TSUNAMI SIMULATION OF THE 1994 JAVA EARTHQUAKE FOR TSUNAMI HAZARD ASSESSMENT ALONG THE SOUTHERN COAST OF EAST JAVA, INDONESIA

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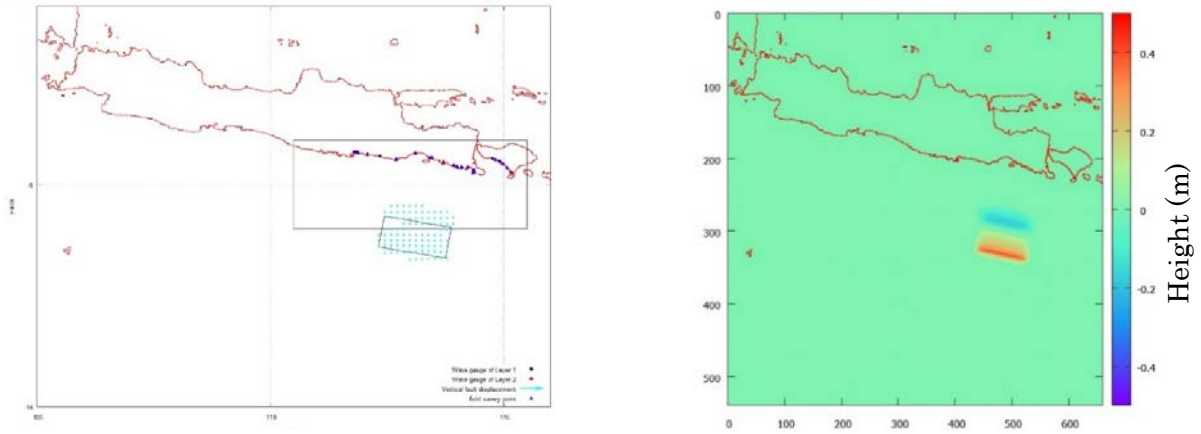
1. Fault Parameters of Tsunami Sources

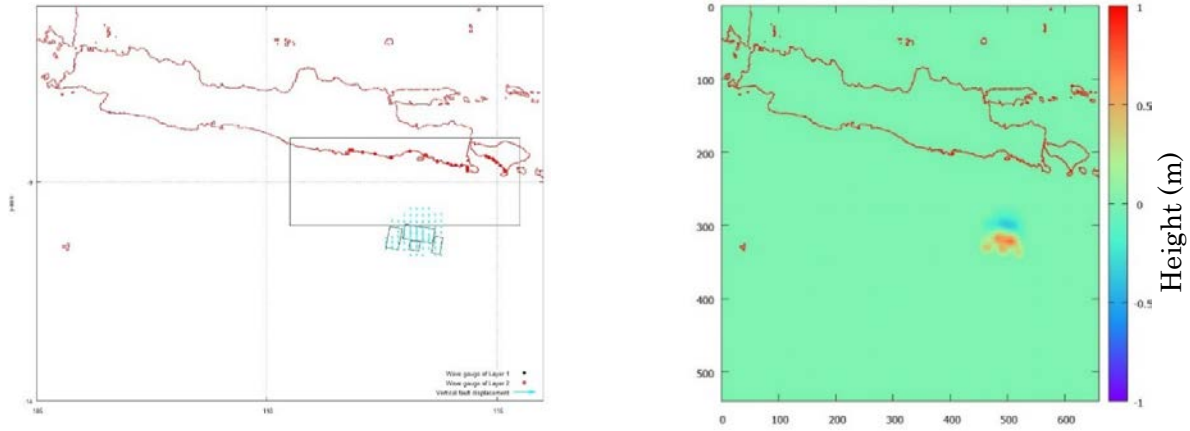
Table 1. Source parameters of the 1994 Java earthquake for tsunami modeling.

