say "...Figures from 4 to 7 present ..." without using comma

> **Answer #15:** We deleted the comma.

Comment #16: - Page 9 Line 14: Please rephrase the sentence "The geographical coordinates and depths their coordinates and depth are given..."

> **Answer #16:** We rephrased the sentences.
>
> The sentence now reads:
> "The geographical coordinates and depths of the VTGs are given in tables 3 and 4."

Comment #17: - Page 10 Line 2: Please don't use comma after 5

> **Answer #17:** We deleted the comma.

Comment #18: - Page 10 Line 9: "... heights reach up to 1.7m"

> **Answer #18:** We rephrased section 5.1.
>
> The sentence now reads:
> "In Great Britain, at the Scilly Islands and Mount´s Bay maximum wave heights vary between 1.7 and 1.9 m."

Comment #19: - Page 11 Line 11: better to use "leading elevation wave" instead of " an upward movement"

> **Answer #19:** We adopted the manuscript according to the referees' suggestion.
>
> The sentence now reads:
> "All VTGs in northern Europe recorded the first wave as leading elevation wave (Fig. 5 (b))."

Comments on Figures and Tables:

Comment #20: - Figure 1: Who suggested the other 2 epicenters of 1761 eq, except Baptista etal (2006)? Are they the ones also shown in Figure 2? If yes, then it is better to write them in Figure 1. Also, what are the lines with small black triangles represent in the zoomed-in map? It was not indicated in the legend.

> **Answer #20:** We agree and include the information in figure 1. We also complete the information in the figure caption and legend.
>
> Please see the change in figure 1.
> "

