

**PROTOTYPE DATABASE FOR TSUNAMI EARLY WARNING SYSTEM WITH
DATA ASSIMILATION IN MALAYSIA**

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1. Fault Parameters of Tsunami Sources

Table 1. Fault parameters for each source point with different magnitudes and depths.

M_w	<i>DCF</i> (km)	Depth of <i>TLC</i> (km)	Slip (cm)	Length (km)	Width (km)	Strike (deg)	Dip (deg)	Rake (deg)
6.5	0	0.000*	70.8	22.4	11.2	340	45	90
6.5	10	5.238	70.8	22.4	11.2	340	45	90
6.5	20	15.238	70.8	22.4	11.2	340	45	90
6.5	30	25.238	70.8	22.4	11.2	340	45	90
7.0	0	0.000*	125.9	39.8	19.9	340	45	90
7.0	10	1.531	125.9	39.8	19.9	340	45	90
7.0	20	11.531	125.9	39.8	19.9	340	45	90
7.0	30	21.531	125.9	39.8	19.9	340	45	90
7.5	0	0.000*	223.9	70.8	35.4	340	45	90
7.5	10	0.000*	223.9	70.8	35.4	340	45	90
7.5	20	4.940	223.9	70.8	35.4	340	45	90
7.5	30	14.940	223.9	70.8	35.4	340	45	90
8.0	0	0.000*	398.1	125.9	62.9	340	45	90
8.0	10	0.000*	398.1	125.9	62.9	340	45	90
8.0	20	0.000*	398.1	125.9	62.9	340	45	90
8.0	30	3.219	398.1	125.9	62.9	340	45	90

Remark: * Depth of *TLC* had negative value and forced to zero.

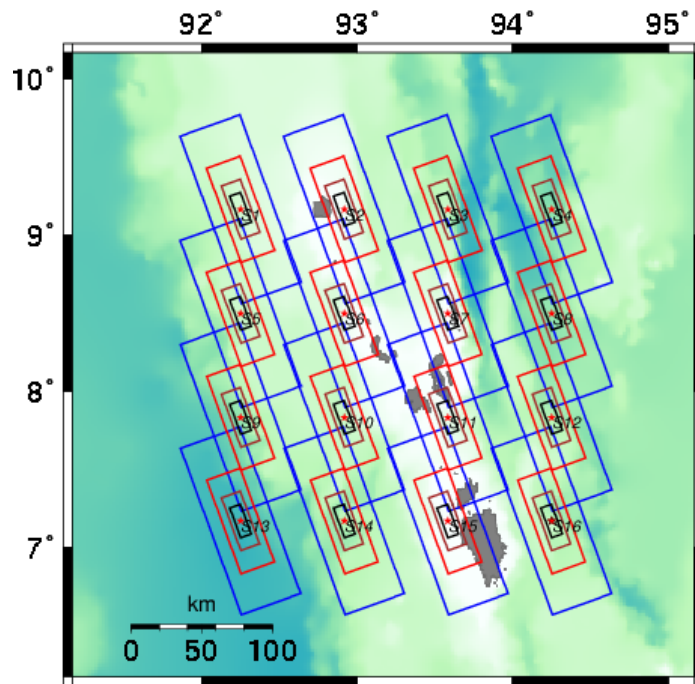


Figure 1. Fault parameters set at source area with different magnitudes of 6.5 (black rectangles), 7.0 (brown rectangles), 7.5 (red rectangles) and 8.0 (blue rectangles).

Red star is center of fault at source point for each source.

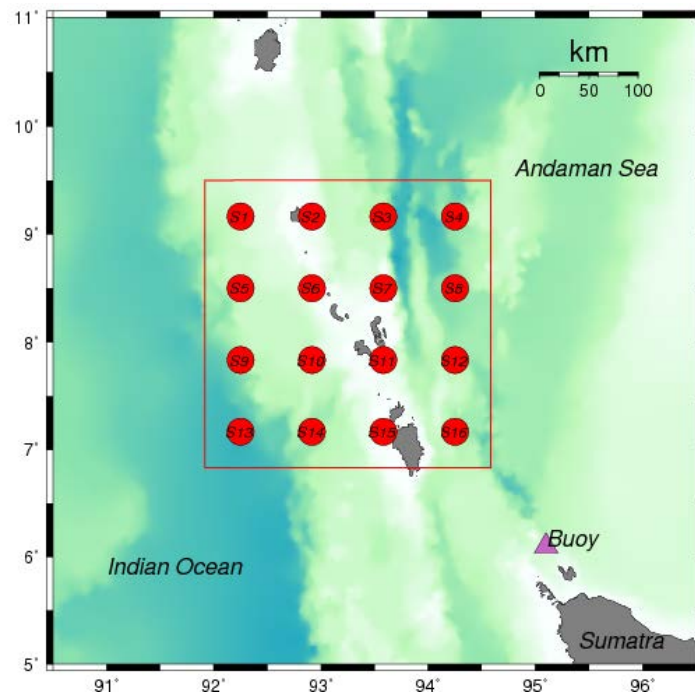


Figure 2. Location of 16 source points (red circles) within the source area (red rectangle) with 40 arc-minutes distance interval to each other. The purple triangle is the location of Malaysian deep ocean buoy.