Source Model	Sub Fault	Lat (deg)	Lon (deg)	Length (km)	Width (km)	Strike (deg)	Dip (deg)	Rake (deg)	Slip (m)	Depth (m)	μ (GPa)	Mo (Nm)	Mw
1		-10.65	113.76	160	80	280	12	90	0.91	8600	30	3.50E+20	7.6
2	A	-10.54	112.86	37	55	280	12	90	1.20	9000	30	7.33E+19	7.2
	B	-10.58	113.3	30	30	280	12	90	1.30	10600		3.51E+19	7.0
	C	-10.65	113.76	35	50	280	12	90	1.00	8600		5.25E+19	7.1
	D	-10.4	113.6	85	40	280	12	90	2.00	15600		2.04E+20	7.5
										Total		3.65E+20	7.6
3		-10.65	113.76	160	80	280	12	90	16.00	8600	30	6.14E+21	8.5
4		-11	113.7	160	40	280	12	90	8.30	1700	10	5.31E+20	7.8
5		-11	113.7	160	40	280	12	90	18.00	0	10	1.15E+21	8.0

1a



2a



3a

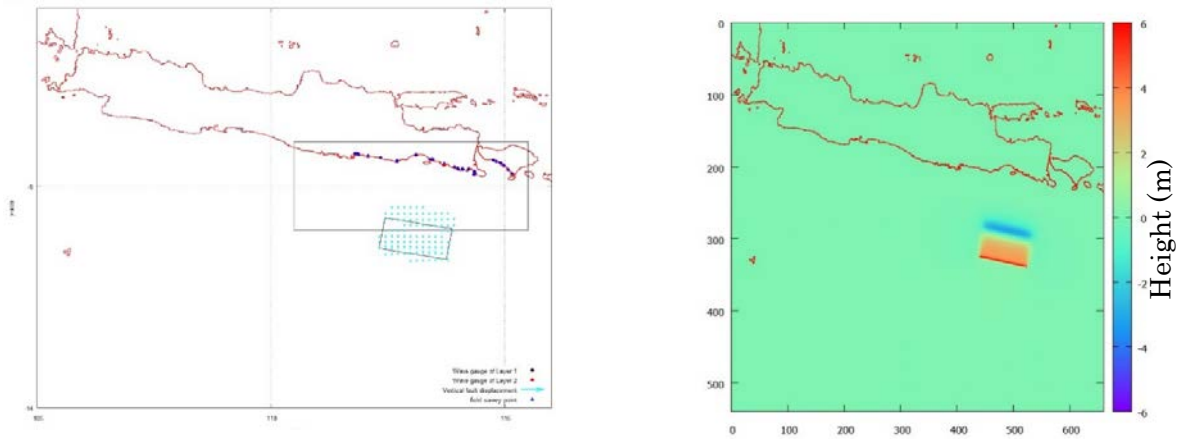
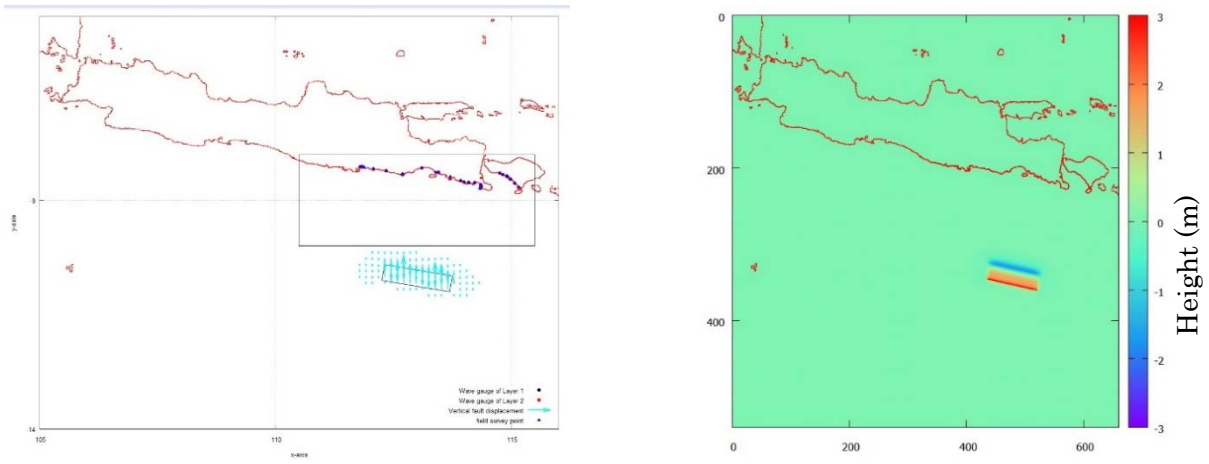
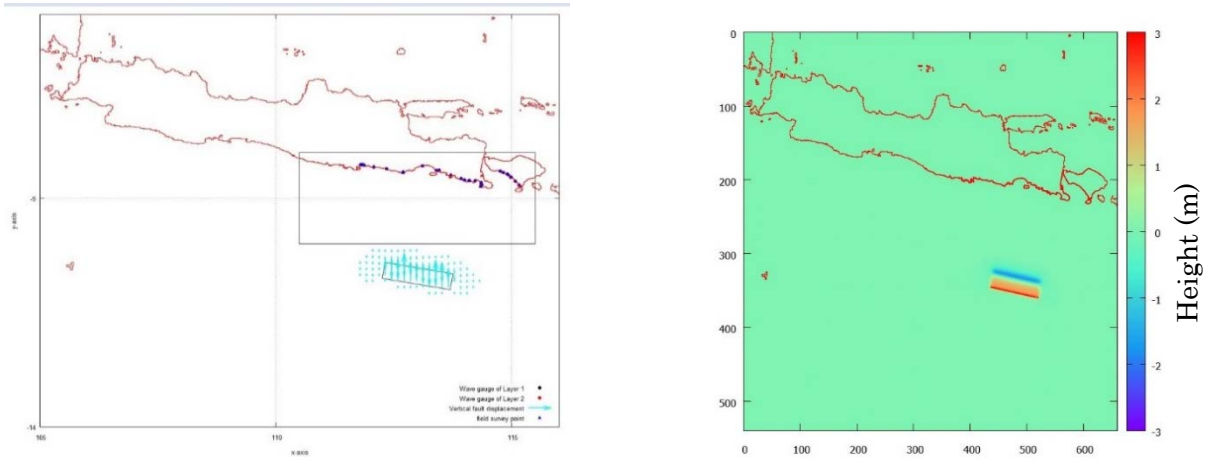


