

APPENDIX A

PLAYBACK PROGRAM

1. EXTRACTP

EXTRACTP retrieve time series data from the ring buffer files is capable of creating a single file per component. The output file is in compressed X1 file format. The EXTRACTP file operates in one of five modes listed below.

Command:

```
extractp -m Arg [ -ii ] [ -dd ] [ -f]
```

-m Manual mode

Arg Start time that require argument (YYYYMMDD.hhmmss)

-i Input option switch

I Ringbuffer path name that require switch argument (steger)

-d Duration option switch (steger)

-f Full name option switch

Example:

```
extractp -m 2005-03-20-04-02-00 -d 300 -i f:\stn01\*.*n -f
```

Result:

```
X-----S_YYYYMMDD.hhmmss (X-file)
```

2. RESPONSE

Response refers to system response file, content of which corresponds with the station response header information in the SEED (Standard Exchange of Earthquake Data) data volume. The response file generated is a text file with a default name seed.rsd. A number of stages describe the parameter of the sensor, analog-digital converter and the digital filter are contained in seed file. The output of the program (seed.rsp) is used by MAKESEED to generate the system response information in a SEED data.

Command:

response

Result:

seed.rsp (text file)

seed.rsp is in: \NMX\BIN\XDATA\

3. MAKESEED

Makeseed is a data conversion utility that create SEED. The program reads in time series file and the response file of system and write the SEED volume containing SEED header and data in Steim compressed data format. The signal required to command line argument of MAKESEED is a direct name. The MAKESEED searches for X files and the system response file in a given directory path and write SEED data volume in the same directory.

Command:

Makeseed

Result:

sYYYYMMDD.hhmmss (seed file, stored in: \NMX\BIN\XDATA\)

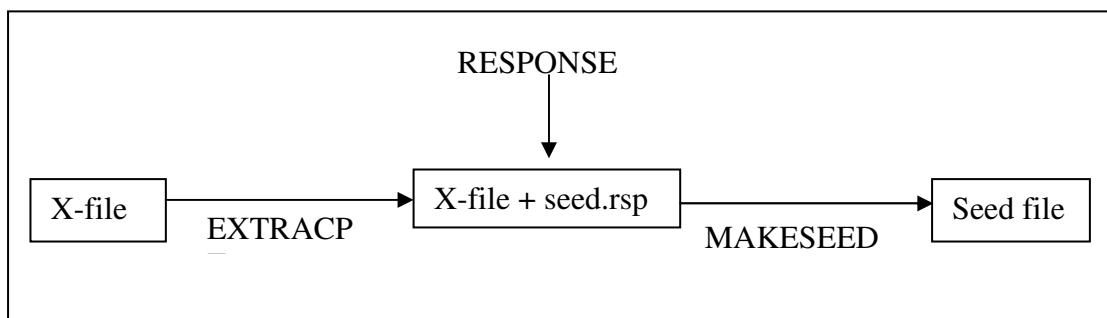
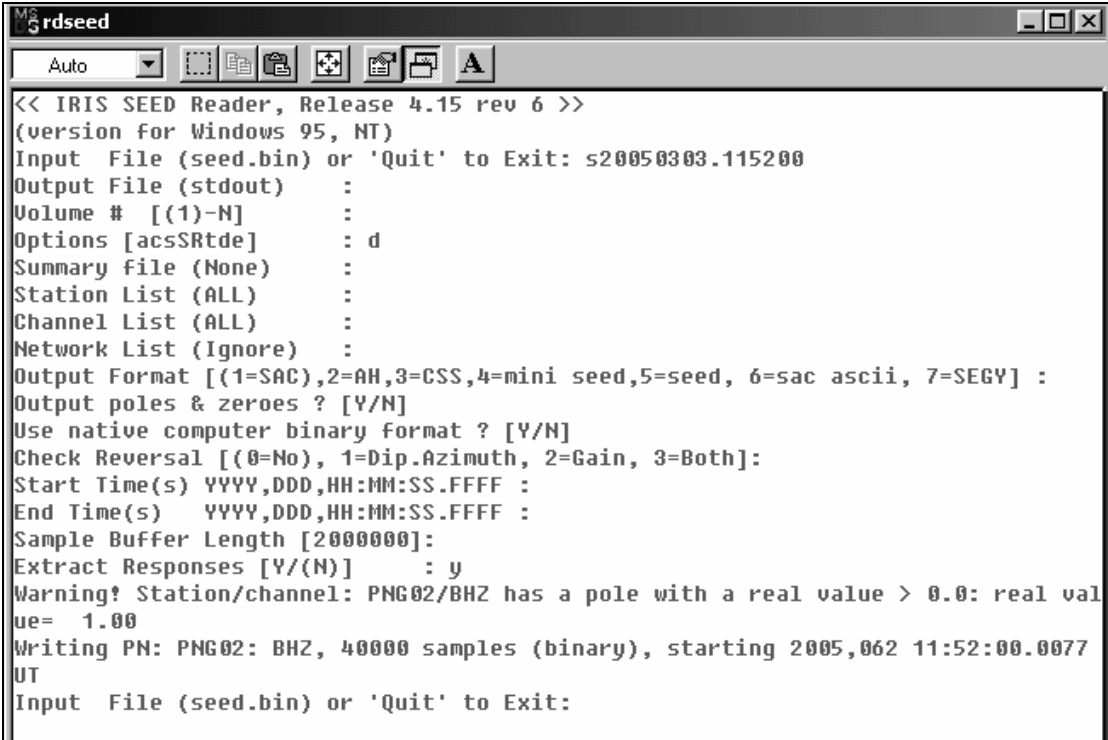


Figure A.1 Step of Playback Program.

APPENDIX B

RDSEED PROGRAM

RDSEED program has been developed by IRIS, it reads a SEED format input file or tape and allows the user to retrieve instrument response information or convert SED data into other formats. The user must run RDSEED in User Prompt Mode.



```

MS-DOS rdseed
Auto
<< IRIS SEED Reader, Release 4.15 rev 6 >>
(version for Windows 95, NT)
Input File (seed.bin) or 'Quit' to Exit: s20050303.115200
Output File (stdout)      :
Volume # [(1)-N]         :
Options [acsSRtde]       : d
Summary file (None)      :
Station List (ALL)       :
Channel List (ALL)       :
Network List (Ignore)    :
Output Format [(1=SAC),2=AH,3=CSS,4=mini seed,5=seed, 6=sac ascii, 7=SEGY] :
Output poles & zeroes ? [Y/N]
Use native computer binary format ? [Y/N]
Check Reversal [(0=No), 1=Dip.Azimuth, 2=Gain, 3=Both]:
Start Time(s)  YYYY,DDD,HH:MM:SS.FFFF :
End Time(s)    YYYY,DDD,HH:MM:SS.FFFF :
Sample Buffer Length [2000000]:
Extract Responses [Y/(N)]      : y
Warning! Station/channel: PNG02/BHZ has a pole with a real value > 0.0: real value= 1.00
Writing PN: PNG02: BHZ, 40000 samples (binary), starting 2005,062 11:52:00.0077
UT
Input File (seed.bin) or 'Quit' to Exit:

```

Figure B.1 Step of RDSEED program.

Input Options:

Input File (seed.bin) : sYYYYMMDD.hhmmss
Output File (stdout) : enter Volume# [(1)-N] : enter
Options[acsSRtde] : d
Summary File : enter
Station List (ALL) : enter

Channel List (All) : enter

Network List (Ignore) : enter

Output Format [(1=SAC), 2=AH, 3=CSS, 4=miniseed, 5= seed, 6=SAC ascii,
7=SEGY] : 1 enter (1=SAC file) or 6 enter (6=SAC ascii)

Check Reversal [(0=No), 1=Dip.Azimuth, 2=Gain, 3=Both] : enter

Start Time(s) (First) : enter

End Buffer Length [2000000] : enter

Extract Responses [Y/(N)] : Y

APPENDIX C

TRAVELTIME TABLE

Table C.1: Travel times tables, here for body wave phases. The distance is expressed in degree, depth in km, the travel time in second (Jeffreys and Bullen, 1967).

Pg							Sg						
Δ	Depth of Source [km]						Δ	Depth of Source [km]					
	0 (sec)	3 (sec)	6 (sec)	9 (sec)	12 (sec)	15 (sec)		0 (sec)	3 (sec)	6 (sec)	9 (sec)	12 (sec)	15 (sec)
0.00	0.000	0.539	1.077	1.616	2.154	2.693	0.00	0.001	0.890	1.780	2.671	3.561	4.451
0.28	5.507	5.533	5.611	5.739	5.913	6.130	0.34	11.378	11.412	11.516	11.687	11.922	12.217
0.55	11.014	11.027	11.067	11.132	11.223	11.339	0.69	22.755	22.773	22.825	22.912	23.032	23.187
0.83	16.521	16.530	16.556	16.600	16.661	16.739	1.03	34.133	34.145	34.179	34.237	34.318	34.422
1.10	22.028	22.035	22.054	22.087	22.133	22.192	1.38	45.511	45.519	45.546	45.589	45.650	45.728
1.38	27.535	27.540	27.556	27.583	27.619	27.667	1.72	56.888	56.895	56.916	56.951	57.000	57.062
1.66	33.042	33.047	33.060	33.082	33.112	33.152	2.07	68.266	68.272	68.289	68.318	68.359	68.411
1.93	38.549	38.553	38.564	38.583	38.609	38.643	2.41	79.644	79.649	79.664	79.688	79.723	79.768
2.21	44.056	44.060	44.069	44.085	44.109	44.139	2.76	91.021	91.026	91.039	91.061	91.091	91.130
2.48	49.563	49.565	49.575	49.590	49.610	49.636	3.10	102.399	102.403	102.415	102.434	102.461	102.496
2.76	55.070	55.073	55.081	55.094	55.113	55.136	3.45	113.777	113.780	113.791	113.808	113.832	113.864
3.03	60.577	60.580	60.587	60.599	60.616	60.637	3.79	125.154	125.158	125.167	125.183	125.205	125.234
3.31	66.084	66.087	66.093	66.104	66.120	66.139	4.14	136.532	136.535	136.544	136.558	136.579	136.605
3.59	71.591	71.594	71.600	71.610	71.624	71.642	4.48	147.910	147.912	147.920	147.934	147.953	147.977
3.86	77.099	77.100	77.106	77.115	77.129	77.146	4.83	159.287	159.290	159.297	159.310	159.327	159.350
4.14	82.606	82.607	82.613	82.621	82.634	82.649	5.17	170.665	170.667	170.674	170.686	170.702	170.723
4.41	88.113	88.114	88.119	88.127	88.139	88.154	5.52	182.043	182.045	182.051	182.062	182.078	182.097
4.69	93.620	93.621	93.626	93.634	93.644	93.658	5.86	193.420	193.423	193.429	193.439	193.453	193.472
4.97	99.127	99.128	99.133	99.140	99.150	99.163	6.21	204.798	204.800	204.806	204.816	204.829	204.846
5.24	104.634	104.635	104.639	104.646	104.656	104.668	6.55	216.176	216.178	216.183	216.192	216.205	216.222
5.52	110.141	110.142	110.146	110.153	110.162	110.174	6.90	227.553	227.555	227.560	227.569	227.581	227.597
5.79	115.648	115.649	115.653	115.659	115.668	115.679	7.24	238.931	238.933	238.938	238.946	238.958	238.973
6.07	121.155	121.156	121.160	121.166	121.174	121.185	7.59	250.309	250.310	250.315	250.323	250.334	250.348
6.34	126.662	126.663	126.666	126.672	126.680	126.691	7.93	261.686	261.688	261.693	261.700	261.711	261.724
6.62	132.169	132.170	132.173	132.179	132.186	132.196	8.28	273.064	273.066	273.070	273.077	273.087	273.100
6.90	137.676	137.677	137.680	137.685	137.693	137.702	8.62	284.442	284.443	284.447	284.454	284.464	284.477
7.17	143.183	143.184	143.187	143.192	143.199	143.208	8.97	295.819	295.821	295.825	295.832	295.841	295.853
7.45	148.690	148.691	148.694	148.699	148.706	148.714	9.31	307.197	307.198	307.202	307.209	307.218	307.229
7.72	154.197	154.198	154.201	154.206	154.212	154.221	9.66	318.575	318.576	318.580	318.586	318.595	318.606
8.00	159.704	159.705	159.707	159.712	159.718	159.726	10.00	329.952	329.953	329.957	329.963	329.971	329.982

Table C.1: (continued)