2. Source Points, Buoy Points and Forecast Points

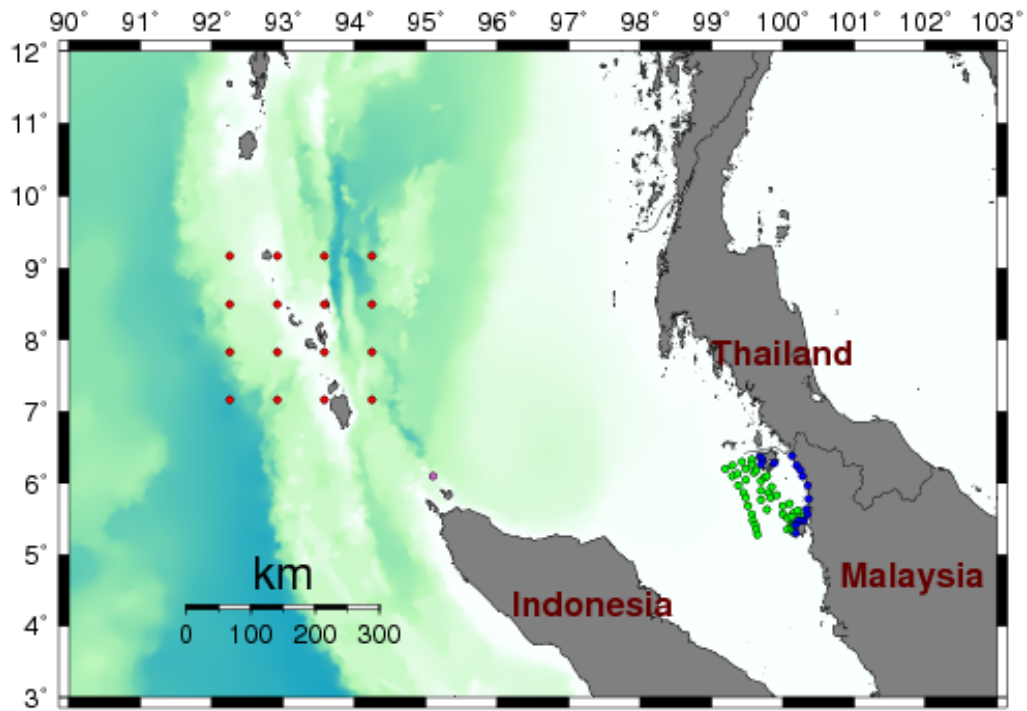


Figure 3. Setting locations of source points (red dots), buoy point (purple dot), forecast points (green dots) and coastal points (blue dots) in scope of study area.

