JANUARY – FEBRUARY 2025 AEGEAN SEA EARTHQUAKE STORM AND POTENTIAL TSUNAMI

Ahmet Cevdet Yalciner[a], Gözde Güney Doğan[a,b], Setenay Pakize Özaslan[a], Bilge Karakütük[a], Arda Özacar[c]

[a]*Middle East Technical University, Department of Civil Engineering, Coastal and Marine Engineering Division, Türkiye*
[b]*Delft University of Technology, Department of Hydraulic Engineering, Netherlands*
[c]*Middle East Technical University, Department of Geological Engineering, Türkiye*
Contact: yalciner@metu.edu.tr

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Since January 26, 2025, there has been a significant increase in seismic activity in a 2500 km² area northeast of Santorini Island. According to data from the National Observatory of Athens (NOA), more than 1,200 earthquakes with magnitudes between 1.0 ≤ M ≤ 5.2 occurred between January 25 and February 7, 2025 (10:00 TS). Among these, 129 had magnitudes of M ≥ 4.0, with the largest recorded at M 5.2. Most earthquakes had focal depths between 10 and 15 km.

Historical records indicate that Santorini experienced a massive volcanic eruption in the Late Bronze Age, leading to a caldera collapse and generating a tsunami that impacted the Eastern Mediterranean. Between 496 BC and 1949 AD, over 20 moderate earthquakes occurred in the region, with those in 1389, 1856, 1866, 1881, and 1949 producing tsunamis. Volcanic activities that occurred in 1707-1711, 1866-1870 and 2011-2012 indicate the active geodynamic structure of the region.

Previous studies indicate that the active fault systems in the region are also linked to volcanic processes (Dimitriadis et al., 2009). Following one of the largest recorded earthquakes in the area, the 1956 Amorgos Earthquake (M 7.7), tsunami waves approximately 2.5 meters high were observed on Kalymnos Island, with flooding extending about 1.5 km inland. Significant material damage was also reported on the islands of Ios, Nisyros, Patnos, Tilos and Lipsos. Along the Fethiye coast, tsunami waves reached approximately 1 meter, with a flooding extent of about 250 meters (KRDAE, 2025).

On the morning of July 9, 1956 (03:11:38 GMT and 03:24:05 GMT), two powerful shocks (Mw >7.4) occurred within 13 minutes interval in the region between Santorini (Thera), Amorgos, and Astypalaea islands, causing destruction across the Aegean islands and resulting in approximately 250 fatalities. The tsunamis triggered by these earthquakes caused damage to 80 boats in the Aegean islands (Yalciner ve Çakır, 2002, 2006).

The ongoing earthquake storm in the region has formed a large NE-SW trending cluster east of Anydros Island (Figure 1a). The calculated focal mechanisms indicate normal faulting with vertical motion. The focal mechanisms of earthquakes with magnitudes M ≥ 5.0 are presented in Figure 1a. Additionally, using its local seismic network, the Seismological Laboratory of the University of Athens has determined the locations of smaller earthquakes, providing a more precise spatial distribution of seismic events (Figure 1b).

The high-precision earthquake locations indicate that the current seismic activity is occurring within the Anydros Rise (Anydros Horst), situated between the NW-dipping Anydros Fault and the SE-dipping Santorini-Anafi Fault. Analyzing the temporal variations in earthquake magnitudes and frequency, it is observed that earthquake magnitudes increased during the early phase of the swarm but have stabilized in recent days (Figure 1c and 1d). The increase in earthquake magnitudes and the swarm-like nature of seismic activity suggest that these events may have been triggered by active volcanic processes. The high non-double-couple component observed in the focal mechanism of the first M ≥ 5.0 earthquake is consistent with volcanic triggering. However, further detailed studies are needed to confirm this hypothesis (Figure 1a).

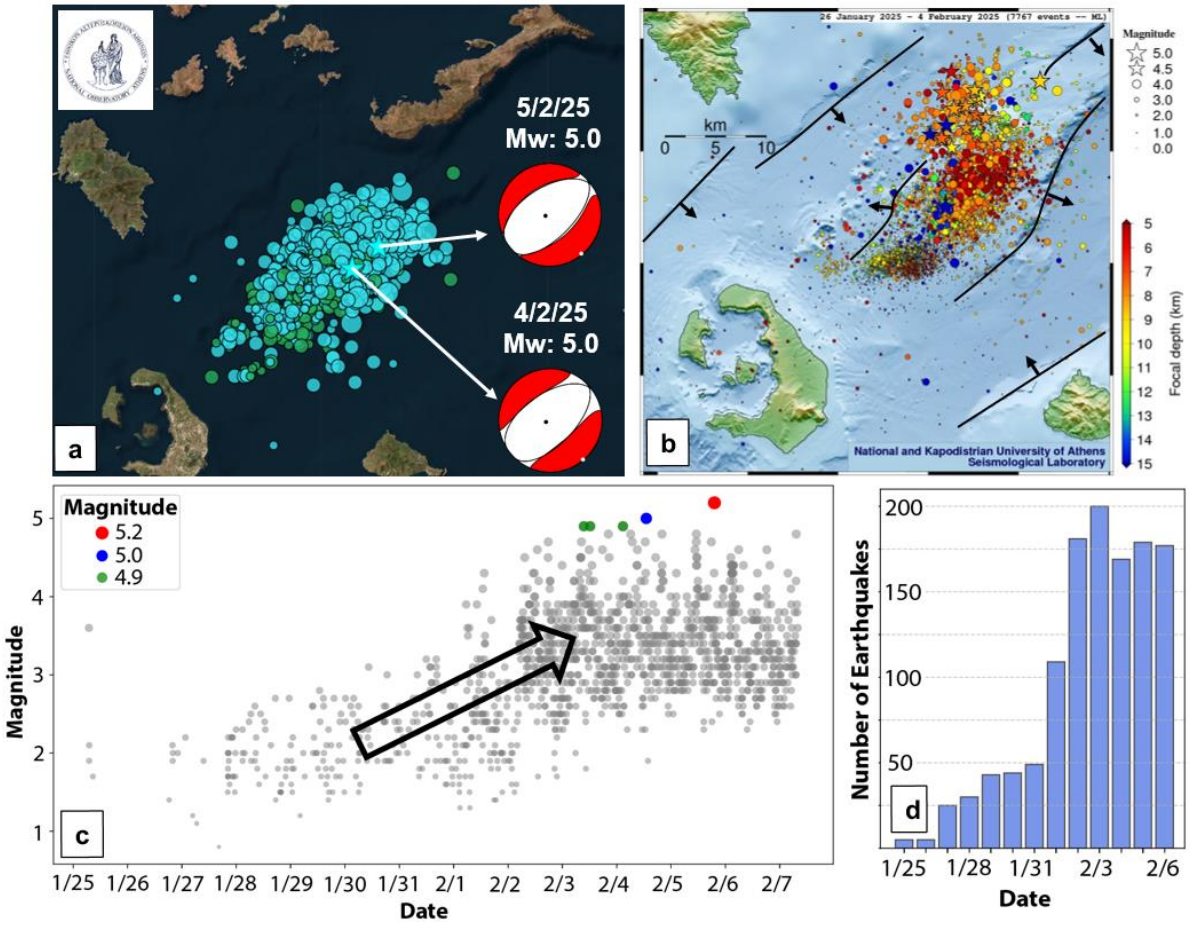


Figure 1: Earthquake distributions of the Aegean Sea Earthquake Storm and focal mechanisms of earthquakes with M ≥ 5, obtained from the National Observatory of Athens (NOA) (a) and the Seismology Laboratory of the University of Athens (b). Active faults are represented by black lines, while the subsiding block is indicated by arrows. Temporal distributions of earthquake magnitudes (c) and numbers (d) recorded by NOA. Earthquake magnitudes increasing over time are shown with a hollow arrow.

The Santorini volcano and the Kolumbo submarine volcano in the region are exhibiting intense activity, and numerous active faults that intersect or are adjacent to these volcanoes have been mapped (Figure 2). Consequently, two possible explanations for the current seismic activity emerge: these earthquakes may be linked to the formation process of a developing submarine volcano, or they could be the result of ongoing tectonic activity in the region (DEU IMST, 2025). Figure 2 presents the detailed bathymetry of the area (Nomikou vd. 2018) along with major active faults. Most of the recent earthquakes have occurred in the Anhydros Horst, a complex bathymetric high, and do not align well with the mapped normal faults. It is still unclear whether these earthquakes are foreshocks of a larger seismic event. However, the Amorgos Fault, which ruptured during the twin earthquakes of 1956, generated a tsunami that caused damage along the Turkish coast (Yalciner ve Çakır, 2002 and 2006). Considering the fault dimensions, the Santorini-Anafi Fault, located next to the current earthquake activity, can produce a tsunamigenic large magnitude earthquake (M > 6.5). Additionally, it is possible that a major earthquake on these active faults could trigger underwater landslides and produce a more destructive tsunami.

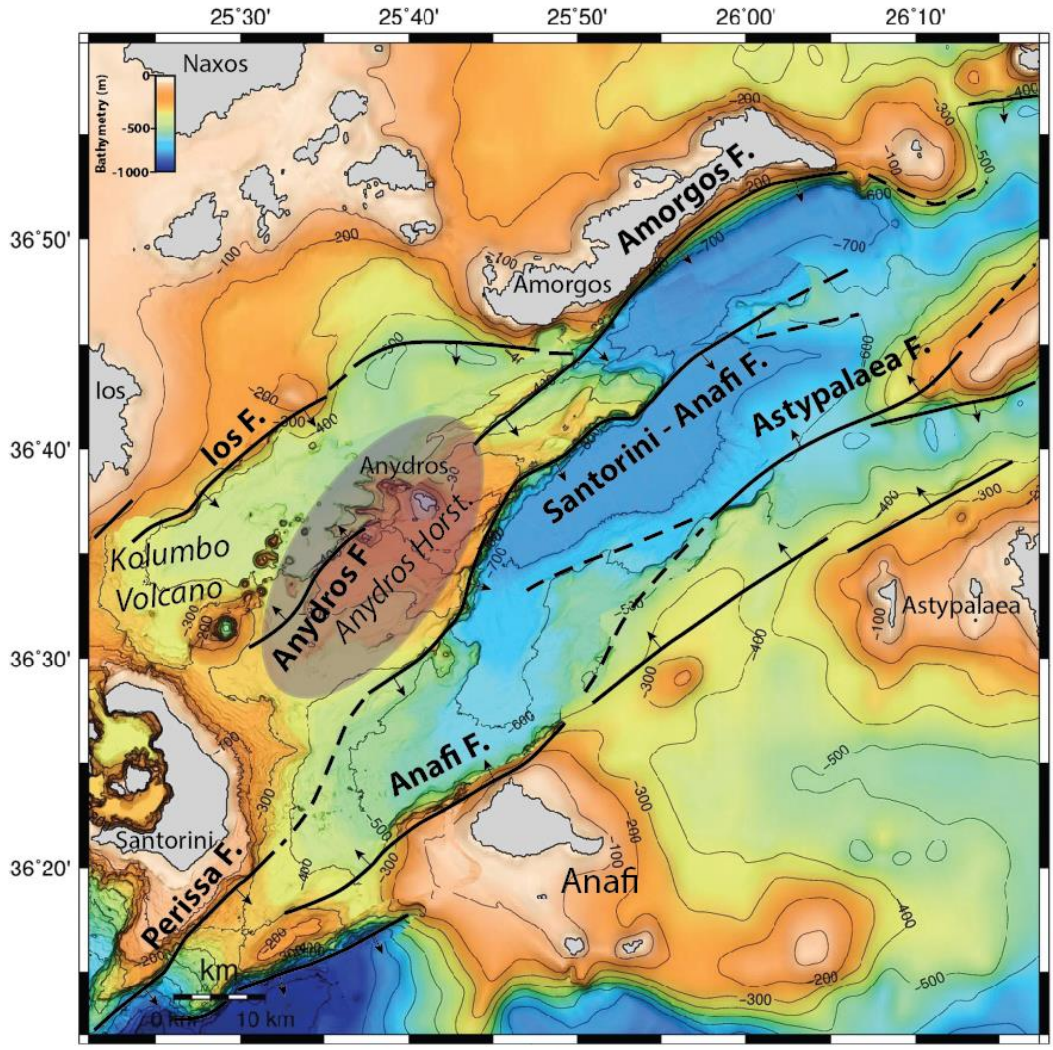


Figure 2: Map of earthquake storm region showing the bathymetry and main active faults (modified from Nomikou et al. 2018). The region where the earthquakes are concentrated is shown with a gray ellipse.

