CHAPTER 3

RESULTS

In the nearly 6-month period from January 14 to June 30, 2005; a total of 210 local seismic events were detected by short-period seismic stations. The events are categorized in two groups, first 173 local earthquakes; second 37 man-made events.

3.1 Local earthquake events

The local earthquakes occurred in an area between latitude 7.25˚ N and 10.12˚ N, longitude 97.26˚ E and 99.69˚ E, with the local magnitude (Ml) ranging from -1.0 to 2.2 on Richter scale. Their origin time, location and magnitude are listed in Table 3.1.

Table 3.1: A total of 173 local earthquake events from 14 January to 30 June 2005 were recorded with largest magnitude (Ml) of 2.2 on 3 March 2005 (11:53:59.0 UTC time) and smallest magnitude (Ml) of -1.0 on 15 March 2005 (10:30:23.1 UTC time) and 24 May 2005 (11:09:13.2 UTC time). Ml calculated after Hutton and Boore (1987).

Origin Time DD/MM/YY hh:mm:ss.0	Longitude (Degree East)	Latitude (Degree North)	Ml
14/01/05 10:08:54.7	98.515	8.545	-0.5
15/01/05 21:54:43.1	98.287	8.507	-0.1
16/01/05 02:46:52.7	99.524	9.361	1.1
16/01/05 04:03:07.5	98.601	8.461	0.5
16/01/05 13:01:20.7	97.467	8.549	1.2
16/01/05 20:57:21.4	99.132	8.507	0.1
17/01/05 04:03:23.2	98.644	8.683	0.6
17/01/05 12:01:13.0	97.467	8.528	1.5
17/01/05 12:08:54.7	97.596	8.919	1.0
17/01/05 17:50:51.9	98.095	8.736	0.9
17/01/05 23:00:55.7	97.987	8.461	0.7
18/01/05 21:39:11.6	98.126	8.173	0.5
20/01/05 09:48:18.8	98.454	9.555	1.0

Table 3.1: (continued)

Origin Time DD/MM/YY hh:mm:ss.0	Longitude (Degree East)	Latitude (Degree North)	Ml
21/01/05 22:23:03.5	98.134	8.573	0.8
05/02/05 12:46:06.4	98.597	8.169	0.4
05/02/05 18:07:42.5	98.075	8.022	0.9
09/02/05 21:04:14.7	100.141	8.191	0.8
15/02/05 13:09:23.9	99.072	7.992	1.2
01/03/05 01:02:31.3	99.513	7.607	0.8
01/03/05 09:26:56.6	99.112	8.771	0.2
01/03/05 09:35:23.9	98.879	7.942	0.5
01/03/05 09:57:44.7	98.428	8.491	-0.4
01/03/05 17:42:37.5	98.509	8.590	-0.9
02/03/05 04:35:34.5	98.098	8.663	0.7
02/03/05 04:46:26.2	99.076	9.315	0.7
02/03/05 06:07:14.4	98.455	9.769	0.9
02/03/05 08:38:04.9	99.576	7.597	0.6
02/03/05 09:13:38.9	98.467	8.012	0.0
02/03/05 14:25:23.4	98.748	8.338	-0.7
03/03/05 00:10:44.4	99.575	8.013	0.6
03/03/05 00:15:59.0	99.582	8.494	0.3
03/03/05 06:57:37.8	98.006	9.020	1.3
03/03/05 09:13:00.9	98.662	9.521	0.5
03/03/05 09:15:30.9	98.962	9.325	0.8
03/03/05 10:01:46.5	99.122	8.767	0.0
03/03/05 10:20:49.4	98.721	9.504	0.8
03/03/05 10:24:46.6	98.587	8.412	-0.8
03/03/05 11:53:59.0	98.555	9.547	2.2
03/03/05 13:54:40.0	98.176	8.189	0.2
03/03/05 14:15:21.6	98.458	9.445	0.5
03/03/05 15:22:49.8	99.446	7.898	0.5
04/03/05 02:48:52.0	99.524	7.546	0.6
04/03/05 07:52:54.4	98.613	9.520	1.6
04/03/05 08:32:10.6	98.776	9.452	1.5
04/03/05 09:35:54.0	99.541	8.193	0.9
04/03/05 09:46:38.7	98.651	8.263	0.0
04/03/05 10:21:59.3	98.580	8.407	-0.8
04/03/05 10:33:00.8	99.341	7.579	1.8
04/03/05 12:31:26.3	99.609	8.557	1.3
04/03/05 21:35:34.8	98.267	9.474	0.4
04/03/05 22:47:02.6	98.502	9.469	0.8
05/03/05 09:52:14.4	98.665	9.568	1.4
06/03/05 23:19:31.5	97.877	7.253	1.3
06/03/05 23:21:52.8	97.950	7.276	1.7
06/03/05 23:30:27.7	97.674	7.469	1.6
06/03/05 23:45:22.3	97.952	7.264	1.1
07/03/05 09:02:34.0	99.747	8.039	0.7
07/03/05 11:31:32.8	98.563	9.541	1.0

Table 3.1: (continued)

Origin Time DD/MM/YY hh:mm:ss.0	Longitude (Degree East)	Latitude (Degree North)	Ml
07/03/05 15:23:31.1	99.551	8.040	0.7
08/03/05 14:01:11.9	98.836	9.419	0.4
08/03/05 16:26:52.6	96.829	7.842	1.0
09/03/05 00:52:14.3	98.549	9.539	0.9
09/03/05 00:53:31.1	98.144	9.519	1.1
09/03/05 06:20:52.8	98.135	8.766	0.4
09/03/05 06:25:52.3	98.168	8.834	1.2
09/03/05 07:06:19.2	97.413	7.481	1.2
09/03/05 07:33:43.4	99.008	8.132	0.4
09/03/05 14:09:26.7	99.002	8.154	0.3
09/03/05 14:56:13.8	98.901	8.040	0.0
10/03/05 03:07:56.1	98.129	8.810	0.2
11/03/05 04:18:28.5	99.619	8.054	0.4
12/03/05 10:01:29.2	98.434	8.508	-0.1
12/03/05 17:07:44.1	98.098	8.623	-0.2
12/03/05 17:42:07.3	98.509	9.549	0.7
12/03/05 22:22:20.4	99.029	8.214	-0.1
13/03/05 09:56:28.5	99.388	7.953	0.4
13/03/05 21:17:47.5	99.366	7.708	0.7
14/03/05 23:47:28.4	98.668	9.607	1.1
15/03/05 10:30:23.1	98.488	8.522	-1.0
17/03/05 10:25:39.3	98.543	8.327	-0.2
17/03/05 20:25:16.9	98.174	8.819	-0.1
18/03/05 10:32:32.0	98.456	8.379	0.5
18/03/05 10:49:25.9	98.550	8.464	-0.9
18/03/05 13:42:33.6	98.827	8.030	0.0
19/03/05 03:57:34.1	98.437	8.500	0.0
20/03/05 10:19:42.1	98.587	8.409	-0.5
20/03/05 12:03:19.5	98.782	8.064	-0.1
21/03/05 00:49:39.8	99.496	7.867	0.9
21/03/05 03:53:46.0	98.470	8.585	0.6
21/03/05 06:14:15.1	98.441	9.553	0.5
21/03/05 10:39:06.6	98.614	8.126	-0.2
21/03/05 23:37:41.4	98.896	7.952	1.4
22/03/05 05:03:57.0	98.077	8.617	0.3
22/03/05 06:00:28.3	98.402	8.333	-0.1
23/03/05 04:19:20.0	98.621	8.316	-0.7
23/03/05 08:52:23.1	98.820	8.288	0.5
23/03/05 10:25:15.4	98.531	8.508	-0.2
24/03/05 09:53:30.1	98.519	8.522	-0.7
26/03/05 14:11:54.2	98.603	8.061	-0.3
26/03/05 16:36:45.4	98.612	7.907	0.0
26/03/05 17:30:05.5	99.568	8.100	0.5
26/03/05 17:49:05.2	98.084	8.757	-0.1

Table 3.1: (continued)