Figure 1. Right: Seafloor deformation from top to down in Cases 1a, 2a and 3a.
Left: Location of assumed fault location**.**

4a



4b



5b

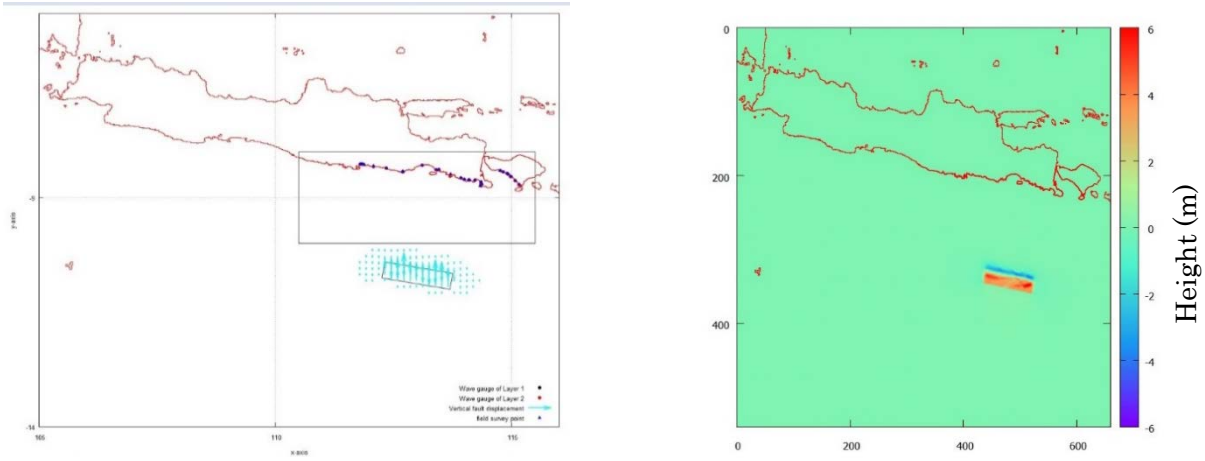


Figure 2. Right: Seafloor deformation from top to down in Cases 4a, 4b and 5b.
Left: Location of assumed fault location

Table 2. Tsunami heights measured by Tsuji et al (1995), used to validate tsunami and inundation modelling for comparing with field survey data.

