TSUNAMI MODELING OF THE 1797 AND 1833 MENTAWAI EARTHQUAKES IN WEST SMATRA

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1. Fault Parameters of Tsunami Sources

Table 1. Fault parameters for Case 1 (the 1833 earthquake, Mw 8.9).

Sub	Location		Slip	Length	Width	Strike	Dip	Slip	Depth
Fault	Lat. (°)	Long. (°)	(m)	(km)	(km)	(°)	(°)	(°)	(m)
1	99.11	-3.01	9	29.4	182	322	15	90	0.001
2	99.50	-3.52	11	70.6	182	322	15	90	0.001
3	100.50	-4.80	18	180	146	322	15	90	0.001

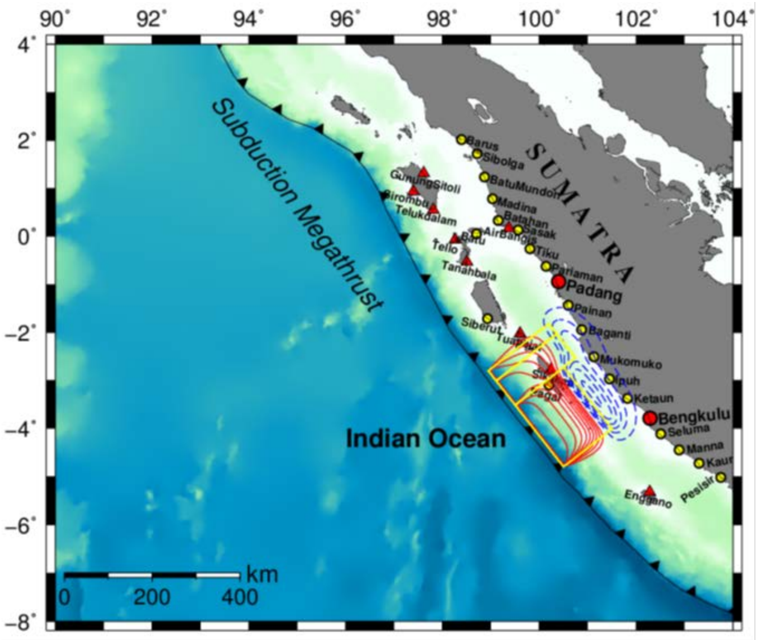

Figure 1. Calculated seafloor deformation for Case 1.

Table 2. Fault parameters for Case 2a (the 1833 earthquake, Mw 8.6).

Sub	Location		Slip	Length	Width	Strike	Dip	Slip	Depth
Fault	Lat. (°)	Long. (°)	(m)	(km)	(km)	(°)	(°)	(°)	(km)
1	99.67	-2.67	7	32.4	101.25	322	15	90	20
2	99.97	-3.06	9	54.675	121.5	322	15	90	20
3	101.05	-4.45	10	194.4	76.95	322	15	90	20

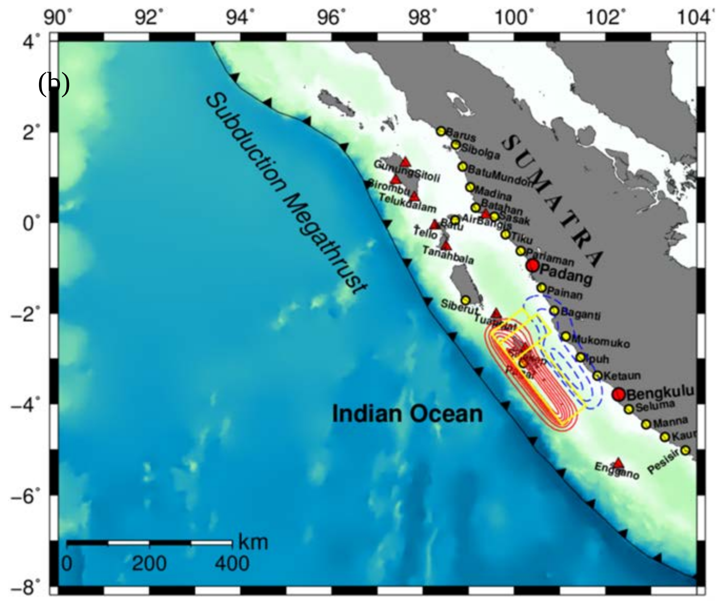

Figure 2. Calculated seafloor deformation for Case 2a

Table 3. Fault parameters for Case 3a (1797, Mw 8.7).