Origin Time DD/MM/YY hh:mm:ss.0	Longitude (Degree East)	Latitude (Degree North)	Ml
26/03/05 19:23:25.5	98.696	7.988	0.2
27/03/05 02:29:50.8	98.428	8.189	-0.1
27/03/05 09:56:34.7	98.606	8.465	-0.8
29/03/05 00:23:36.0	98.218	8.888	0.2
30/03/05 09:01:42.4	98.694	8.417	0.0
30/03/05 23:53:21.2	98.116	9.504	0.6
31/03/05 10:37:13.1	98.582	8.420	-0.5
06/04/05 11:32:23.9	97.196	8.241	0.9
06/04/05 16:08:49.6	98.164	8.443	-0.3
08/04/05 08:58:09.1	98.961	7.685	0.9
08/04/05 10:55:35.8	98.528	8.655	-0.3
08/04/05 20:35:36.7	98.782	7.842	0.2
09/04/05 09:21:14.6	98.115	8.884	0.1
09/04/05 22:27:32.9	98.145	8.943	0.2
10/04/05 09:35:42.6	98.539	8.668	0.0
11/04/05 04:53:07.6	98.504	8.597	0.8
12/04/05 03:51:24.6	98.546	8.588	0.4
13/04/05 05:43:36.8	98.694	8.338	-0.6
15/04/05 09:46:25.0	98.096	8.842	0.0
15/04/05 14:41:31.4	98.943	8.019	0.6
17/04/05 22:28:41.6	98.800	8.699	-0.1
17/04/05 22:46:00.6	98.178	8.862	-0.1
17/04/05 23:22:55.6	98.252	8.976	0.3
17/04/05 23:39:27.2	98.225	8.929	-0.2
18/04/05 02:28:54.8	98.166	8.916	0.0
18/04/05 09:59:14.1	98.606	8.417	-0.6
18/04/05 14:02:36.5	98.053	8.875	0.3
18/04/05 15:06:20.1	98.095	8.751	0.4
18/04/05 17:29:42.3	98.765	7.937	0.4
18/04/05 23:05:36.9	98.078	8.894	0.4
19/04/05 00:15:53.6	98.195	8.902	0.2
19/04/05 04:55:43.8	99.015	8.079	0.3
19/04/05 09:54:32.2	98.510	8.526	-0.2
25/04/05 23:47:36.7	98.193	8.563	-0.2
26/04/05 10:19:21.3	98.591	8.432	-0.3
28/04/05 16:46:36.8	98.326	8.149	0.0
28/04/05 18:03:49.2	98.115	8.616	0.0
29/04/05 04:03:13.4	97.605	8.457	1.2
29/04/05 12:25:51.8	98.598	8.427	-0.1
29/04/05 12:31:31.4	98.823	8.219	0.5
30/04/05 04:01:17.2	98.561	8.659	-0.3
02/05/05 04:00:47.8	98.596	8.429	-0.7
03/05/05 08:52:03.8	98.815	8.900	-0.4
06/05/05 04:03:42.6	98.616	8.467	-0.5
09/05/05 04:03:49.4	98.601	8.426	-0.6

Table 3.1: (continued)

Origin Time DD/MM/YY hh:mm:ss.0	Longitude (Degree East)	Latitude (Degree North)	Ml
10/05/05 14:10:16.2	98.487	8.788	-0.3
11/05/05 03:55:29.1	98.590	8.613	-0.2
13/05/05 09:59:48.9	98.594	8.462	-0.4
14/05/05 10:24:49.4	98.802	8.457	-0.4
18/05/05 04:05:07.7	98.470	8.570	-0.3
24/05/05 06:45:05.4	98.684	8.403	-0.4
24/05/05 11:09:13.2	98.489	8.603	-1.0
27/05/05 04:22:25.0	98.509	8.590	0.1
30/05/05 09:05:23.5	98.720	8.368	-0.6
31/05/05 12:28:17.5	98.780	8.064	0.4
05/06/05 11:41:19.2	98.810	8.192	0.0
09/06/05 10:09:02.3	98.588	8.410	-0.5
11/06/05 09:57:26.0	98.454	8.507	-0.4
11/06/05 10:43:40.0	98.506	8.256	-0.2
15/06/05 22:28:34.1	98.183	8.915	-0.1
16/06/05 02:25:59.0	98.249	9.031	0.3
21/06/05 01:51:17.2	97.457	7.139	1.6
21/06/05 17:41:59.0	98.045	8.318	-0.1
22/06/05 19:24:46.4	98.035	8.553	0.2
22/06/05 21:26:54.0	98.754	8.014	0.1
23/06/05 04:58:48.0	98.545	8.541	-0.9
24/06/05 08:37:14.7	98.516	8.721	-0.3
26/06/05 23:32:23.4	98.892	8.049	-0.1
27/06/05 09:08:27.3	98.561	8.767	0.1
29/06/05 09:05:24.4	98.514	8.747	0.0
30/06/05 11:32:34.0	98.410	8.834	-0.3

3.2 Number of earthquakes in relation to origin time

The 173 local earthquakes occurred at different times. At the beginning of the measuring period, the frequency of occurrence increased until 21 January 2005 (Figure 3.1). After that until 1 March 2005, only four earthquakes were determined. Beginning with 1 March 2005 the number of earthquake occurrences increased again in a logarithmic way until the end of the measurement period on 30 June 2005. With the 28 March 2005 Mw=8.7 Sumatra Earthquake no significant increase in the earthquake occurrence was recorded.

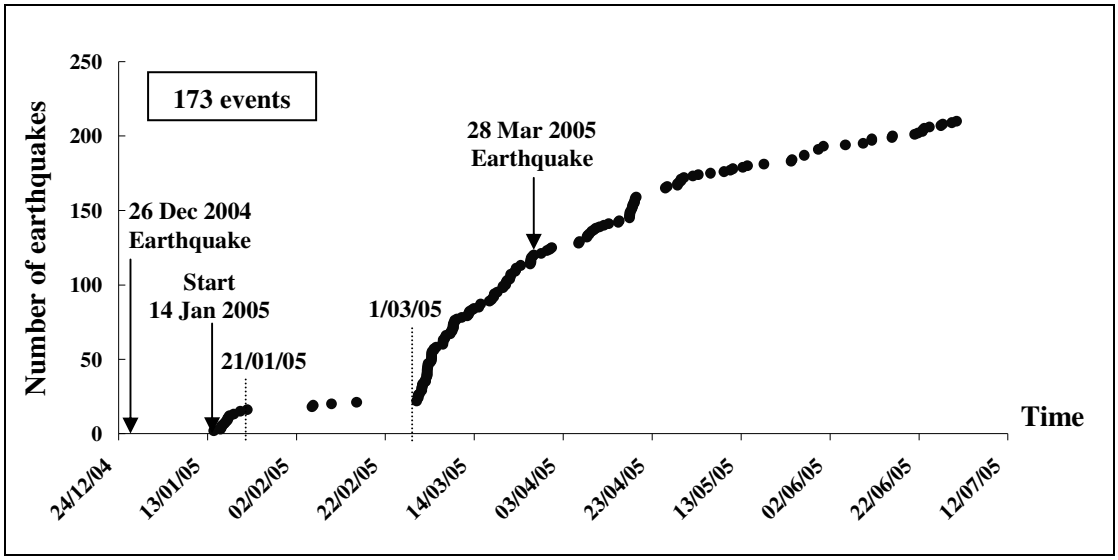


Figure 3.1. Cumulative number of earthquakes versus origin time. The measurement period is from 14 January to 30 March 2005. The Mw=9.3 Earthquake on 26 December 2004 and the Mw=8.7 on 28 March 2005 are marked.

3.3 Origin time of earthquakes in relation to their magnitudes

The time of the earthquake occurrences in relation to their local magnitude can be separated in three phases. The first phase is from beginning of the measurements to the end of February with maximum Ml=1.5, while the lowest of Ml = -0.5 occurred at the beginning of the measurements. The second phase is from the beginning of March to the middle of May 2005, with the highest magnitude Ml=2.2 on 3 March 2005; and the lowest Ml= -1.0 on 15 March 2004. At the

beginning of this phase, events with the whole range of magnitude values occurred, from Ml= -1 to Ml=2.2. After that, the range of magnitudes decreased gradually until the end of this phase. The third phase started on 15 May and last until the end of the measurements on 30 June 2004. Most events have a magnitude between -0.5 to 0.5 with the largest magnitude of Ml=1.6 on 21 June 2005; and the lowest of Ml= -1.0 on 24 May 2005 (Figure 3.2). However, the magnitudes of all events in this phase are below Ml= -0.5, except one event with Ml=1.6.