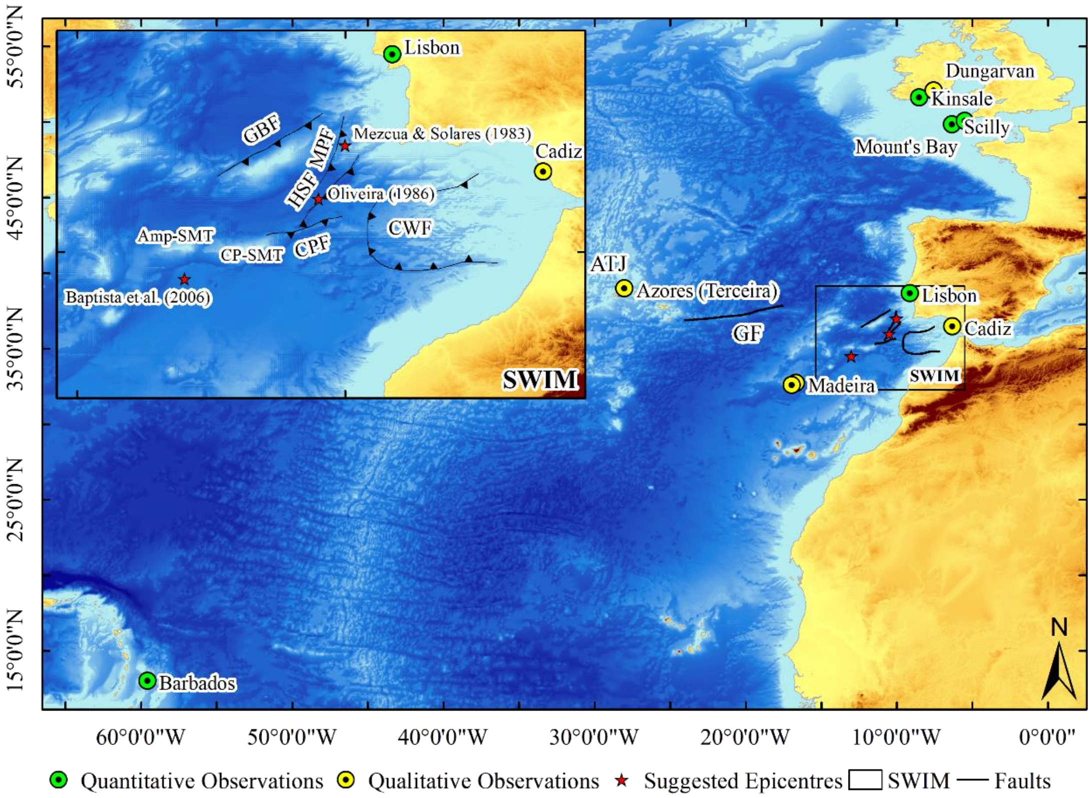


Figure 1. Source location by Baptista et al. (2006) and the tsunami observation points of the tsunami in 1761. The main features of the Azores Gibraltar fracture zone are the Azores Triple Junction (ATJ), the Gloria Fault (GF) and the Southwest Iberian Margin (SWIM). The inset shows the position of the Ampere seamount (Amp-SMT), the Coral Patch Seamount (CP-SMT) and the locations of the known faults. The black lines mark the faults, and the triangles indicate the direction of dip. The known faults are the Coral Patch Fault (CPF), the Cadiz Wedge Fault (CWF), the Gorringe Bank fault (GBF), the Horseshoe Fault (HSF) and the Marques de Pombal Fault (MPF).

"

Comment #21: - Figure 2: In the caption, better to write "backward ray tracing" instead of "back ray.."

Answer #21: We changed the figure caption as suggested.

Comment #22: - The plots in (b) and (c) of Figures 5 and 7 are not visible! They can be plotted with longer x-axis or separately one under the other with shorter y-axis.

Answer #22: We agree and changed figures 5 and 7.

Figures 5 and 7 read now:

"