P_n	Depth of Source [km]												
	Δ	0	3	6	9	12	15	18	21	24	27	30	33
	(sec)	(sec)	(sec)	(sec)	(sec)	(sec)	(sec)	(sec)	(sec)	(sec)	(sec)	(sec)	(sec)
0.80	18.355	17.976	17.596	17.217	16.837	16.458	16.195	15.932	15.669	15.406	15.143	14.880	
1.05	21.894	21.515	21.135	20.756	20.376	19.997	19.734	19.471	19.208	18.945	18.682	18.419	
1.30	25.433	25.054	24.675	24.295	23.916	23.536	23.273	23.010	22.747	22.484	22.221	21.958	
1.54	28.973	28.593	28.214	27.834	27.455	27.076	26.813	26.550	26.287	26.024	25.761	25.498	
1.79	32.512	32.133	31.753	31.374	30.994	30.615	30.352	30.089	29.826	29.563	29.300	29.037	
2.04	36.051	35.672	35.292	34.913	34.534	34.154	33.891	33.628	33.365	33.102	32.839	32.576	
2.29	39.591	39.211	38.832	38.452	38.073	37.694	37.431	37.168	36.905	36.642	36.379	36.116	
2.54	43.130	42.751	42.371	41.992	41.612	41.233	40.970	40.707	40.444	40.181	39.918	39.655	
2.79	46.669	46.290	45.910	45.531	45.152	44.772	44.509	44.246	43.983	43.720	43.457	43.194	
3.03	50.209	49.829	49.450	49.070	48.691	48.312	48.049	47.786	47.523	47.260	46.997	46.734	
3.28	53.748	53.369	52.989	52.610	52.230	51.851	51.588	51.325	51.062	50.799	50.536	50.273	
3.53	57.287	56.908	56.528	56.149	55.770	55.390	55.127	54.864	54.601	54.338	54.075	53.812	
3.78	60.827	60.447	60.068	59.688	59.309	58.930	58.667	58.404	58.141	57.878	57.615	57.352	
4.03	64.366	63.987	63.607	63.228	62.848	62.469	62.206	61.943	61.680	61.417	61.154	60.891	
4.28	67.905	67.526	67.146	66.767	66.388	66.008	65.745	65.482	65.219	64.956	64.693	64.430	
4.52	71.445	71.065	70.686	70.306	69.927	69.548	69.285	69.022	68.759	68.496	68.233	67.970	
4.77	74.984	74.605	74.225	73.846	73.466	73.087	72.824	72.561	72.298	72.035	71.772	71.509	
5.02	78.523	78.144	77.764	77.385	77.006	76.626	76.363	76.100	75.837	75.574	75.311	75.048	
5.27	82.063	81.683	81.304	80.924	80.545	80.166	79.903	79.640	79.377	79.114	78.851	78.588	
5.52	85.602	85.223	84.843	84.464	84.084	83.705	83.442	83.179	82.916	82.653	82.390	82.127	
5.77	89.141	88.762	88.382	88.003	87.624	87.244	86.981	86.718	86.455	86.192	85.929	85.666	
6.01	92.681	92.301	91.922	91.542	91.163	90.784	90.521	90.258	89.995	89.732	89.469	89.206	
6.26	96.220	95.841	95.461	95.082	94.702	94.323	94.060	93.797	93.534	93.271	93.008	92.745	
6.51	99.759	99.380	99.000	98.621	98.242	97.862	97.599	97.336	97.073	96.810	96.547	96.284	
6.76	103.299	102.919	102.540	102.160	101.781	101.402	101.139	100.876	100.613	100.350	100.087	99.824	
7.01	106.838	106.459	106.079	105.700	105.320	104.941	104.678	104.415	104.152	103.889	103.626	103.363	
7.26	110.377	109.998	109.618	109.239	108.860	108.480	108.217	107.954	107.691	107.428	107.165	106.902	
7.50	113.917	113.537	113.158	112.778	112.399	112.020	111.757	111.494	111.231	110.968	110.705	110.442	
7.75	117.456	117.077	116.697	116.318	115.938	115.559	115.296	115.033	114.770	114.507	114.244	113.981	
8.00	120.995	120.616	120.236	119.857	119.477	119.098	118.835	118.572	118.309	118.046	117.783	117.520	

Table C.1: (continued)

Δ	Depth of Source [km]											
	0	3	6	9	12	15	18	21	24	27	30	33
	(sec)	(sec)	(sec)	(sec)	(sec)	(sec)	(sec)	(sec)	(sec)	(sec)	(sec)	(sec)
0.80	31.275	30.692	30.109	29.527	28.944	28.361	27.918	27.474	27.031	26.587	26.144	25.701
1.12	39.255	38.673	38.090	37.507	36.924	36.342	35.898	35.455	35.011	34.568	34.124	33.681
1.43	47.236	46.653	46.071	45.488	44.905	44.322	43.879	43.436	42.992	42.549	42.105	41.662
1.75	55.217	54.634	54.051	53.469	52.886	52.303	51.860	51.416	50.973	50.529	50.086	49.643
2.07	63.198	62.615	62.032	61.450	60.867	60.284	59.841	59.397	58.954	58.510	58.067	57.623
2.39	71.179	70.596	70.013	69.430	68.848	68.265	67.821	67.378	66.935	66.491	66.048	65.604
2.70	79.160	78.577	77.994	77.411	76.829	76.246	75.802	75.359	74.915	74.472	74.029	73.585
3.02	87.140	86.558	85.975	85.392	84.809	84.227	83.783	83.340	82.896	82.453	82.009	81.566
3.34	95.121	94.538	93.956	93.373	92.790	92.207	91.764	91.321	90.877	90.434	89.990	89.547
3.66	103.102	102.519	101.937	101.354	100.771	100.188	99.745	99.301	98.858	98.415	97.971	97.528
3.97	111.083	110.500	109.917	109.335	108.752	108.169	107.726	107.282	106.839	106.395	105.952	105.508
4.29	119.064	118.481	117.898	117.315	116.733	116.150	115.707	115.263	114.820	114.376	113.933	113.489
4.61	127.045	126.462	125.879	125.296	124.714	124.131	123.687	123.244	122.801	122.357	121.914	121.470
4.92	135.025	134.443	133.860	133.277	132.694	132.112	131.668	131.225	130.781	130.338	129.894	129.451
5.24	143.006	142.424	141.841	141.258	140.675	140.093	139.649	139.206	138.762	138.319	137.875	137.432
5.56	150.987	150.404	149.822	149.239	148.656	148.073	147.630	147.187	146.743	146.300	145.856	145.413
5.88	158.968	158.385	157.802	157.220	156.637	156.054	155.611	155.167	154.724	154.280	153.837	153.394
6.19	166.949	166.366	165.783	165.201	164.618	164.035	163.592	163.148	162.705	162.261	161.818	161.374
6.51	174.930	174.347	173.764	173.181	172.599	172.016	171.572	171.129	170.686	170.242	169.799	169.355
6.83	182.911	182.328	181.745	181.162	180.580	179.997	179.553	179.110	178.666	178.223	177.780	177.336
7.14	190.891	190.309	189.726	189.143	188.560	187.978	187.534	187.091	186.647	186.204	185.760	185.317
7.46	198.872	198.289	197.707	197.124	196.541	195.958	195.515	195.072	194.628	194.185	193.741	193.298
7.78	206.853	206.270	205.688	205.105	204.522	203.939	203.496	203.052	202.609	202.166	201.722	201.279
8.10	214.834	214.251	213.668	213.086	212.503	211.920	211.477	211.033	210.590	210.146	209.703	209.259
8.41	222.815	222.232	221.649	221.066	220.484	219.901	219.458	219.014	218.571	218.127	217.684	217.240
8.73	230.796	230.213	229.630	229.047	228.465	227.882	227.438	226.995	226.551	226.108	225.665	225.221
9.05	238.776	238.194	237.611	237.028	236.445	235.863	235.419	234.976	234.532	234.089	233.645	233.202
9.37	246.757	246.175	245.592	245.009	244.426	243.844	243.400	242.957	242.513	242.070	241.626	241.183
9.68	254.738	254.155	253.573	252.990	252.407	251.824	251.381	250.938	250.494	250.051	249.607	249.164
10.00	262.718	262.136	261.553	260.970	260.387	259.805	259.361	258.918	258.474	258.031	257.587	257.144

APPENDIX D

MARK PRODUCT L4-3D SEISMOMETER

The specification of Mark Product L4-3D

Channel Order

(Positive voltage on DAS channel mean ground moved in given direction)

- | | |
|---|-------|
| 1 | Up |
| 2 | North |
| 3 | East |

Sensitivity

171 volts / meter / second

Typical DAS parameters:

Gain	32
Cal Amplitude	1.0 Volt
Cal Interval	5 seconds
Cal Step Size	6 seconds

Physical Characteristics:

Size	cylinder 30 cm diameter, 30 cm high
Weight	12 kg
Shipping	Weight 40 lbs, Size 12x12x24 inches (wooden Gbox)
Power consumption	None, passive sensor

Frequency Response:

Natural Freq.	1.0 Hz
Damping	0.707 critical
Zeros	two at zero
Poles	$-4.44 + 4.44i$, $-4.44 - 4.44i$

Response file:

Mark Product L4-3D seismometer at Station 1
(PSUHY), Station 2 (PNG02), Station 3 (PSUNM),
Station 4 (TBK)

<< IRIS SEED Reader, Release 4.15 >>

===== CHANNEL RESPONSE DATA =====

B050F03 Station: PNG02

B050F16 Network: PN

B052F04 Channel: BHZ

B052F22 Start date: 2000,032,07:53:40.0000

B052F23 End date: 2006,082,04:20:04.0000

 Response (Poles & Zeros), PNG02 ch BHZ

B053F03 Transfer function type: A [Laplace Transform (Rad/sec)]
 B053F04 Stage sequence number: 1
 B053F05 Response in units lookup: M/S - Velocity in Meter Per Second
 B053F06 Response out units lookup: V - Volts
 B053F07 A0 normalization factor: 1
 B053F08 Normalization frequency: 1
 B053F09 Number of zeroes: 2
 B053F14 Number of poles: 2

Complex zeroes:

	i	real	imag	real_error	imag_error
B053F10-13	0	0.000000E+000	0.000000E+000	0.000000E+000	0.000000E+000
B053F10-13	1	0.000000E+000	0.000000E+000	0.000000E+000	0.000000E+000

Complex poles:

	i	real	imag	real_error	imag_error
B053F15-18	0	-4.442210E+000	4.442210E+000	0.000000E+000	0.000000E+000
B053F15-18	1	-4.442210E+000	-4.442210E+000	0.000000E+000	0.000000E+000

 Decimation, PNG02 ch BHZ

B057F03 Stage sequence number: 1
 B057F04 Input sample rate: 0.000000E+000
 B057F05 Decimation factor: 1
 B057F06 Decimation offset: 0
 B057F07 Estimated delay (seconds): 0.000000E+000
 B057F08 Correction applied (seconds): 0.000000E+000

 Channel Gain, PNG02 ch BHZ

```

-----
B058F03 Stage sequence number:      1
B058F04 Gain:                       1.705000E+002
B058F05 Frequency of gain:          1.000000E+001 HZ
B058F06 Number of calibrations:      0

```

```

-----
Response (Poles & Zeros), PNG02 ch BHZ
-----

```

```

B053F03 Transfer function type:      A [Laplace Transform (Rad/sec)]
B053F04 Stage sequence number:      2
B053F05 Response in units lookup:   V - Volts
B053F06 Response out units lookup:  V - Volts
B053F07 A0 normalization factor:    1.40568E+012
B053F08 Normalization frequency:    1
B053F09 Number of zeroes:           0
B053F14 Number of poles:             3

```

Complex zeroes:

```

  i real    imag    real_error  imag_error

```

Complex poles:

```

  i real    imag    real_error  imag_error

```

```

B053F15-18  0 -9.904800E+003  3.786000E+003  0.000000E+000  0.000000E+000
B053F15-18  1 -9.904800E+003 -3.786000E+003  0.000000E+000  0.000000E+000
B053F15-18  2 -1.250700E+004  0.000000E+000  0.000000E+000  0.000000E+000

```

```

-----
Decimation, PNG02 ch BHZ
-----

```

```

B057F03 Stage sequence number:      2
B057F04 Input sample rate:          3.000000E+004
B057F05 Decimation factor:          1
B057F06 Decimation offset:          0
B057F07 Estimated delay (seconds):  0.000000E+000
B057F08 Correction applied (seconds): 0.000000E+000

```

```

-----
Channel Gain, PNG02 ch BHZ
-----

```

```

B058F03 Stage sequence number:      2
B058F04 Gain:                       7.533000E+000
B058F05 Frequency of gain:          1.000000E+001 HZ

```

B058F06 Number of calibrations: 0

 Response (Poles & Zeros), PNG02 ch BHZ

B053F03 Transfer function type: A [Laplace Transform (Rad/sec)]