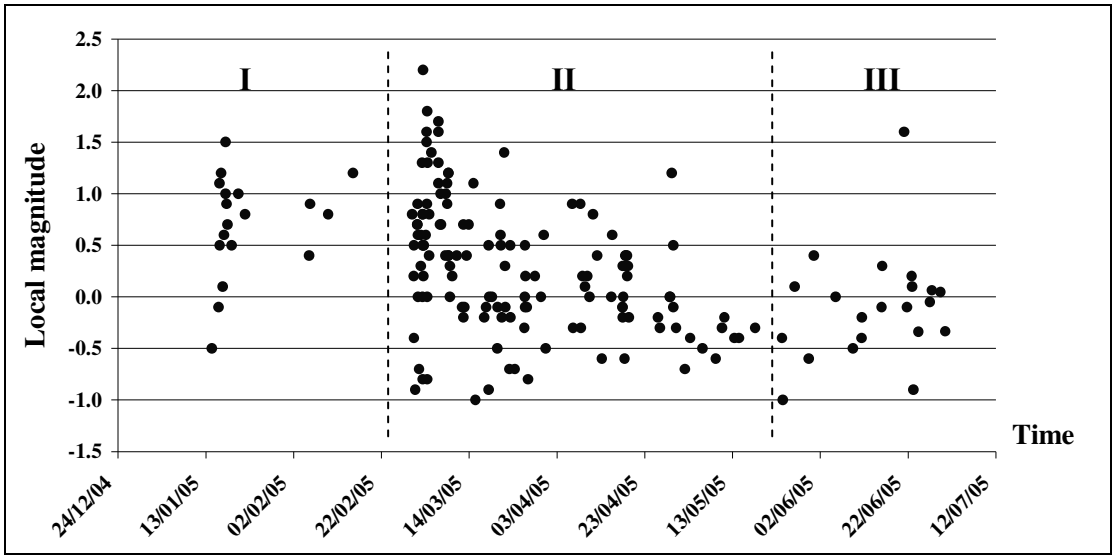


Figure 3.2. Local magnitudes in relation to the earthquake origin time can be separated in three phases. Phase I from beginning of the measurements to the end of February, Phase II from the beginning of March to the end of April, and Phase III from the beginning of May until the end of June 2005.

3.4 Number of earthquakes in relation to local magnitude

The number of earthquakes in relation to their local magnitude is shown in Figure 3.3. The earthquakes are grouped in classes with a width of 0.5 magnitude values. The highest numbers of earthquakes were in the 0.0–0.4 magnitude range (48 events) and a single event in the 2.0 – 2.5 magnitude range. In the class (-1.0) - (-0.6) magnitude there are 16 events, between (-0.5) - (-0.1) magnitude value 43 events, between 0.5 and 0.9 local magnitude 40 events , 18 events have a magnitude between 1.0 and 1.4 magnitude, and 7 events are in the 1.5-1.9 magnitude range.

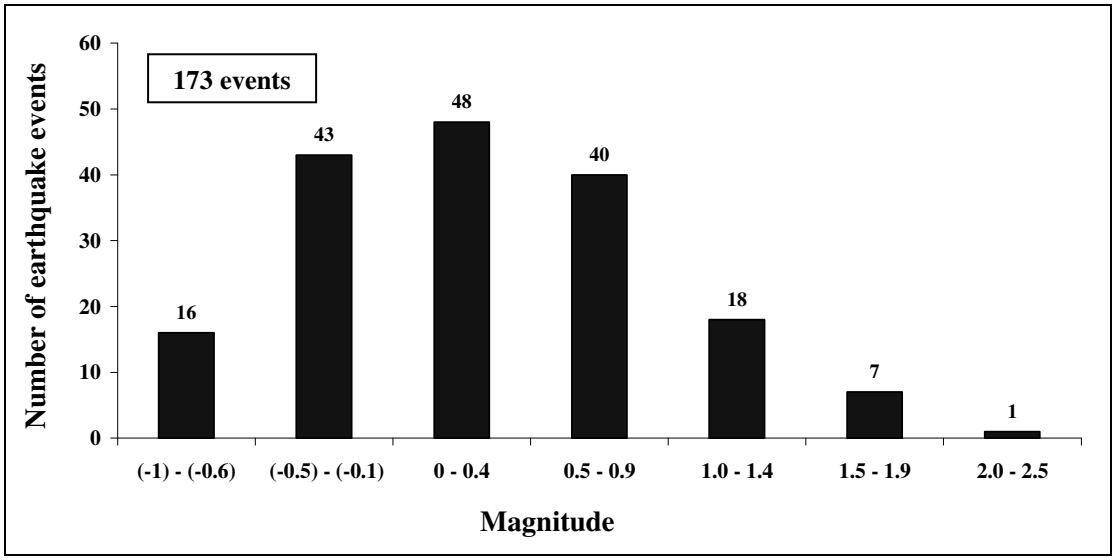


Figure 3.3. Number of earthquakes in relation to their local magnitude, in classes of 0.5 magnitude values. Numbers on the histograms are the total number of earthquake events in each class.

3.5 Earthquake events in relation to their locations

The earthquakes occurred in Southern Thailand, in the Andaman Sea and in the Gulf of Thailand (see Figure 3.4 and Figure 3.5). The locations on land are distributed in the provinces of Ranong, Surath Thani, Phang Nga, Krabi, Nakhon Si Thammarat and Trang. There is a cluster of earthquake locations in the Andaman Sea, offshore of Krabi and Phang Nga Province and on the land in Trang Phang Nga and Krabi Province. The earthquake locations are distributed in an ENE-WSW trend in Ranong Province with magnitude (Ml) 0.5 to 2.2. There are earthquake locations in an N-S trend in Nakhon Si Thammarat and Krabi Province with magnitudes (Ml) -0.5 to 1.5. This trend is parallel to the know orientation of the Ranong Fault Zone (see Figure 3.6). Further, there are events in an NE-SW trend in the Andaman Sea, on land and off shore of Phang Nga Province with magnitudes (Ml) -1.0 to 2.5.

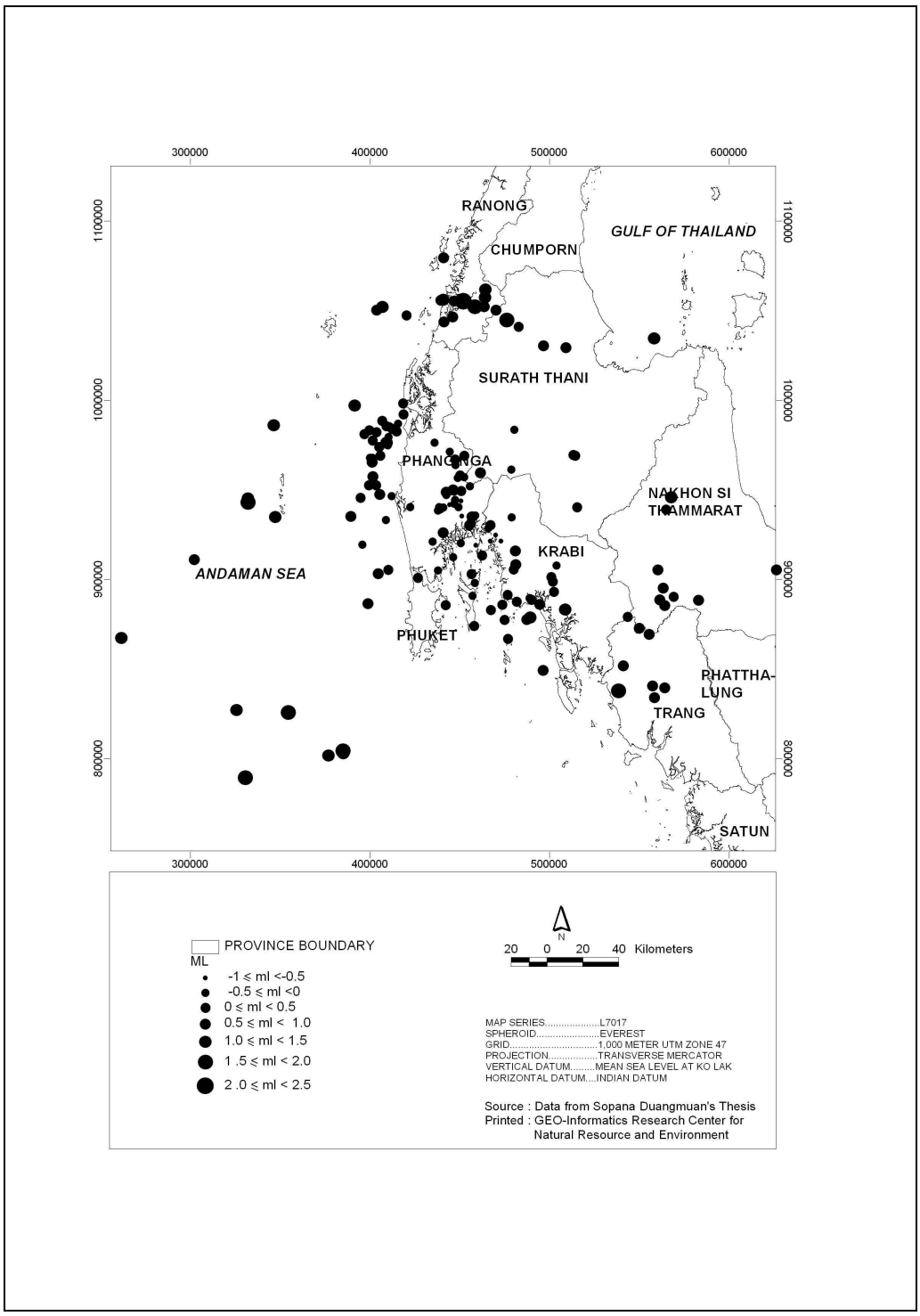


Figure 3.4. Earthquake locations with their local magnitude (size of the circle) in Southern Thailand from 14 January to 30 June 2005. Base map with provincial boundaries.