According to seismic and bathymetric studies carried out in the region, it is thought that the Kolumbo underwater volcano, located just west of the earthquake storm, became active in 1650 and that the pressure change caused by the movement of volcanic sediments accumulated on its slopes triggered a powerful explosion and created devastating tsunamis (Karstens vd. 2023a). In addition, it has been determined that the pyroclastic flows that occurred during the Minoan volcanic eruption in Santorini (Late Bronze Age), along with the subsequent caldera formation and collapse, also caused landslides on the volcano slopes and generated destructive tsunamis (Karstens vd. 2023b). In summary, new eruptions and related underwater landslides that may occur in the region's volcanoes also have the potential to produce destructive tsunamis.

The recorded seismic activity between the islands of Santorini, Amorgos, Astypalaea, and Anafi shows the ongoing possibility of tsunami generation in the region. Due to the increasing seismic activity in the region, scientific investigation of tsunami generation in the Aegean Sea due to seismic or volcanic mechanisms is important in order to be prepared for future tsunami events in the region. Considering the ongoing earthquakes in the Aegean Sea as of February 9, 2025, related volcanic mechanisms, and the potential for triggering submarine landslides, it would be beneficial to develop different tsunami scenarios and investigate their possible coastal effects by using numerical modeling.

This study aims to investigate the propagation of the selected tsunami scenarios (generated by seismic, volcanic or submarine landslide mechanisms) in the region bounded by Santorini-Amorgos-Astypalaea-Anafi islands and the Santorini-Kolumbo volcanos region by numerical modeling.

In this study NAMI DANCE tsunami numerical code that solves the nonlinear shallow water equations according to the initial water surface and velocity fields is utilized. Based on the vast validation of NAMI DANCE model, the nearshore amplification process of tsunami waves has already been satisfied, including harbor resonance. Dogan et al., 2021a, 2021b and 2021c; Yalciner and Zaytsev, 2017; Yalciner, Zaytsev, Yalciner, (2017), Lynett et al., 2017 are some of the papers that present the capability of NAMI DANCE model in properly representing the tsunami numerical modeling and computation of the tsunami propagation and nearshore amplification process due to bathymetry and topography applied in various tsunami events.

The bathymetric and topographic database created within the scope of the TÜBİTAK 121M751 Project was used for the numerical modeling study. In the modeling 250 m resolution bathymetry/topography database covering the whole Aegean Sea is created using the open source database EMODnet (https://emodnet.ec.europa.eu/en/bathymetry, ~115 m resolution) and ASTER digital elevation model (https://asterweb.jpl.nasa.gov/gdem.asp, ~30m resolution) data sets. The bathymetry of the Aegean Sea used in the numerical modeling is given in Figure 3. The brief information on the selected tsunami scenarios is summarized in Table 1.

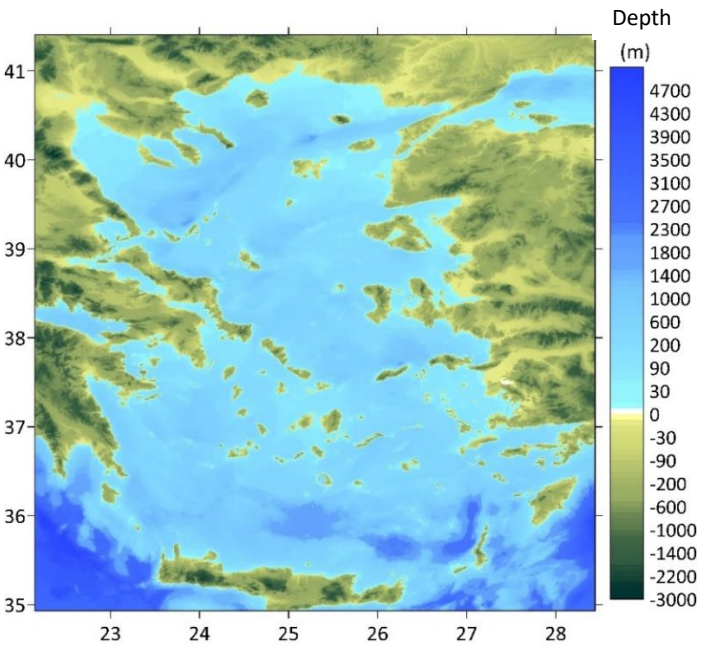


Figure 3: Map of the Aegean Sea bathymetry/topography used in the model

Table 1: Selected Tsunami Scenarios

Scenario No	Case Study Considered	Tsunami Source Mechanism
Scenario 1	1956 Amorgos earthquake and tsunami event	Past earthquake (1956) Table 2
Scenario 2	Potential Santorini-Anafi earthquake and tsunami (Dr. Arda Ozacar)	Potential earthquake Table 3
Scenario 3	Potential Landslide on Outer Slopes of Santorini Island	Potential landslide at North Outer Slopes of Santorini
Scenario 4	Late Bronze Age Eruption of Santorini Island	BC 1630 Past Eruption and Caldera Collapse of Santorini (10 km Diameter -450m collapse)
Scenario 5	Potential Kolumbo Submarine Volcano Explosion (Ulvrova et al. 2016) Explosive Energy: 3*10^14 – 5.4*10^16 Joules • **Scenario 5a:** Explosive Energy: 3*10^14 Joules, Diameter: 0.4 km • **Scenario 5b:** Explosive Energy: 5*10^15 Joules, Diameter: 1.0 km • **Scenario 5c:** Explosive Energy: 5.4*10^16 Joules, Diameter: 2.0 km	Potential (submarine) explosion - Kolumbo

The selected fault parameters for earthquake sources in Scenario 1 and Scenario 2 are shown in Table 2 and Table 3.

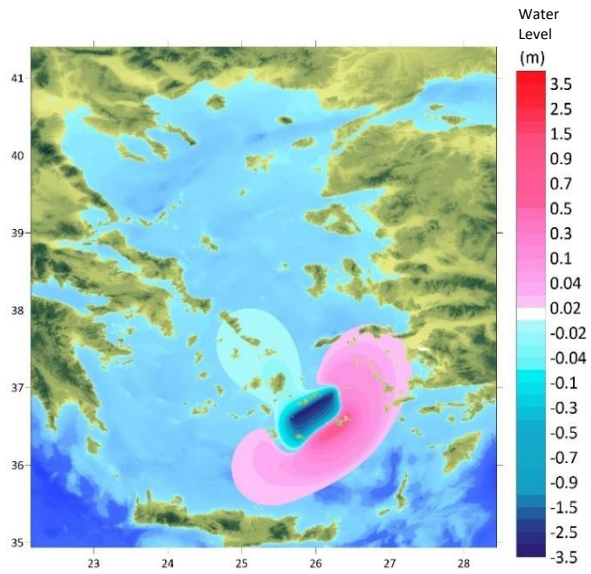
Table 2: Selected Fault Parameters for the 1956 Amorgos Earthquake Source

Source Parameters	Values
Geographic Coordinate (Longitude, Latitude)	25,66 – 36,6
Length (km)	75
Width (km)	40
Strike Angles (degree - clockwise)	60
Focal Depth (km)	5
Dip Angle (degree - clockwise)	25
Rake Angle (degree - clockwise)	246
Displacement (m)	7

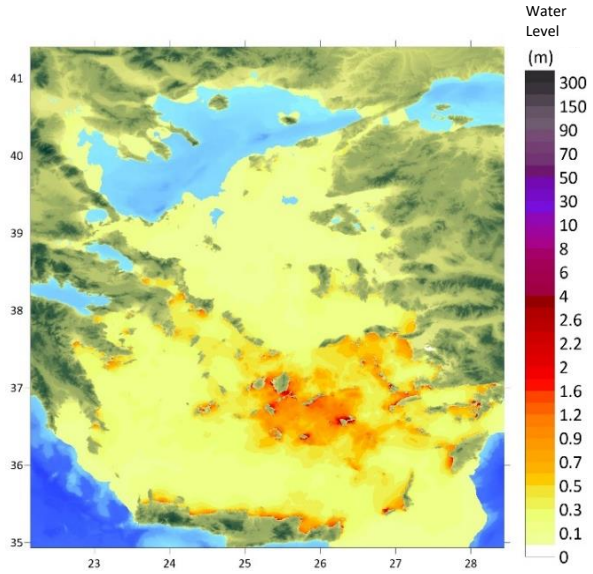
Table 3: Selected Fault Parameters for Potential Santorini-Anafi Earthquake Source

Source Parameters	Values
Geographic Coordinate (Longitude, Latitude)	25,73 – 36,53
Length (km)	90
Width (km)	30
Strike Angles (degree - clockwise)	50
Focal Depth (km)	5
Dip Angle (degree - clockwise)	40
Rake Angle (degree - clockwise)	270
Displacement (m)	5

The six-hour tsunami simulations have been conducted for the selected scenarios, and the tsunami sources (initial water elevations) and distributions of the computed maximum water elevations as a result of the simulations are presented in Figures 4-10, respectively. Detailed scenario results are tabulated in Tables 5, 6, and 7.

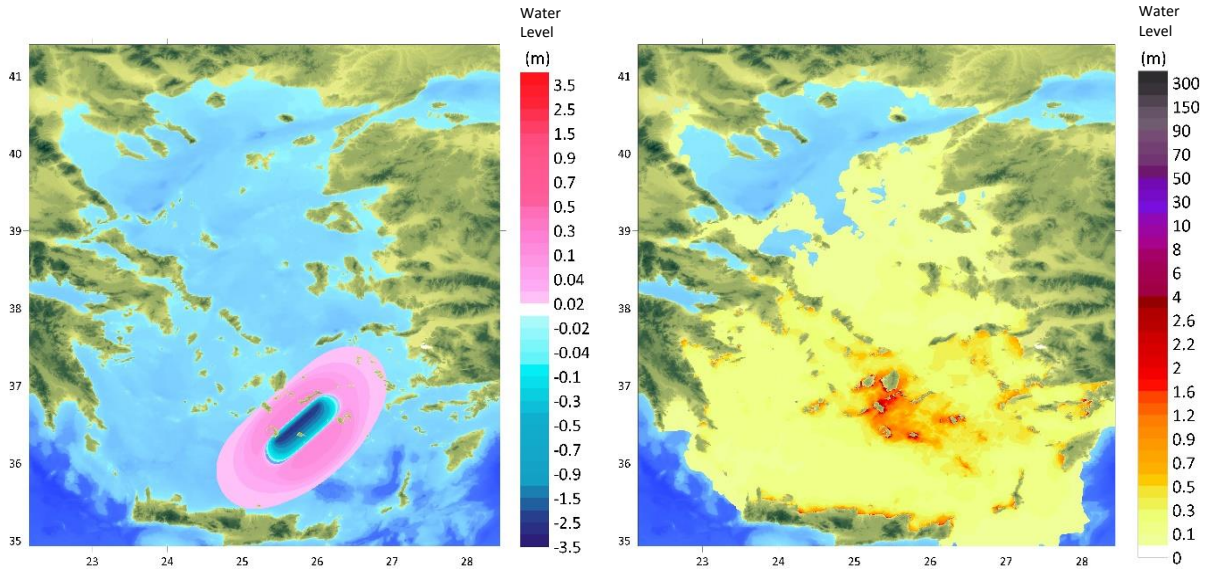


(a)