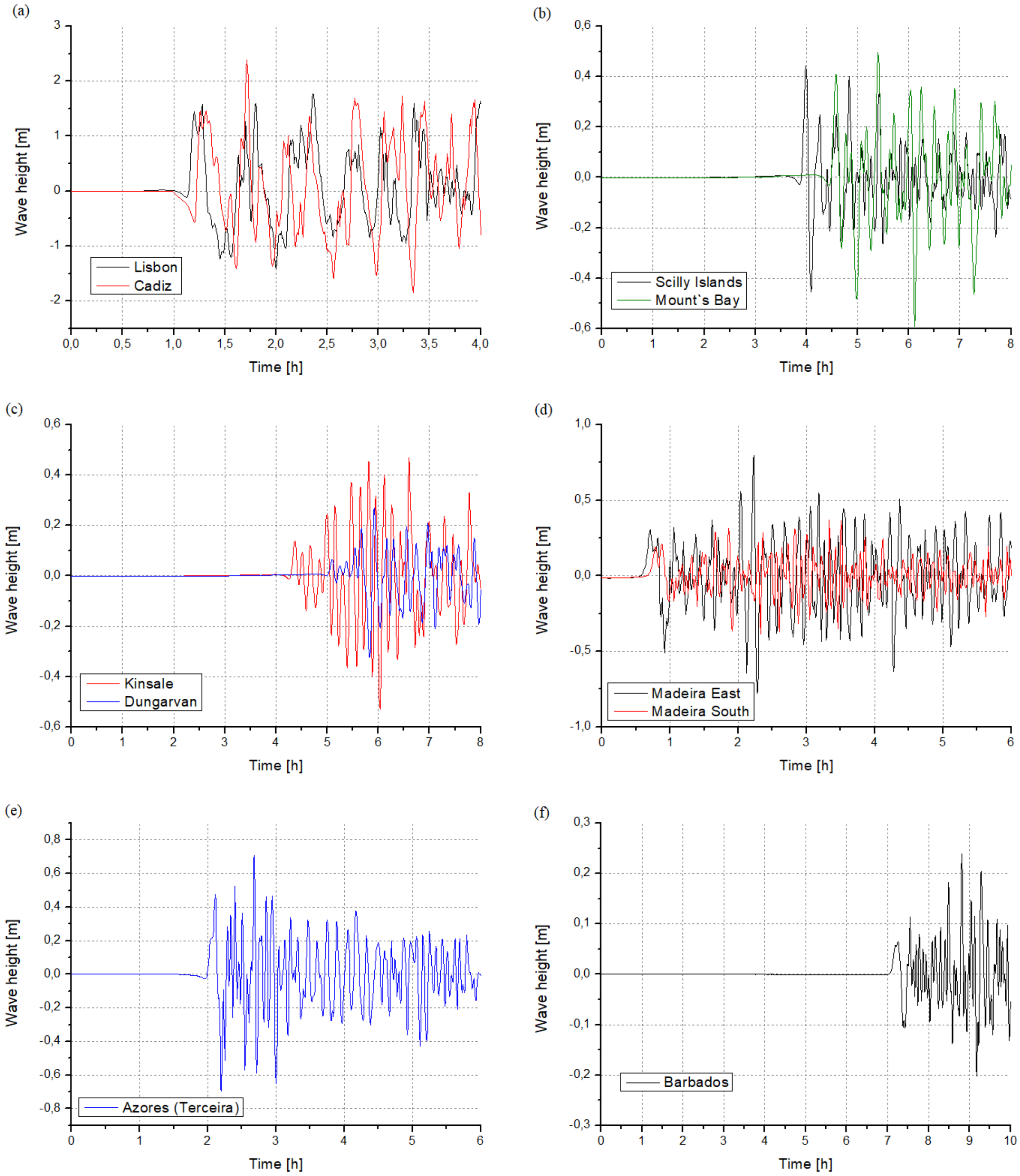


Figure 5. VTG records for hypothesis A-MS at the coordinates of the locations presented in table 3.

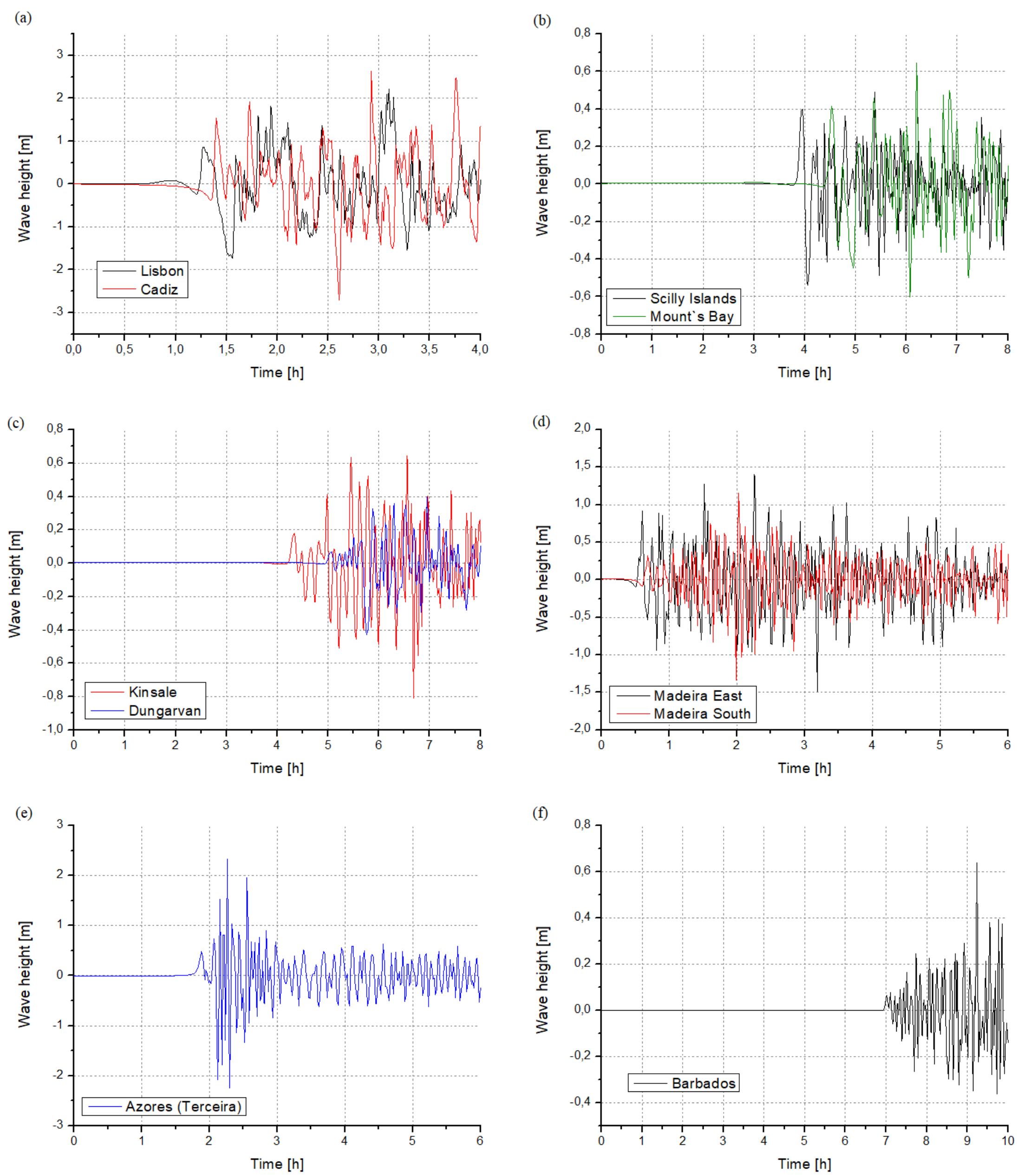


Figure 7. VTG records for hypothesis B at the coordinates of the locations presented in table 4.