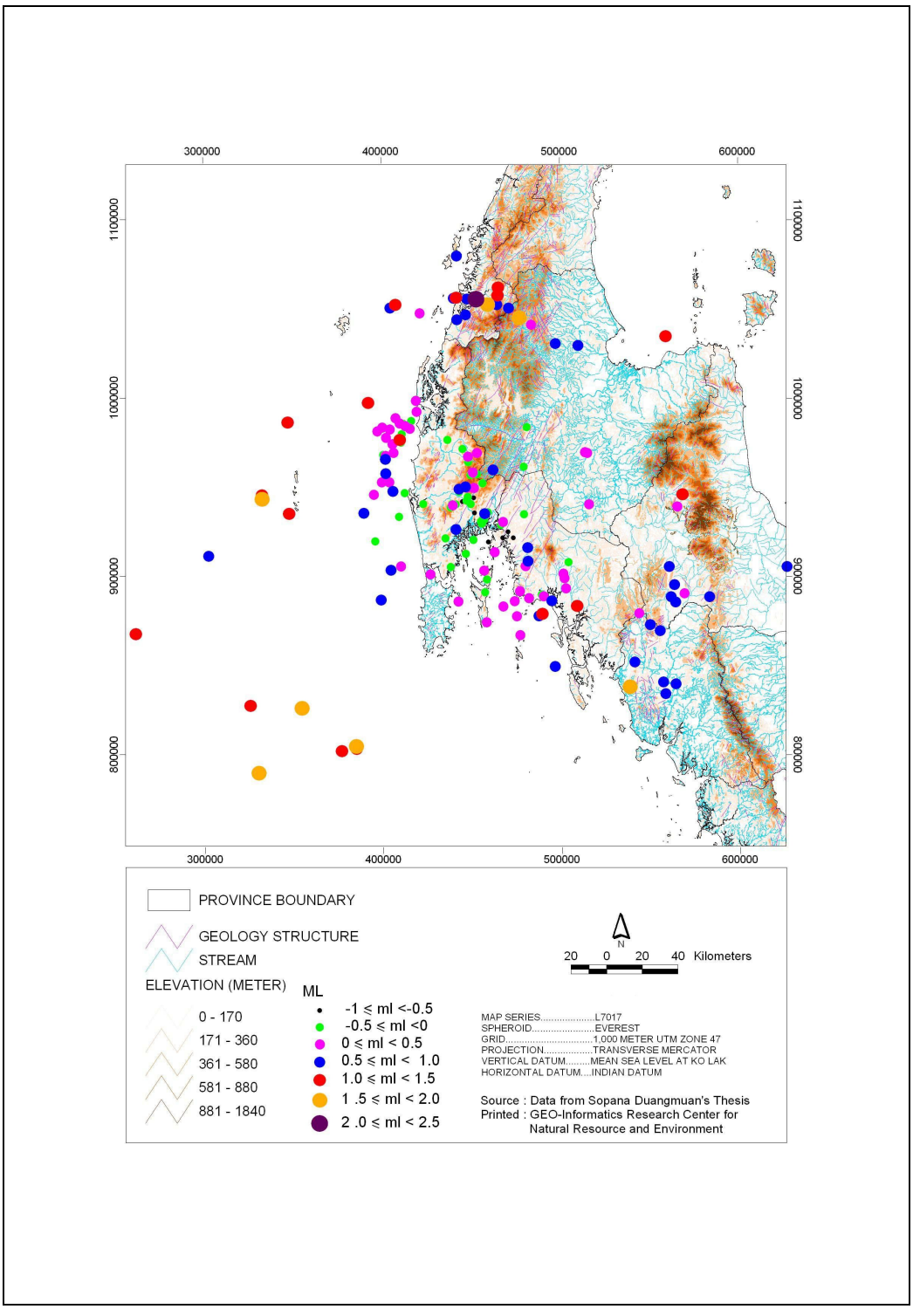


Figure 3.5. Earthquake locations with their local magnitude (size and color of the circle) in Southern Thailand from 14 January to 30 June 2005. Base map with topography, stream distribution and geological structures, here faults (after DMR, 1997a).

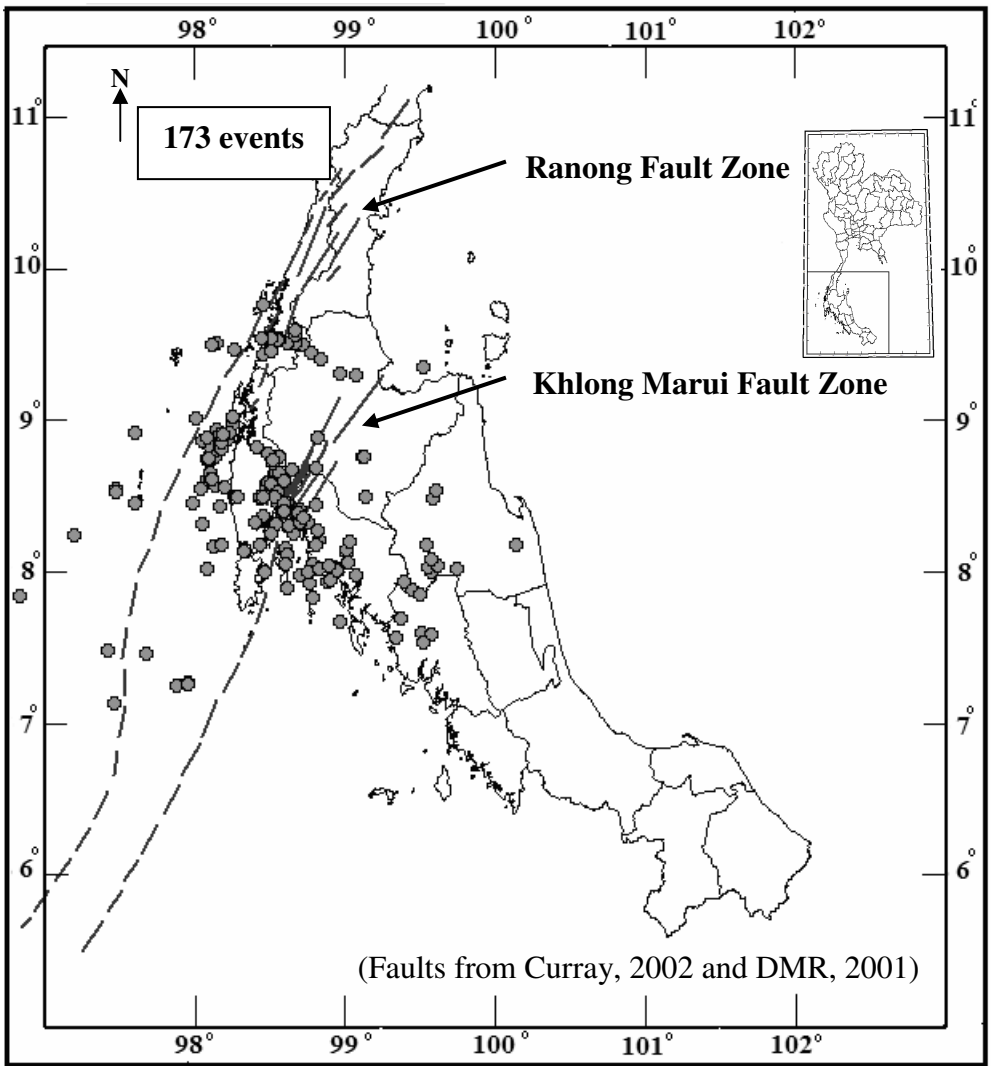


*Figure 3.*6. Locations of local earthquakes in southern Thailand between 14 January and 30 June 2005. The dashed lines represent the Ranong and Khlong Marui Fault Zone (Curray, 2002 and DMR, 2001), both with a northeast-southwest trend. The circles are the locations of the earthquake events.