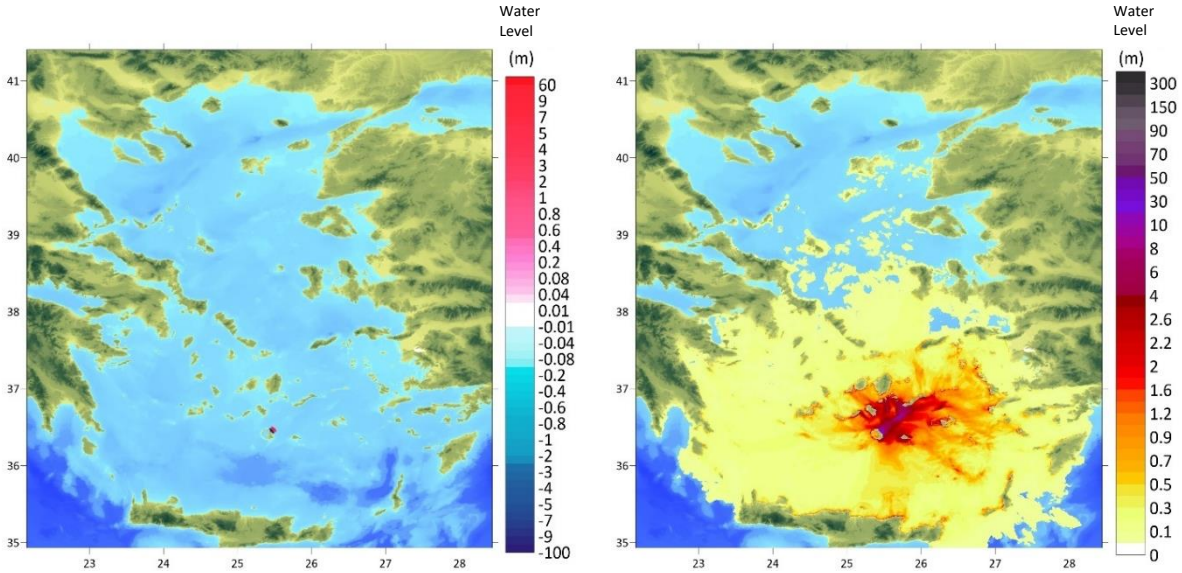
(b)

Figure 4: a. Initial sea surface displacement b. Distribution of maximum sea level computed during the 6-hour simulation of Scenario 1



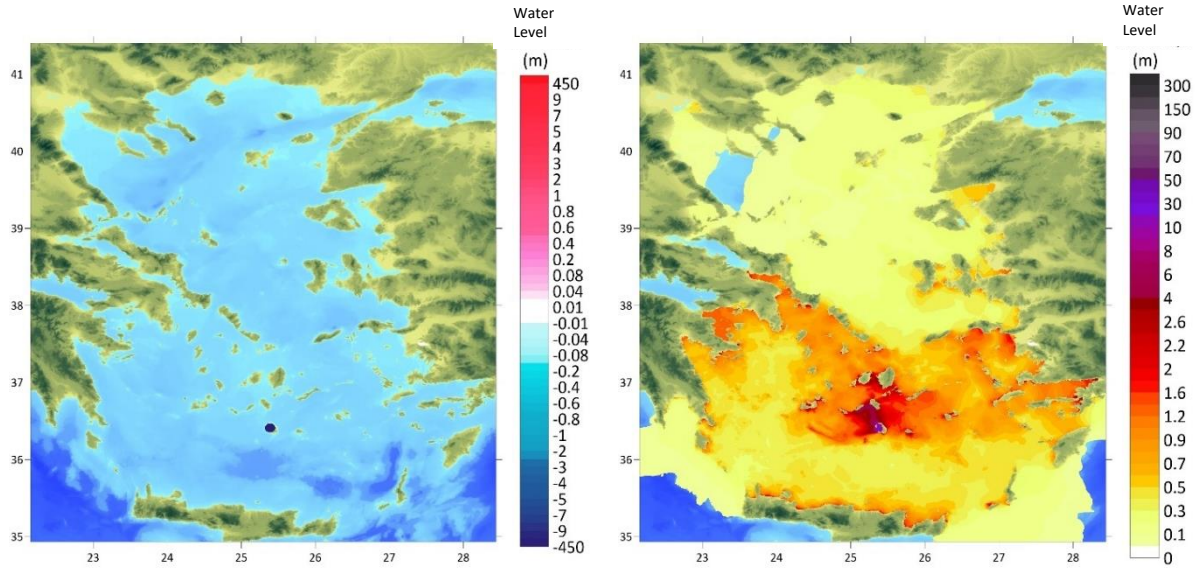
(a) (b)

Figure 5: a. Initial sea surface displacement b. Distribution of maximum sea level computed during the 6-hour simulation of Scenario 2



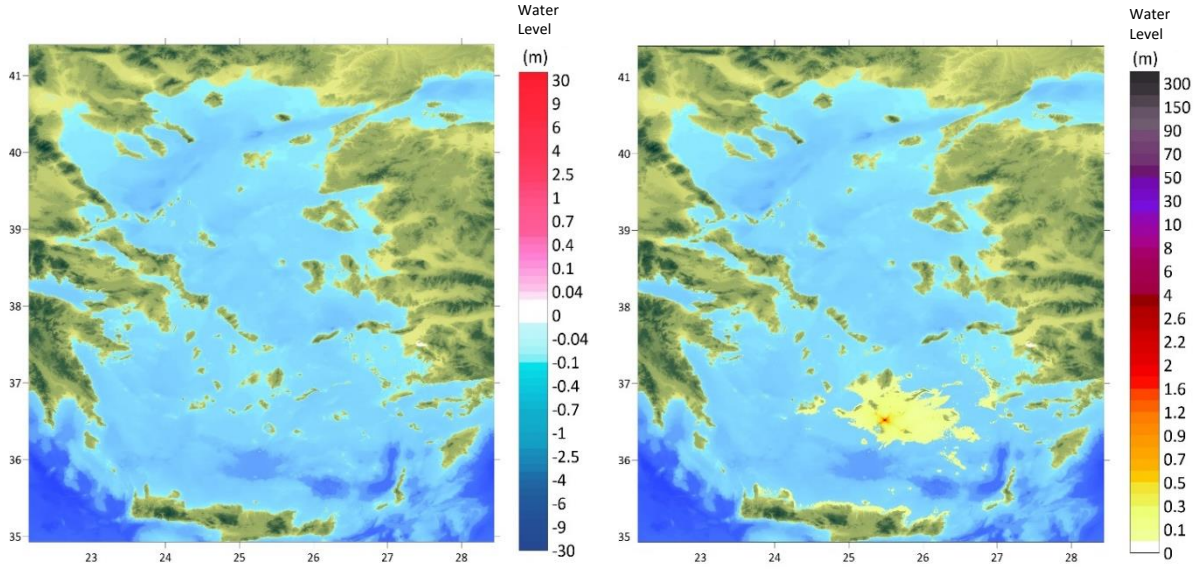
(a) (b)

Figure 6: a. Initial sea surface displacement b. Distribution of maximum sea level computed during the 6-hour simulation of Scenario 3



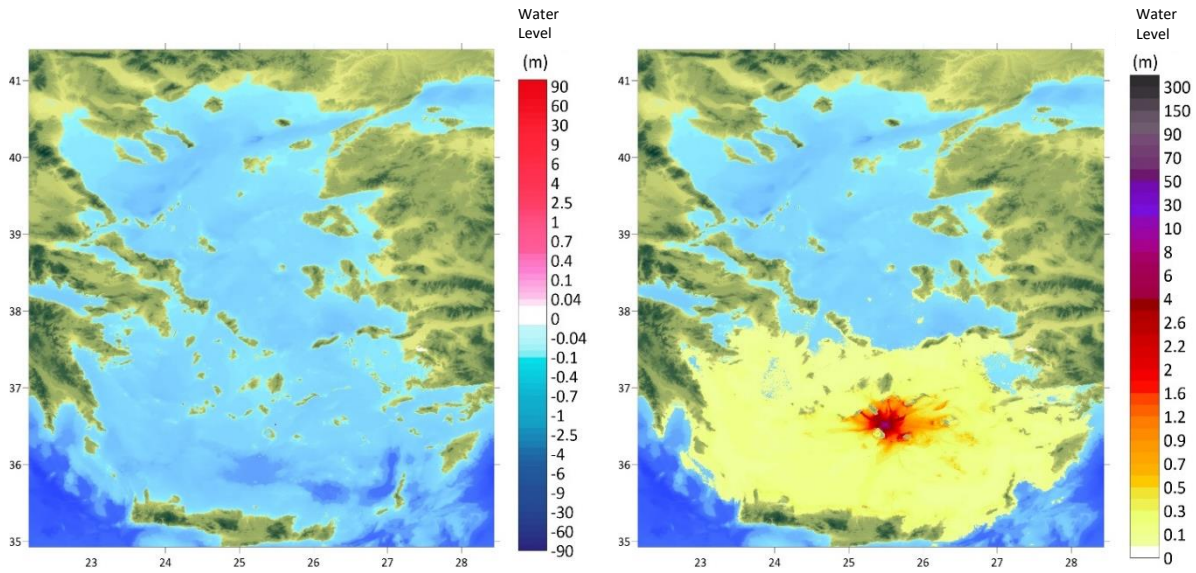
(a) (b)

Figure 7: a. Initial sea surface displacement b. Distribution of maximum sea level computed during the 6-hour simulation of Scenario 4



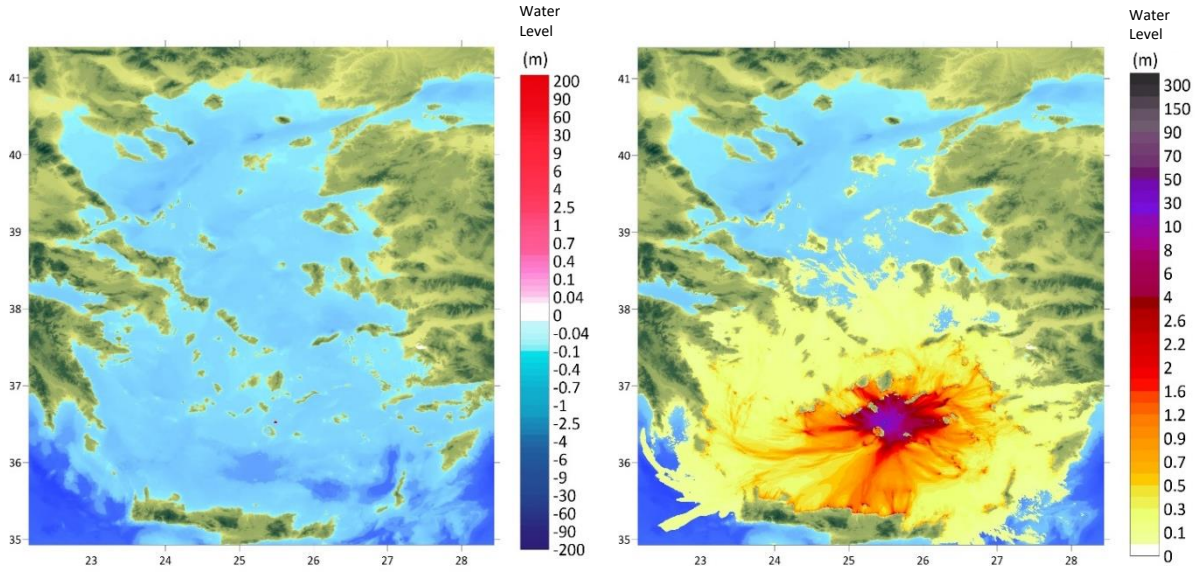
(a) (b)

Figure 8: a. Initial sea surface displacement b. Distribution of maximum sea level computed during the 6-hour simulation of Scenario 5a



(a) (b)

Figure 9: a. Initial sea surface displacement b. Distribution of maximum sea level computed during the 6-hour simulation of Scenario 5b



(a) (b)

Figure 10: a. Initial sea surface displacement b. Distribution of maximum sea level computed during the 6-hour simulation of Scenario 5c

The time histories of computed water elevations at 19 selected numerical gauges (Table 4 and Figure 11) for five different tsunami scenarios are presented in Figures 12-23. The distributions of the first tsunami arrival time computed for the simulation of the 1956 Amorgos tsunami (Scenario 1) and potential Kolumbo volcano explosion (Scenario 5c) are presented in Figures 24 and 25.