No	Regency	Village	Longitude (^{o} S)	Latitude (^{o}E)	Height Abv MSL (m)
1	Bali	Kuta	8.7095	115.1657	1
2		Tanah Lot	8.6198	115.0858	1.8
3		Soka	8.5265	114.9932	3.7
4		Antor	8.5275	114.9953	4.1
5		Surabratan	8.4746	114.9303	2.6
6		Penggraguan	8.4633	114.9077	3.2
7		Pakutatan	8.4336	114.8235	2.8
8		Rambutsiwi	8.4050	114.7672	2.7
9	Banyuwangi	Tg.Purwa5	8.7395	114.3427	5.6
10		G-Land, Plengkung	8.6948	114.3760	4
11		Trianggul Asih1	8.6568	114.3607	4.9
12		Grajagan West2	8.6081	114.2267	4.1
13		Purwoasri	8.6151	114.1138	1.3
14		Lampon East	8.6000	114.0967	9.3
15		Pancer	8.5900	114.0050	9.4
16		Rajekwesi	8.5565	113.9352	13.9
17		Bandialit W	8.4823	113.7113	6
18		Besini-Ngarpuger	8.3803	113.4655	5.9
19		Geten	8.3861	113.4082	3.1
20	Lumajang	Bambangan	8.2893	113.1085	4.6
21	Malang	Sendangbiru	8.4166	112.7103	3.6
22		Sempu Is	8.4293	112.6922	2.7
23		Ngliyep	8.3500	112.3533	4.3
24	Tulungagung	Tambakrejo	8.3000	112.0833	5.4
25		Sine Gulf	8.2666	111.8833	4.2
26		Gerangan	8.2570	111.8398	5.5
27		Brumbung	8.2616	111.8337	4.8
28		Popoh Port	8.2630	111.8043	3.9
29		Sidem	8.2556	111.8000	3.1

2. Assumed Output Points

Table 3. Location of output points Layer 2.

Point No.	Longitude	Latitude	Depth (m)	Point No.	Longitude	Latitude	Depth (m)
1	115.1590	-8.7136	0.667	16	113.9350	-8.5732	3.704
2	115.0810	-8.6191	0.601	17	113.7110	-8.5281	4.074
3	114.9930	-8.5406	1.184	18	113.4670	-8.3833	4.000
4	114.9830	-8.5337	3.073	19	113.4180	-8.3900	0.593
5	114.9300	-8.4854	2.39	20	113.1090	-8.2894	4.145
6	114.9080	-8.4669	1.163	21	112.7110	-8.4280	6.741
7	114.8240	-8.4337	5.594	22	112.6950	-8.4340	3.674
8	114.7720	-8.4002	6.074	23	112.3530	-8.3504	0.481
9	114.3580	-8.6609	0.063	24	112.0830	-8.3170	1.748
10	114.3660	-8.6899	1.573	25	111.8660	-8.2670	5.096
11	114.3620	-8.7422	0.31	26	111.8480	-8.2650	1.444
12	114.2340	-8.6084	10.259	27	111.8310	-8.2690	1.324
13	114.1140	-8.6114	0.444	28	111.8050	-8.2622	1.000
14	114.0970	-8.6115	6.148	29	111.7990	-8.2616	1.667
15	114.0050	-8.6005	1.926				

Table 4. Location of output points Layer 3.