3.6 Earthquake location in relation to their local magnitude

Figure 3.7 shows the locations of the local earthquakes in relation to their magnitude. The location of the earthquakes with magnitudes between Ml= -1.0 and -0.5 are concentrated in the area between Phang Nag and Krabi Province (Figure 3.7a, see also Figure 3.4.) With increasing magnitude, between ML= -0.5 and 0.0 the locations move further into Phang Nga Province (Figure 3.7b).

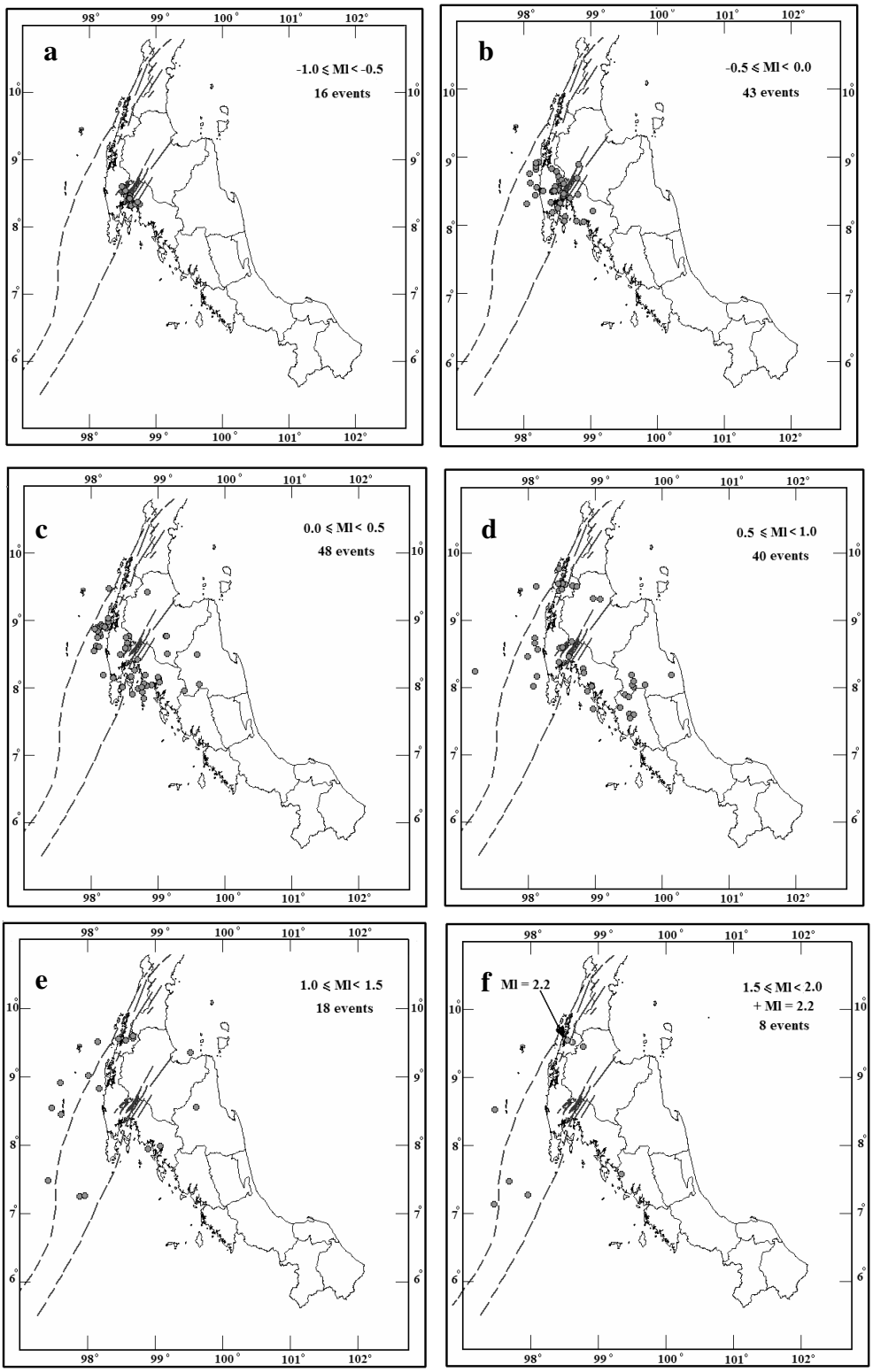


*Figure 3.*7. Earthquake locations (circles) in relation to their magnitude (in classes of 0.5). The dashed lines represent the Ranong and Khlong Marui Fault Zone (Curray, 2002 and DMR, 2001)

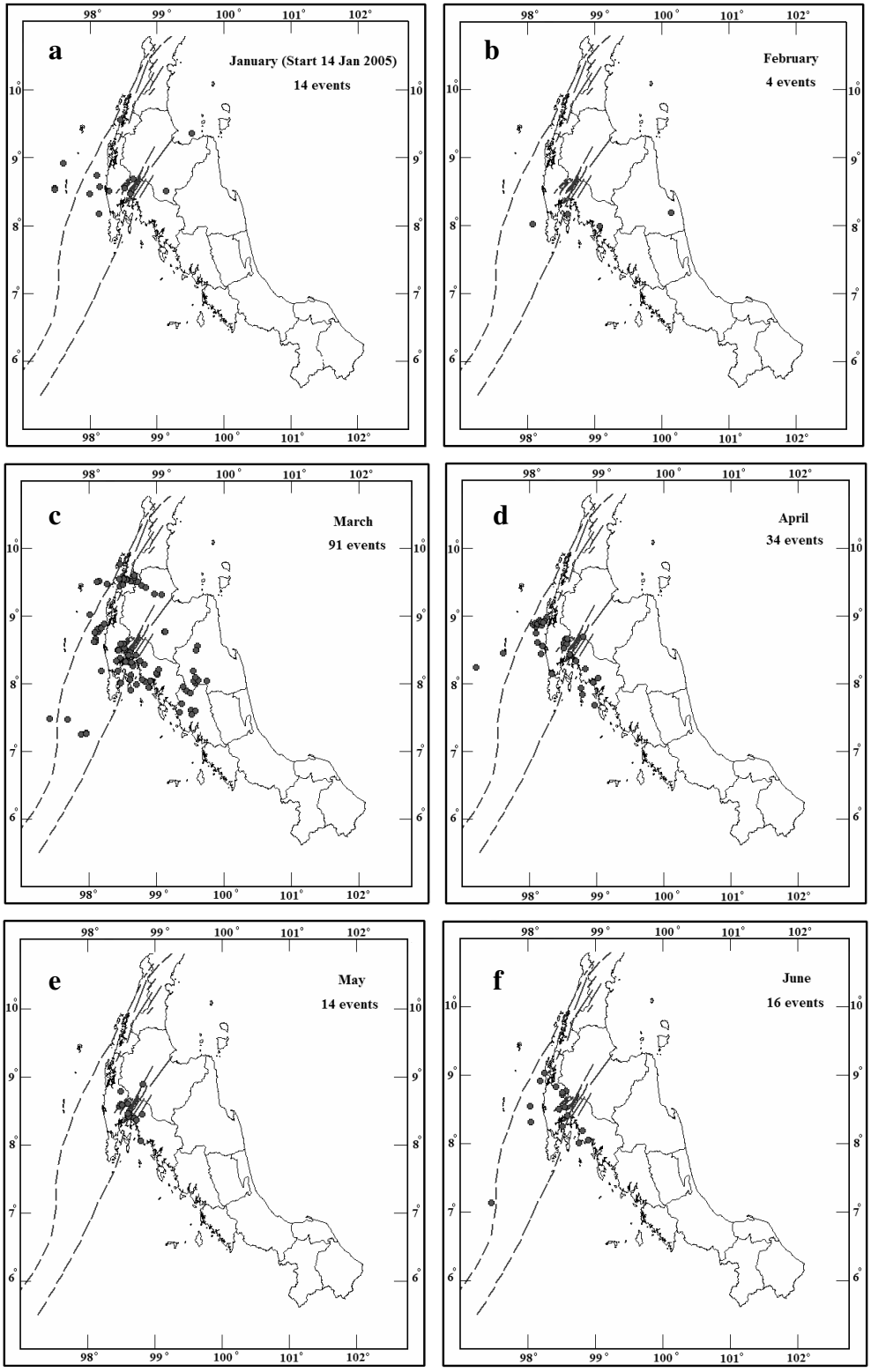


*Figure 3.*8. Earthquake locations for each month from January to June of 2005 (start on 14 January – 30 June 2005). The dashed lines represent the Ranong and Khlong Marui Fault Zones (Curray, 2002 and DMR, 2001).