Table 4: List and Coordinates of the Selected Numerical Gauges for Time History Plots

No	Numerical Observation Point	Longitude (º)	Latitude (º)	Water Depth
1	Cesme	26.2973	38.3249	1.1
2	Alacati	26.3881	38.2564	0.8
3	Sigacik	26.7851	38.1971	0.7
4	Kusadasi	27.2499	37.823	2.7
5	Didim-1	27.2034	37.4883	0.2
6	Didim-2	27.1902	37.3534	1.9
7	Gulluk-Bogazici	27.5708	37.2143	1.6
8	Bodrum	27.4284	37.028	3.5
9	Turgutreis	27.2544	37	1.1
10	Orhaniye	28.1163	36.7747	4.1
11	Oren	27.9797	37.0277	1.2
12	Gokova	28.3255	37.0438	6.4

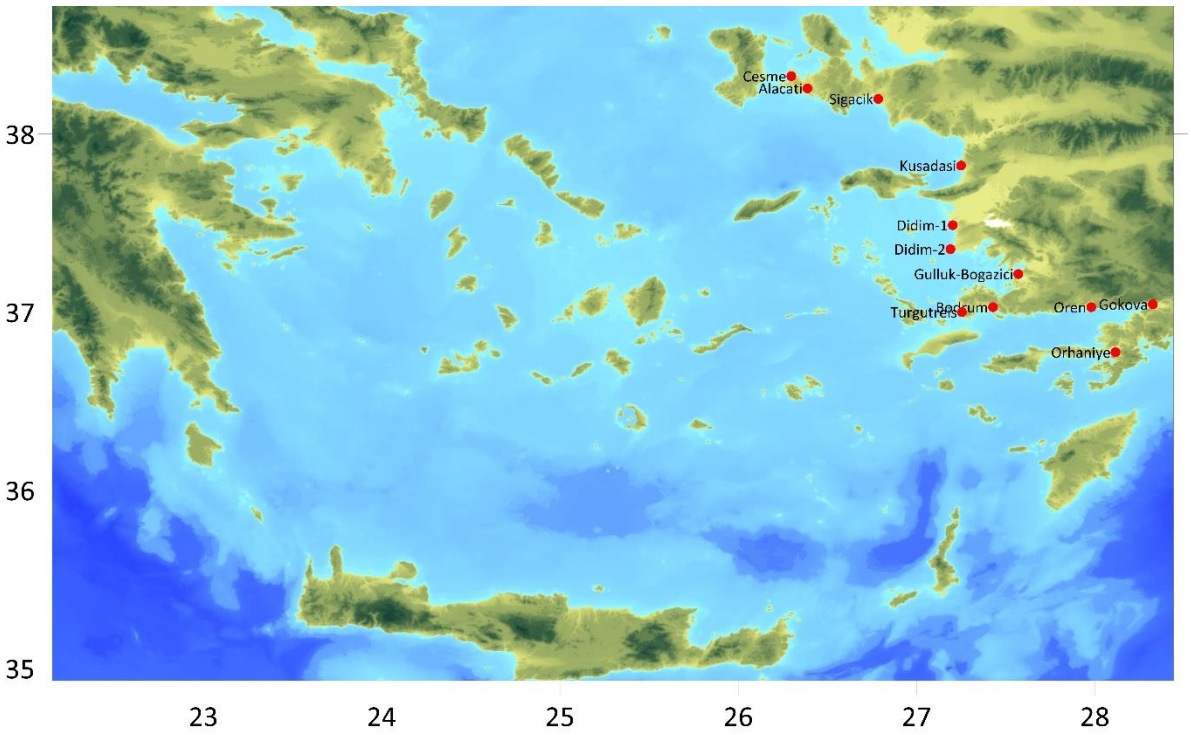


Figure 11: Locations of Selected Numerical Gauges for Time History Plots

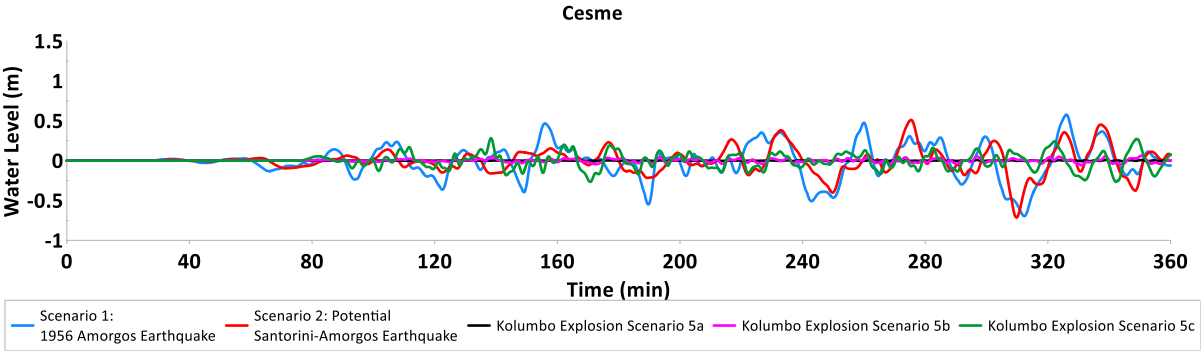


Figure 12: Time series of Computed Water Elevations in Cesme for 5 Different Scenarios

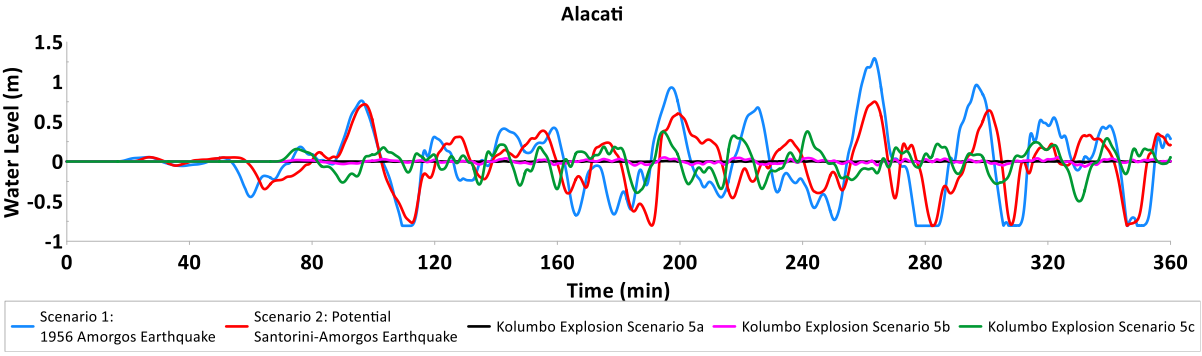


Figure 13: Time series of Computed Water Elevations in Alacati for 5 Different Scenarios

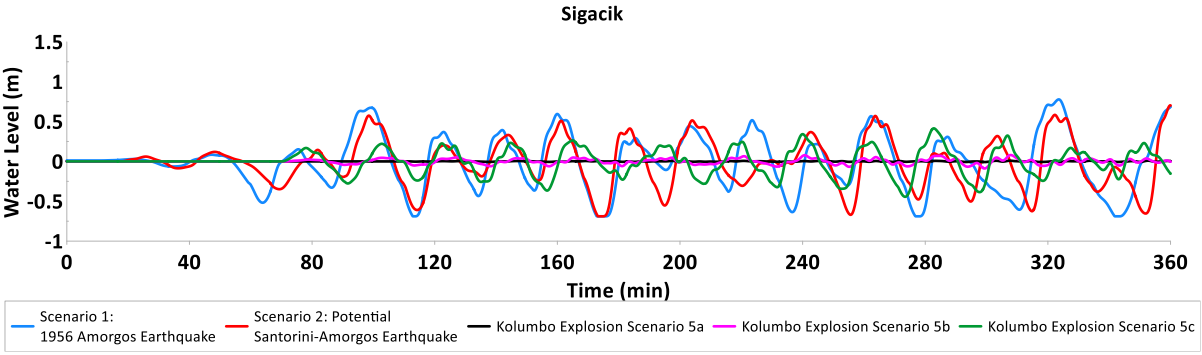


Figure 14: Time series of Computed Water Elevations in Sigacik for 5 Different Scenarios

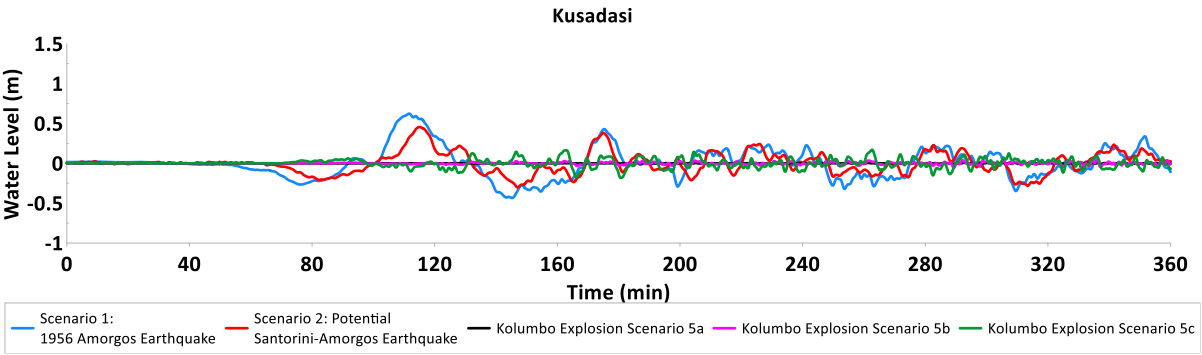


Figure 15: Time series of Computed Water Elevations in Kusadasi for 5 Different Scenarios

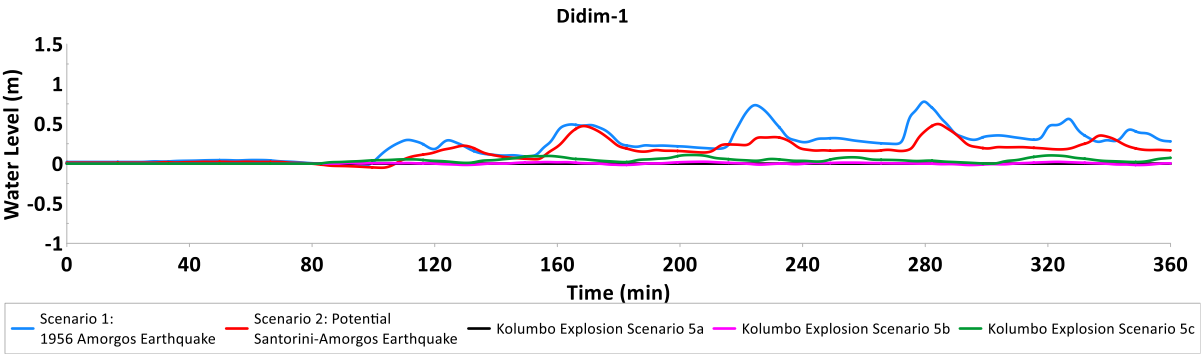


Figure 16: Time series of Computed Water Elevations in Didim-1 for 5 Different Scenarios

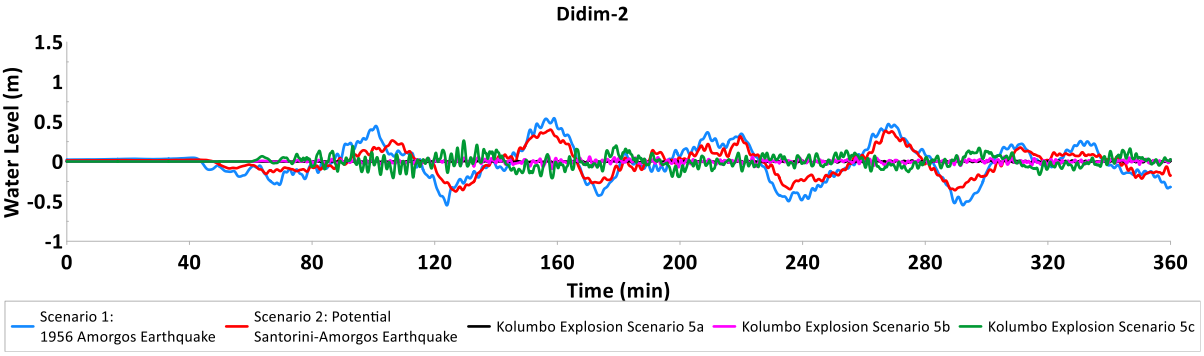


Figure 17: Time series of Computed Water Elevations in Didim-2 for 5 Different Scenarios

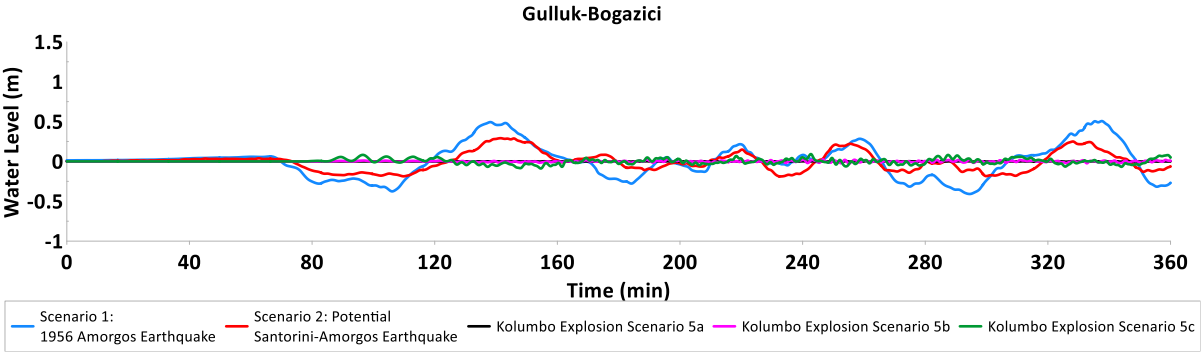


Figure 18: Time series of Computed Water Elevations in Gulluk-Bogazici for 5 Different Scenarios