Sub Fault	Location		Slip	Length	Width	Strike	Dip	Slip	Depth
	Lat. (°)	Long. (°)	(m)	(km)	(km)	(°)	(°)	(°)	(m)
1	98.74	-2.57	6	222.222	150	324	15	90	0.001
2	99.12	-3.10	8	72.222	127.777	324	15	90	0.001
3	99.47	-3.59	6	66.666	144.444	324	15	90	0.001
4	99.56	-3.71	4	16.666	172.222	324	15	90	0.001

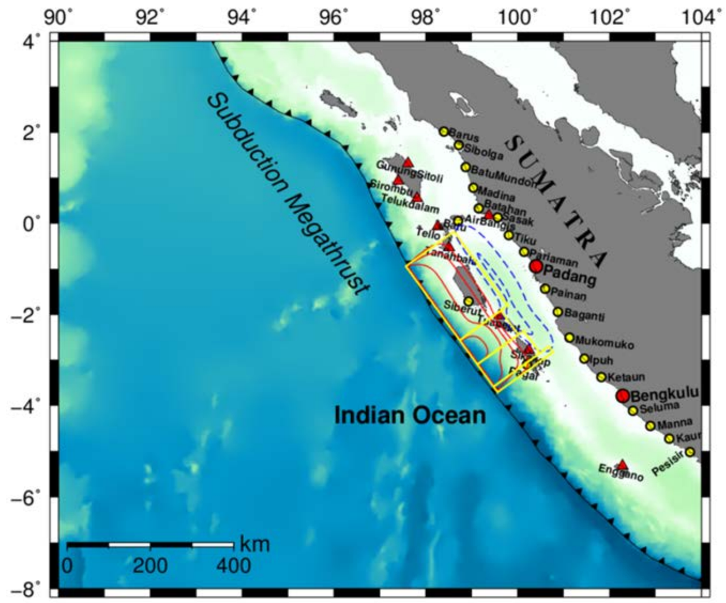

Figure 3. Calculated seafloor deformation for Case 3a.

Table 4. Fault parameters for Case 2b (1833, Mw 8.2).

Sub Fault	Location		Slip	Length	Width	Strike	Dip	Slip	Depth
	Lat. (°)	Long. (°)	(m)	(km)	(km)	(°)	(°)	(°)	(km)
1	99.67	-2.67	7	32.4	101.25	322	15	90	20
2	99.97	-3.06	9	54.675	121.5	322	15	90	20

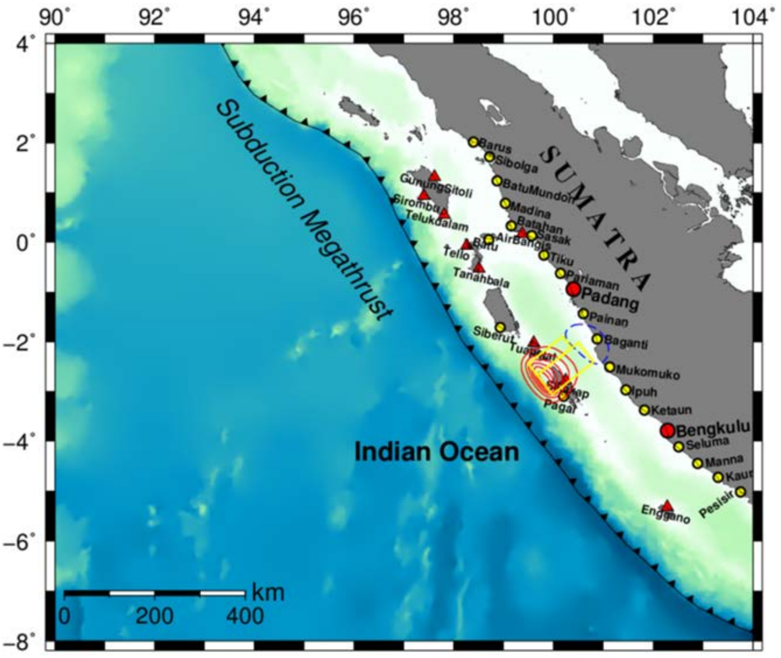

Figure 4. Calculated seafloor deformation for Case 2b of the 1833 earthquake (Mw 8.2).