B053F04 Stage sequence number: 3

B053F05 Response in units lookup: V - Volts

B053F06 Response out units lookup: COUNTS - Digital Counts

B053F07 A0 normalization factor: 1

B053F08 Normalization frequency: 1

B053F09 Number of zeroes: 0

B053F14 Number of poles: 0

Complex zeroes:

i real imag real_error imag_error

Complex poles:

i real imag real_error imag_error

 Decimation, PNG02 ch BHZ

B057F03 Stage sequence number: 3

B057F04 Input sample rate: 3.000000E+004

B057F05 Decimation factor: 1

B057F06 Decimation offset: 0

B057F07 Estimated delay (seconds): 0.000000E+000

B057F08 Correction applied (seconds): 0.000000E+000

 Channel Gain, PNG02 ch BHZ

B058F03 Stage sequence number: 3

B058F04 Gain: 7.880330E+005

B058F05 Frequency of gain: 1.000000E+001 HZ

B058F06 Number of calibrations: 0

 Response (Coefficients), PNG02 ch BHZ

B054F03 Transfer function type: D

B054F04 Stage sequence number: 4

B054F05 Response in units lookup: COUNTS - Digital Counts

B054F06 Response out units lookup: COUNTS - Digital Counts

B054F07 Number of numerators: 34

B054F10 Number of denominators: 0

Numerator coefficients:

i, coefficient, error

B054F08-09	0	3.788770E-005	0.000000E+000
B054F08-09	1	1.997270E-004	0.000000E+000
B054F08-09	2	5.912770E-004	0.000000E+000
B054F08-09	3	1.198340E-003	0.000000E+000
B054F08-09	4	1.677200E-003	0.000000E+000
B054F08-09	5	1.234440E-003	0.000000E+000
B054F08-09	6	-1.158770E-003	0.000000E+000
B054F08-09	7	-6.071730E-003	0.000000E+000
B054F08-09	8	-1.261020E-002	0.000000E+000
B054F08-09	9	-1.766690E-002	0.000000E+000
B054F08-09	10	-1.615370E-002	0.000000E+000
B054F08-09	11	-2.631810E-003	0.000000E+000
B054F08-09	12	2.601660E-002	0.000000E+000
B054F08-09	13	6.805390E-002	0.000000E+000
B054F08-09	14	1.159860E-001	0.000000E+000
B054F08-09	15	1.582340E-001	0.000000E+000
B054F08-09	16	1.830500E-001	0.000000E+000
B054F08-09	17	1.830500E-001	0.000000E+000
B054F08-09	18	1.582340E-001	0.000000E+000
B054F08-09	19	1.159860E-001	0.000000E+000
B054F08-09	20	6.805390E-002	0.000000E+000
B054F08-09	21	2.601660E-002	0.000000E+000
B054F08-09	22	-2.631810E-003	0.000000E+000
B054F08-09	23	-1.615370E-002	0.000000E+000
B054F08-09	24	-1.766690E-002	0.000000E+000
B054F08-09	25	-1.261020E-002	0.000000E+000
B054F08-09	26	-6.071730E-003	0.000000E+000
B054F08-09	27	-1.158770E-003	0.000000E+000
B054F08-09	28	1.234440E-003	0.000000E+000
B054F08-09	29	1.677200E-003	0.000000E+000
B054F08-09	30	1.198340E-003	0.000000E+000
B054F08-09	31	5.912770E-004	0.000000E+000
B054F08-09	32	1.997270E-004	0.000000E+000

B054F08-09 33 3.788770E-005 0.000000E+000

Decimation, PNG02 ch BHZ

B057F03 Stage sequence number: 4
 B057F04 Input sample rate: 3.000000E+004
 B057F05 Decimation factor: 5
 B057F06 Decimation offset: 0
 B057F07 Estimated delay (seconds): 0.000000E+000
 B057F08 Correction applied (seconds): 0.000000E+000

Channel Gain, PNG02 ch BHZ

B058F03 Stage sequence number: 4
 B058F04 Gain: 1.000000E+000
 B058F05 Frequency of gain: 1.000000E+001 HZ
 B058F06 Number of calibrations: 0

Response (Coefficients), PNG02 ch BHZ

B054F03 Transfer function type: D
 B054F04 Stage sequence number: 5
 B054F05 Response in units lookup: COUNTS - Digital Counts
 B054F06 Response out units lookup: COUNTS - Digital Counts
 B054F07 Number of numerators: 30
 B054F10 Number of denominators: 0

Numerator coefficients:

i, coefficient, error

B054F08-09 0 6.587910E-005 0.000000E+000
 B054F08-09 1 1.899970E-004 0.000000E+000
 B054F08-09 2 -4.827190E-005 0.000000E+000
 B054F08-09 3 -1.216780E-003 0.000000E+000
 B054F08-09 4 -2.457610E-003 0.000000E+000
 B054F08-09 5 -5.687040E-004 0.000000E+000
 B054F08-09 6 6.495280E-003 0.000000E+000
 B054F08-09 7 1.294970E-002 0.000000E+000
 B054F08-09 8 5.449010E-003 0.000000E+000
 B054F08-09 9 -2.159300E-002 0.000000E+000

B054F08-09 10 -4.696460E-002 0.000000E+000
 B054F08-09 11 -2.711070E-002 0.000000E+000
 B054F08-09 12 6.566510E-002 0.000000E+000
 B054F08-09 13 2.029430E-001 0.000000E+000
 B054F08-09 14 3.061830E-001 0.000000E+000
 B054F08-09 15 3.061830E-001 0.000000E+000
 B054F08-09 16 2.029430E-001 0.000000E+000
 B054F08-09 17 6.566510E-002 0.000000E+000
 B054F08-09 18 -2.711070E-002 0.000000E+000
 B054F08-09 19 -4.696460E-002 0.000000E+000
 B054F08-09 20 -2.159300E-002 0.000000E+000
 B054F08-09 21 5.449010E-003 0.000000E+000
 B054F08-09 22 1.294970E-002 0.000000E+000
 B054F08-09 23 6.495280E-003 0.000000E+000
 B054F08-09 24 -5.687040E-004 0.000000E+000
 B054F08-09 25 -2.457610E-003 0.000000E+000
 B054F08-09 26 -1.216780E-003 0.000000E+000
 B054F08-09 27 -4.827190E-005 0.000000E+000
 B054F08-09 28 1.899970E-004 0.000000E+000
 B054F08-09 29 6.587910E-005 0.000000E+000

 Decimation, PNG02 ch BHZ

B057F03 Stage sequence number: 5
 B057F04 Input sample rate: 6.000000E+003
 B057F05 Decimation factor: 3
 B057F06 Decimation offset: 0
 B057F07 Estimated delay (seconds): 0.000000E+000
 B057F08 Correction applied (seconds): 0.000000E+000

 Channel Gain, PNG02 ch BHZ

B058F03 Stage sequence number: 5
 B058F04 Gain: 1.000000E+000
 B058F05 Frequency of gain: 1.000000E+001 HZ
 B058F06 Number of calibrations: 0

 Response (Coefficients), PNG02 ch BHZ

```

-----
B054F03  Transfer function type:      D
B054F04  Stage sequence number:           6
B054F05  Response in units lookup:        COUNTS - Digital Counts
B054F06  Response out units lookup:       COUNTS - Digital Counts
B054F07  Number of numerators:            118
B054F10  Number of denominators:          0

```

Numerator coefficients:

i, coefficient, error

```

B054F08-09  0 -1.046900E-005  0.000000E+000
B054F08-09  1 -2.377590E-005  0.000000E+000
B054F08-09  2 -5.718980E-006  0.000000E+000
B054F08-09  3  3.423590E-005  0.000000E+000
B054F08-09  4  3.051090E-005  0.000000E+000
B054F08-09  5 -4.393140E-005  0.000000E+000
B054F08-09  6 -7.445010E-005  0.000000E+000
B054F08-09  7  3.356970E-005  0.000000E+000
B054F08-09  8  1.362690E-004  0.000000E+000
B054F08-09  9  1.277560E-005  0.000000E+000
B054F08-09 10 -2.025090E-004  0.000000E+000
B054F08-09 11 -1.122150E-004  0.000000E+000
B054F08-09 12  2.488130E-004  0.000000E+000
B054F08-09 13  2.730090E-004  0.000000E+000
B054F08-09 14 -2.378790E-004  0.000000E+000
B054F08-09 15 -4.882990E-004  0.000000E+000
B054F08-09 16  1.257250E-004  0.000000E+000
B054F08-09 17  7.273430E-004  0.000000E+000
B054F08-09 18  1.293680E-004  0.000000E+000
B054F08-09 19 -9.317630E-004  0.000000E+000
B054F08-09 20 -5.524020E-004  0.000000E+000
B054F08-09 21  1.016530E-003  0.000000E+000
B054F08-09 22  1.135690E-003  0.000000E+000
B054F08-09 23 -8.796330E-004  0.000000E+000
B054F08-09 24 -1.823780E-003  0.000000E+000
B054F08-09 25  4.200990E-004  0.000000E+000
B054F08-09 26  2.504270E-003  0.000000E+000
B054F08-09 27  4.363560E-004  0.000000E+000
B054F08-09 28 -3.008320E-003  0.000000E+000

```

B054F08-09 29 -1.707710E-003 0.000000E+000
B054F08-09 30 3.124310E-003 0.000000E+000
B054F08-09 31 3.327180E-003 0.000000E+000
B054F08-09 32 -2.625740E-003 0.000000E+000
B054F08-09 33 -5.122460E-003 0.000000E+000
B054F08-09 34 1.311450E-003 0.000000E+000
B054F08-09 35 6.808530E-003 0.000000E+000
B054F08-09 36 9.463450E-004 0.000000E+000
B054F08-09 37 -7.998370E-003 0.000000E+000
B054F08-09 38 -4.153490E-003 0.000000E+000
B054F08-09 39 8.232390E-003 0.000000E+000
B054F08-09 40 8.152580E-003 0.000000E+000
B054F08-09 41 -7.023110E-003 0.000000E+000
B054F08-09 42 -1.259590E-002 0.000000E+000
B054F08-09 43 3.906000E-003 0.000000E+000
B054F08-09 44 1.693530E-002 0.000000E+000
B054F08-09 45 1.518940E-003 0.000000E+000
B054F08-09 46 -2.042210E-002 0.000000E+000
B054F08-09 47 -9.579910E-003 0.000000E+000
B054F08-09 48 2.209430E-002 0.000000E+000
B054F08-09 49 2.060820E-002 0.000000E+000
B054F08-09 50 -2.067740E-002 0.000000E+000
B054F08-09 51 -3.521950E-002 0.000000E+000
B054F08-09 52 1.417050E-002 0.000000E+000
B054F08-09 53 5.525580E-002 0.000000E+000
B054F08-09 54 1.904590E-003 0.000000E+000
B054F08-09 55 -8.790200E-002 0.000000E+000
B054F08-09 56 -4.504150E-002 0.000000E+000
B054F08-09 57 1.822970E-001 0.000000E+000
B054F08-09 58 4.105860E-001 0.000000E+000
B054F08-09 59 4.105860E-001 0.000000E+000
B054F08-09 60 1.822970E-001 0.000000E+000
B054F08-09 61 -4.504150E-002 0.000000E+000
B054F08-09 62 -8.790200E-002 0.000000E+000
B054F08-09 63 1.904590E-003 0.000000E+000
B054F08-09 64 5.525580E-002 0.000000E+000
B054F08-09 65 1.417050E-002 0.000000E+000
B054F08-09 66 -3.521950E-002 0.000000E+000

B054F08-09 67 -2.067740E-002 0.000000E+000
B054F08-09 68 2.060820E-002 0.000000E+000
B054F08-09 69 2.209430E-002 0.000000E+000
B054F08-09 70 -9.579910E-003 0.000000E+000
B054F08-09 71 -2.042210E-002 0.000000E+000
B054F08-09 72 1.518940E-003 0.000000E+000
B054F08-09 73 1.693530E-002 0.000000E+000
B054F08-09 74 3.906000E-003 0.000000E+000
B054F08-09 75 -1.259590E-002 0.000000E+000
B054F08-09 76 -7.023110E-003 0.000000E+000
B054F08-09 77 8.152580E-003 0.000000E+000
B054F08-09 78 8.232390E-003 0.000000E+000
B054F08-09 79 -4.153490E-003 0.000000E+000
B054F08-09 80 -7.998370E-003 0.000000E+000
B054F08-09 81 9.463450E-004 0.000000E+000
B054F08-09 82 6.808530E-003 0.000000E+000
B054F08-09 83 1.311450E-003 0.000000E+000
B054F08-09 84 -5.122460E-003 0.000000E+000
B054F08-09 85 -2.625740E-003 0.000000E+000
B054F08-09 86 3.327180E-003 0.000000E+000
B054F08-09 87 3.124310E-003 0.000000E+000
B054F08-09 88 -1.707710E-003 0.000000E+000
B054F08-09 89 -3.008320E-003 0.000000E+000
B054F08-09 90 4.363560E-004 0.000000E+000
B054F08-09 91 2.504270E-003 0.000000E+000
B054F08-09 92 4.200990E-004 0.000000E+000
B054F08-09 93 -1.823780E-003 0.000000E+000
B054F08-09 94 -8.796330E-004 0.000000E+000
B054F08-09 95 1.135690E-003 0.000000E+000
B054F08-09 96 1.016530E-003 0.000000E+000
B054F08-09 97 -5.524020E-004 0.000000E+000
B054F08-09 98 -9.317630E-004 0.000000E+000
B054F08-09 99 1.293680E-004 0.000000E+000
B054F08-09 100 7.273430E-004 0.000000E+000
B054F08-09 101 1.257250E-004 0.000000E+000
B054F08-09 102 -4.882990E-004 0.000000E+000
B054F08-09 103 -2.378790E-004 0.000000E+000
B054F08-09 104 2.730090E-004 0.000000E+000