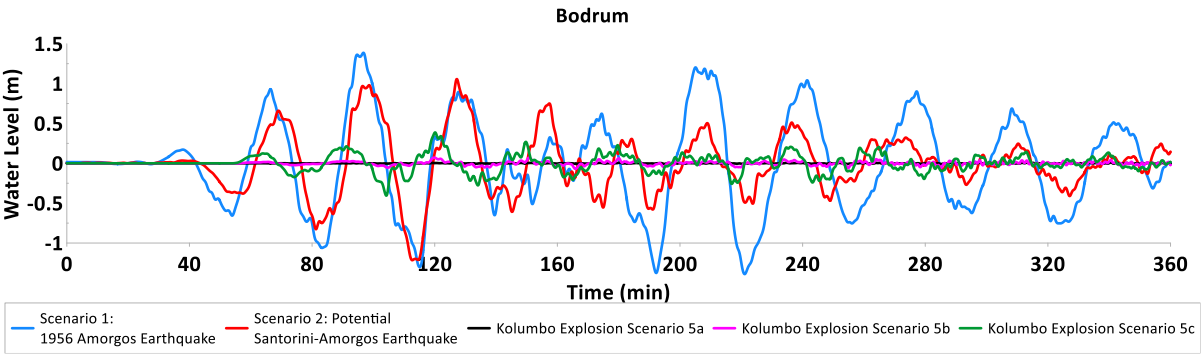


Figure 19: Time series of Computed Water Elevations in Bodrum for 5 Different Scenarios

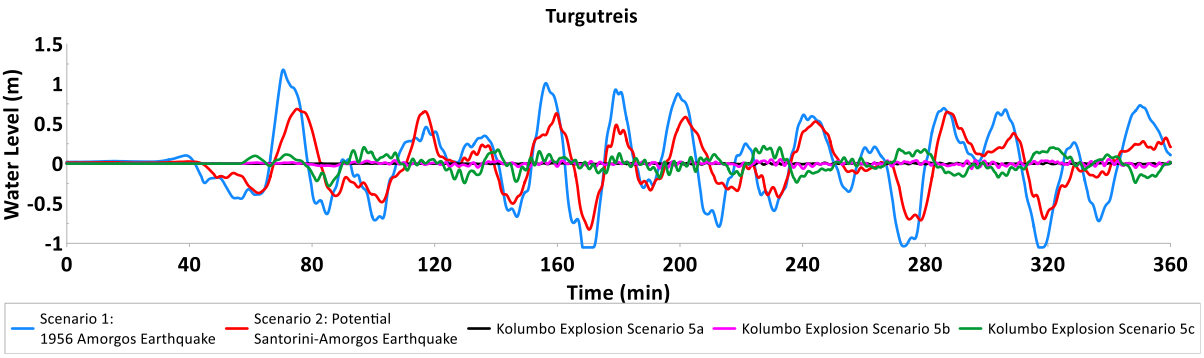


Figure 20: Time series of Computed Water Elevations in Turgutreis for 5 Different Scenarios

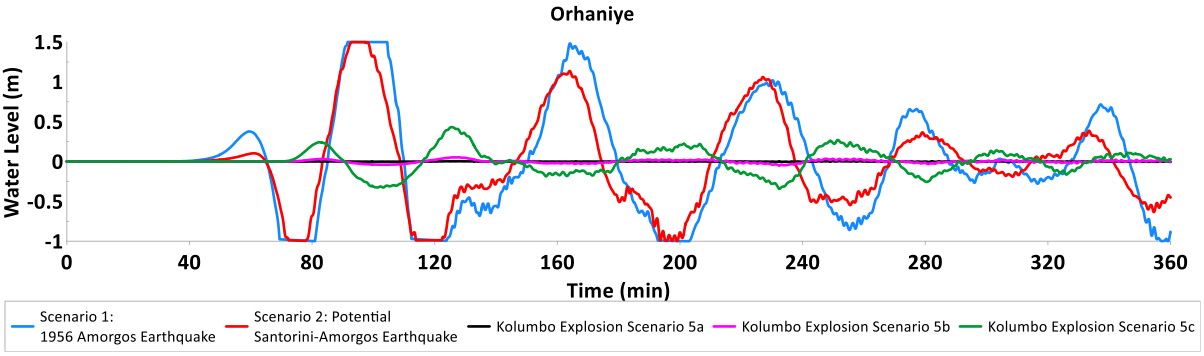


Figure 21: Time series of Computed Water Elevations in Orhaniye for 5 Different Scenarios

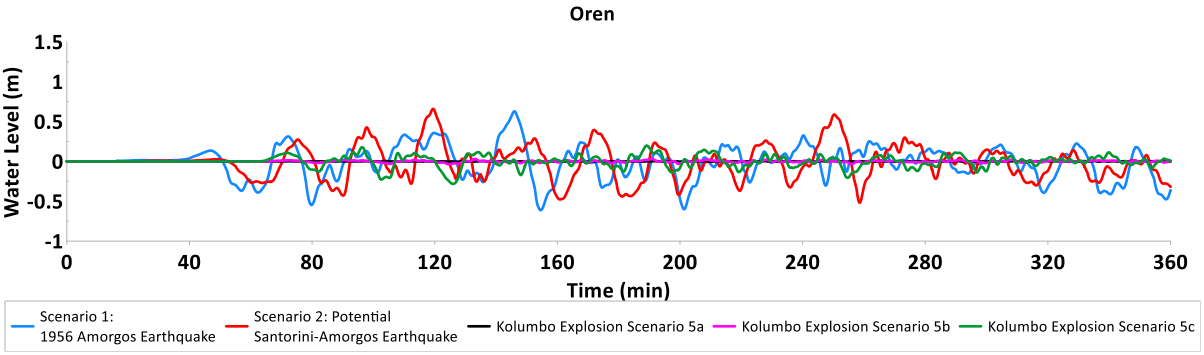


Figure 22: Time series of Computed Water Elevations in Oren for 5 Different Scenarios

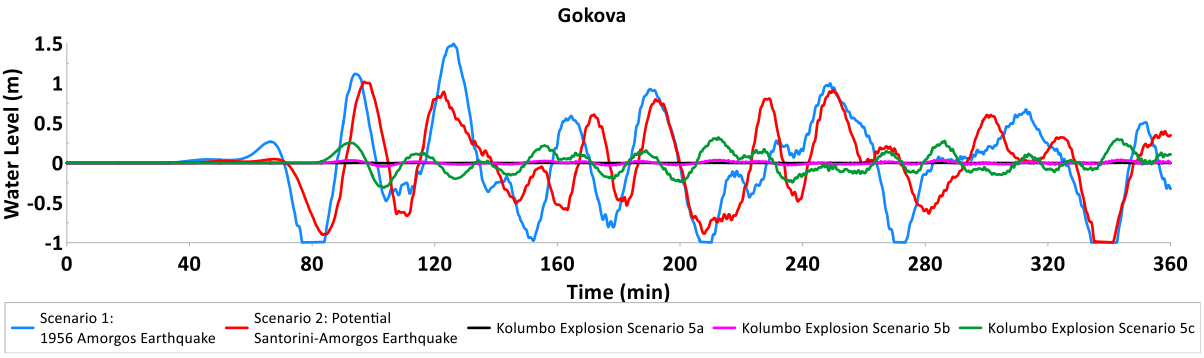


Figure 23: Time series of Computed Water Elevations in Gokova for 5 Different Scenarios

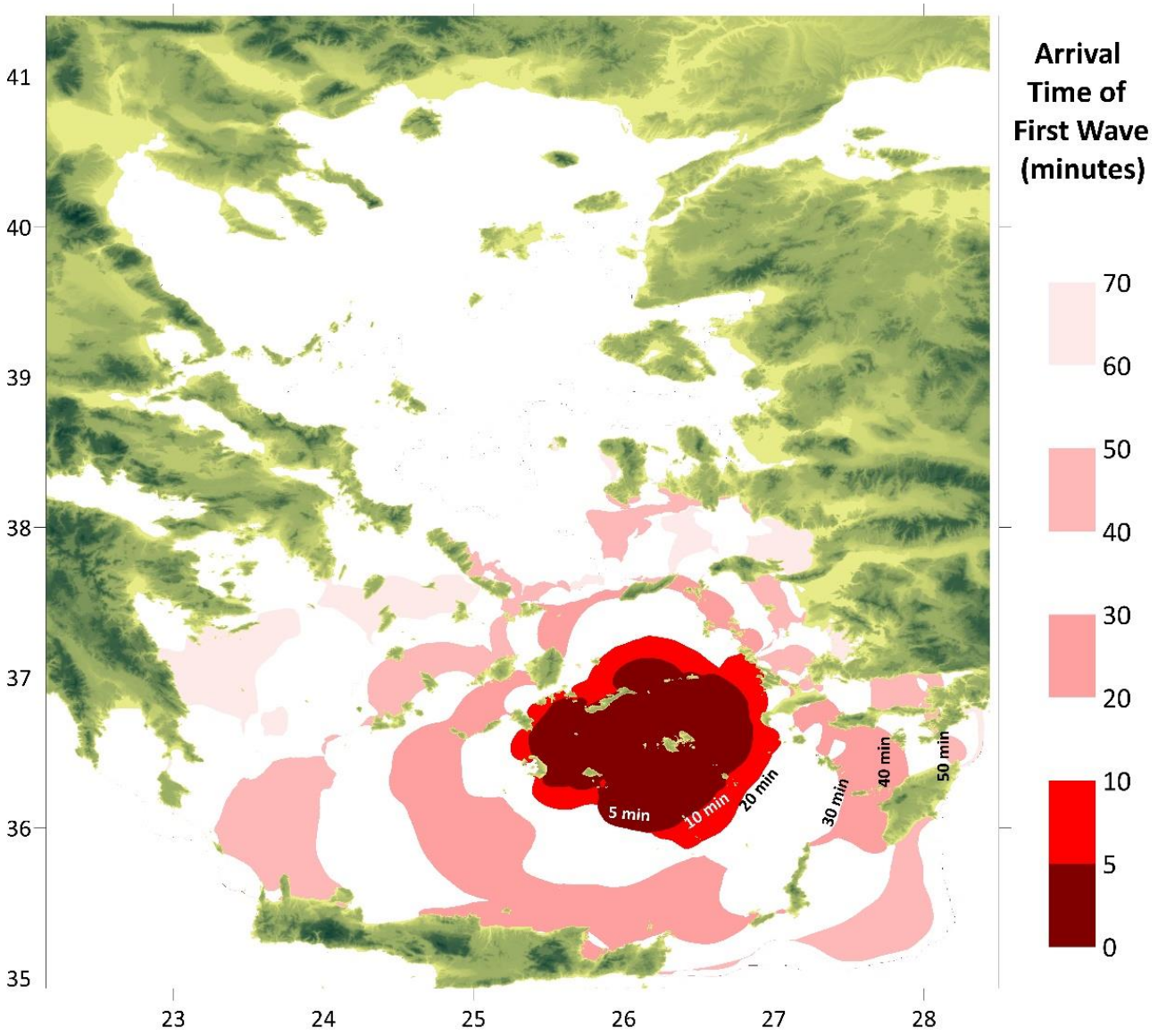


Figure 24: Distribution of Tsunami Arrival Time according to the 1956 Amorgos Tsunami Simulation (Scenario 1)