Table 5. Fault parameters for Case 3b (1797, Mw 8.5).

Sub Fault	Location		Slip	Length	Width	Strike	Dip	Slip	Depth
	Lat. (°)	Long. (°)	(m)	(km)	(km)	(°)	(°)	(°)	(m)
1	98.74	-2.57	6	222.222	150	324	15	90	0.001
2	99.12	-3.10	8	72.222	127.777	324	15	90	0.001

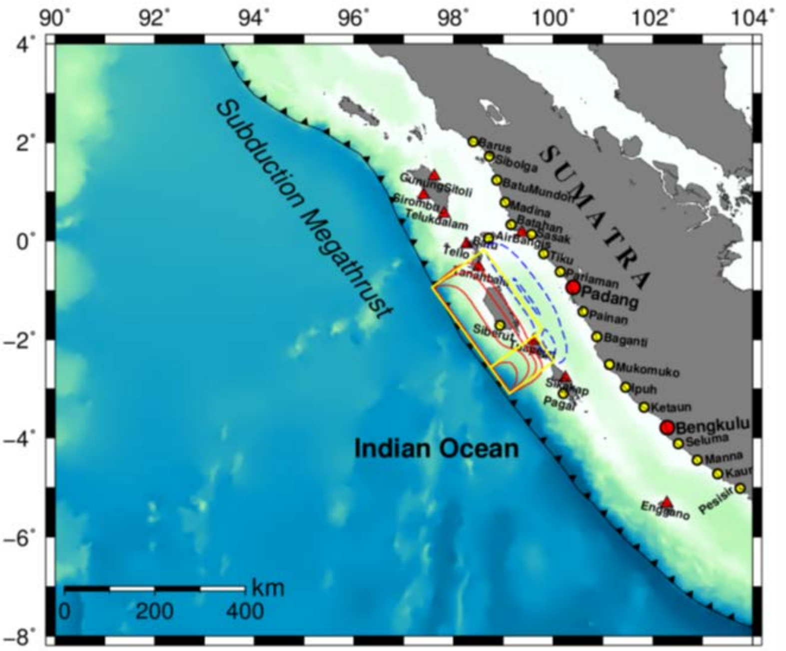

Figure 5. Calculated seafloor deformation for Case 3b of the 1797 earthquake (Mw 8.5).

2. Tide Gauge Stations

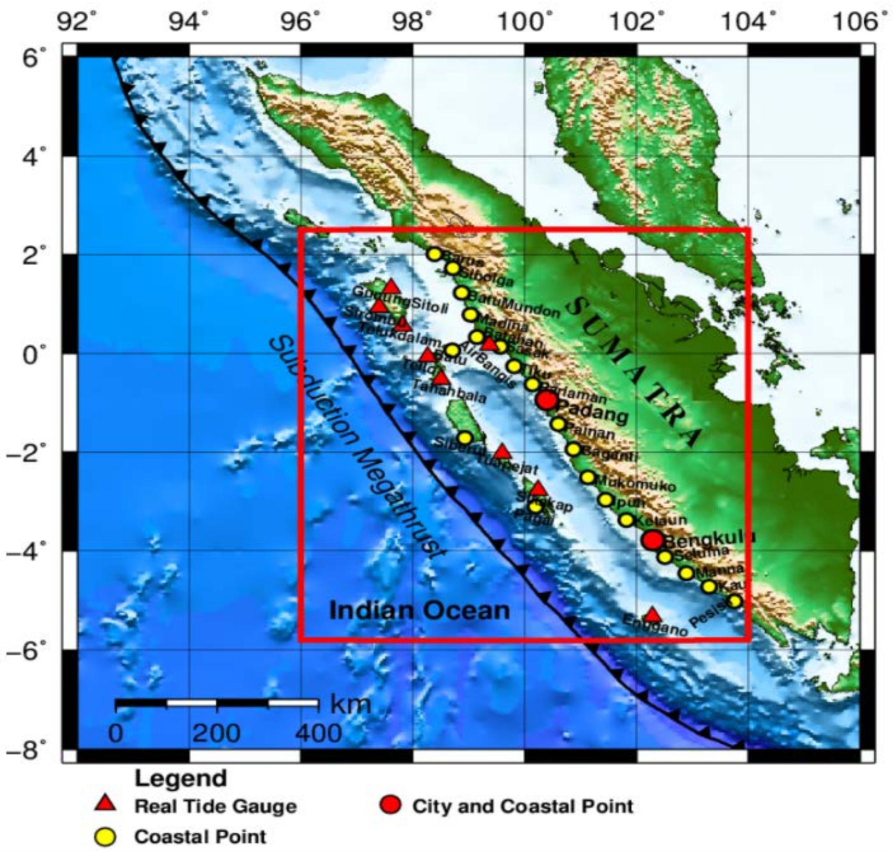

Figure 6. Location of tide gauges and coastal points.