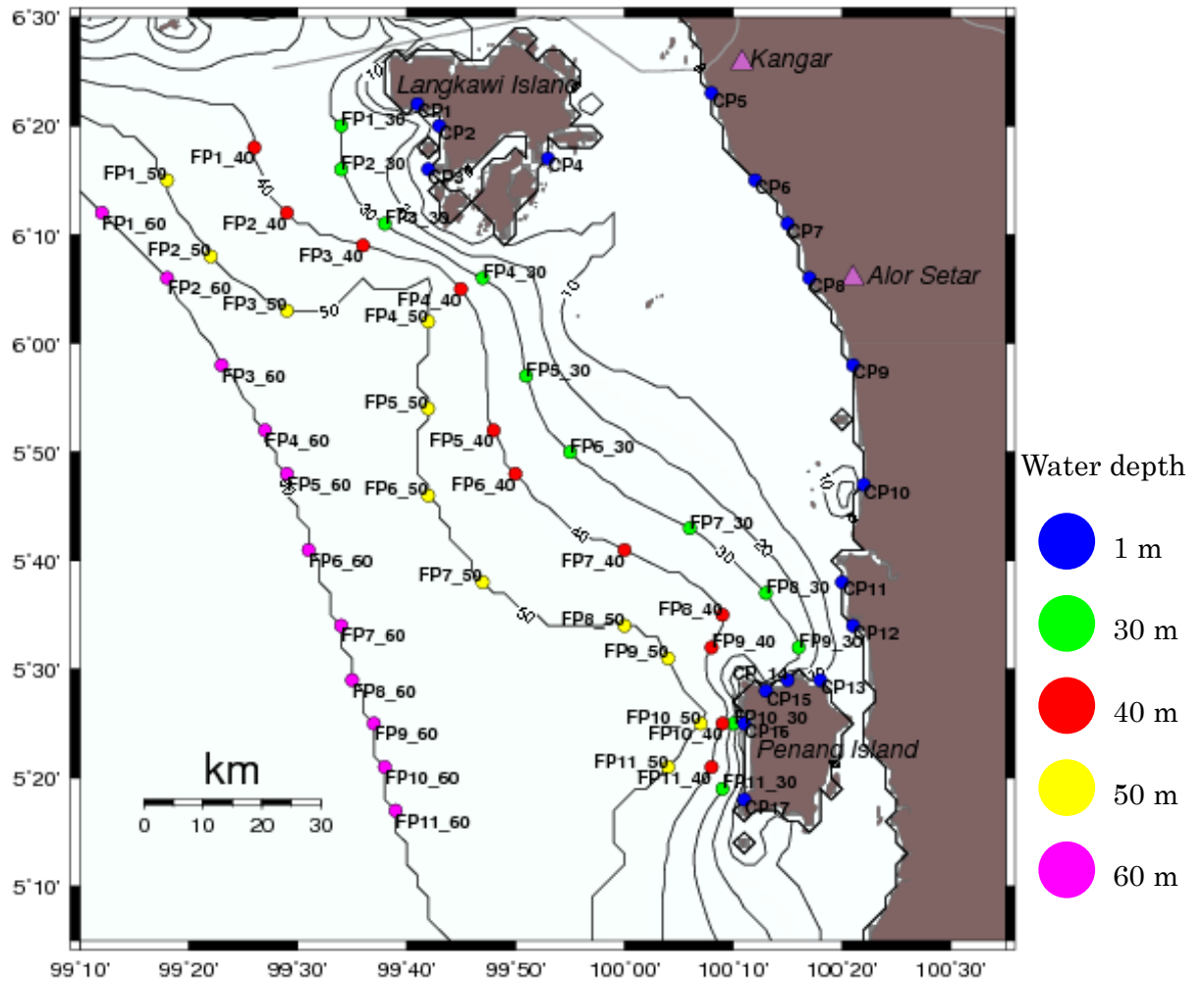


Figure 4. Bathymetry grid contour map of coastal points (blue circles) and forecast points (green, red, yellow and purple circles).

Table 2-1. Location of 16 source points.

Source Point	Longitude (⁰ E)	Latitude (⁰ N)
S1	92.250	9.167
S2	92.917	9.167
S3	93.583	9.167
S4	94.250	9.167
S5	92.250	8.500
S6	92.917	8.500
S7	93.583	8.500
S8	94.250	8.500
S9	92.250	7.833
S10	92.917	7.833
S11	93.583	7.833
S12	94.250	7.833
S13	92.250	7.167
S14	92.917	7.167
S15	93.583	7.167
S16	94.250	7.167

Table 2-2. Location of forecast points at 30 m bathymetry contour depth.

Forecast Point (at 30 m depth)	Longitude (⁰ E)	Latitude (⁰ N)	Depth (m)
FP1_30	99.567	6.333	30
FP2_30	99.567	6.267	30
FP3_30	99.633	6.183	30
FP4_30	99.783	6.100	30
FP5_30	99.850	5.950	30
FP6_30	99.917	5.833	30
FP7_30	100.100	5.717	30
FP8_30	100.217	5.617	30
FP9_30	100.267	5.533	30
FP10_30*	100.167	5.417	28
FP11_30*	100.150	5.317	31

Table 2-3. Location of forecast points at 40 m bathymetry contour depth.

Forecast Point (at 40 m depth)	Longitude (°E)	Latitude (°N)	Depth (m)
FP1_40	99.433	6.300	40
FP2_40	99.483	6.200	40
FP3_40	99.600	6.150	40
FP4_40	99.750	6.083	40
FP5_40	99.800	5.867	40
FP6_40	99.833	5.800	40
FP7_40	100.000	5.683	40
FP8_40	100.150	5.583	40
FP9_40	100.133	5.533	40
FP10_40*	100.150	5.417	42
FP11_40	100.133	5.350	40

Table 2-4. Location of forecast points at 50 m bathymetry contour depth.

Forecast Point (at 50 m depth)	Longitude (°E)	Latitude (°N)	Depth (m)
FP1_50	99.300	6.250	50
FP2_50	99.367	6.133	50
FP3_50	99.483	6.050	50
FP4_50	99.700	6.033	50
FP5_50	99.700	5.900	50
FP6_50	99.700	5.767	50
FP7_50	99.783	5.633	50
FP8_50	100.000	5.567	50
FP9_50	100.067	5.517	50
FP10_50	100.117	5.417	50
FP11_50	100.067	5.350	50

Table 2-5. Location of forecast points at 60 m bathymetry contour depth.

Forecast Point (at 60 m depth)	Longitude (°E)	Latitude (°N)	Depth (m)
FP1_60	99.200	6.200	60
FP2_60	99.300	6.100	60
FP3_60	99.383	5.967	60
FP4_60	99.450	5.867	60
FP5_60	99.483	5.800	60
FP6_60	99.517	5.683	60
FP7_60	99.567	5.567	60
FP8_60	99.583	5.483	60
FP9_60	99.617	5.417	60
FP10_60	99.633	5.350	60
FP11_60	99.650	5.283	60

Table 2-6. Location of coastal points with bathymetry contour depth.

Coastal Point (Location Name)	Coastal Point	Longitude (°E)	Latitude (°N)	Depth (m)	Block
Pantai Kok	CP1*	99.683	6.367	2	I
Pantai Cenang	CP2	99.717	6.333	1	I
Pulau Tepor	CP3*	99.700	6.267	2	I
Kuah	CP4	99.883	6.283	1	I
Kuala Perlis	CP5	100.133	6.383	1	II
Kuala Sanglang	CP6	100.200	6.250	1	III
Kampung Jeruju	CP7	100.250	6.183	1	III
Kuala Muda	CP8	100.283	6.100	1	III
Jemerlang	CP9	100.350	5.967	1	III
Yan	CP10*	100.367	5.783	2	III
Pantai Merdeka	CP11*	100.333	5.633	2	III
Kota Kuala Muda	CP12	100.350	5.567	1	III
Tanjung Bunga	CP13*	100.300	5.483	3	III
Batu Ferringhi	CP14	100.250	5.483	1	IV
Teluk Bahang	CP15	100.217	5.467	1	IV
Pantai Aceh	CP16	100.183	5.417	1	IV
Pasir Panjang	CP17	100.183	5.300	1	IV

Remark: * The nearest grid point is selected to locate the forecast point or coastal point.