B054F08-09 105 2.488130E-004 0.000000E+000
 B054F08-09 106 -1.122150E-004 0.000000E+000
 B054F08-09 107 -2.025090E-004 0.000000E+000
 B054F08-09 108 1.277560E-005 0.000000E+000
 B054F08-09 109 1.362690E-004 0.000000E+000
 B054F08-09 110 3.356970E-005 0.000000E+000
 B054F08-09 111 -7.445010E-005 0.000000E+000
 B054F08-09 112 -4.393140E-005 0.000000E+000
 B054F08-09 113 3.051090E-005 0.000000E+000
 B054F08-09 114 3.423590E-005 0.000000E+000
 B054F08-09 115 -5.718980E-006 0.000000E+000
 B054F08-09 116 -2.377590E-005 0.000000E+000
 B054F08-09 117 -1.046900E-005 0.000000E+000

 Decimation, PNG02 ch BHZ

B057F03 Stage sequence number: 6
 B057F04 Input sample rate: 2.000000E+003
 B057F05 Decimation factor: 2
 B057F06 Decimation offset: 0
 B057F07 Estimated delay (seconds): 0.000000E+000
 B057F08 Correction applied (seconds): 0.000000E+000

 Channel Gain, PNG02 ch BHZ

B058F03 Stage sequence number: 6
 B058F04 Gain: 1.000000E+000
 B058F05 Frequency of gain: 1.000000E+001 HZ
 B058F06 Number of calibrations: 0

 Response (Coefficients), PNG02 ch BHZ

B054F03 Transfer function type: D
 B054F04 Stage sequence number: 7
 B054F05 Response in units lookup: COUNTS - Digital Counts
 B054F06 Response out units lookup: COUNTS - Digital Counts
 B054F07 Number of numerators: 56
 B054F10 Number of denominators: 0

Numerator coefficients:

i, coefficient, error

B054F08-09	0	1.278290E-005	0.000000E+000
B054F08-09	1	4.864360E-005	0.000000E+000
B054F08-09	2	1.144120E-004	0.000000E+000
B054F08-09	3	1.910120E-004	0.000000E+000
B054F08-09	4	2.191870E-004	0.000000E+000
B054F08-09	5	1.043080E-004	0.000000E+000
B054F08-09	6	-2.426290E-004	0.000000E+000
B054F08-09	7	-8.288110E-004	0.000000E+000
B054F08-09	8	-1.497340E-003	0.000000E+000
B054F08-09	9	-1.894280E-003	0.000000E+000
B054F08-09	10	-1.544020E-003	0.000000E+000
B054F08-09	11	-5.733420E-005	0.000000E+000
B054F08-09	12	2.574220E-003	0.000000E+000
B054F08-09	13	5.724080E-003	0.000000E+000
B054F08-09	14	8.086910E-003	0.000000E+000
B054F08-09	15	7.981330E-003	0.000000E+000
B054F08-09	16	4.009120E-003	0.000000E+000
B054F08-09	17	-4.101320E-003	0.000000E+000
B054F08-09	18	-1.480030E-002	0.000000E+000
B054F08-09	19	-2.455140E-002	0.000000E+000
B054F08-09	20	-2.845130E-002	0.000000E+000
B054F08-09	21	-2.161210E-002	0.000000E+000
B054F08-09	22	-9.396190E-004	0.000000E+000
B054F08-09	23	3.330760E-002	0.000000E+000
B054F08-09	24	7.683240E-002	0.000000E+000
B054F08-09	25	1.218950E-001	0.000000E+000
B054F08-09	26	1.591560E-001	0.000000E+000
B054F08-09	27	1.802510E-001	0.000000E+000
B054F08-09	28	1.802510E-001	0.000000E+000
B054F08-09	29	1.591560E-001	0.000000E+000
B054F08-09	30	1.218950E-001	0.000000E+000
B054F08-09	31	7.683240E-002	0.000000E+000
B054F08-09	32	3.330760E-002	0.000000E+000
B054F08-09	33	-9.396190E-004	0.000000E+000
B054F08-09	34	-2.161210E-002	0.000000E+000
B054F08-09	35	-2.845130E-002	0.000000E+000

B054F08-09 36 -2.455140E-002 0.000000E+000
 B054F08-09 37 -1.480030E-002 0.000000E+000
 B054F08-09 38 -4.101320E-003 0.000000E+000
 B054F08-09 39 4.009120E-003 0.000000E+000
 B054F08-09 40 7.981330E-003 0.000000E+000
 B054F08-09 41 8.086910E-003 0.000000E+000
 B054F08-09 42 5.724080E-003 0.000000E+000
 B054F08-09 43 2.574220E-003 0.000000E+000
 B054F08-09 44 -5.733420E-005 0.000000E+000
 B054F08-09 45 -1.544020E-003 0.000000E+000
 B054F08-09 46 -1.894280E-003 0.000000E+000
 B054F08-09 47 -1.497340E-003 0.000000E+000
 B054F08-09 48 -8.288110E-004 0.000000E+000
 B054F08-09 49 -2.426290E-004 0.000000E+000
 B054F08-09 50 1.043080E-004 0.000000E+000
 B054F08-09 51 2.191870E-004 0.000000E+000
 B054F08-09 52 1.910120E-004 0.000000E+000
 B054F08-09 53 1.144120E-004 0.000000E+000
 B054F08-09 54 4.864360E-005 0.000000E+000
 B054F08-09 55 1.278290E-005 0.000000E+000

 Decimation, PNG02 ch BHZ

B057F03 Stage sequence number: 7
 B057F04 Input sample rate: 1.000000E+003
 B057F05 Decimation factor: 5
 B057F06 Decimation offset: 0
 B057F07 Estimated delay (seconds): 0.000000E+000
 B057F08 Correction applied (seconds): 0.000000E+000

 Channel Gain, PNG02 ch BHZ

B058F03 Stage sequence number: 7
 B058F04 Gain: 1.000000E+000
 B058F05 Frequency of gain: 1.000000E+001 HZ
 B058F06 Number of calibrations: 0

Response (Coefficients), PNG02 ch BHZ

```

-----
B054F03  Transfer function type:      D
B054F04  Stage sequence number:           8
B054F05  Response in units lookup:        COUNTS - Digital Counts
B054F06  Response out units lookup:       COUNTS - Digital Counts
B054F07  Number of numerators:            118
B054F10  Number of denominators:          0

```

Numerator coefficients:

i, coefficient, error

```

B054F08-09  0 -1.046900E-005 0.000000E+000
B054F08-09  1 -2.377590E-005 0.000000E+000
B054F08-09  2 -5.718980E-006 0.000000E+000
B054F08-09  3 3.423590E-005 0.000000E+000
B054F08-09  4 3.051090E-005 0.000000E+000
B054F08-09  5 -4.393140E-005 0.000000E+000
B054F08-09  6 -7.445010E-005 0.000000E+000
B054F08-09  7 3.356970E-005 0.000000E+000
B054F08-09  8 1.362690E-004 0.000000E+000
B054F08-09  9 1.277560E-005 0.000000E+000
B054F08-09 10 -2.025090E-004 0.000000E+000
B054F08-09 11 -1.122150E-004 0.000000E+000
B054F08-09 12 2.488130E-004 0.000000E+000
B054F08-09 13 2.730090E-004 0.000000E+000
B054F08-09 14 -2.378790E-004 0.000000E+000
B054F08-09 15 -4.882990E-004 0.000000E+000
B054F08-09 16 1.257250E-004 0.000000E+000
B054F08-09 17 7.273430E-004 0.000000E+000
B054F08-09 18 1.293680E-004 0.000000E+000
B054F08-09 19 -9.317630E-004 0.000000E+000
B054F08-09 20 -5.524020E-004 0.000000E+000
B054F08-09 21 1.016530E-003 0.000000E+000
B054F08-09 22 1.135690E-003 0.000000E+000
B054F08-09 23 -8.796330E-004 0.000000E+000
B054F08-09 24 -1.823780E-003 0.000000E+000
B054F08-09 25 4.200990E-004 0.000000E+000
B054F08-09 26 2.504270E-003 0.000000E+000
B054F08-09 27 4.363560E-004 0.000000E+000

```

B054F08-09 28 -3.008320E-003 0.000000E+000
B054F08-09 29 -1.707710E-003 0.000000E+000
B054F08-09 30 3.124310E-003 0.000000E+000
B054F08-09 31 3.327180E-003 0.000000E+000
B054F08-09 32 -2.625740E-003 0.000000E+000
B054F08-09 33 -5.122460E-003 0.000000E+000
B054F08-09 34 1.311450E-003 0.000000E+000
B054F08-09 35 6.808530E-003 0.000000E+000
B054F08-09 36 9.463450E-004 0.000000E+000
B054F08-09 37 -7.998370E-003 0.000000E+000
B054F08-09 38 -4.153490E-003 0.000000E+000
B054F08-09 39 8.232390E-003 0.000000E+000
B054F08-09 40 8.152580E-003 0.000000E+000
B054F08-09 41 -7.023110E-003 0.000000E+000
B054F08-09 42 -1.259590E-002 0.000000E+000
B054F08-09 43 3.906000E-003 0.000000E+000
B054F08-09 44 1.693530E-002 0.000000E+000
B054F08-09 45 1.518940E-003 0.000000E+000
B054F08-09 46 -2.042210E-002 0.000000E+000
B054F08-09 47 -9.579910E-003 0.000000E+000
B054F08-09 48 2.209430E-002 0.000000E+000
B054F08-09 49 2.060820E-002 0.000000E+000
B054F08-09 50 -2.067740E-002 0.000000E+000
B054F08-09 51 -3.521950E-002 0.000000E+000
B054F08-09 52 1.417050E-002 0.000000E+000
B054F08-09 53 5.525580E-002 0.000000E+000
B054F08-09 54 1.904590E-003 0.000000E+000
B054F08-09 55 -8.790200E-002 0.000000E+000
B054F08-09 56 -4.504150E-002 0.000000E+000
B054F08-09 57 1.822970E-001 0.000000E+000
B054F08-09 58 4.105860E-001 0.000000E+000
B054F08-09 59 4.105860E-001 0.000000E+000
B054F08-09 60 1.822970E-001 0.000000E+000
B054F08-09 61 -4.504150E-002 0.000000E+000
B054F08-09 62 -8.790200E-002 0.000000E+000
B054F08-09 63 1.904590E-003 0.000000E+000
B054F08-09 64 5.525580E-002 0.000000E+000
B054F08-09 65 1.417050E-002 0.000000E+000

B054F08-09 66 -3.521950E-002 0.000000E+000
B054F08-09 67 -2.067740E-002 0.000000E+000
B054F08-09 68 2.060820E-002 0.000000E+000
B054F08-09 69 2.209430E-002 0.000000E+000
B054F08-09 70 -9.579910E-003 0.000000E+000
B054F08-09 71 -2.042210E-002 0.000000E+000
B054F08-09 72 1.518940E-003 0.000000E+000
B054F08-09 73 1.693530E-002 0.000000E+000
B054F08-09 74 3.906000E-003 0.000000E+000
B054F08-09 75 -1.259590E-002 0.000000E+000
B054F08-09 76 -7.023110E-003 0.000000E+000
B054F08-09 77 8.152580E-003 0.000000E+000
B054F08-09 78 8.232390E-003 0.000000E+000
B054F08-09 79 -4.153490E-003 0.000000E+000
B054F08-09 80 -7.998370E-003 0.000000E+000
B054F08-09 81 9.463450E-004 0.000000E+000
B054F08-09 82 6.808530E-003 0.000000E+000
B054F08-09 83 1.311450E-003 0.000000E+000
B054F08-09 84 -5.122460E-003 0.000000E+000
B054F08-09 85 -2.625740E-003 0.000000E+000
B054F08-09 86 3.327180E-003 0.000000E+000
B054F08-09 87 3.124310E-003 0.000000E+000
B054F08-09 88 -1.707710E-003 0.000000E+000
B054F08-09 89 -3.008320E-003 0.000000E+000
B054F08-09 90 4.363560E-004 0.000000E+000
B054F08-09 91 2.504270E-003 0.000000E+000
B054F08-09 92 4.200990E-004 0.000000E+000
B054F08-09 93 -1.823780E-003 0.000000E+000
B054F08-09 94 -8.796330E-004 0.000000E+000
B054F08-09 95 1.135690E-003 0.000000E+000
B054F08-09 96 1.016530E-003 0.000000E+000
B054F08-09 97 -5.524020E-004 0.000000E+000
B054F08-09 98 -9.317630E-004 0.000000E+000
B054F08-09 99 1.293680E-004 0.000000E+000
B054F08-09 100 7.273430E-004 0.000000E+000
B054F08-09 101 1.257250E-004 0.000000E+000
B054F08-09 102 -4.882990E-004 0.000000E+000
B054F08-09 103 -2.378790E-004 0.000000E+000