Table 6. Location of tide gauges and coastal points.

No.	Location	Latitude (°)	Longitude (°)	Status
1	Padang	-0.79	100.28	Real
2	Sikakap	-2.78	100.22	Real
3	Gunung Sitoli	1.31	97.61	Real
4	Sirombu	0.94	97.41	Real
5	Tello Island	-0.05	98.29	Real
6	Teluk Dalam	0.55	97.82	Real
7	Enggano	-5.35	102.28	Real
8	Baai Island (Bengkulu)	-3.38	101.85	Real
9	Tanahbala	-0.53	98.50	Real
10	Tuapejat	-2.03	99.59	Real
11	Air Bangis	0.20	99.38	Real
12	North Pagai	-2.99	100.19	Coastal Point
13	North Siberut	-1.72	98.93	Coastal Point
14	Batu Island	0.07	98.66	Coastal Point
15	Ketaun	-3.40	101.80	Coastal Point
16	Ipuh	-3.05	101.45	Coastal Point
17	Mukomuko	-2.50	101.00	Coastal Point
18	Baganti	-1.95	100.85	Coastal Point
19	Pariaman	-0.65	100.10	Coastal Point
20	Painan	-1.35	100.55	Coastal Point
21	Tiku	-0.25	99.75	Coastal Point
22	Sasak	0.10	99.50	Coastal Point
23	Batahan	0.35	99.10	Coastal Point
24	Madina	0.80	99.00	Coastal Point
25	Sibolga	1.70	98.75	Coastal Point
26	Barus	2.00	98.35	Coastal Point
27	BatuMundon	1.25	98.80	Coastal Point
28	Manna	-4.45	102.85	Coastal Point
29	Seluma	-4.15	102.50	Coastal Point
30	Kaur	-4.80	103.30	Coastal Point
31	Pesisir	-5.10	103.80	Coastal Point

3. Results (Tsunami Height)

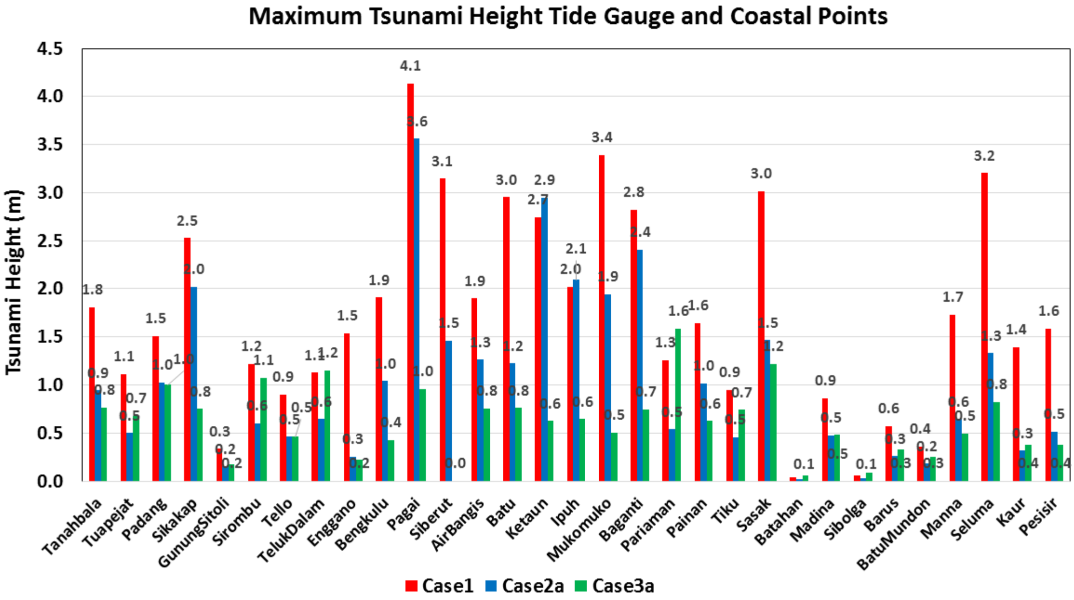

Figure 7. Comparison of maximum tsunami height for Case 1, Case 2a and Case 3a.