3. Results (Tsunami Height)

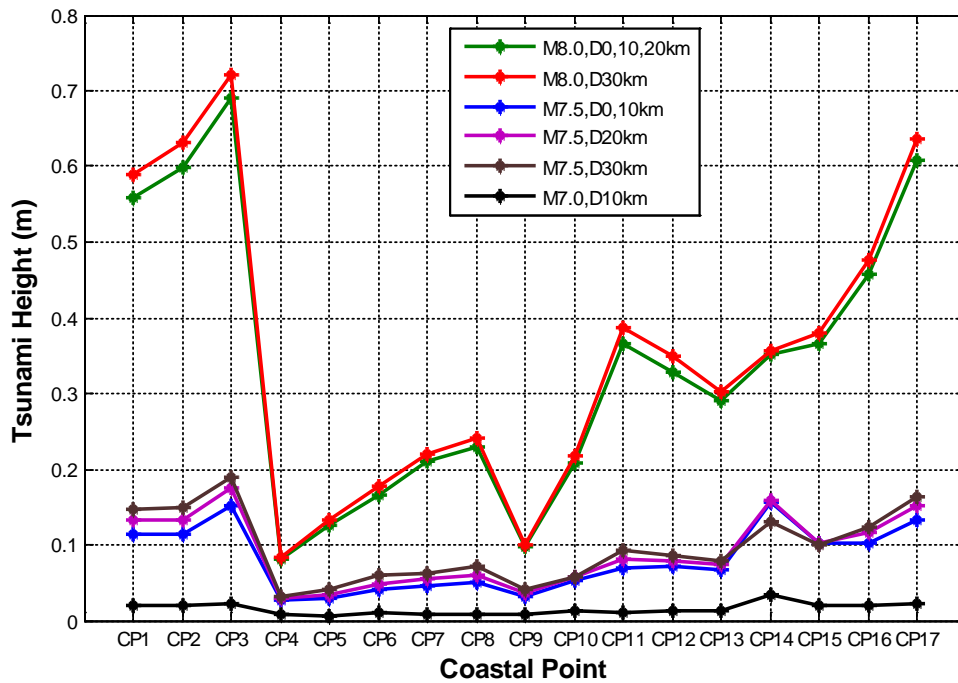


Figure 5. Tsunami heights at coastal points according to different magnitudes and depths.

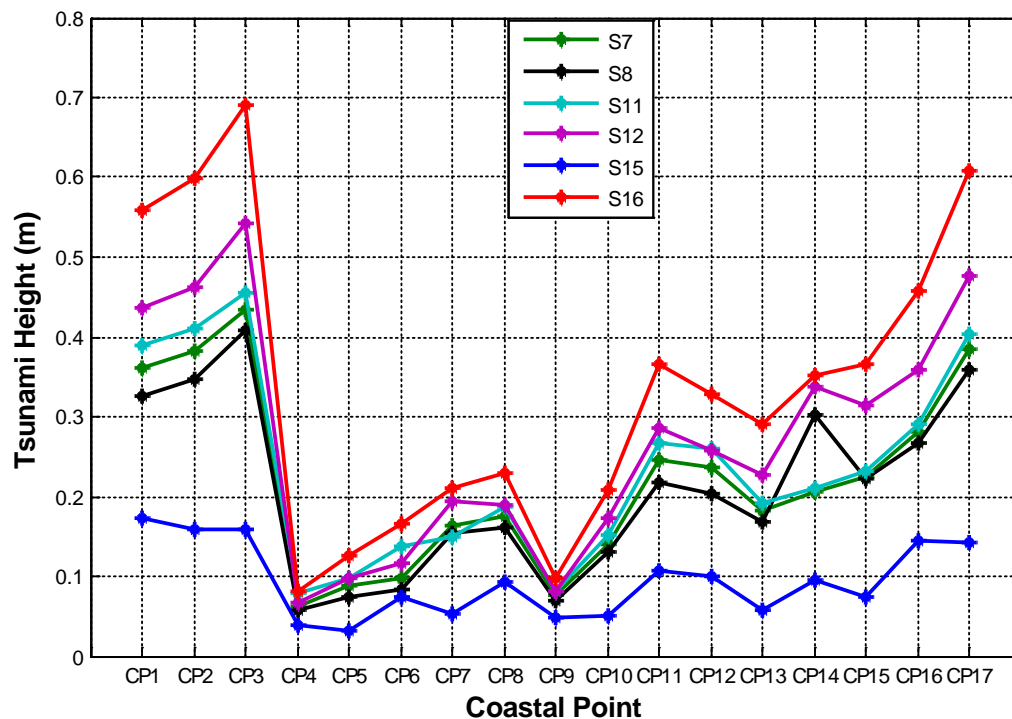


Figure 6. Tsunami heights at coastal points according to different source points.