Point No.	Longitude	Latitude	Depth (m)	Point No.	Longitude	Latitude	Depth (m)
1	115.1660	-8.7097	2.117	16	113.9340	-8.5696	7.298
2	115.0820	-8.6194	4.356	17	113.7120	-8.4859	4.694
3	114.9900	-8.5284	5.305	18	113.4670	-8.3819	0.039
4	114.9920	-8.5297	4.179	19	113.4070	-8.3874	1.257
5	114.9250	-8.4752	4.382	20	113.1090	-8.2874	6.657
6	114.9050	-8.4636	6.96	21	112.7150	-8.4208	1.944
7	114.8230	-8.4363	2.656	22	112.7160	-8.4326	12.417
8	114.7650	-8.4086	2.498	23	112.3570	-8.3531	0.719
9	114.3360	-8.7402	9.943	24	112.0840	-8.3214	2.98
10	114.3720	-8.6945	3.643	25	111.8620	-8.2783	7.938
11	114.3550	-8.6588	2.018	26	111.8480	-8.2692	1.172
12	114.2310	-8.6090	1.238	27	111.8450	-8.2714	0.072
13	114.1140	-8.6131	60.564	28	111.7990	-8.2661	8.602
14	114.0970	-8.6131	62.104	29	111.7940	-8.2596	5.079
15	114.0070	-8.5907	10.315				

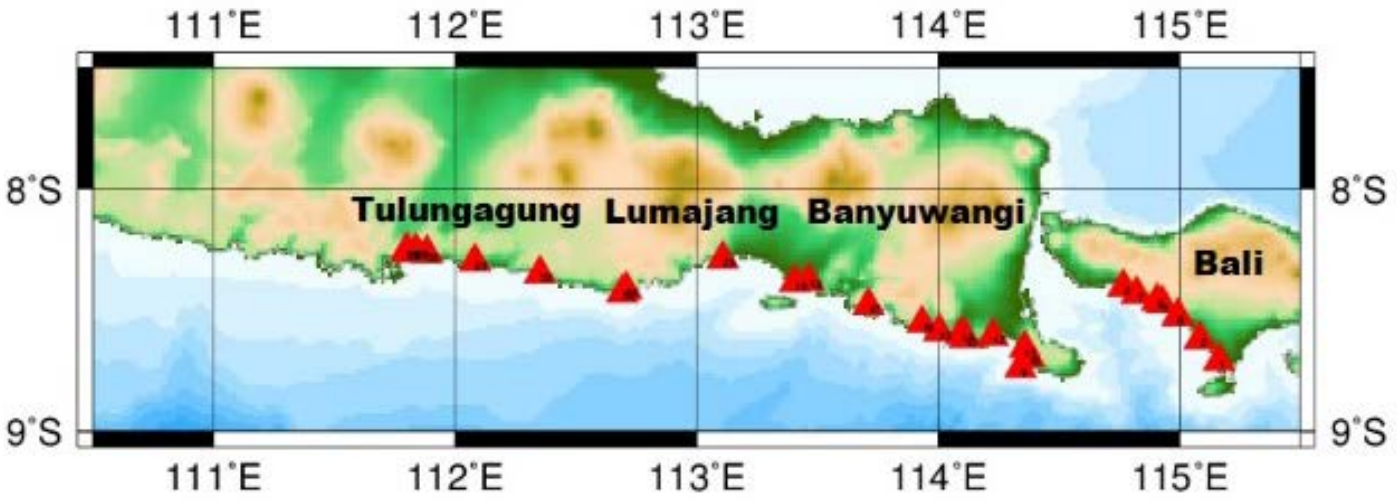


Figure 3. Assumed output points in southern East Java and Bali by red triangles.