"

Comment #23: - Tables 3 and 4 should include historical tsunami observations at these locations in a different column.

Answer #23: We agree and introduced and additional column. Please see **answer #3**.

Comment #24: - Page 13 Line 4: better to use "withdraw" instead of "downward movement"; "occurs" instead of "arrives"

Answer #24: We changed the manuscript according to the suggestion.

Comment #25: - Page 13 Line 5: better to use "water surface elevation" instead of "upward movement"

Answer #25: We agree and adapted the manuscript according to the suggestion.

Comment #26: - Page 13 Line 6: “wave ascending” instead of “upward movement”

Answer #26: We rephrased the sentence.

The manuscript now reads:
“The first wave reaches 0.4 m, arriving close to 4 h after the earthquake.**”**

Comment #27: - Page 13 Line 7: “... waveform shows around 15 minutes wave period.”

Answer #27: We agree and adapted the manuscript according to the suggestion.

Comment #28: - Page 13 Line 8: something missing here “... wave arrives at the ____ after 4 hours..”

Answer #28: We rephrased the sentence.

The manuscript now reads:
“In Mount`s Bay, the first wave of 0.4 m arrives after 4 hours and 30 minutes with a 15-minute period.”

Comment #29: - Page 13 Line 8: “... 15-minute period and 0.6m wave height” is better

Answer #29: We agree and rephrased the paragraph in section 5.

The paragraph now reads:
“The maximum wave heights at the Scilly Islands is 0.5 m (Fig. 7 (b)). The first wave reaches 0.4 m, arriving close to 4 h after the earthquake. The synthetic tsunami waveform shows around 15-minute wave period. In Mount`s Bay, the first wave of 0.4 m arrives after 4 hours and 30 minutes with a 15-minute wave period. Here, the maximum wave height, 0.7 m, comes more than 6 hours after the earthquake. In Kinsale, hypothesis B produces a maximum wave height of 0.6 m. The first wave of 0.2 m wave height in the VTG arrives after 4 hours and 15 minutes of tsunami propagation; here, the period is shorter than 15 min (Fig. 7 (c)).”

Comment #30: - Page 15 Line 9: Better to use word “delays or time difference” instead of “error”

Answer #30: We agree and changed the manuscript accordingly.

The manuscript now reads:
“Our tests produce a set of TTTs compatible with the observations with a 15-minute delay in the near-field and 30-minute delay in the far-field. These differences are acceptable considering that the location of the observation point is unknown.”

Comment #31: - Page 15 Line 19: Please rephrase the sentence starting with “Our source ...”

Answer #31: We rephrased the corresponding paragraphs in section 6.

The manuscript now reads in section 6:
“Our tests produce a set of TTTs compatible with the observations with a 15-minute delay in the near-field and 30-minute delay in the far-field. These differences are acceptable considering that the location of the observation point is unknown. These results are valid for A, B and A-MS as the locations are similar. Tables 3 and 4 show that the predicted travel times are compatible with a source located in the area of the Coral Patch.
Any source located in the Northeast Atlantic south of the Scilly islands produces a shorter tsunami travel time to Scilly island than Mount’s Bay. The 6 hours TTT reported in Kinsale contradicts the 4 hours TTT reported for Dungarvan (Fig. 1). On the other hand, the tsunami

travel times predicted by our numerical simulation are consistent with their relative geographical position."

Comment #32: - Page 16 Line 20: Please rephrase this sentence; it is not clear.

Answer #32: We rephrased section 6.

The corresponding paragraph now reads:
"The tidal range in Barbados is about 1 m. This small range might favor the observability of small first waves at tsunami arrival. For source A, the first wave in Barbados is about 0.1 m which raises the question if people might have noticed the advance of the sea. Close to 9 o'clock 2 hours after tsunami arrival, the peak at the VTG is higher than 0.2 m which results in 0.4 m when estimating the wave height applying the Green's Law for 5 m depth close to the shore. The coeval sources report similar wave height values."

Comment #33: -The following references are not listed in the reference list:
- Gutenberg and Richter (1949)
- Moreira (1984)
- DeMets etal (1990)

Answer #33: We included the missing references.