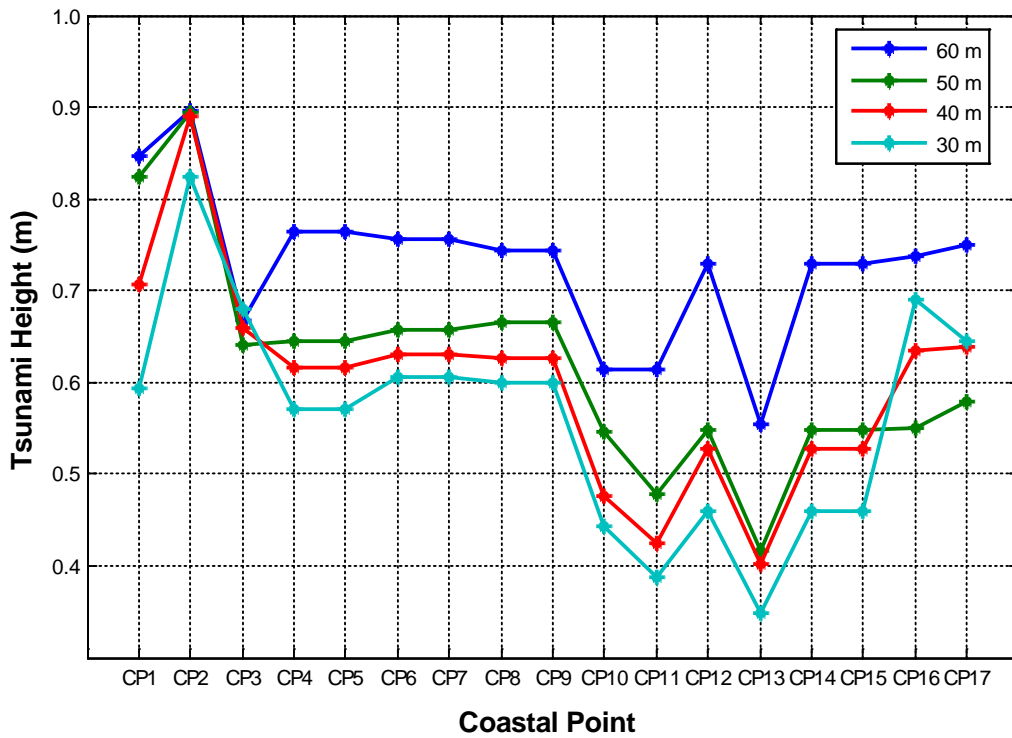


Figure 7. Tsunami height of Green's Law calculation for coastal points by different bathymetry water depths.

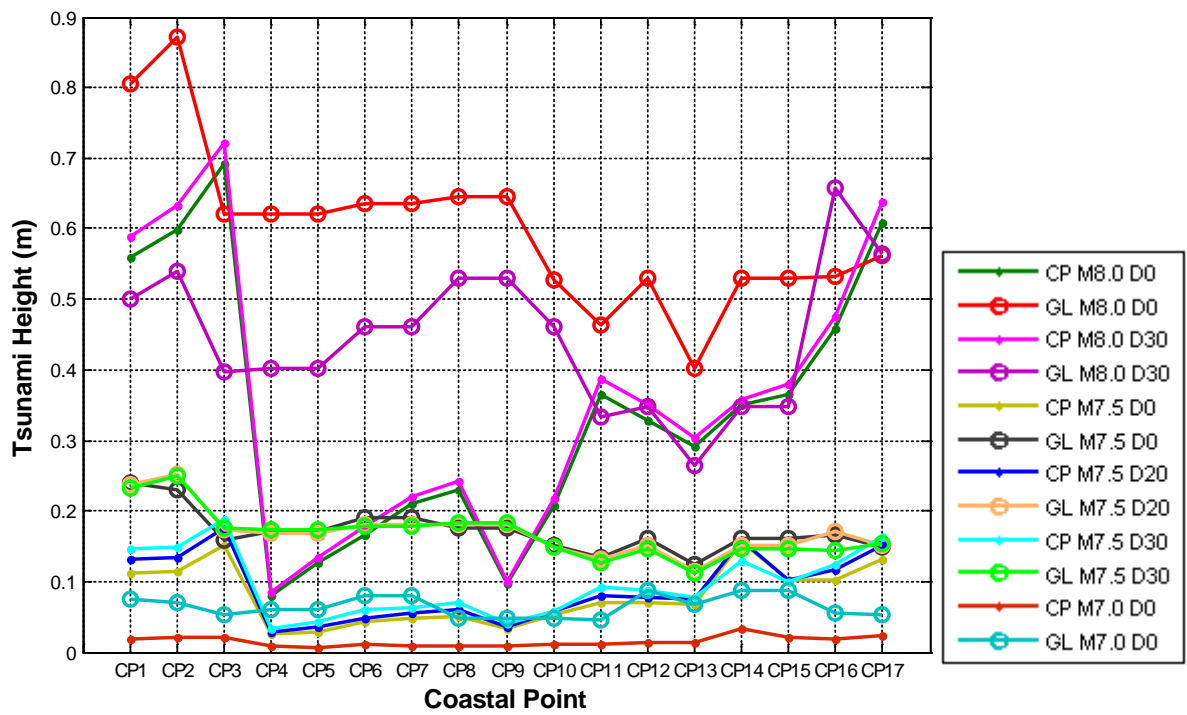


Figure 8. Tsunami heights at coastal points and Green's Law calculation by different magnitudes and depths.