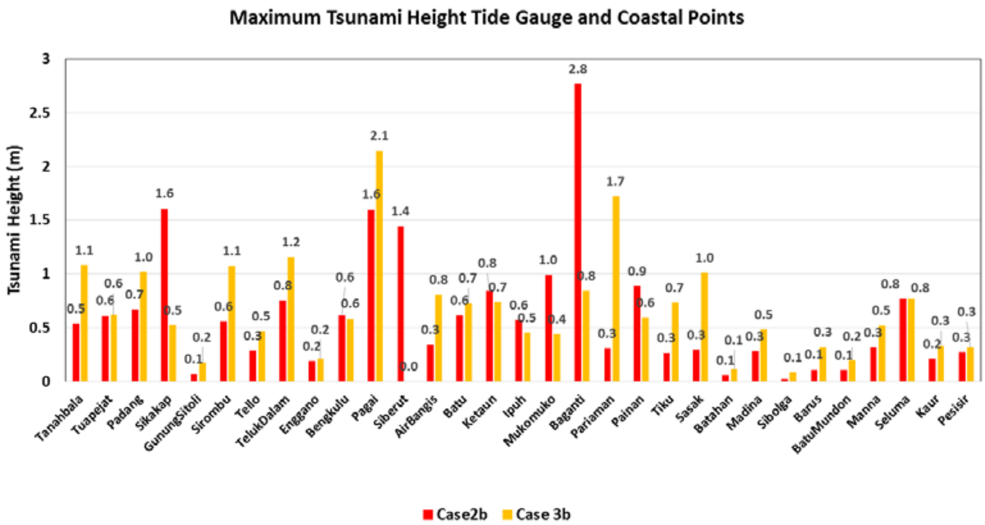

Figure 8. Comparison of maximum tsunami height for Case 2b and Case 3b.

Table 7. Calculated maximum tsunami height and tsunami inundation depth in the target area.

No.	Region	Source Model	Magnitude (Mw)	Historical Tsunami Height (m)	Tsunami Height (m)	Tsunami Inundation Depth (m)
1	Padang	Case 1	8.9	3 - 4.5	4.05	3.70
		Case 3a	8.7	5.0	2.80	2.40
2	Pariaman	Case 1	8.9	-	2.10	2.00
		Case 3b	8.5	-	1.88	1.78
3	Baganti	Case 1	8.9	-	6.70	6.80
		Case 2b	8.2	-	4.97	4.67
4	Muko-muko	Case 1	8.9	-	7.30	7.20
		Case 2a	8.6	-	6.10	6.00
		Case 3a	8.7	-	1.50	2.20

4. Conditions for Computation

Table 8. Computation regions and data used for simulation.

Boundary of Area		nx	ny	Bathymetry Grid	Δt	nt
8.00° S- 4.00°N	90.00°E – 104.00°E	840	720	GEBCO 1 arc-min.	3 s	3600 (3 hours)