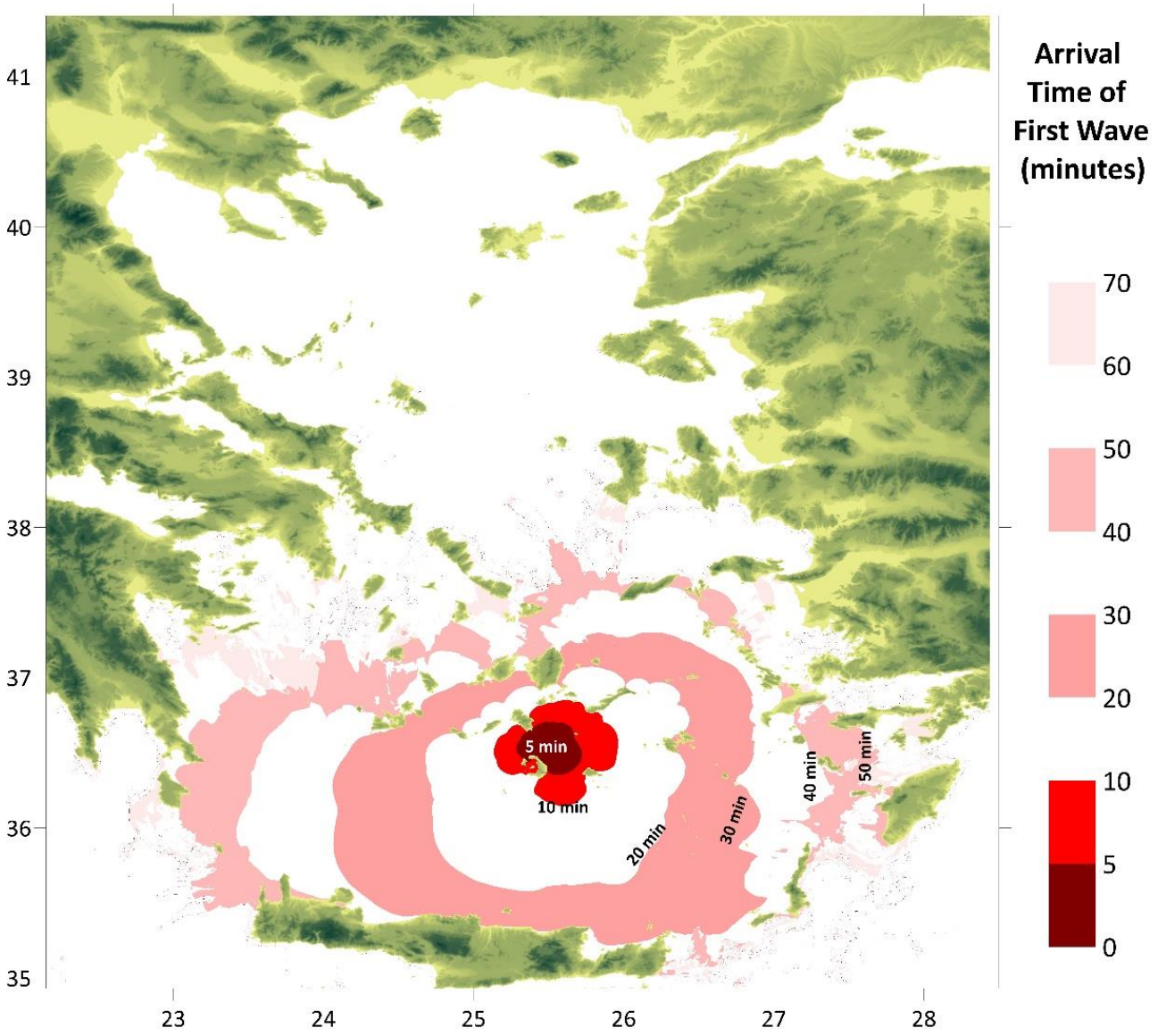
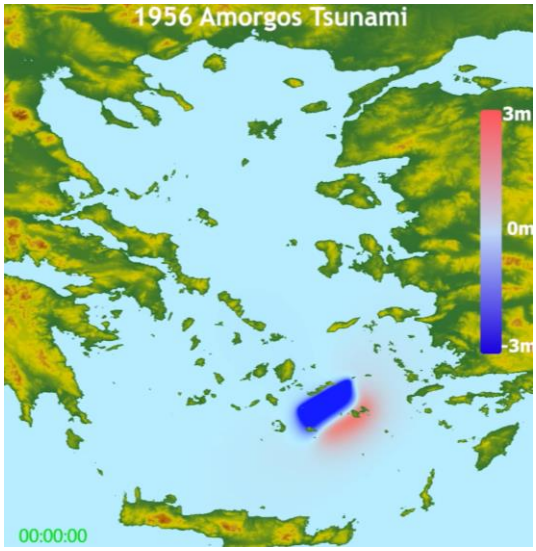


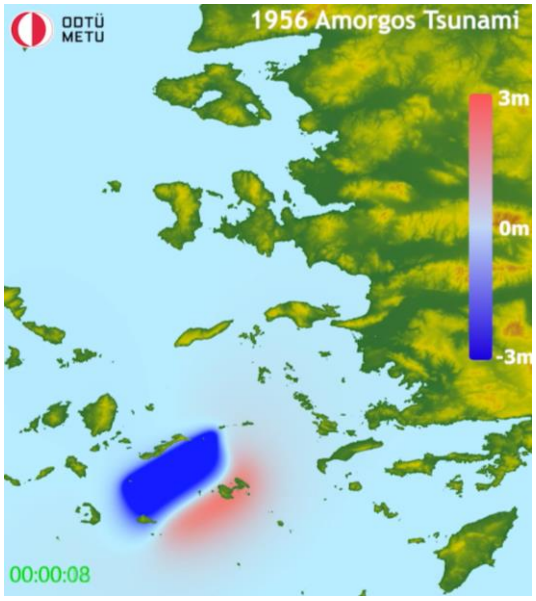
Figure 25: Distribution of Tsunami Arrival Time according to the Potential Kolumbo Explosion (Scenario 5c)

ANIMATIONS OF TSUNAMI PROPAGATION IN THE AEGEAN SEA ACCORDING TO DIFFERENT SCENARIO SIMULATIONS



Scenario 1: Tsunami propagation due to the 1956 Amorgos earthquake

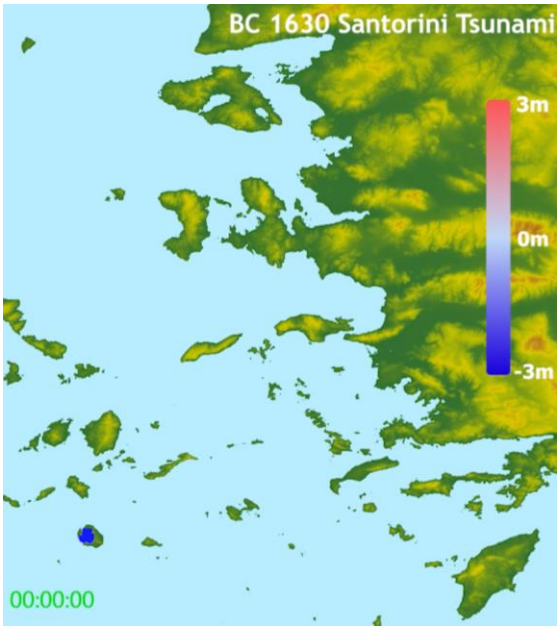
Video link:
https://drive.google.com/file/d/1wjMObvTzxQOunDwVEzx0GU3y06HdFVKn/view?usp=sharing



Scenario 1a: Tsunami propagation due to the 1956 Amorgos earthquake (Closer view)

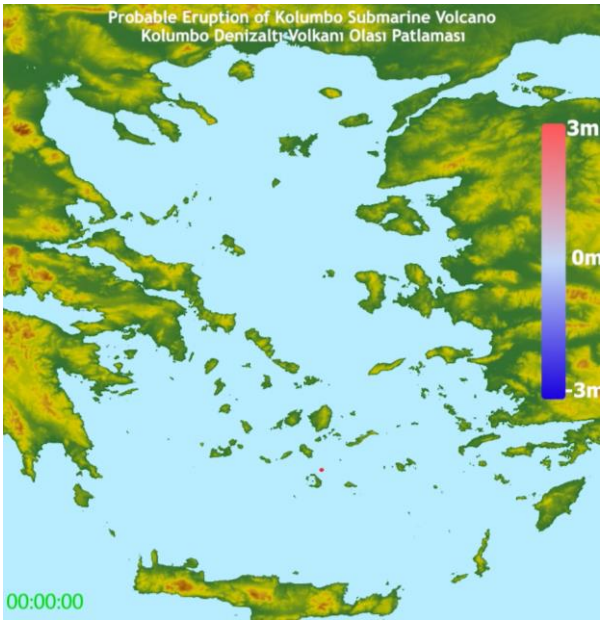
Video link:

https://drive.google.com/file/d/1mcbSVR0DQ3-TyQeCI3hj1WZMVsYBUvp0/view?usp=sharing



Scenario 4: Tsunami propagation due to Santorini Island Late Bronze Age Eruption

Video link:
https://drive.google.com/file/d/1SDOV-KyX5O2xOBV3zmtLxxKndXiq5s7b/view?usp=sharing



Scenario 5c: Tsunami propagation due to a potential Kolumbo (submarine volcano) explosion (Ulvrova et al. 2016) Explosive Energy: 5.4*10^16 Joules

Video link:
https://drive.google.com/file/d/1W9jxUbJAKXVh3DXIVT1Zz0SomCmzcY2m/view?usp=sharing

Table 5: Tsunami Arrival Times and Maximum Water Levels Computed from Different Scenarios

No	Numerical Gauge	Water Depth (m)	Coordinate (Longitude, Latitude)	Earliest Arrival Time among all Scenarios	Scenario 1: 1956 Amorgos EQ-Tsunami	Scenario 2: Santorini-Amorgos EQ-Tsunami	Scenario 3: Landslide-Santorini	Scenario 4: BC-1630 Santorini Eruption Not realistic on the date of this report This column is for information only and not used in comparisons	Scenario 5a: Kolumbo Explosion	Scenario 5b: Kolumbo Explosion	Scenario 5c: Kolumbo Explosion
				First Wave Arrival Time (minute)	Maximum Water Level (m)	Maximum Water Level (m)	Maximum Water Level (m)	Maximum Water Level (m)	Maximum Water Level (m)	Maximum Water Level (m)	Maximum Water Level (m)
1	**Saros2**	5.8	(26.7965,40.6287)	191	**0.25**	0.14	0.02	0.28	0.00	0.00	0.03
2	**Saros1**	54.0	(26.62,40.6238)	306	**0.11**	0.06	0.02	0.22	0.00	0.00	0.01
3	**Canakkale-AnzakKoyu**	7.6	(26.272,40.2365)	253	**0.15**	0.12	0.07	0.35	0.00	0.02	0.05
4	**Canakkale**	6.1	(26.4051,40.1556)	216	**0.25**	0.16	0.03	0.15	0.00	0.00	0.03
5	**Gokceada1**	3.7	(25.9749,40.1534)	271	**0.15**	0.12	0.07	0.35	0.00	0.01	0.06
6	**Gokceada2**	9.0	(25.9418,40.1203)	189	**0.25**	0.18	0.10	0.22	0.00	0.02	0.06
7	**Geyikli**	5.0	(26.1315,39.8435)	217	**0.20**	**0.24**	0.08	0.21	0.00	0.02	0.06
8	**Bozcaada**	1.5	(26.0787,39.835)	214	**0.21**	0.23	0.09	0.26	0.00	0.02	0.09
9	**Akcay-Edremit**	3.0	(26.8998,39.5825)	215	0.15	**0.15**	0.04	0.68	0.00	0.01	0.04
10	**Babakale**	6.3	(26.0677,39.4991)	250	0.10	**0.11**	0.08	0.14	0.00	0.03	0.09
11	**Ayvalik**	4.0	(26.6358,39.3196)	240	0.16	**0.18**	0.03	0.47	0.00	0.01	0.07