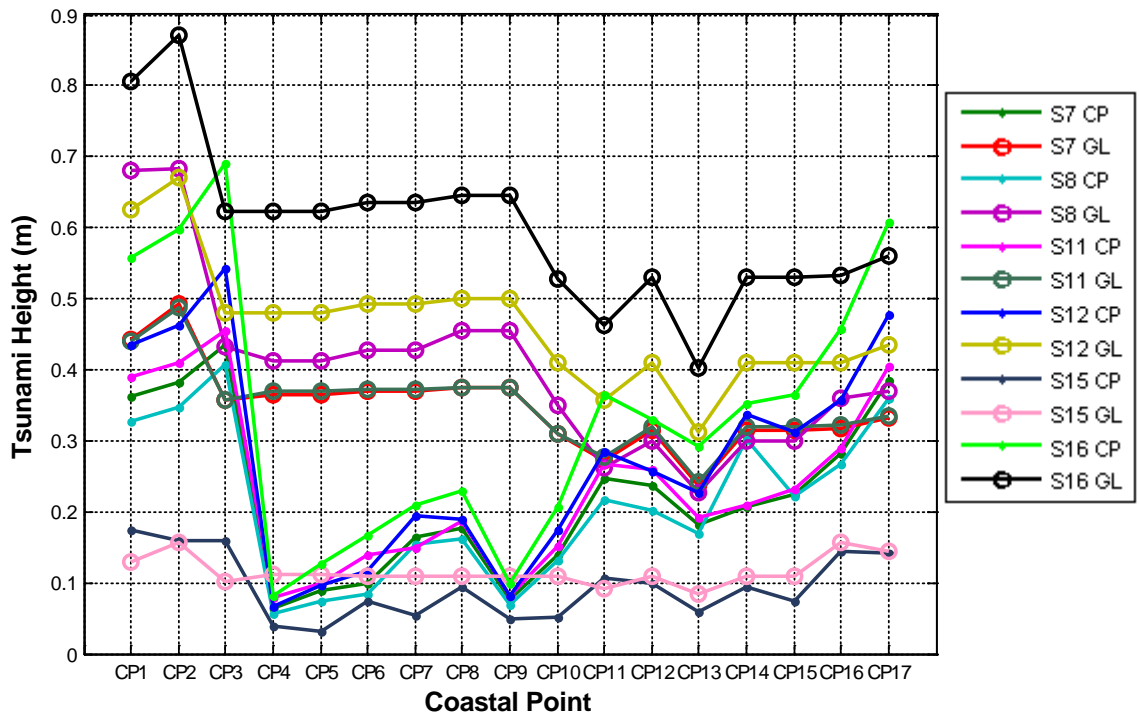


Figure 9. Tsunami heights at coastal points were obtained by numerical simulation and Green's Law calculation by different sources.

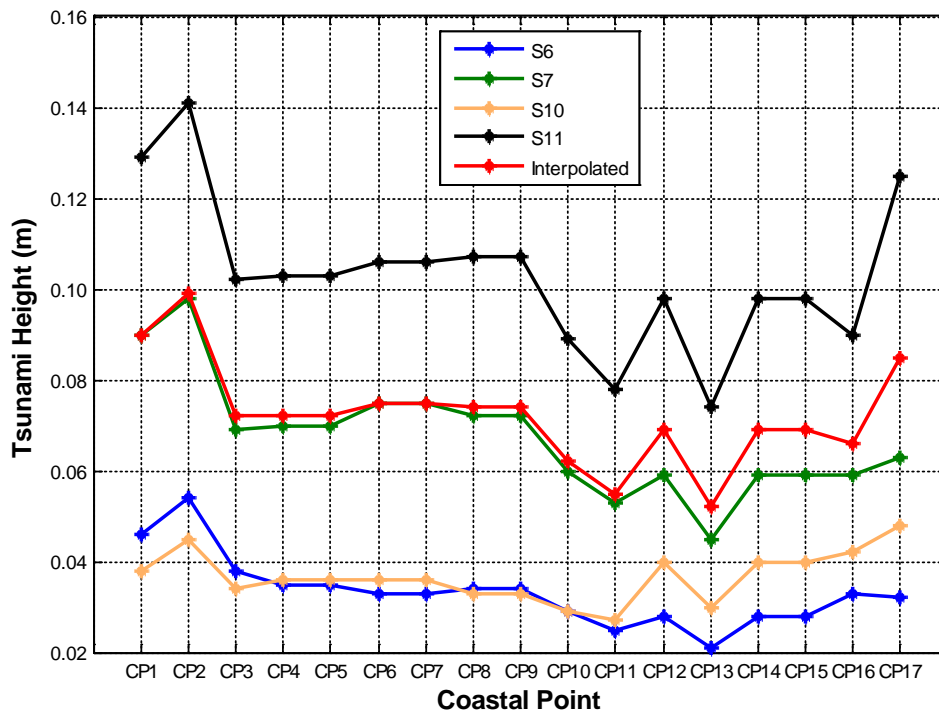


Figure 10. Tsunami heights at coastal points retrieved by interpolation method.