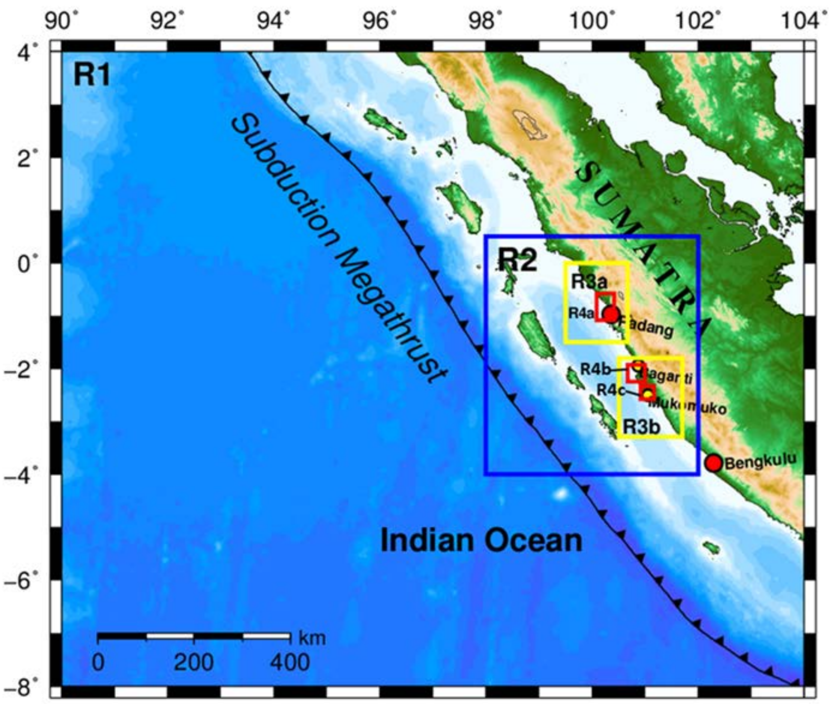

Figure 9. Computation area with nesting grid system.

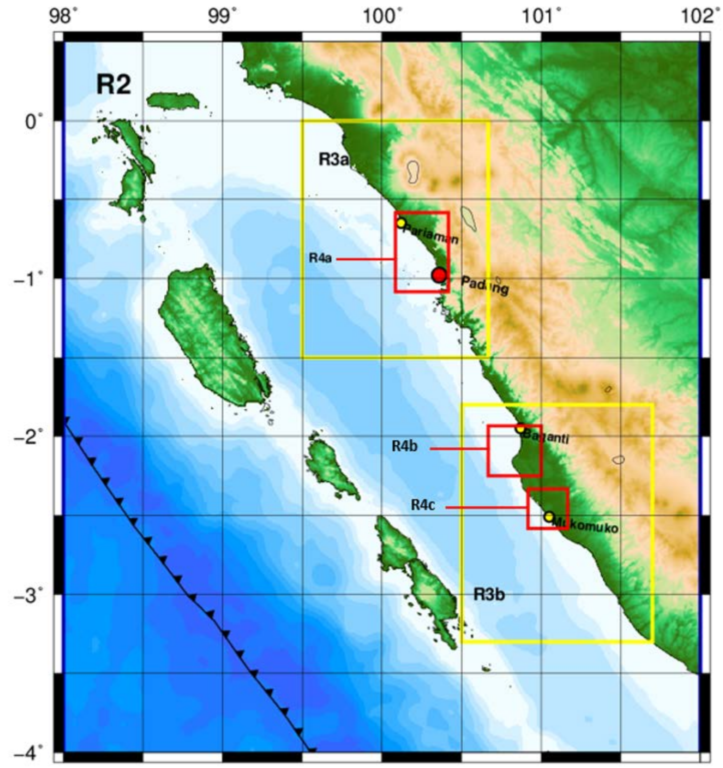

Figure 10. Location and boundary of smaller regions in Region 2.

Table 9. Boundary and data resolution of computation in Regions 1, 2 and 3.

Region	Latitude	Longitude	Grid Size (arc-min)	nx	ny	Bathymetry/Topography
1	8.0° S- 4.0° N	90.0° E – 104.00° E	1’	840	720	GEBCO 30’’
2	4.0° S- 0.5° N	98.0° E – 102.00° E	0.333333’	720	810	GEBCO 30’’
3a	1.5° S- 0.0° S	99.5° E – 100.67° E	0.111111’	630	810	GEBCO 30’’
3b	3.3° S- 1.8° S	100.5° E – 101.7° E	0.111111’	648	810	GEBCO 30’’

nx : Total grid number in x direction, ny : Total grid number in y direction

Table 10. Boundary and data resolution of computation Regions 3 and 4.

Target Area	Region	Latitude	Longitude	Grid Size (arc-min)	nx	ny	Bathymetry/ Topography
Padang, Pariaman	3a	1.50°S- 0.00°S	99.50°E – 100.67°E	0.111111’	630	810	GEBCO 30’’
	4a	1.08°S- 0.58°S	100.08°E – 100.41°E	0.037037’	540	810	GEBCO 30’’
Baganti, Muko-muko	3b	3.30°S- 1.80°S	100.50°E – 101.70°E	0.111111’	648	810	GEBCO 30’’
Baganti	4b	2.25°S- 1.93°S	100.67°E – 101.00°E	0.037037’	540	513	GEBCO 30’’
Muko-muko	4c	2.58°S- 2.35°S	100.91°E – 101.16°E	0.037037’	405	378	GEBCO 30’’

nx : Total grid number in x direction

ny : Total grid number in y direction