12	**Dikili**	1.7	(26.8812,39.0664)	193	**0.29**	0.19	0.06	0.49	0.00	0.01	0.04
13	**Candarli**	3.4	(26.929,38.9341)	155	**0.26**	0.18	0.11	0.38	0.00	0.02	0.08
14	**Aliaga**	0.8	(26.9709,38.8073)	119	**0.28**	0.28	0.08	0.54	0.00	0.02	0.09
15	**Yeni-Foca**	1.5	(26.8364,38.7431)	201	**0.26**	0.20	0.13	0.43	0.00	0.02	0.08
16	**Foca**	9.0	(26.7465,38.6706)	226	0.23	**0.34**	0.12	0.59	0.00	0.03	0.15
17	**Karaburun**	1.4	(26.5246,38.6487)	311	**0.11**	0.07	0.06	0.24	0.00	0.02	0.06
18	**KarantinaAdasi**	2.1	(26.7008,38.5432)	326	**0.11**	0.11	0.05	0.41	0.00	0.01	0.05
19	**Mavisehir**	0.3	(27.0723,38.4655)	174	**0.16**	0.15	0.03	1.24	0.00	0.01	0.05
20	**Karsiyaka**	3.6	(27.1318,38.4629)	172	**0.21**	0.21	0.02	1.37	0.00	0.00	0.02
21	**Bayrakli**	0.7	(27.1664,38.4564)	172	0.22	**0.23**	0.02	1.40	0.00	0.00	0.03
22	**Alsancak-Liman**	5.5	(27.1532,38.4444)	172	0.20	**0.21**	0.02	1.38	0.00	0.00	0.02
23	**IlturKoyu**	1.7	(26.5142,38.4298)	95	**0.46**	0.25	0.09	0.80	0.00	0.02	0.11
24	**Konak**	3.6	(27.1272,38.422)	173	**0.16**	0.15	0.01	1.28	0.00	0.00	0.03
25	**Inciralti**	1.6	(27.0472,38.4115)	269	**0.12**	0.11	0.02	1.02	0.00	0.00	0.03
26	**Narlidere**	7.4	(26.9608,38.3928)	267	**0.11**	0.11	0.02	0.67	0.00	0.00	0.02
27	**Cesme-Marina**	1.1	(26.2973,38.3249)	64	**0.58**	0.51	0.28	1.14	0.01	0.06	0.28
28	**Balikliova**	2.4	(26.693,38.3156)	148	**0.40**	0.40	0.07	0.81	0.00	0.01	0.13
29	**Alacati-Marina**	0.8	(26.3881,38.2564)	55	**1.29**	0.75	0.46	1.59	0.01	0.05	0.38
30	**Sigacik-Teos**	0.7	(26.7851,38.1971)	56	**0.78**	0.70	0.32	1.28	0.01	0.08	0.41
31	**TeosAntikKenti**	3.3	(26.8966,38.0575)	57	**0.50**	0.31	0.45	0.48	0.01	0.06	0.32
32	**PineBay-Kusadasi**	2.3	(27.2607,37.9122)	62	**0.39**	0.34	0.18	0.59	0.01	0.04	0.14
33	**Kusadasi**	2.7	(27.2499,37.823)	67	**0.62**	0.46	0.24	0.75	0.01	0.05	0.17
34	**Guzelcamli**	12.6	(27.0519,37.683)	57	**0.57**	0.32	0.28	0.76	0.01	0.04	0.19
35	**TavsanAdasi**	4.1	(27.0003,37.6497)	48	**0.61**	0.44	0.29	0.98	0.02	0.09	0.20
36	**Doganbey1**	0.2	(27.1366,37.6231)	60	**1.28**	0.95	0.74	2.39	0.01	0.06	0.33
37	**Doganbey2**	1.9	(27.2136,37.5665)	113	**0.47**	0.28	0.10	1.06	0.00	0.01	0.04

38	**Didim-Akkoy**	0.2	(27.2034,37.4883)	102	**0.78**	0.50	0.11	1.52	0.00	0.02	0.11
39	**Didim-Yalikoy**	0.8	(27.4157,37.4117)	84	**0.29**	0.24	0.04	0.69	0.00	0.01	0.07
40	**Didim-Tavsanburnu**	0.1	(27.2228,37.4075)	54	**0.78**	0.68	0.38	1.57	0.01	0.05	0.29
41	**Didim-PoseidonSunagi**	1.9	(27.1902,37.3534)	46	**0.54**	0.40	0.27	1.20	0.02	0.07	0.26
42	**GurcamlarSahili**	0.3	(27.4886,37.3256)	68	**1.23**	0.66	0.17	1.07	0.01	0.04	0.21
43	**Kazikli**	11.0	(27.4768,37.2937)	64	**0.62**	0.37	0.09	0.72	0.01	0.04	0.15
44	**AkarcaCiftligi1**	0.1	(27.6089,37.2769)	94	**0.99**	0.62	0.08	1.45	0.00	0.02	0.17
45	**AkarcaCiftligi2**	0.3	(27.6045,37.2738)	86	**0.84**	0.50	0.06	1.44	0.00	0.02	0.13
46	**Zeytinliluyu**	10.0	(27.497,37.2388)	67	**0.27**	0.29	0.09	0.88	0.01	0.05	0.10
47	**Bodrum-Bogazici1**	1.6	(27.5708,37.2143)	76	**0.51**	0.29	0.11	1.08	0.00	0.03	0.09
48	**Bodrum-Bogazici2**	0.4	(27.5731,37.2139)	76	**0.52**	0.30	0.18	1.09	0.00	0.03	0.13
49	**Bodrum**	2.8	(27.5368,37.1736)	68	**0.60**	0.38	0.13	1.12	0.01	0.03	0.14
50	**Bodrum-Guvercinlik**	19.7	(27.537,37.1308)	73	**0.73**	0.61	0.07	1.28	0.00	0.03	0.18
51	**Bodrum-Turkbuku**	0.5	(27.3926,37.1216)	64	**0.48**	0.40	0.23	1.07	0.01	0.04	0.15
52	**Bodrum-Yalikavak**	30.2	(27.2727,37.1042)	47	**0.70**	0.47	0.25	0.98	0.02	0.05	0.27
53	**Bodrum-Torba**	0.7	(27.4596,37.0837)	70	**0.58**	0.43	0.33	1.29	0.01	0.03	0.16
54	**Bodrum-Marina**	3.5	(27.4284,37.028)	34	**1.39**	1.06	0.38	1.70	0.01	0.07	0.39
55	**Gumbet**	0.4	(27.3978,37.0285)	35	**1.57**	1.13	0.84	1.63	0.02	0.12	0.42
56	**Bitez**	0.2	(27.3782,37.0237)	35	**1.75**	1.31	0.41	2.59	0.01	0.08	0.37
57	**Adabogazi-Akvaryum**	0.1	(27.385,37.0066)	32	**0.91**	0.70	0.67	1.08	0.02	0.11	0.32
58	**Turgut-Reis-Marina-S**	1.1	(27.2544,37)	38	**1.18**	0.69	0.30	1.54	0.01	0.06	0.22
59	**Karabogaz**	0.0	(27.4819,36.9853)	64	**1.26**	0.99	0.56	1.53	0.01	0.03	0.32
60	**Karaincir**	1.0	(27.3022,36.9724)	32	**1.12**	1.24	1.12	2.16	0.02	0.12	0.54
61	**Marmaris**	21.6	(28.2688,36.8029)	64	**0.89**	0.61	0.12	0.58	0.01	0.03	0.15

62	**Kormen-Karakoy**	38.5	(27.6205,36.7922)	36	**0.30**	0.29	0.25	1.02	0.03	0.05	0.17
63	**Orhaniye**	4.1	(28.1163,36.7747)	51	**2.30**	1.62	0.21	2.98	0.01	0.05	0.43
64	**Datca**	8.8	(27.6928,36.7243)	32	**0.88**	0.67	0.62	0.98	0.02	0.11	0.39
65	**Palamutbuku**	0.6	(27.5079,36.6706)	25	**0.74**	0.57	1.06	0.87	0.03	0.21	0.76
66	**Sogutkoy**	18.3	(28.0903,36.6443)	41	**2.51**	1.92	0.38	1.78	0.01	0.07	0.42
67	**OrenMarina**	1.2	(27.9797,37.0277)	44	**0.63**	0.66	0.35	1.56	0.01	0.03	0.20
68	**Gokova**	6.4	(28.3255,37.0438)	60	**1.49**	1.02	0.32	2.93	0.00	0.04	0.32
69	**Gokova-Akbuk**	30.2	(28.1038,37.0305)	52	**0.76**	0.76	0.21	1.84	0.01	0.04	0.21

DISCUSSIONS

Tsunami scenarios that may occur according to different mechanisms in the region between the tectonically and volcanically active islands of Santorini, Amorgos, Astypalaea and Anafi were examined with the help of tsunami numerical model NAMI DANCE using the current data on the date of this report. The effects of possible tsunami events that may occur due to each scenario are investigated by focusing on their effects on the Aegean Sea coast of Türkiye.

The results are based on 250-meter resolution database. Due to the effects of local morphological conditions and effects of existing coastal structures, higher wave run-up values than the values given in the Tables can be expected according to local morphology in the small bays and basins, steeply sloped coasts, creek, stream or river mouths, low-elevation coastal areas and wetlands adjacent to the coast.

In this report, only scenarios related to the tsunami events that may occur in the region of earthquake storms in the Aegean Sea between Santorini, Amorgos, Astypalaea and Anafi islands are investigated and the results are presented according to the selected scenarios.

It has to be noted here that the (seismic, volcanic or landslide origin) tsunami events that may occur in other regions of the Aegean Sea may cause much different coastal impact on the Aegean coast of Türkiye. However, according to the simulated scenarios the arrival time of tsunami to the Aegean Coast of Türkiye is about one hour.

This report will be updated with new data and new field research and modeling studies, considering the high-resolution database and other possible source alternatives.

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APPENDIX

Table 6: Tsunami Arrival Times and Maximum Water Levels Computed for Scenario 1, Scenario 2 and Scenario 3

Numerical Gauge	Water Depth (m)	Coordinates (Longitude, Latitude)	Scenario 1: 1956 Amorgos EQ-Tsunami		Scenario 2: Santorini-Amorgos EQ-Tsunami		Scenario 3: Landslide-Santorini	
			First Wave Arrival Time (minute)	Maximum Water Level (m)	First Wave Arrival Time (minute)	Maximum Water Level (m)	First Wave Arrival Time (minute)	Maximum Water Level (m)
Saroz2	5.8	(26.7965,40.6287)	191	0.25	311	0.14	-	0.02
Saroz1	54.0	(26.62,40.6238)	306	0.11	-	0.06	-	0.02
Canakkale-AnzakKoyu	7.6	(26.272,40.2365)	253	0.15	281	0.12	-	0.07
Canakkale	6.1	(26.4051,40.1556)	216	0.25	322	0.16	-	0.03
Gokceada1	3.7	(25.9749,40.1534)	271	0.15	281	0.12	-	0.07
Gokceada2	9.0	(25.9418,40.1203)	189	0.25	265	0.18	266	0.10
Geyikli	5.0	(26.1315,39.8435)	217	0.20	224	0.24	-	0.08
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Babakale	6.3	(26.0677,39.4991)	250	0.10	317	0.11	-	0.08
Ayvalik	4.0	(26.6358,39.3196)	240	0.16	221	0.18	-	0.03
Dikili	1.7	(26.8812,39.0664)	193	0.29	178	0.19	-	0.06
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Bayrakli	0.7	(27.1664,38.4564)	172	0.22	183	0.23	-	0.02
Alsancak-Liman	5.5	(27.1532,38.4444)	172	0.20	184	0.21	-	0.02
IlturKoyu	1.7	(26.5142,38.4298)	95	0.46	128	0.25	351	0.09
Konak	3.6	(27.1272,38.422)	173	0.16	293	0.15	-	0.01
Inciralti	1.6	(27.0472,38.4115)	269	0.12	274	0.11	-	0.02
Narlidere	7.4	(26.9608,38.3928)	267	0.11	271	0.11	-	0.02
Cesme-Marina	1.1	(26.2973,38.3249)	64	0.58	103	0.51	101	0.28
Balikliova	2.4	(26.693,38.3156)	148	0.40	158	0.40	-	0.07
Alacati-Marina	0.8	(26.3881,38.2564)	55	1.29	61	0.75	75	0.46
Sigacik-Teos	0.7	(26.7851,38.1971)	56	0.78	46	0.70	78	0.32
TeosAntikKenti	3.3	(26.8966,38.0575)	57	0.50	65	0.31	79	0.45
PineBay-Kusadasi	2.3	(27.2607,37.9122)	62	0.39	76	0.34	138	0.18
Kusadasi	2.7	(27.2499,37.823)	67	0.62	75	0.46	124	0.24
Samos-MalagaryPort	0.3	(26.9698,37.7499)	53	0.61	60	0.57	79	0.43
Guzelcamli	12.6	(27.0519,37.683)	57	0.57	66	0.32	87	0.28
TavsanAdasi	4.1	(27.0003,37.6497)	48	0.61	55	0.44	70	0.29
Doganbey1	0.2	(27.1366,37.6231)	60	1.28	65	0.95	81	0.74
Doganbey2	1.9	(27.2136,37.5665)	113	0.47	123	0.28	-	0.10
Didim-Akkoy	0.2	(27.2034,37.4883)	102	0.78	114	0.50	166	0.11
Didim-Yalikoy	0.8	(27.4157,37.4117)	84	0.29	90	0.24	-	0.04
Didim-Tavsanburnu	0.1	(27.2228,37.4075)	54	0.78	59	0.68	76	0.38
Didim-PoseidonSunagi	1.9	(27.1902,37.3534)	46	0.54	63	0.40	70	0.27
GurcamlarSahili	0.3	(27.4886,37.3256)	68	1.23	72	0.66	89	0.17
Kazikli	11.0	(27.4768,37.2937)	64	0.62	69	0.37	-	0.09
AkarcaCiftligi1	0.1	(27.6089,37.2769)	94	0.99	95	0.62	305	0.08