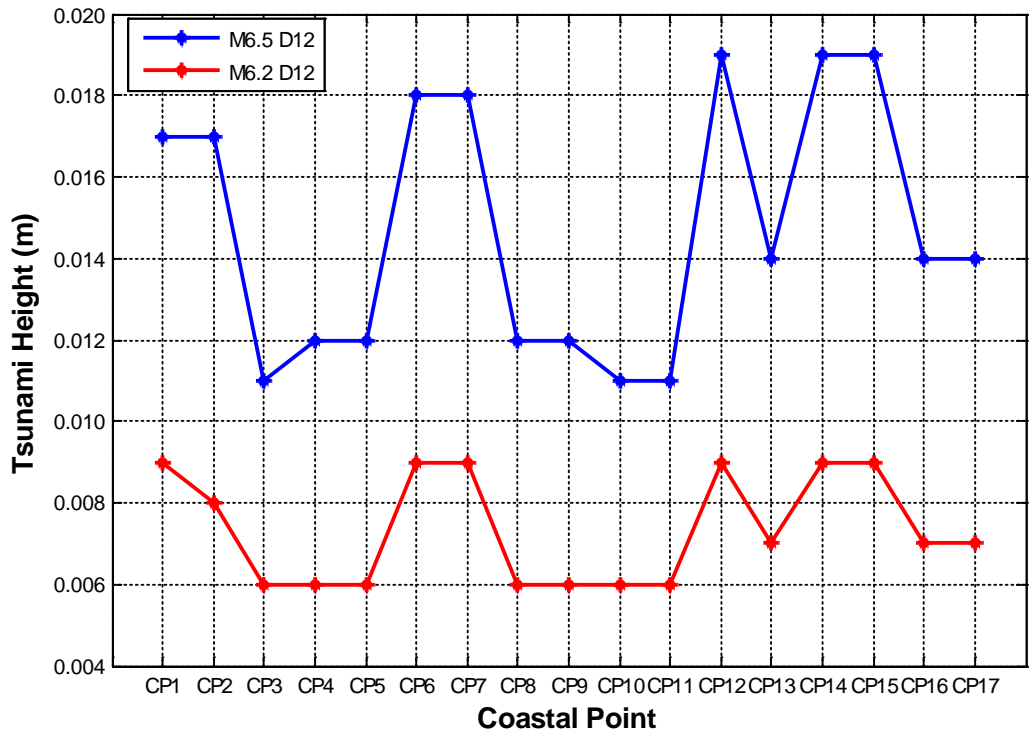


Figure 11. The tsunami heights at coastal points retrieved by extrapolation method (M_w 6.2).

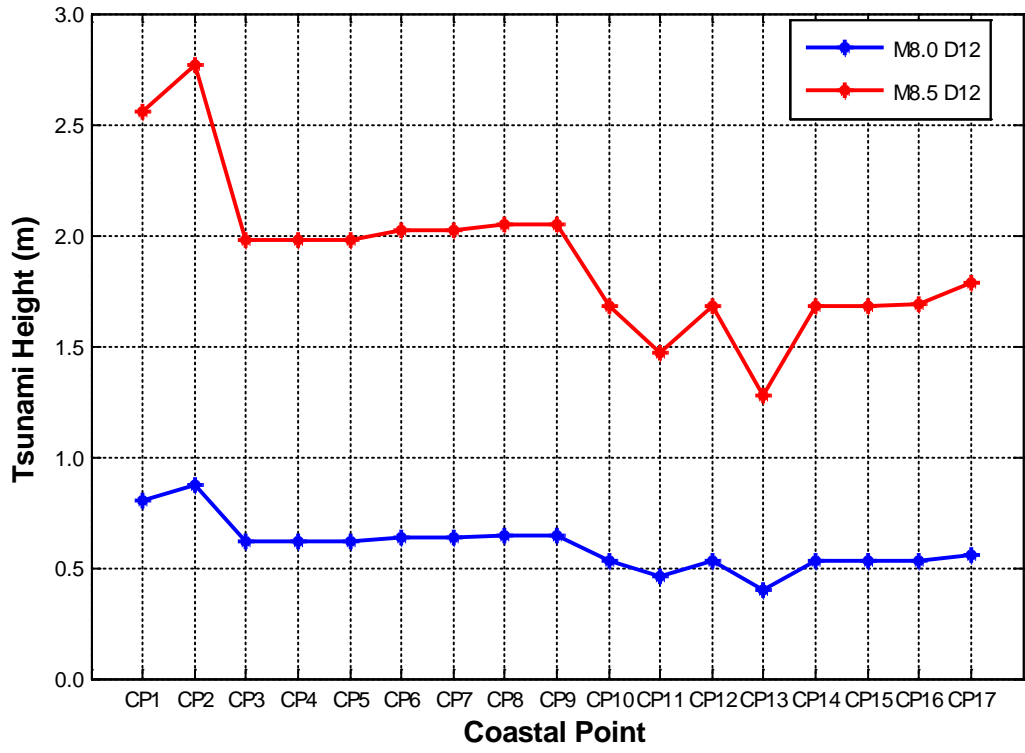


Figure 12. The tsunami heights at coastal points retrieved by extrapolation method (M_w 8.5).