From Ml=0.0 to 1.0 the locations of the events spread out to other provinces further south and west, and also offshore Phang Nga and Ranong Province in the Andaman Sea (Figure 3.7c, d). With Ml=1.0 and higher magnitudes the earthquake locations are mainly in the further offshore area in the Andaman Sea, and some are scattered further west on land (Figure 3.7e, f). The earthquake with the highest magnitude Ml=2.2 is located in Ranong Province (Figure 3.7f).

3.7 Origin time in relation to earthquake location

The location of earthquakes in one-month periods for the first half of 2005 are shown in Figure 3.8, started from 14 January until 30 June 2005. In the last two weeks of January, a few earthquakes occured on land, whereas more offshore of Phang Nga and Krabi Provinces, altogether 14 events (Figure 3.7a). In February there are only four events, one in Nakhon Si Thammarat Province and three occurred offshore of Phang Nga and Krabi Provinces (Figure 3.7b). March was the month where most earthquakes were recorded, 91 events. They occurred offshore in Andaman Sea and on land in Ranong, Surath Thani, Phang Nga, Krabi, Trang and Nakhon Si Thammarat Provinces (Figure 3.7c). In April, the 34 events occured on land and offshore of Krabi and Phang Nga Provinces (Figure 3.7d). The 14 events in May are located in Phang Nga and Krabi Provinces (Figure 3.7e), whereas in June the 16 events also occurred offshore Phang Nga and Krabi Provinces (Figure 3.7f).

3.8 Man-made events

From all events recorded during the measurement period from 14 January to 30 June 2005, altogether 37 were man made events. They occurred at the similar daytime at around 11:00 and 12:00 in the morning and at a similar location (see Chapter 3.11), and they exhibit a similar waveform with surface phases (see Figure 1.23 in Chapter 1). Table 3.2 shows the origin time (after Nilsuwan, 2006) and the local magnitude of all man made events.

3.9 Number of man-made events in relation to origin time

From the total 37 man-made events three occurred in January (Figure 3.9). After a 27 day long break man made events were recorded with the beginning of June until the end of the measurement period, however with breaks. Usually only one man made event occurred on one day. One break was the Thai New Year Holiday from 10 to 15 April 2005 and later in April and May 2005 there was a 28 long break (Figure 3.9).

Table 3.2: Origin time and local magnitude of all man-made events detected from 14 January to 30 June, 2005 (origin time from Nilsuwan, 2006).

Event	Date Time	Ml
1	14/01/05 03:54:31.51	-0.3
2	20/01/05 04:11:31.31	-0.3
3	22/01/05 04:07:34.52	-0.6
4	01/03/05 04:08:32.15	-0.3
5	02/03/05 04:14:23.52	-0.3
6	03/03/05 04:13:41.67	-0.4
7	06/03/05 04:02:01.34	-0.6
8	15/03/05 03:56:33.17	-0.4
9	16/03/05 04:04:17.36	-0.8
10	18/03/05 04:06:21.98	-0.2
11	19/03/05 04:10:18.81	-0.5
12	20/03/05 04:04:02.15	-0.6
13	22/03/05 04:12:02.33	-0.8
14	23/03/05 04:09:28.38	-0.4
15	24/03/05 04:10:56.16	-0.3
16	30/03/05 04:08:58.24	-0.5
17	03/04/05 03:58:18.84	-1.1
18	06/04/05 04:13:25.23	-0.5
19	07/04/05 04:05:58.37	-0.3

Event	Date Time	Ml
20	08/04/05 04:19:33.12	-0.5
21	09/04/05 04:03:20.81	-0.1
22	16/04/05 04:05:51.87	-0.7
23	18/04/05 04:13:41.11	-0.5
24	19/04/05 04:19:18.22	-1.4
25	20/04/05 04:03:15.86	0.0
26	22/04/05 03:50:54.59	-0.5
27	23/04/05 04:05:10.58	-0.3
28	24/04/05 04:14:17.51	-1.4
29	25/04/05 04:14:16.50	-1.0
30	24/05/05 04:14:37.45	-0.9
31	25/05/05 04:04:44.63	-1.0
32	26/05/05 04:00:30.06	-0.5
33	28/05/05 04:04:12.30	-0.7
34	29/05/05 04:11:26.62	-1.0
35	30/05/05 03:56:05.79	-1.1
36	31/05/05 04:08:36.92	-0.7
37	11/06/05 04:02:59.43	-0.6

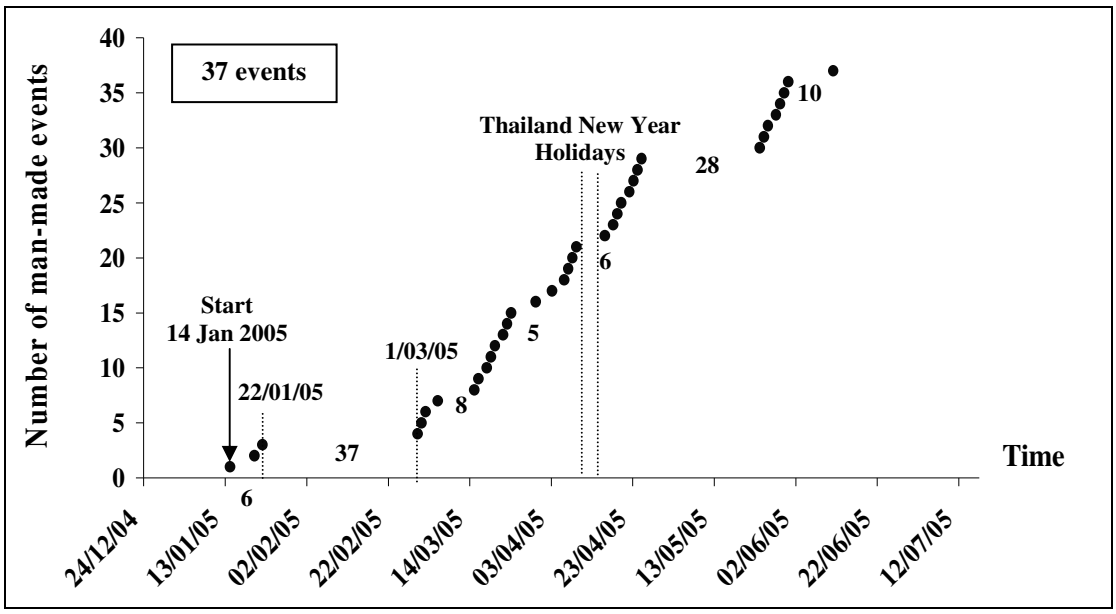


Figure 3.9. Cumulative number of man-made events in relation to their origin time. They occurred usually once a day. The numbers are the days in-between with no events. Beginning and end of a long break in February is marked, as well as the Thai New Year Holiday.

3.10 Local magnitude of man-made events in relation to origin time

The occurrence of man made events in relation to their magnitude can be separated into three periods (see Figure 3.10). The first period (I) from 14 to 22 January 2005 has only three events with the largest local magnitude of Ml= -0.3. The second period (II) is from 1 March to 25 April 2005. Here the largest magnitude is Ml=0.0, which is also the largest magnitude for all man made events. The event number 25 was on 20 April 2005 (see Table 3.2). In the last period (III), from 24 May to 11 June 2005, there were only eight events, with the largest magnitude of Ml= -0.5. No events were determined between 22 January and 28 February 2005, and between 25 April and 24 May 2005 (Figure 3.10).