3. Results (Tsunami Height)

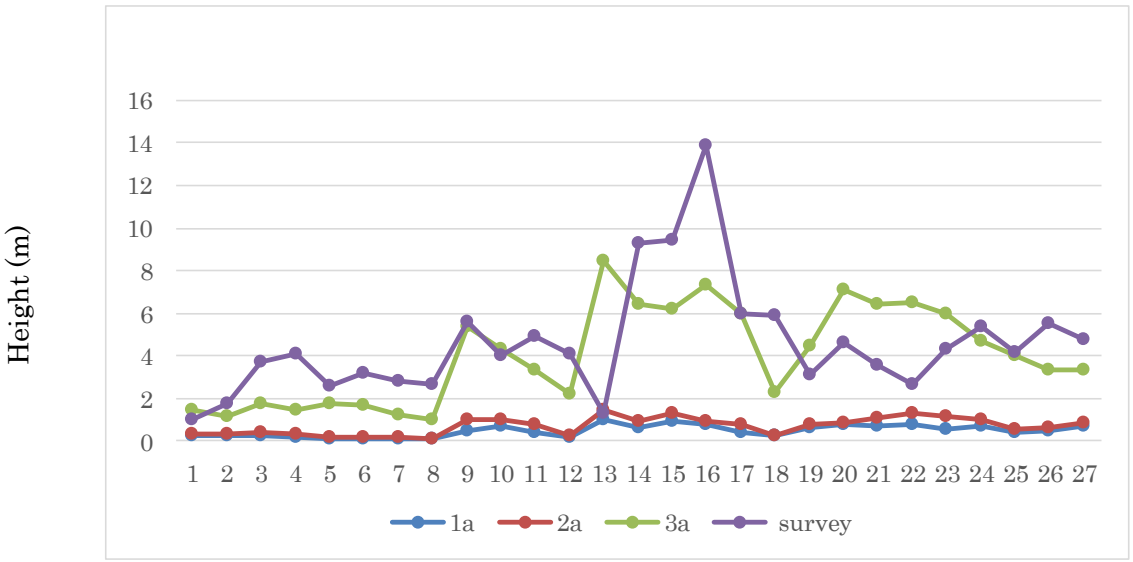


Figure 4. Comparison of tsunami heights in Cases 1a, 2a, 3a with field survey data at all coastal output points.

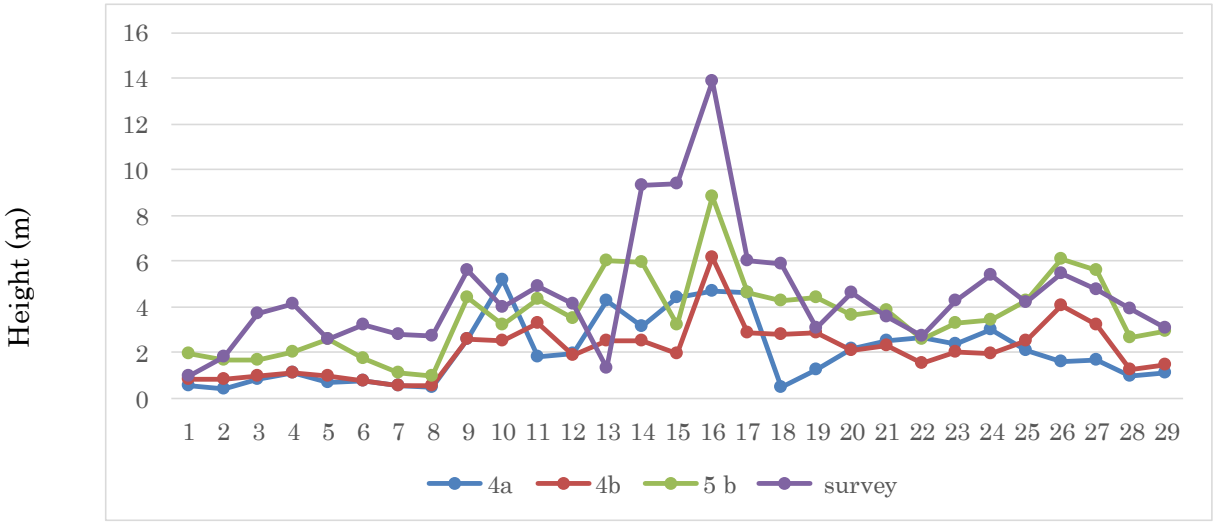


Figure 5. Comparison of tsunami heights in Cases 4a, 4b, 5b with the field survey data at all coastal output points.