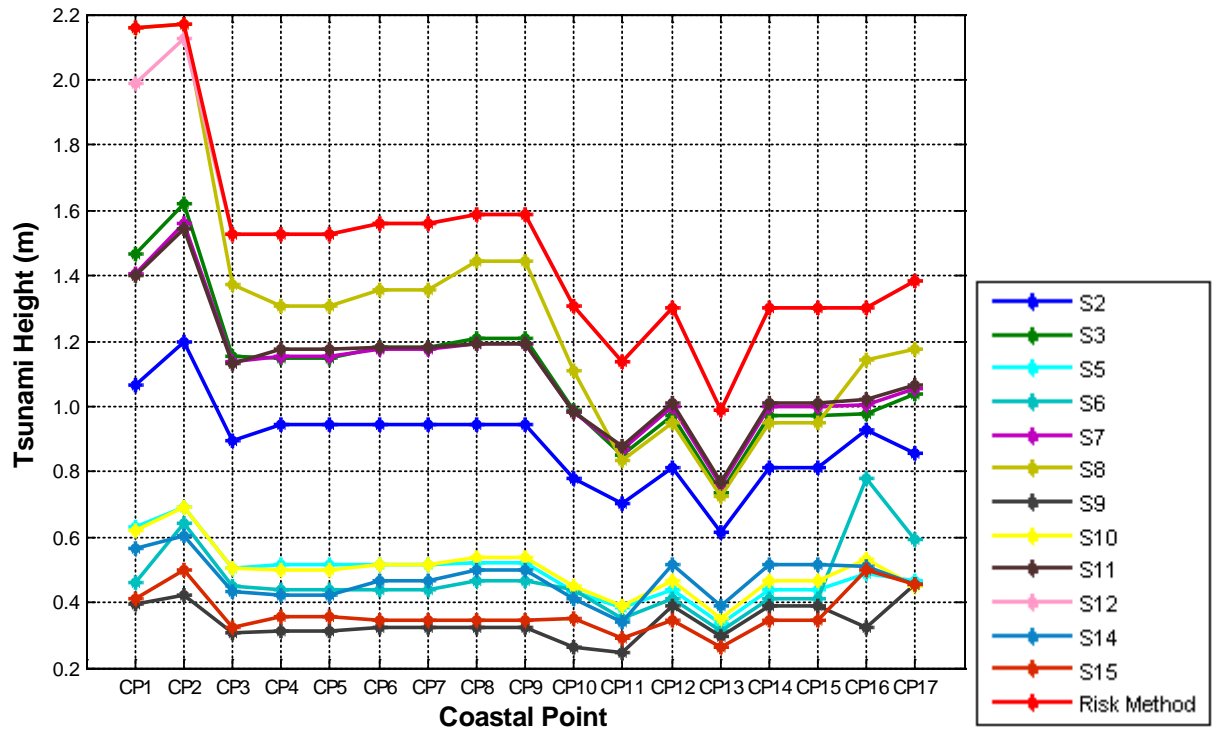


Figure 13. The tsunami heights at coastal points retrieved by maximum risk method 1.

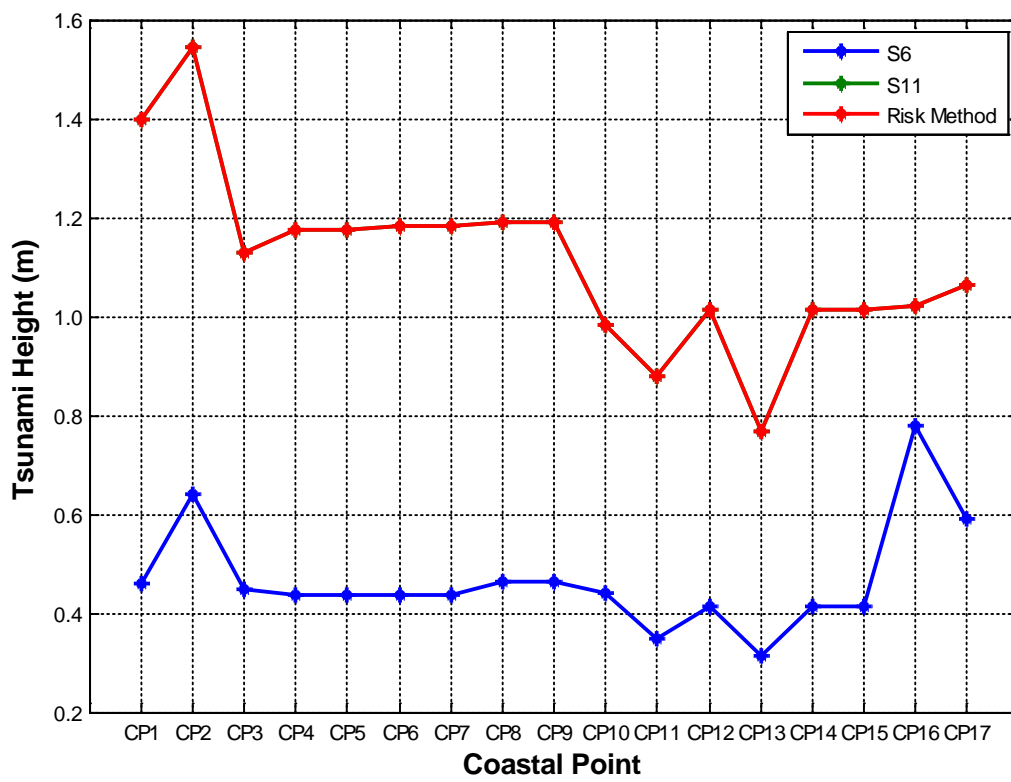


Figure 14. The tsunami heights at coastal points retrieved by maximum risk method 2.

4. Conditions for Computation

Table 3. Region for computation and data used for simulation.

Area	90.0° E-103.0° E / 3.0° N- 12.0 °S
Bathymetry data	1 arc-minute GEBCO
Δt	3.0 s (6.1 s when spatial grid size (Δx) is 1850 m, gravity acceleration (g) is 9.8 m/s^2 and the greatest sea depth in the calculated area (h_{max}) is 4682 m