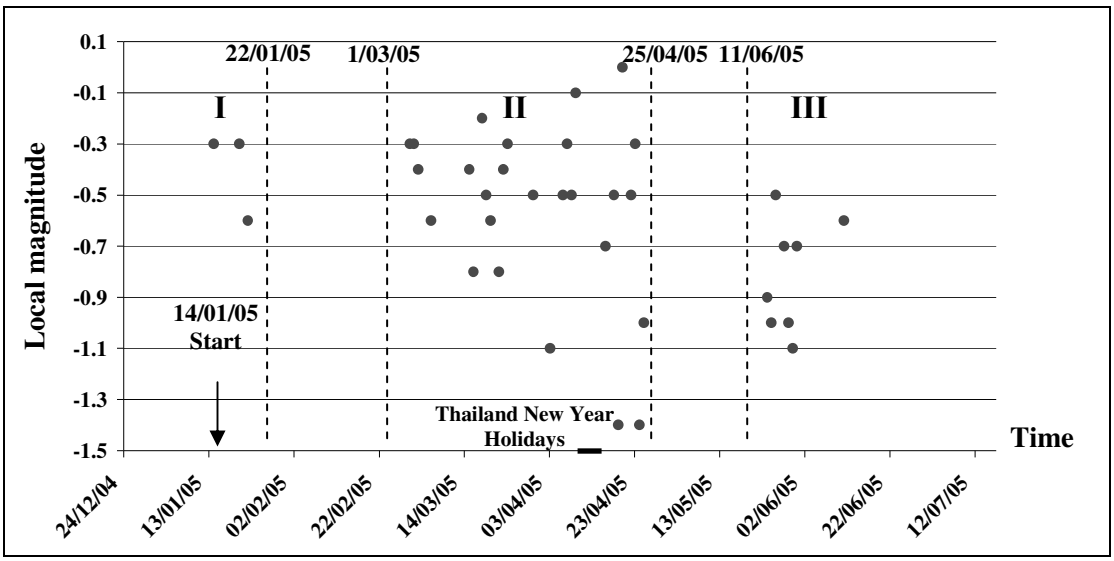


*Figure 3.*10. Number of man-made events in relation to local magnitudes. The events are distributed over three periods: Period I from 14 to 22 January 2005; Period II from 1 March to 25 April 2005, and Period III from May to 11 June 2005. There were two periods with no events, between 22 January and 1 March 2005, and between 25 April and 11 June 2005.

3.11 Number of man-made events in relation to local magnitude

The 37 man-made events recorded in southern Thailand show following local magnitude distribution, see Figure 3.11: In the magnitude range from Ml= -0.4 to -0.5 there are 10 events, the highest number. In the magnitude range -0.2 to -0.3 there are 8 events, and in the magnitude range between -0.1 to 0.0 there are 2 events, with the highest magnitude of Ml=0.0. Further, in the magnitude range -0.6 to -0.7 there are 7 events, in the range -0.8 to -0.9 there are 3 events, in the range -1.0 to -1.1 there are 5 events, and in the range -1.2 to -1.4 there are 2 events.

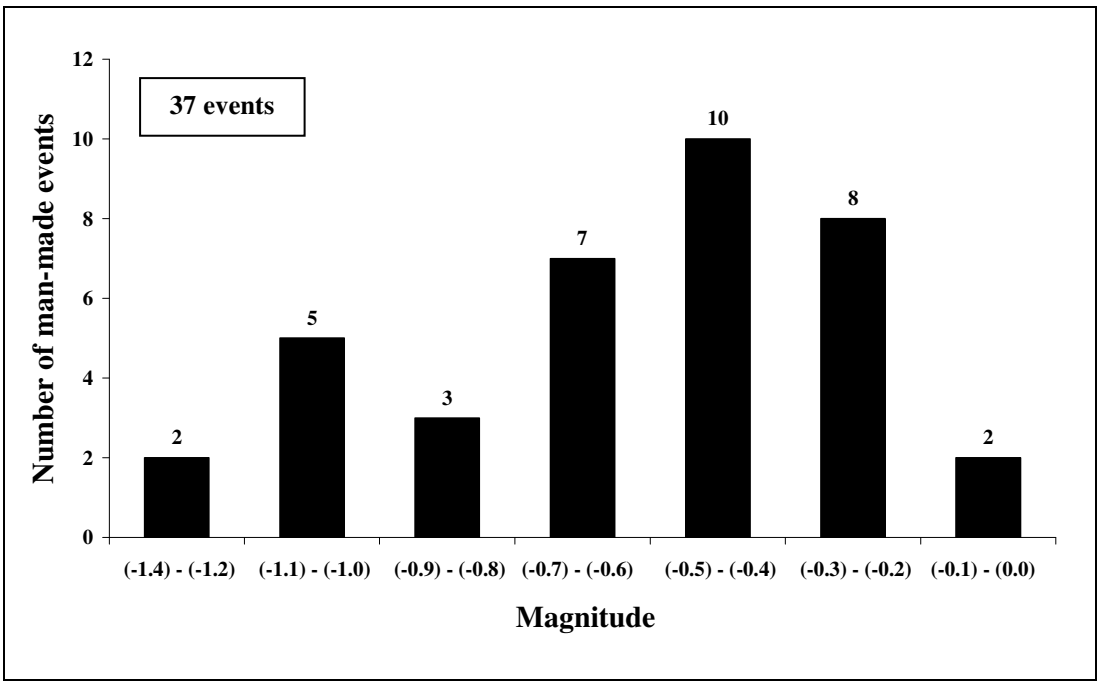


Figure 3.11. Number of man-made events in relation to local magnitude. The numbers on top of the histogram show the total number of man-made events in each class.

3.12 The location of the man-made events

A detailed analysis of the seismograms of all three components from Station 1 and Station 2 for all 37 man-made events was done by Nilsuwan (2006). The average delta time for all events recorded at Station 1 using all components, E, N, and Z, is 1.318 s with a standard deviation of 0.052 s. For Station 2 the delta time average using all components is 1.184 s with a standard deviation of 0.044 s (see Table 3.3).

Table 3.3: The average and standard deviation (STDEV) for delta times (Δt) of the E-, N-, and vertical Z-component for all 37 man made events recorded at Station 1 and Station 2 (after Nilsuwan, 2006).

components	Δt (s)			
	Station 1		Station 2	
	Average	STDEV	Average	STDEV
E	1.314	0.034	1.184	0.043
N	1.336	0.071	1.185	0.047
Z	1.302	0.042	1.182	0.045
All	1.318	0.052	1.184	0.044

Using the JB traveltime-distance tables for local events at 0 km depth the corresponding distances between the average events and the seismic stations are 11.190 km for Station 1 and 10.053 km for Station 2. Both distances added together gives 21.243 km, which is shorter than the direct distance between Station 1 and Station 2 (21.709 km), having a difference of 466 m.

In Figure 3.12 for all events, the distances from Station 1 versus the distances from Station 2 are plotted for the North-, East- and vertical (Z) component. The straight line represents the shortest distances, or direct line, between Station 1 and Station 2. The points below the line show the distances of events from Station 1 and Station 2, which are shorter than the direct distance between both stations. The points above the direct line show the distances of event location from Station 1 and Station 2 that are greater than direct distance between both stations