B054F08-09 104 2.730090E-004 0.000000E+000
 B054F08-09 105 2.488130E-004 0.000000E+000
 B054F08-09 106 -1.122150E-004 0.000000E+000
 B054F08-09 107 -2.025090E-004 0.000000E+000
 B054F08-09 108 1.277560E-005 0.000000E+000
 B054F08-09 109 1.362690E-004 0.000000E+000
 B054F08-09 110 3.356970E-005 0.000000E+000
 B054F08-09 111 -7.445010E-005 0.000000E+000
 B054F08-09 112 -4.393140E-005 0.000000E+000
 B054F08-09 113 3.051090E-005 0.000000E+000
 B054F08-09 114 3.423590E-005 0.000000E+000
 B054F08-09 115 -5.718980E-006 0.000000E+000
 B054F08-09 116 -2.377590E-005 0.000000E+000
 B054F08-09 117 -1.046900E-005 0.000000E+000

 Decimation, PNG02 ch BHZ

B057F03 Stage sequence number: 8
 B057F04 Input sample rate: 2.000000E+002
 B057F05 Decimation factor: 2
 B057F06 Decimation offset: 0
 B057F07 Estimated delay (seconds): 0.000000E+000
 B057F08 Correction applied (seconds): 0.000000E+000

 Channel Gain, PNG02 ch BHZ

B058F03 Stage sequence number: 8
 B058F04 Gain: 1.000000E+000
 B058F05 Frequency of gain: 1.000000E+001 HZ
 B058F06 Number of calibrations: 0

 Response (Poles & Zeros), PNG02 ch BHZ

B053F03 Transfer function type: D [Digital (Z-transform)]
 B053F04 Stage sequence number: 9
 B053F05 Response in units lookup: COUNTS - Digital Counts
 B053F06 Response out units lookup: COUNTS - Digital Counts
 B053F07 A0 normalization factor: 0.999969

B053F08 Normalization frequency: 1
 B053F09 Number of zeroes: 2
 B053F14 Number of poles: 2

Complex zeroes:

	i	real	imag	real_error	imag_error
B053F10-13	0	1.000000E+000	0.000000E+000	0.000000E+000	0.000000E+000
B053F10-13	1	-1.000000E+000	0.000000E+000	0.000000E+000	0.000000E+000

Complex poles:

	i	real	imag	real_error	imag_error
B053F15-18	0	1.000000E+000	0.000000E+000	0.000000E+000	0.000000E+000
B053F15-18	1	-9.999370E-001	0.000000E+000	0.000000E+000	0.000000E+000

 Decimation, PNG02 ch BHZ

B057F03 Stage sequence number: 9
 B057F04 Input sample rate: 1.000000E+002
 B057F05 Decimation factor: 1
 B057F06 Decimation offset: 0
 B057F07 Estimated delay (seconds): 0.000000E+000
 B057F08 Correction applied (seconds): 0.000000E+000

 Channel Gain, PNG02 ch BHZ

B058F03 Stage sequence number: 9
 B058F04 Gain: 1.000000E+000
 B058F05 Frequency of gain: 1.000000E+001 HZ
 B058F06 Number of calibrations: 0

 Channel Sensitivity, PNG02 ch BHZ

B058F03 Stage sequence number: 0
 B058F04 Sensitivity: 1.012130E+009
 B058F05 Frequency of sensitivity: 1.000000E+001 HZ
 B058F06 Number of calibrations: 0

ORION PORTABLE SEISMOGRAPH

Input Channels

Sensor channel	3 standard, 6 optional
Type	Differential
Sensitivity	2.55uV/bit, default
Gain	Resistor programmable
Input level	40 Vpp Differential
Damping	Provisions for internal resistor
Impedance	Typically 1 Mohm with no damping
Noise level	Typically 1.25 counts rms at 1.9 microVolt/bit & 100 sps (shorted input)
Dynamic Range	132 db rms-rms

Digitizer

Type	24-bit delta-sigma
Analog filter	3 rd order Bessel -3db 3.7 KHz
Digital filter	-140db at output Nyquist
Hardware Sample Rate	256 KHz
Phase	Linear in passband
Cross talk	> -80 dB typical
Sample Instant	Simultaneous
Sample rates	10, 20, 40, 50, 80, 100, 125, 200, 250, 500, 1000 Consult factory for other sample rate
Output format	Compressed, non-approximating first difference Absolute UTC time reference
Preview channel	2 Channels at 1 sps to 600 seconds Bandpassed filtered min & max over interval

Auxiliary Data Channels

First Channels	3 channel +/- 10V at 1 to 1/600 sps
Slow Channels	3 channels +/- 10V at 1/8 to 1/600 sps
Resolution	10-bit
Sensitivity	49 mV/bit

State-of-Health

Internal	Temperature, disk temperature, supply voltage
Self-test	Performs a complete self test at power up

Timing System

Timing System	UTC timed with DCXO disciplined to GPS
System accuracy	1 ms (typically 20 microseconds GPS 100%)
Internal oscillator	DCXO, typically 0.4 ppm over temperature range Fine channel GPS receiver
GPS Duty cycle	1 to 99 % operator set
Antenna	Active, typically 25 dB gain
Cable length	2m standard Optional 10m cable
Time to first fix	Typically 30 seconds
Power Consumption	1.3 watt continuous mode, one fix per second

Acquisition Modes

Continuous mode	Operator set start / stop time Continuous with trigger fags
Event mode	As determined by event trigger
Window mode	Ten programmable windows with repeats Continuous or event recording in each window
Recording method	Ring buffer or no overwrite

Event Detector

Trigger pre-filter	Band pass, high pass or low pass, to 5 th order
Triggering	STA / LTA or absolute level (%g) trigger Up to 6 independent triggers
Trigger threshold	Ratio 1 to 99.9
Pre-event memory	1 to 99 seconds
Post-event memory	1 to 200 seconds

Data Cartridge

Data Compression	Non-approximating, typically 1.3 bytes / sample
Shock	Drives float in form within the disk drive package for

	added shock protection
Temperature range	-20 to +40 C (with heating)
Drive heating	All cartridges include a 15 W heating element Heating is operator-set, and can be enabled or disabled
Size	Length 22 cm, height 6 cm, width 14 cm
Weight	0.5 kg (1.1 lbs.) varies with drive capacity

User Interface

Liquid crystal display 240x64 graphic display

Contrast & backlight Set via menu

Input keys Four push buttons

LED's indicators:

Disk Disk activity

GPS GPS locked or unlocked

Battery Battery voltage & low voltage shutdown

Event An event is being processed

ACQ-CPU Acquisition processor status

USRE-CPU User interface processor status

Power

Typical: 5.2 watts (100 sps, 3 channels and GPS 10 % duty cycled)

Voltage 11V to 17V DC

Battery: 12 Ahrs (two 6 volt 12 Amp Hr) internally mounted

Overvoltage protection No damage at +/-30 V

Main power supply / charger

Input Voltage 58 VAC to 264 VAC

Input Frequency Range 47 Hz to 440 Hz

Output Voltage 13.5 VDC

Connectors

External

Sensor 19 pin for Three channel sensor

GPS antenna: Coaxial

Communications: 19 pin I/O, series port, SOH

Power:	4 pin 12V battery, charger input and earth
Data Cartridge	50 pin SCSI connector for data cartridge 24 pin 'D' connector for cartridge power / control

Environmental

Operating Temperature	20 to +40 C
Humidity	100%
Packaging	ABS alloy case
Dimensions	Length 47 cm, Width 37 cm, Depth 19 cm
Weight	10.9 kg (24 lbs) including batteries

APPENDIX E

RAW DATA TABLE

Table E.1: Raw data table of 173 earthquake events employs the following acronyms:

Event: order of earthquake events, Date represents the date/month/year of event., Stn.: Station name (pkt symbolizes Station 4), Station 3 in the first month with time shift and hence the origin time from this station is not applicable, P-arrival T. and S-arrival T.: P-wave and S-wave arrival time in hour:minute:second, Origin T. and Origin T. (average.): Origin time and average origin time in hour:minute:second. (Origin T (average.) refers to origin time from $(\text{Stn.1}+\text{Stn.2})/2$ or $(\text{Stn. 2} + \text{pkt})/2$). Dist.: Distance in km, long: Longitude, lat: Latitude, Amp. (E), Amp. (N) and Amp. (ave): Amplitude in east, north, and vector sum of both in nanometer, respectively, MI and MI (highest): Local magnitude and the highest local magnitude from each station.

Table E.2: Earthquake data from one station with 3 components: Event: Order of earthquake events, Date Date/month/year, Time: Origin time, Stn.: Station name, Dist: Distance in km, Amp. in counts: Amplitude in counts, Azimuth (AZI): Azimuth angle, Location: Earthquake location.

Table E.3: Man-made seismic events: Event: Order of man-made events, Day: Mo = Monday, Tue = Tuesday, Wed = Wednesday, Thur = Thursday, Fr = Friday, Sat = Saturday, Sun = Sunday, Date: date/month/year, Time: Origin time, MI and MI (highest): Local magnitude and highest local magnitude from each station, MI calculation based on data from Station 2.

Table E.1

Event	Date	Stn.	P-arrival T. hh:mm:ss.0	S-arrival T. hh:mm:ss.0	Delta(S-P) hh:mm:ss.0	Origin T. hh:mm:ss.0	Origin T.(ave) hh:mm:ss.0	Dist. (km)	long (East)	lat (North)	Amp.(E) (nm)	Amp.(N) (nm)	Amp.(ave) (nm)	MI	MI (highest)
2	14/1/2005	1	10:08:56.9	10:08:57.9	00:00:01.0	10:08:55.3	10:08:54.7	8.9	98.515	8.545	1.7	0.6	1.8	-0.8	-0.5
		2	10:08:58.1	10:09:00.7	00:00:02.6	10:08:54.2		21.8			1.0	0.8	1.3	-0.5	
		3	10:08:52.5	10:08:55.6	00:00:03.1	10:08:47.7		26.6			0.6	0.5	0.8	-0.6	
		pkt	-	-	-	-		-			-	-	-	-	
3	15/1/2005	1	-	-	-	-		-	98.287	8.507	-	-	-	-	
		2	21:54:53.1	21:54:58.0	00:00:04.9	21:54:45.7	21:54:43.1	41.4			0.6	0.3	0.7	-0.4	-0.1
		3	21:54:49.8	21:54:55.8	00:00:06.0	21:54:40.6		51.3			0.6	0.7	0.9	-0.1	
		pkt	21:54:54.8	21:55:02.9	00:00:08.1	21:54:42.4		68.7							
4	16/1/2005	1	-	-	-	-		-	99.524	9.361	-	-	-	-	
		2	02:47:16.6	02:47:31.9	00:00:15.3	02:46:53.2	02:46:52.7	130.3			2.8	2.8	4.0	1.1	1.1
		3	02:47:17.0	02:47:33.3	00:00:16.3	02:46:52.2		138.1			1.6	1.5	2.2	0.9	
		pkt	02:47:30.6	02:47:55.2	00:00:24.6	02:46:56.9		208.3			2.7	0.9	2.8	1.3	
5	16/1/2005	1	-	-	-	-		-	98.601	8.461	-	-	-	-	
		2	04:03:11.1	04:03:12.6	00:00:01.5	04:03:08.8	04:03:07.5	12.9			18.6	10.2	21.2	0.5	0.5
		3	04:03:09.3	04:03:11.3	00:00:02.0	04:03:06.3		16.9			2.2	0.7	2.3	-0.3	
		pkt	04:03:20.2	04:03:28.3	00:00:08.1	04:03:07.8		68.7			10.3	1.8	10.5	1.1	
6	16/1/2005	1	-	-	-	-		-	97.467	8.549	-	-	-	-	
		2	13:01:44.4	13:01:59.8	00:00:15.4	13:01:20.8	13:01:20.7	131.1			3.4	3.1	4.6	1.2	1.2
		3	13:01:44.9	13:02:00.9	00:00:16.0	13:01:20.5		135.6			1.4	0.7	1.6	0.7	
		pkt	13:01:41.0	13:01:55.3	00:00:14.3	13:01:19.1		121.6			3.2	1.6	3.6	1.0	
7	16/1/2005	1	-	-	-	-		-	99.132	8.507	-	-	-	-	
		2	20:57:30.9	20:57:37.0	00:00:06.1	20:57:21.5	20:57:21.4	52.2			1.5	0.7	1.7	0.1	0.1
		3	20:57:29.3	20:57:34.6	00:00:05.3	20:57:21.2		45.0			0.9	0.8	1.2	-0.1	
		pkt	20:57:41.3	20:57:54.3	00:00:13.0	20:57:21.5		110.3			0.6	0.4	0.7	0.2	
8	17/1/2005	1	-	-	-	-		-	98.644	8.683	-	-	-	-	
		2	04:03:27.4	04:03:29.0	00:00:01.6	04:03:24.9	04:03:23.2	13.7			24.3	12.0	27.1	0.6	0.6
		3	04:03:28.0	04:03:32.2	00:00:04.2	04:03:21.5		36.0			0.9	0.7	1.1	-0.2	
		pkt	04:03:41.7	04:03:52.9	00:00:11.2	04:03:24.7		94.7			7.4	1.4	7.5	1.2	
9	17/1/2005	1	-	-	-	-		-	97.467	8.528	-	-	-	-	
		2	12:01:36.5	12:01:51.9	00:00:15.4	12:01:12.9	12:01:13.0	131.1			8.9	6.4	11.0	1.5	1.5
		3	12:01:38.0	12:01:54.8	00:00:16.8	12:01:13.0		140.4			4.0	1.7	4.3	1.2	
		pkt	12:00:40.5	12:00:54.6	00:00:14.1	12:00:18.9		119.9			4.7	1.6	5.0	1.1	
10	17/1/2005	1	-	-	-	-		-	97.596	8.919	-	-	-	-	
		2	12:09:17.0	12:09:31.5	00:00:14.5	12:08:54.8	12:08:54.7	123.3			2.1	2.3	3.1	1.0	1.0
		3	12:09:19.2	12:09:35.7	00:00:16.5	12:08:54.5		138.6			0.9	1.6	1.8	0.8	
		pkt	12:09:19.7	12:09:36.6	00:00:16.9	12:08:54.7		141.0			4.7	0.5	4.7	1.2	
11	17/1/2005	1	-	-	-	-		-	98.095	8.736	-	-	-	-	
		2	17:21:04.6	17:21:12.2	00:00:07.6	17:20:53.0	17:50:51.9	64.6			5.1	2.1	5.5	0.8	0.9
		3	18:21:05.4	18:21:15.0	00:00:09.6	18:20:50.8		81.3			4.6	2.4	5.2	0.9	
		pkt	19:21:11.1	19:21:22.5	00:00:11.4	19:20:53.8		96.4			2.5	0.5	2.5	0.7	
12	17/1/2005	1	-	-	-	-		-	97.987	8.461	-	-	-	-	
		2	23:01:09.7	23:01:18.5	00:00:08.8	23:00:56.3	23:00:55.7	74.6			3.9	0.7	4.0	0.7	0.7
		3	23:01:10.1	23:01:19.9	00:00:09.8	23:00:55.2		82.9			2.3	0.9	2.5	0.6	
		pkt	23:01:08.9	23:01:17.7	00:00:08.8	23:00:55.5		74.6			1.1	0.8	1.4	0.3	
13	18/1/2005	1	21:39:20.9	21:39:27.0	00:00:06.1	21:39:11.6	21:39:11.6	51.7	98.126	8.173	4.1	0.3	4.1	0.5	0.5
		2	21:39:24.7	21:39:33.3	00:00:08.6	21:39:11.5		73.4			1.9	1.1	2.2	0.5	
		3	21:39:25.3	21:39:33.9	00:00:08.6	21:39:12.1		73.4			1.0	0.3	1.0	0.1	
		pkt	-	-	-	-		-			-	-	-	-	