AkarcaCiftligi2	0.3	(27.6045,37.2738)	86	0.84	89	0.50	-	0.06
Zeytinliluyu	10.0	(27.497,37.2388)	67	0.27	72	0.29	-	0.09
Bodrum-Bogazici1	1.6	(27.5708,37.2143)	76	0.51	79	0.29	99	0.11
Bodrum-Bogazici2	0.4	(27.5731,37.2139)	76	0.52	78	0.30	95	0.18
Bodrum	2.8	(27.5368,37.1736)	68	0.60	73	0.38	120	0.13
Bodrum-Guvercinlik	19.7	(27.537,37.1308)	73	0.73	78	0.61	-	0.07
Bodrum-Turkbuku	0.5	(27.3926,37.1216)	64	0.48	70	0.40	85	0.23
Bodrum-Yalikavak	30.2	(27.2727,37.1042)	47	0.70	53	0.47	89	0.25
Bodrum-Torba	0.7	(27.4596,37.0837)	70	0.58	75	0.43	100	0.33
Bodrum-Marina	3.5	(27.4284,37.028)	34	1.39	47	1.06	69	0.38
Gumbet	0.4	(27.3978,37.0285)	35	1.57	47	1.13	62	0.84
Bitez	0.2	(27.3782,37.0237)	35	1.75	47	1.31	62	0.41
Adabogazi-Akvaryum	0.1	(27.385,37.0066)	32	0.91	60	0.70	66	0.67
Turgut-Reis-Marina-S	1.1	(27.2544,37)	38	1.18	47	0.69	63	0.30
Karabogaz	0.0	(27.4819,36.9853)	64	1.26	67	0.99	75	0.56
Karaincir	1.0	(27.3022,36.9724)	32	1.12	44	1.24	59	1.12
Marmaris	21.6	(28.2688,36.8029)	64	0.89	67	0.61	178	0.12
Kormen-Karakoy	38.5	(27.6205,36.7922)	36	0.30	41	0.29	62	0.25
Orhaniye	4.1	(28.1163,36.7747)	51	2.30	60	1.62	78	0.21
Datca	8.8	(27.6928,36.7243)	32	0.88	44	0.67	56	0.62
Palamutbuku	0.6	(27.5079,36.6706)	25	0.74	38	0.57	50	1.06
Sogutkoy	18.3	(28.0903,36.6443)	41	2.51	55	1.92	69	0.38
OrenMarina	1.2	(27.9797,37.0277)	44	0.63	56	0.66	78	0.35
Gokova	6.4	(28.3255,37.0438)	60	1.49	74	1.02	88	0.32
Gokova-Akbuk	30.2	(28.1038,37.0305)	52	0.76	65	0.76	80	0.21

Table 7: Tsunami Arrival Times and Maximum Water Levels Computed for Scenario 4 and Scenarios 5a, 5b and 5c

Numerical Gauge	Water Depth (m)	Coordinates (Longitude, Latitude)	Scenario 4: BC 1630 Santorini Eruption		Scenario 5a: Kolumbo Explosion		Scenario 5b: Kolumbo Explosion		Scenario 5c: Kolumbo Explosion	
			First Wave Arrival Time (minute)	Maximum Water Level (m)	First Wave Arrival Time (minute)	Maximum Water Level (m)	First Wave Arrival Time (minute)	Maximum Water Level (m)	First Wave Arrival Time (minute)	Maximum Water Level (m)
Saroz2	5.8	(26.7965,40.6287)	199	0.28	-	0.00	360	0.00	-	0.03
Saroz1	54.0	(26.62,40.6238)	192	0.22	-	0.00	359	0.00	-	0.01
Canakkale-AnzakKoyu	7.6	(26.272,40.2365)	174	0.35	-	0.00	354	0.02	-	0.05
Canakkale	6.1	(26.4051,40.1556)	191	0.15	-	0.00	345	0.00	-	0.03
Gokceada1	3.7	(25.9749,40.1534)	175	0.35	-	0.00	358	0.01	-	0.06
Gokceada2	9.0	(25.9418,40.1203)	156	0.22	-	0.00	310	0.02	-	0.06
Geyikli	5.0	(26.1315,39.8435)	153	0.21	-	0.00	331	0.02	-	0.06
Bozcaada	1.5	(26.0787,39.835)	152	0.26	-	0.00	332	0.02	-	0.09
Akcay-Edremit	3.0	(26.8998,39.5825)	170	0.68	-	0.00	301	0.01	-	0.04
Babakale	6.3	(26.0677,39.4991)	141	0.14	-	0.00	345	0.03	-	0.09
Ayvalik	4.0	(26.6358,39.3196)	154	0.47	-	0.00	352	0.01	-	0.07
Dikili	1.7	(26.8812,39.0664)	141	0.49	-	0.00	357	0.01	-	0.04
Candarli	3.4	(26.929,38.9341)	132	0.38	-	0.00	347	0.02	-	0.08
Aliaga	0.8	(26.9709,38.8073)	136	0.54	-	0.00	305	0.02	-	0.09
Yeni-Foca	1.5	(26.8364,38.7431)	127	0.43	-	0.00	342	0.02	263	0.08
Foca	9.0	(26.7465,38.6706)	124	0.59	-	0.00	268	0.03	234	0.15
Karaburun	1.4	(26.5246,38.6487)	132	0.24	-	0.00	359	0.02	-	0.06
KarantinaAdasi	2.1	(26.7008,38.5432)	135	0.41	-	0.00	188	0.01	-	0.05
Mavisehir	0.3	(27.0723,38.4655)	183	1.24	-	0.00	360	0.01	-	0.05
Karsiyaka	3.6	(27.1318,38.4629)	185	1.37	-	0.00	359	0.00	-	0.02
Bayrakli	0.7	(27.1664,38.4564)	186	1.40	-	0.00	341	0.00	-	0.03

Alsancak-Liman	5.5	(27.1532,38.4444)	185	1.38	-	0.00	235	0.00	-	0.02
IlturKoyu	1.7	(26.5142,38.4298)	112	0.80	-	0.00	279	0.02	272	0.11
Konak	3.6	(27.1272,38.422)	184	1.28	-	0.00	354	0.00	-	0.03
Inciralti	1.6	(27.0472,38.4115)	179	1.02	-	0.00	351	0.00	-	0.03
Narlidere	7.4	(26.9608,38.3928)	159	0.67	-	0.00	337	0.00	-	0.02
Cesme-Marina	1.1	(26.2973,38.3249)	87	1.14	-	0.01	350	0.06	101	0.28
Baliklova	2.4	(26.693,38.3156)	163	0.81	-	0.00	348	0.01	320	0.13
Alacati-Marina	0.8	(26.3881,38.2564)	78	1.59	-	0.01	323	0.05	73	0.38
Sigacik-Teos	0.7	(26.7851,38.1971)	80	1.28	-	0.01	308	0.08	75	0.41
TeosAntikKenti	3.3	(26.8966,38.0575)	74	0.48	-	0.01	251	0.06	115	0.32
PineBay-Kusadasi	2.3	(27.2607,37.9122)	83	0.59	-	0.01	287	0.04	231	0.14
Kusadasi	2.7	(27.2499,37.823)	83	0.75	-	0.01	336	0.05	112	0.17
Guzelcamli	12.6	(27.0519,37.683)	82	0.76	-	0.01	303	0.04	106	0.19
TavsanAdasi	4.1	(27.0003,37.6497)	73	0.98	-	0.02	198	0.09	67	0.20
Doganbey1	0.2	(27.1366,37.6231)	85	2.39	-	0.01	124	0.06	78	0.33
Doganbey2	1.9	(27.2136,37.5665)	182	1.06	-	0.00	279	0.01	-	0.04
Didim-Akkoy	0.2	(27.2034,37.4883)	131	1.52	-	0.00	207	0.02	200	0.11
Didim-Yalikoy	0.8	(27.4157,37.4117)	104	0.69	-	0.00	223	0.01	-	0.07
Didim-Tavsanburnu	0.1	(27.2228,37.4075)	77	1.57	-	0.01	186	0.05	71	0.29
Didim-PoseidonSunagi	1.9	(27.1902,37.3534)	70	1.20	-	0.02	157	0.07	82	0.26
GurcamlarSahili	0.3	(27.4886,37.3256)	91	1.07	-	0.01	328	0.04	86	0.21
Kazikli	11.0	(27.4768,37.2937)	87	0.72	-	0.01	266	0.04	162	0.15
AkarcaCiftligi1	0.1	(27.6089,37.2769)	111	1.45	-	0.00	305	0.02	146	0.17
AkarcaCiftligi2	0.3	(27.6045,37.2738)	107	1.44	-	0.00	303	0.02	147	0.13
Zeytinliluyu	10.0	(27.497,37.2388)	87	0.88	-	0.01	261	0.05	276	0.10
Bodrum-Bogazici1	1.6	(27.5708,37.2143)	95	1.08	-	0.00	196	0.03	-	0.09

Bodrum-Bogazici2	0.4	(27.5731,37.2139)	95	1.09	-	0.00	188	0.03	96	0.13
Bodrum	2.8	(27.5368,37.1736)	90	1.12	-	0.01	277	0.03	173	0.14
Bodrum-Guvercinlik	19.7	(27.537,37.1308)	95	1.28	-	0.00	339	0.03	214	0.18
Bodrum-Turkbuku	0.5	(27.3926,37.1216)	88	1.07	-	0.01	208	0.04	83	0.15
Bodrum-Yalikavak	30.2	(27.2727,37.1042)	70	0.98	-	0.02	146	0.05	89	0.27
Bodrum-Torba	0.7	(27.4596,37.0837)	93	1.29	-	0.01	276	0.03	138	0.16
Bodrum-Marina	3.5	(27.4284,37.028)	65	1.70	-	0.01	151	0.07	63	0.39
Gumbet	0.4	(27.3978,37.0285)	66	1.63	-	0.02	153	0.12	60	0.42
Bitez	0.2	(27.3782,37.0237)	66	2.59	-	0.01	212	0.08	60	0.37
Adabogazi-Akvaryum	0.1	(27.385,37.0066)	62	1.08	-	0.02	155	0.11	56	0.32
Turgut-Reis-Marina-S	1.1	(27.2544,37)	66	1.54	-	0.01	340	0.06	71	0.22
Karabogaz	0.0	(27.4819,36.9853)	86	1.53	-	0.01	86	0.03	85	0.32
Karaincir	1.0	(27.3022,36.9724)	63	2.16	-	0.02	147	0.12	58	0.54
Marmaris	21.6	(28.2688,36.8029)	83	0.58	-	0.01	333	0.03	89	0.15
Kormen-Karakoy	38.5	(27.6205,36.7922)	58	1.02	-	0.03	202	0.05	64	0.17
Orhaniye	4.1	(28.1163,36.7747)	80	2.98	-	0.01	128	0.05	77	0.43
Datca	8.8	(27.6928,36.7243)	61	0.98	-	0.02	156	0.11	56	0.39
Palamutbuku	0.6	(27.5079,36.6706)	55	0.87	-	0.03	74	0.21	49	0.76
Sogutkoy	18.3	(28.0903,36.6443)	70	1.78	-	0.01	197	0.07	67	0.42
OrenMarina	1.2	(27.9797,37.0277)	74	1.56	-	0.01	133	0.03	71	0.20
Gokova	6.4	(28.3255,37.0438)	91	2.93	-	0.00	285	0.04	87	0.32
Gokova-Akbuk	30.2	(28.1038,37.0305)	82	1.84	-	0.01	197	0.04	78	0.21