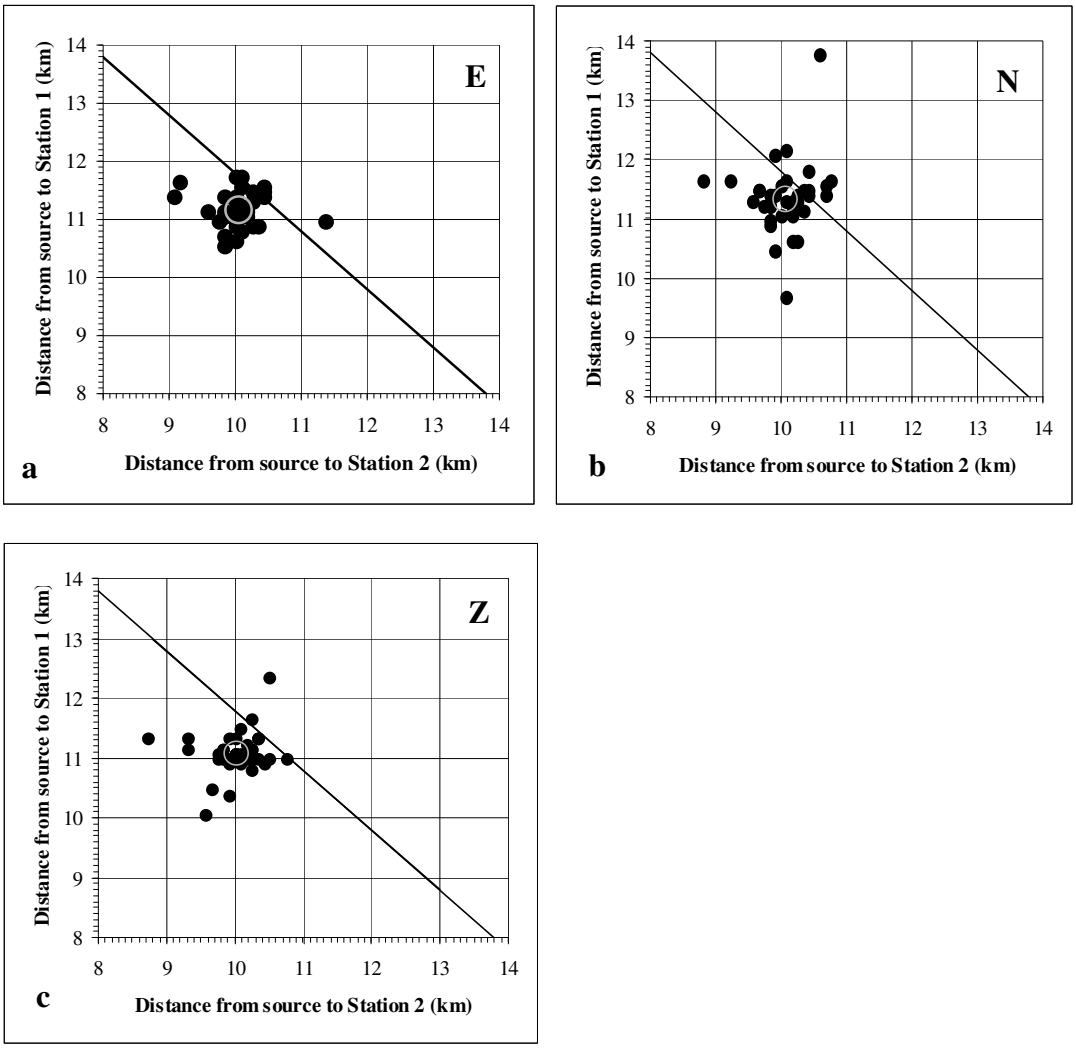
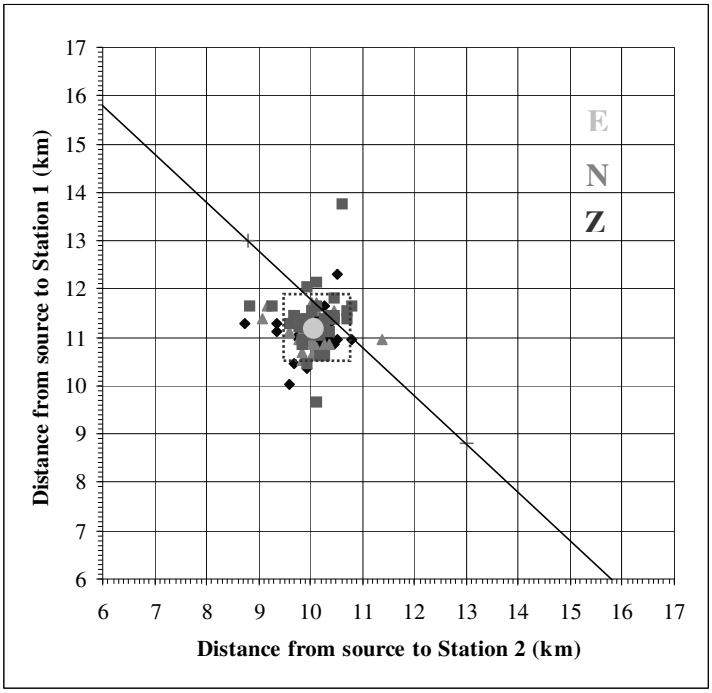


Figure 3.12. The distances of man-made events from Station 1 and Station 2 for the E-, N- and Z-component, respectively. The open circles indicate the average location for each component and the lines indicate the minimum distance between Station 1 and Station 2, which is 21.709 km (after Nilsuwan, 2006).

In Figure 3.13, all event locations are plotted using data from all three components. Most of the events plot in a 1.5 km x 1.5 km area indicating a similar confined location. However, the average location is below the straight line from Station 1 to Station 2, the difference of 466 m in comparison to the strait connection between both stations.

This small difference might be either explained by the uncertainty in the data. Then the average location of all man-made events is likely to be on or near the direct line connecting Station 1 and Station 2. Another explanation might be that the velocities used for the distance calculation are not reflecting the real world situation. In this case, the average location of the man-made events might be somehow further away from the direct line between Station 1 and Station 2, however in the limits given by the possible seismic velocity ranges.



Note ▲ = E-, ■ = N-, ◆ = Z-component
● = Point of average event location
▭ = Range of average event locations (1.5 km x 1.5 km)

Figure 3.13. Distribution of the distances of man-made events from Station 1 and Station 2 using data from all three components. The circle represents the average distances of from all three components in a 1.5 km x 1.5 km area where most of the events plot. The line is minimum distance between Station 1 and Station 2.

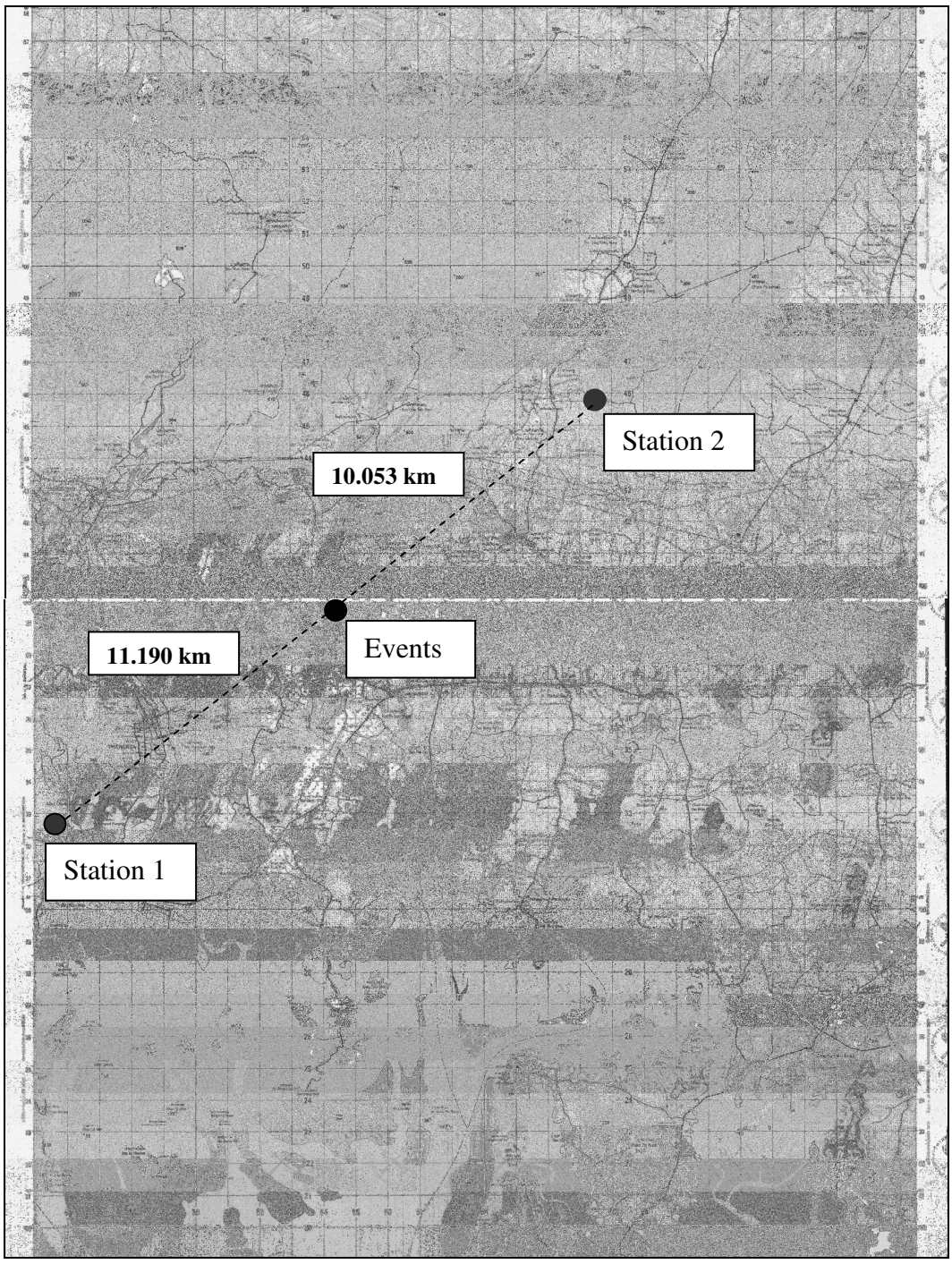


Figure 3.14. Topographic map of Thap Put District in Pang-Nga province where Station 1 and Station 2 were established. The averages locations of man-made events are shown with the distances from Station 1 to average event location of 11.190 km and 10.053 km from Station 2. Grid length is of 1 km (RTS, 2000a, b).

Figure 3.14 shows the location of Station 1 and Station 2 on the topographic map of the area. Assuming uncertainties in the delta time respectively distance data and that therefore the average location of all man-made events is on the direct line between Station 1 and Station2, the location will be at Zone 47, 939497 N, 454576 E, WGS-84 (Figure 3.14). Then the events will be 11.386 km from Station 1 and 10.324 km from Station 2.