Table E.1: (continued)

Event	Date	Stn.	P-arrival T.	S-arrival T.	Delta(S-P)	Origin T.	Origin T.(ave)	Dist.	long	lat	Amp.(E)	Amp.(N)	Amp.(ave)	MI	MI (highest)
			hh:mm:ss.0	hh:mm:ss.0	hh:mm:ss.0	hh:mm:ss.0	hh:mm:ss.0								
15	20/1/2005	1	09:48:38.1	09:48:52.4	00:00:14.3	09:48:16.3	09:48:18.8	121.3	98.454	9.555	1.9	1.9	2.7	0.9	1.0
		2	09:48:40.8	09:48:53.5	00:00:12.7	09:48:21.4		108.0			3.1	2.7	4.1	1.0	
		3	09:48:43.1	09:48:58.6	00:00:15.5	09:48:19.5		131.2			2.6	1.1	2.8	1.0	
		pkt	-	-	-	-		-			-	-	-	-	
16	21/1/2005	1	22:23:11.7	22:23:16.9	00:00:05.2	22:23:03.8	22:23:03.5	44.1	98.134	8.573	3.8	1.9	4.2	0.4	0.8
		2	22:23:13.5	22:23:20.3	00:00:06.8	22:23:03.1		57.6			6.6	2.6	7.1	0.8	
		3	22:23:21.5	22:23:29.7	00:00:08.2	22:23:09.0		69.6			4.1	1.3	4.3	0.7	
		pkt	-	-	-	-		-			-	-	-	-	
18	5/2/2005	1	12:46:11.9	12:46:15.5	00:00:03.6	12:46:06.4	12:46:06.4	30.6	98.597	8.169	1.5	0.6	1.6	-0.2	0.4
		2	12:46:14.3	12:46:19.5	00:00:05.2	12:46:06.4		44.1			3.1	1.7	3.5	0.4	
		pkt	12:46:13.4	12:46:18.3	00:00:04.9	12:46:06.0		41.4			4.2	1.1	4.3	0.4	
19	5/2/2005	1	18:07:55.7	18:08:03.5	00:00:07.8	18:07:43.8	18:07:42.5	66.2	98.075	8.022	2.0	0.8	2.2	0.4	0.9
		2	18:07:57.0	18:08:07.4	00:00:10.4	18:07:41.2		87.9			4.1	1.1	4.2	0.9	
		pkt	18:07:49.8	18:07:53.7	00:00:03.9	18:07:43.8		33.3			1.3	0.7	1.5	-0.2	
20	9/2/2005	1	21:04:45.0	21:05:07.0	00:00:22.0	21:04:14.8	21:04:14.7	181.5	100.141	8.191	0.8	0.2	0.8	0.7	0.8
		2	21:04:43.1	21:05:03.7	00:00:20.6	21:04:14.6		168.0			1.1	0.4	1.2	0.8	
		pkt	21:04:47.7	21:05:11.6	00:00:23.9	21:04:15.1		200.1			1.0	0.7	1.2	0.9	
21	15/2/2005	1	13:09:38.8	13:09:48.1	00:00:09.3	13:09:24.6	13:09:23.9	78.8	99.072	7.992	1.9	3.2	3.7	0.7	1.2
		2	13:09:37.1	13:09:46.3	00:00:09.2	13:09:23.1		77.9			4.9	9.1	10.3	1.2	
		pkt	13:09:41.7	13:09:51.2	00:00:09.5	13:09:27.2		80.4			2.0	2.7	3.4	0.7	
22	1/3/2005	1	01:02:56.6	01:03:13.9	00:00:17.3	01:02:31.2	01:02:31.3	143.5	99.513	7.607	0.6	1.7	1.8	0.8	0.8
		2	01:02:56.5	01:03:13.5	00:00:17.0	01:02:31.4		141.6			1.0	0.2	1.0	0.6	
		pkt	01:02:54.3	01:03:09.8	00:00:15.5	01:02:30.6		132.0			3.8	1.7	4.2	1.1	
24	1/3/2005	1	09:27:10.2	09:27:19.2	00:00:09.0	09:26:56.5	09:26:56.6	76.3	99.112	8.771	0.9	0.7	1.1	0.2	0.2
		2	09:27:06.6	09:27:13.1	00:00:06.5	09:26:56.7		54.9			0.9	0.6	1.1	0.0	
		pkt	09:27:20.3	09:27:35.5	00:00:15.2	09:26:57.0		129.4			1.9	1.0	2.1	0.8	
25	1/3/2005	1	09:35:35.9	09:35:43.9	00:00:08.0	09:35:23.7	09:35:23.9	67.9	98.879	7.942	1.0	0.8	1.3	0.2	0.5
		2	09:35:37.4	09:35:46.1	00:00:08.7	09:35:24.1		73.8			2.2	1.5	2.7	0.5	
		pkt	09:35:36.1	09:35:43.0	00:00:06.9	09:35:25.6		58.5			2.3	2.1	3.1	0.5	
26	1/3/2005	1	09:57:47.8	09:57:49.1	00:00:01.3	09:57:45.8	09:57:44.7	11.3	98.428	8.491	1.3	0.3	1.3	-0.8	-0.4
		2	09:57:48.7	09:57:52.0	00:00:03.3	09:57:43.7		28.0			0.7	0.7	1.0	-0.4	
		pkt	09:57:57.6	09:58:05.5	00:00:07.9	09:57:45.5		67.1			1.7	0.4	1.7	0.3	
27	1/3/2005	1	17:42:39.4	17:42:41.5	00:00:02.1	17:42:36.2	17:42:37.5	17.7	98.509	8.590	0.4	0.2	0.4	-1.0	-0.9
		2	17:42:41.9	17:42:43.9	00:00:02.0	17:42:38.9		16.9			0.5	0.3	0.6	-0.9	
		pkt	17:42:53.3	17:43:02.7	00:00:09.4	17:42:39.0		79.6			1.3	1.4	1.9	0.5	
29	2/3/2005	1	04:35:44.0	04:35:50.1	00:00:06.1	04:35:34.6	04:35:34.5	52.2	98.098	8.663	0.5	0.5	0.7	-0.2	0.7
		2	04:35:45.8	04:35:53.2	00:00:07.4	04:35:34.5		62.9			4.7	1.2	4.9	0.7	
		pkt	04:35:54.3	04:36:04.9	00:00:10.6	04:35:38.0		90.4			1.7	0.7	1.8	0.5	
30	2/3/2005	1	04:46:46.9	04:47:00.6	00:00:13.7	04:46:26.0	04:46:26.2	116.4	99.076	9.315	0.4	1.8	1.8	0.7	0.7
		2	04:46:43.6	04:46:54.9	00:00:11.3	04:46:26.4		95.6			1.0	0.7	1.2	0.4	
		pkt	04:46:56.0	04:47:17.5	00:00:21.5	04:46:26.3		177.3			1.7	0.8	1.9	1.0	
31	2/3/2005	1	06:07:40.4	06:07:58.6	00:00:18.2	06:07:14.3	06:07:14.4	148.9	98.455	9.769	0.6	0.3	0.7	0.4	0.9
		2	06:07:39.0	06:07:55.1	00:00:16.1	06:07:14.6		136.2			1.9	1.6	2.5	0.9	
		pkt	06:07:48.5	06:08:13.3	00:00:24.8	06:07:14.7		209.3			7.0	3.9	8.0	1.8	
32	2/3/2005	1	08:38:31.1	08:38:49.4	00:00:18.3	08:38:04.9	08:38:04.9	149.5	99.576	7.597	0.6	0.2	0.6	0.4	0.6
		2	08:38:30.8	08:38:48.7	00:00:17.9	08:38:05.0		147.1			0.7	0.7	1.0	0.6	
		pkt	08:38:29.0	08:38:45.6	00:00:16.6	08:38:04.2		139.2			2.6	1.2	2.9	1.0	

Table E.1: (continued)