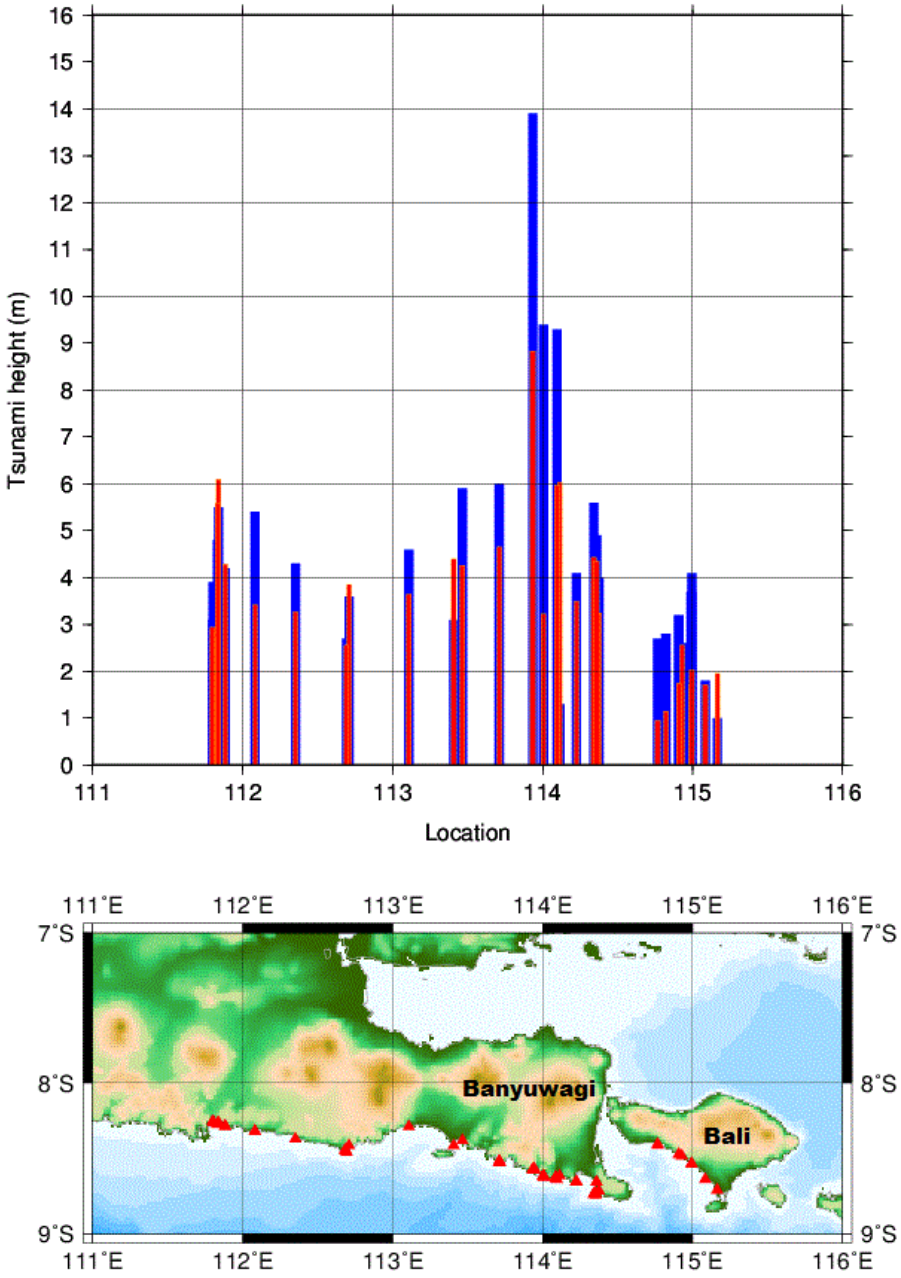


Figure 6. Comparison of Case 5b with the field survey data. Red bars show the result of tsunami modeling and blue bars show the field survey data.

4. Conditions for Computation

Table 5. Computation layers and data used for simulation.

Layer	Latitude	Longitude	Bathymetry data	Topography data	Spatial grid size	Grid (*nx* x *ny*) dimension
1	14°S -5°S	105°E-116°E	GEBCO 1 arc-min		1 arc-min	661 x 541
2	10°S -8°S	110.5°E-115.5°E	GEBCO 1 arc-min		0.33333 arc- min	901 x 601
3	9°S -8.16°S	111.5°E-115.33°E	GEBCO 30 arc-sec		0.11111 arc-min	2071 x 471
4	8.75°S -8.5°S	113.75°E-114.25°E	GEBCO 30 arc-sec	SRTM 3 arc-sec	0.03704 arc-min	810 x 405

The temporal grid size (Δt) is set to 3.0 s.