Event	Date	Stn.	P-arrival T. hh:mm:ss.0	S-arrival T. hh:mm:ss.0	Delta(S-P) hh:mm:ss.0	Origin T. hh:mm:ss.0	Origin T.(ave) hh:mm:ss.0	Dist. (km)	long (East)	lat (North)	Amp.(E) (nm)	Amp.(N) (nm)	Amp.(ave) (nm)	MI	MI (highest)
33	2/3/2005	1	09:13:47.8	09:13:53.3	00:00:05.5	09:13:39.4	09:13:38.9	46.8	98.467	8.012	0.7	0.3	0.8	-0.3	0.0
		2	09:13:50.1	09:13:57.7	00:00:07.6	09:13:38.5		64.6			0.6	0.6	0.8	0.0	
		pkt	09:13:40.3	09:13:42.5	00:00:02.2	09:13:37.0		18.5			1.7	1.4	2.2	-0.3	
34	2/3/2005	1	14:25:28.2	14:25:31.5	00:00:03.3	14:25:23.1	14:25:23.4	28.2	98.748	8.338	0.5	0.3	0.6	-0.7	-0.7
		2	14:25:28.4	14:25:31.5	00:00:03.1	14:25:23.6		26.6			0.5	0.2	0.5	-0.7	
		pkt	14:25:34.8	14:25:42.6	00:00:07.8	14:25:22.9		66.2			2.3	0.5	2.4	0.4	
35	3/3/2005	1	00:11:07.9	00:11:22.7	00:00:14.8	00:10:45.2	00:10:44.4	126.0	99.575	8.013	0.5	0.4	0.6	0.3	0.6
		2	00:11:04.7	00:11:18.5	00:00:13.8	00:10:43.7		117.0			1.0	1.0	1.4	0.6	
		pkt	00:11:12.7	00:11:28.6	00:00:15.9	00:10:48.5		134.7			1.4	0.3	1.4	0.7	
36	3/3/2005	1	00:16:20.2	00:16:34.1	00:00:13.9	00:15:59.0	00:15:58.9	118.1	99.582	8.494	0.6	0.4	0.7	0.3	0.3
		2	00:16:17.1	00:16:29.1	00:00:12.0	00:15:58.8		101.7			0.6	0.7	0.9	0.3	
		pkt	00:16:25.1	00:16:43.8	00:00:18.7	00:15:58.8		151.3			3.7	0.4	3.7	1.2	
38	3/3/2005	1	06:57:55.0	06:58:05.1	00:00:10.1	06:57:39.6	06:57:37.8	85.4	98.006	9.020	5.3	3.8	6.5	1.0	1.3
		2	06:57:51.8	06:58:02.2	00:00:10.4	06:57:36.0		87.9			10.1	8.0	12.9	1.3	
		pkt	06:58:05.7	06:58:21.1	00:00:15.4	06:57:42.1		131.1			4.3	1.4	4.5	1.2	
39	3/3/2005	1	09:13:23.0	09:13:37.4	00:00:14.4	09:13:01.0	09:13:00.9	122.5	98.662	9.521	1.1	0.2	1.1	0.5	0.5
		2	09:13:20.0	09:13:32.6	00:00:12.6	09:13:00.8		106.9			0.9	0.9	1.3	0.5	
		pkt	09:13:31.5	09:13:53.8	00:00:22.3	09:13:00.9		184.6			1.6	1.2	2.0	1.1	
40	3/3/2005	1	09:15:51.0	09:16:04.1	00:00:13.1	09:15:31.0	09:15:30.9	111.2	98.962	9.325	1.2	0.9	1.5	0.6	0.8
		2	09:15:47.3	09:15:58.1	00:00:10.8	09:15:30.9		91.3			1.9	2.5	3.1	0.8	
		pkt	09:16:01.2	09:16:22.4	00:00:21.2	09:15:32.0		173.2			1.3	2.0	2.4	1.1	
41	3/3/2005	1	10:02:00.4	10:02:09.5	00:00:09.1	10:01:46.5	10:01:46.5	77.1	99.122	8.767	0.6	0.4	0.7	0.0	0.0
		2	10:01:56.6	10:02:03.2	00:00:06.6	10:01:46.6		55.8			0.9	0.5	1.0	0.0	
		pkt	10:02:09.8	10:02:25.0	00:00:15.2	10:01:46.5		129.4			3.2	2.0	3.8	1.1	
42	3/3/2005	1	10:21:11.2	10:21:25.5	00:00:14.3	10:20:49.3	10:20:49.4	121.6	98.721	9.504	1.1	0.5	1.2	0.5	0.8
		2	10:21:08.3	10:21:20.7	00:00:12.4	10:20:49.4		105.1			1.5	2.0	2.5	0.8	
		pkt	10:21:21.2	10:21:43.4	00:00:22.2	10:20:50.7		183.5			1.9	1.0	2.1	1.1	
43	3/3/2005	1	10:24:48.4	10:24:49.4	00:00:01.0	10:24:46.9	10:24:46.6	8.5	98.587	8.412	1.0	0.3	1.0	-1.0	-0.8
		2	10:24:49.9	10:24:52.2	00:00:02.3	10:24:46.4		19.5			0.6	0.4	0.7	-0.8	
		pkt	10:24:58.0	10:25:05.4	00:00:07.4	10:24:46.7		62.9			1.2	0.7	1.4	0.2	
44	3/3/2005	1	11:54:21.4	11:54:36.0	00:00:14.6	11:53:59.1	11:53:59.0	124.2	98.555	9.547	21.7	16.5	27.3	1.9	2.2
		2	11:54:18.7	11:54:31.7	00:00:13.0	11:53:58.9		110.3			35.9	47.8	59.8	2.2	
		pkt	11:54:31.1	11:54:53.5	00:00:22.4	11:54:00.4		185.6			9.7	4.8	10.8	1.8	
45	3/3/2005	1	13:54:49.6	13:54:55.0	00:00:05.4	13:54:41.4	13:54:40.0	45.7	98.176	8.189	1.0	0.2	1.0	-0.2	0.2
		2	13:54:51.0	13:54:59.1	00:00:08.1	13:54:38.7		68.4			1.2	0.5	1.3	0.2	
		pkt	13:54:45.6	13:54:49.9	00:00:04.3	13:54:39.1		36.4			1.7	1.2	2.1	0.0	
46	3/3/2005	1	14:15:42.4	14:15:55.7	00:00:13.3	14:15:22.1	14:15:21.6	112.9	98.458	9.445	0.6	0.3	0.7	0.2	0.5
		2	14:15:39.3	14:15:51.2	00:00:11.9	14:15:21.2		100.8			1.1	1.1	1.6	0.5	
		pkt	14:15:49.3	14:16:10.5	00:00:21.2	14:15:20.1		173.2			1.7	0.8	1.9	1.0	
47	3/3/2005	1	15:23:12.2	15:23:26.2	00:00:14.0	15:22:50.8	15:22:49.8	119.0	99.446	7.898	0.7	0.3	0.8	0.3	0.5
		2	15:23:09.3	15:23:22.7	00:00:13.4	15:22:48.8		113.8			0.7	0.9	1.1	0.5	
		pkt	15:23:09.0	15:23:23.2	00:00:14.2	15:22:47.3		120.7			2.7	1.9	3.3	1.0	
48	4/3/2005	1	02:49:18.0	02:49:36.2	00:00:18.2	02:48:51.9	02:48:52.0	148.9	99.524	7.546	0.6	0.7	0.9	0.6	0.6
		2	02:49:18.0	02:49:36.0	00:00:18.0	02:48:52.1		147.7			0.8	0.5	0.9	0.6	
		pkt	02:49:16.6	02:49:32.5	00:00:15.9	02:48:52.3		135.0			1.6	1.2	2.0	0.8	

Table E.1: (continued)

Event	Date	Stn.	P-arrival T.	S-arrival T.	Delta(S-P)	Origin T.	Origin T.(ave)	Dist.	long	lat	Amp.(E)	Amp.(N)	Amp.(ave)	MI	MI (highest)
			hh:mm:ss.0	hh:mm:ss.0	hh:mm:ss.0	hh:mm:ss.0	hh:mm:ss.0								
49	4/3/2005	1	07:53:16.1	07:53:30.4	00:00:14.3	07:52:54.2	07:52:54.4	121.6	98.613	9.520	6.2	5.6	8.4	1.4	1.6
		2	07:53:13.7	07:53:26.3	00:00:12.6	07:52:54.5		106.9			13.0	9.3	16.0	1.6	
		pkt	07:53:24.9	07:53:47.1	00:00:22.2	07:52:54.4		183.5				3.9	1.1	4.1	1.4
50	4/3/2005	1	08:32:31.8	08:32:45.6	00:00:13.8	08:32:10.7	08:32:10.6	117.3	98.776	9.452	5.8	5.1	7.7	1.3	1.5
		2	08:32:28.4	08:32:40.2	00:00:11.8	08:32:10.4		99.9			10.7	9.7	14.4	1.5	
		pkt	08:32:40.6	08:33:02.4	00:00:21.8	08:32:10.6		179.9				5.5	0.8	5.6	1.5
51	4/3/2005	1	09:36:15.5	09:36:29.2	00:00:13.7	09:35:54.6	09:35:54.0	116.4	99.541	8.193	2.6	1.3	2.9	0.9	0.9
		2	09:36:12.3	09:36:24.7	00:00:12.4	09:35:53.4		105.1			2.6	2.0	3.3	0.9	
		pkt	09:36:18.4	09:36:34.4	00:00:16.0	09:35:54.0		135.5				8.7	3.5	9.4	1.5
52	4/3/2005	1	09:46:42.9	09:46:45.7	00:00:02.8	09:46:38.5	09:46:38.7	24.2	98.651	8.263	0.3	0.1	0.3	-1.0	0.0
		2	09:46:44.9	09:46:48.8	00:00:03.9	09:46:38.9		33.3			2.0	1.3	2.4	0.0	
		pkt	09:46:49.3	09:46:55.6	00:00:06.3	09:46:39.7		53.1				1.7	0.4	1.7	0.2
53	4/3/2005	1	10:22:01.1	10:22:02.1	00:00:01.0	10:21:59.6	10:21:59.3	8.1	98.580	8.407	1.8	0.7	1.9	-0.8	-0.8
		2	10:22:02.5	10:22:04.8	00:00:02.3	10:21:59.0		19.3			0.6	0.4	0.7	-0.8	
		pkt	10:22:11.0	10:22:18.4	00:00:07.4	10:21:59.7		62.9				1.1	5.5	5.6	0.8
54	4/3/2005	1	10:33:26.1	10:33:41.7	00:00:15.6	10:33:02.3	10:33:00.8	132.3	99.341	7.579	7.0	6.5	9.6	1.5	1.8
		2	10:33:23.3	10:33:39.0	00:00:15.7	10:32:59.3		133.5			14.6	11.2	18.4	1.8	
		pkt	10:33:21.6	10:33:36.5	00:00:14.9	10:32:58.8		126.5				5.5	1.4	5.7	1.2
55	4/3/2005	1	12:31:47.9	12:32:02.2	00:00:14.3	12:31:26.0	12:31:26.3	121.6	99.609	8.557	2.8	1.9	3.4	1.0	1.3
		2	12:31:45.3	12:31:57.6	00:00:12.3	12:31:26.5		104.3			5.0	6.3	8.0	1.3	
		pkt	12:31:52.2	12:32:11.8	00:00:19.6	12:31:25.1		156.8				2.9	0.9	3.0	1.1
56	4/3/2005	1	21:35:57.1	21:36:11.1	00:00:14.0	21:35:55.7	21:35:54.8	119.0	98.267	9.474	0.5	0.4	0.6	0.2	0.4
		2	21:35:53.8	21:36:06.8	00:00:13.0	21:35:54.0		110.3			0.9	0.6	1.1	0.4	
		pkt	21:36:05.2	21:36:26.7	00:00:21.5	21:35:55.6		176.3				0.8	0.2	0.8	0.7
57	4/3/2005	1	22:47:23.8	22:47:37.4	00:00:13.6	22:47:03.0	22:47:02.6	115.5	98.502	9.469	0.9	0.8	1.2	0.5	0.8
		2	22:47:20.7	22:47:32.8	00:00:12.1	22:47:02.3		102.5			1.8	2.1	2.8	0.8	
		pkt	22:47:33.1	22:47:54.6	00:00:21.5	22:47:03.5		176.3				1.2	0.4	1.3	0.8
58	5/3/2005	1	09:52:37.3	09:52:52.3	00:00:15.0	09:52:14.3	09:52:14.4	127.7	98.665	9.568	3.7	3.6	5.2	1.2	1.4
		2	09:52:34.6	09:52:47.8	00:00:13.2	09:52:14.4		112.1			7.4	6.5	9.8	1.4	
		pkt	09:52:46.2	09:53:09.0	00:00:22.8	09:52:14.9		189.7				2.6	1.8	3.2	1.3
60	6/3/2005	1	23:19:56.3	23:20:14.4	00:00:18.1	23:19:30.3	23:19:31.5	148.3	97.877	7.253	4.0	2.1	4.5	1.3	1.3
		2	23:20:01.4	23:20:22.2	00:00:20.8	23:19:32.7		169.1			3.1	2.7	4.1	1.3	
		pkt	23:19:45.1	23:19:55.5	00:00:10.4	23:19:29.3		87.9				13.5	2.7	13.8	1.4
61	6/3/2005	1	23:22:16.9	23:22:34.0	00:00:17.1	23:21:51.7	23:21:52.8	142.2	97.950	7.276	9.9	5.7	11.4	1.6	1.7
		2	23:22:21.7	23:22:41.9	00:00:20.2	23:21:53.9		162.8			10.6	4.3	11.4	1.7	
		pkt	23:22:09.3	23:22:18.9	00:00:09.6	23:21:54.7		81.3				12.4	14.1	18.8	1.5
62	6/3/2005	1	23:30:52.6	23:31:09.4	00:00:16.8	23:30:27.6	23:30:27.7	140.4	97.674	7.469	7.2	3.5	8.0	1.5	1.6
		2	23:30:55.6	23:31:15.8	00:00:20.2	23:30:27.8		162.8			6.7	5.0	8.4	1.6	
		pkt	23:30:42.9	23:30:53.3	00:00:10.4	23:30:27.1		87.9				14.9	3.0	15.2	1.4
63	6/3/2005	1	23:45:46.4	23:46:03.7	00:00:17.3	23:45:21.0	23:45:22.3	143.5	97.952	7.264	2.7	1.8	3.2	1.1	1.1
		2	23:45:51.6	23:46:11.8	00:00:20.2	23:45:23.6		163.8			2.2	1.0	2.4	1.1	
		pkt	23:45:35.6	23:45:45.3	00:00:09.7	23:45:20.8		82.1				7.8	2.5	8.2	1.1
64	7/3/2005	1	09:02:59.4	09:03:16.5	00:00:17.1	09:02:34.2	09:02:34.0	142.2	99.747	8.039	0.6	0.5	0.8	0.5	0.7
		2	09:02:57.8	09:03:13.5	00:00:15.7	09:02:33.9		132.9			1.4	0.8	1.6	0.7	
		pkt	09:02:01.2	09:02:20.5	00:00:19.3	09:01:34.4		154.4				3.1	5.1	6.0	1.4

Table E.1: (continued)

Event	Date	Stn.	P-arrival T. hh:mm:ss.0	S-arrival T. hh:mm:ss.0	Delta(S-P) hh:mm:ss.0	Origin T. hh:mm:ss.0	Origin T.(ave) hh:mm:ss.0	Dist. (km)	long (East)	lat (North)	Amp.(E) (nm)	Amp.(N) (nm)	Amp.(ave) (nm)	MI	MI (highest)
65	7/3/2005	1	11:31:55.1	11:32:09.6	00:00:14.5	11:31:32.9	11:31:32.8	123.3	98.563	9.541	1.8	1.3	2.2	0.8	1.0
		2	11:31:52.4	11:32:05.3	00:00:12.9	11:31:32.7		109.5			2.6	3.6	4.4	1.0	
		pkt	11:32:03.6	11:32:25.9	00:00:22.3	11:31:32.9		185.0			2.6	0.7	2.7	1.2	
66	7/3/2005	1	15:23:54.2	15:24:08.6	00:00:14.4	15:23:32.2	15:23:31.1	122.5	99.551	8.040	1.2	0.4	1.3	0.6	0.7
		2	15:23:50.5	15:24:03.9	00:00:13.4	15:23:30.0		113.8			1.4	1.6	2.1	0.7	
		pkt	15:22:53.0	15:23:08.7	00:00:15.7	15:22:29.0		133.7			2.2	1.0	2.4	0.9	
67	8/3/2005	1	14:01:32.2	14:01:45.8	00:00:13.6	14:01:11.4	14:01:11.9	115.5	98.836	9.419	0.6	0.4	0.7	0.3	0.4
		2	14:01:29.8	14:01:41.3	00:00:11.5	14:01:12.3		97.3			0.9	1.0	1.3	0.4	
		pkt	14:01:42.2	14:02:03.9	00:00:21.7	14:01:12.3		178.4			3.3	0.2	3.3	1.3	
68	8/3/2005	1	16:27:23.9	16:27:46.7	00:00:22.8	16:26:52.6	16:26:52.6	189.7	96.829	7.842	1.3	0.6	1.4	1.0	1.0
		2	16:27:26.5	16:27:51.3	00:00:24.8	16:26:52.5		210.3			0.9	0.6	1.1	0.9	
		pkt	16:27:20.8	16:27:40.8	00:00:20.0	16:26:53.2		160.7			2.1	0.6	2.2	1.0	
69	9/3/2005	1	00:52:36.3	00:52:50.8	00:00:14.5	00:52:14.1	00:52:14.3	123.3	98.549	9.539	1.6	1.3	2.1	0.8	0.9
		2	00:52:34.1	00:52:47.0	00:00:12.9	00:52:14.4		109.5			2.8	1.7	3.3	0.9	
		pkt	00:52:47.4	00:53:09.7	00:00:22.3	00:52:16.8		184.6			5.8	0.8	5.9	1.5	
70	9/3/2005	1	00:53:54.2	00:54:09.2	00:00:15.0	00:53:31.2	00:53:31.1	127.7	98.144	9.519	1.6	1.3	2.1	0.8	1.1
		2	00:53:52.7	00:54:06.9	00:00:14.2	00:53:31.0		120.7			2.9	3.3	4.4	1.1	
		pkt	00:54:01.4	00:54:23.5	00:00:22.1	00:53:31.0		182.5			4.4	2.5	5.1	1.5	
71	9/3/2005	1	06:21:03.4	06:21:09.9	00:00:06.5	06:20:53.5	06:20:52.8	55.1	98.135	8.766	2.4	0.5	2.5	0.3	0.4
		2	06:21:03.3	06:21:10.6	00:00:07.3	06:20:52.1		62.2			2.3	1.4	2.7	0.4	
		pkt	06:21:09.3	06:21:21.0	00:00:11.7	06:20:51.4		99.4			4.3	14.1	14.7	1.5	
72	9/3/2005	1	06:26:02.2	06:26:09.1	00:00:06.9	06:25:51.7	06:25:52.3	58.5	98.168	8.834	0.8	2.3	2.4	0.4	1.2
		2	06:26:04.1	06:26:11.4	00:00:07.3	06:25:52.9		62.1			1.3	0.8	1.5	0.2	
		pkt	06:26:09.4	06:26:22.0	00:00:12.6	06:25:50.2		106.9			7.1	2.7	7.6	1.2	
73	9/3/2005	1	07:06:45.6	07:07:05.6	00:00:20.0	07:06:18.0	07:06:19.2	160.7	97.413	7.481	3.2	2.1	3.8	1.2	1.2
		2	07:06:50.7	07:07:12.8	00:00:22.1	07:06:20.3		182.5			2.7	1.1	2.9	1.2	
		pkt	07:06:39.0	07:06:52.3	00:00:13.3	07:06:18.7		112.9			6.3	1.0	6.4	1.2	
74	9/3/2005	1	07:33:54.0	07:34:01.8	00:00:07.8	07:33:42.1	07:33:43.4	66.0	99.008	8.132	0.8	0.7	1.1	0.1	0.4
		2	07:33:56.1	07:34:03.6	00:00:07.5	07:33:44.7		63.5			1.8	1.8	2.5	0.4	
		pkt	07:33:53.0	07:34:02.1	00:00:09.1	07:33:39.1		77.1			6.2	2.5	6.7	1.0	
75	9/3/2005	1	14:09:37.0	14:09:44.6	00:00:07.6	14:09:25.4	14:09:26.7	64.7	99.002	8.154	0.9	0.7	1.1	0.1	0.3
		2	14:09:39.2	14:09:46.5	00:00:07.3	14:09:28.0		62.2			1.4	1.2	1.8	0.3	
		pkt	14:09:37.0	14:09:46.1	00:00:09.1	14:09:23.1		77.1			2.1	0.5	2.2	0.5	
76	9/3/2005	1	14:56:24.0	14:56:31.3	00:00:07.3	14:56:12.8	14:56:13.8	62.2	98.901	8.040	0.5	0.5	0.7	-0.1	0.0
		2	14:56:26.4	14:56:34.0	00:00:07.6	14:56:14.8		64.7			0.7	0.5	0.9	0.0	
		pkt	14:56:21.0	14:56:28.3	00:00:07.3	14:56:09.8		62.2			1.2	0.6	1.3	0.1	
77	10/3/2005	1	03:08:06.6	03:08:13.6	00:00:07.0	03:07:55.9	03:07:56.1	59.4	98.129	8.810	0.7	0.7	1.0	0.0	0.2
		2	03:08:07.9	03:08:15.5	00:00:07.6	03:07:56.3		64.6			1.2	0.9	1.5	0.2	
		pkt	03:08:12.9	03:08:25.3	00:00:12.4	03:07:54.0		105.1			3.9	2.1	4.4	1.0	
78	11/3/2005	1	04:18:52.0	04:19:07.2	00:00:15.2	04:18:28.8	04:18:28.5	128.9	99.619	8.054	0.5	0.5	0.7	0.3	0.4
		2	04:18:49.6	04:19:03.7	00:00:14.1	04:18:28.1		119.6			0.8	0.3	0.9	0.4	
		pkt	no					no							
79	12/3/2005	1	10:01:32.0	10:01:33.4	00:00:01.4	10:01:29.9	10:01:29.2	11.9	98.434	8.508	2.7	2.9	4.0	-0.3	-0.1
		2	10:01:33.1	10:01:36.1	00:00:03.0	10:01:28.5		25.4			1.5	1.8	2.3	-0.1	
		pkt	no					no							

Table E.1: (continued)

Event	Date	Stn.	P-arrival T.	S-arrival T.	Delta(S-P)	Origin T.	Origin T.(ave)	Dist.	long	lat	Amp.(E)	Amp.(N)	Amp.(ave)	MI	MI (highest)
			hh:mm:ss.0	hh:mm:ss.0	hh:mm:ss.0	hh:mm:ss.0	hh:mm:ss.0								
80	12/3/2005	1	17:07:53.0	17:07:58.9	00:00:05.9	17:07:44.0	17:07:44.1	50.0	98.098	8.623	0.7	0.3	0.8	-0.2	-0.2
		2	17:07:55.3	17:08:02.6	00:00:07.3	17:07:44.1		62.2			0.5	0.2	0.5	-0.3	
		pkt	-	-	-	-									
81	12/3/2005	1	17:42:30.0	17:42:44.6	00:00:14.6	17:42:07.7	17:42:07.3	124.2	98.509	9.549	0.7	0.3	0.8	0.4	0.7
		2	17:42:26.8	17:42:39.8	00:00:13.0	17:42:06.9		110.5			1.1	1.6	1.9	0.7	
		pkt	-	-	-	-									
82	12/3/2005	1	22:22:30.0	22:22:37.3	00:00:07.3	22:22:18.8	22:22:20.4	62.2	99.029	8.214	0.7	0.4	0.8	-0.1	-0.1
		2	22:22:32.0	22:22:38.6	00:00:06.6	22:22:21.9		56.0			0.6	0.1	0.6	-0.3	
		pkt	-	-	-	-									
83	13/3/2005	1	09:56:49.0	09:57:02.2	00:00:13.2	09:56:28.9	09:56:28.5	112.0	99.388	7.953	1.0	0.4	1.1	0.4	0.4
		2	09:56:47.2	09:56:59.7	00:00:12.5	09:56:28.1		106.0			1.0	0.2	1.0	0.4	
		pkt	-	-	-	-									
84	13/3/2005	1	21:18:11.0	21:18:25.6	00:00:14.6	21:17:48.7	21:17:47.5	124.2	99.366	7.708	0.7	0.2	0.7	0.3	0.7
		2	21:18:08.4	21:18:22.9	00:00:14.5	21:17:46.3		123.1			1.7	0.5	1.8	0.7	
		pkt	-	-	-	-									
85	14/3/2005	1	23:47:52.1	23:48:07.6	00:00:15.5	23:47:28.4	23:47:28.4	132.0	98.668	9.607	0.8	1.1	1.4	0.6	1.1
		2	23:47:49.4	23:48:03.1	00:00:13.7	23:47:28.5		116.4			2.8	3.4	4.4	1.1	
		pkt	-	-	-	-									
87	15/3/2005	1	10:30:25.0	10:30:26.2	00:00:01.2	10:30:23.2	10:30:23.1	10.2	98.488	8.522	0.7	0.2	0.7	-1.1	-1.0
		2	10:30:26.6	10:30:28.9	00:00:02.3	10:30:23.1		19.5			0.4	0.2	0.4	-1.0	
		pkt	-	-	-	-									
89	17/3/2005	1	10:25:42.0	10:25:43.5	00:00:01.5	10:25:39.7	10:25:39.3	12.7	98.543	8.327	3.8	1.8	4.2	-0.2	-0.2
		2	10:25:44.0	10:25:47.4	00:00:03.4	10:25:38.8		28.8			0.8	0.5	0.9	-0.4	
		pkt	-	-	-	-									
90	17/3/2005	1	20:25:26.6	20:25:33.3	00:00:06.7	20:25:16.4	20:25:16.9	56.7	98.174	8.819	0.8	0.1	0.8	-0.1	-0.1
		2	20:25:28.2	20:25:35.3	00:00:07.1	20:25:17.4		60.3			0.7	0.3	0.8	-0.1	
		pkt	-	-	-	-									
92	18/3/2005	1	10:32:38.0	10:32:41.7	00:00:03.7	10:32:32.4	10:32:32.0	31.3	98.456	8.379	7.0	1.8	7.2	0.5	0.5
		2	10:32:37.1	10:32:40.7	00:00:03.6	10:32:31.6		30.5			1.5	1.6	2.2	0.0	
		pkt	-	-	-	-									
93	18/3/2005	1	10:49:26.4	10:49:27.1	00:00:00.7	10:49:25.4	10:49:25.9	5.6	98.550	8.464	1.4	0.7	1.6	-1.1	-0.9
		2	10:49:29.4	10:49:31.3	00:00:01.9	10:49:26.5		16.1			0.5	0.4	0.6	-0.9	
		pkt	-	-	-	-									
94	18/3/2005	1	13:42:43.9	13:42:50.6	00:00:06.7	13:42:33.7	13:42:33.6	56.7	98.827	8.030	1.0	0.5	1.1	0.0	0.0
		2	13:42:46.0	13:42:54.2	00:00:08.2	13:42:33.4		69.9			0.5	0.2	0.5	-0.2	
		pkt	-	-	-	-									
95	19/3/2005	1	03:57:38.0	03:57:39.4	00:00:01.4	03:57:35.9	03:57:34.1	11.9	98.437	8.500	4.1	6.3	7.5	0.0	0.0
		2	03:57:41.8	03:57:48.0	00:00:06.2	03:57:32.4		52.4			0.9	0.4	1.0	-0.1	
		pkt	03:57:43.0	03:57:51.1	00:00:08.1	03:57:30.7		68.4			8.7	2.9	9.2	1.0	
98	20/3/2005	1	10:19:43.9	10:19:44.9	00:00:01.0	10:19:42.3	10:19:42.1	8.9	98.587	8.409	1.9	2.7	3.3	-0.5	-0.5
		2	10:19:45.3	10:19:47.5	00:00:02.2	10:19:42.0		18.5			0.7	0.6	0.9	-0.7	
		pkt	10:19:53.4	10:20:00.9	00:00:07.5	10:19:41.9		63.7			7.9	1.3	8.0	0.9	
99	20/3/2005	1	12:03:28.1	12:03:34.0	00:00:05.9	12:03:19.0	12:03:19.5	50.4	98.782	8.064	0.9	0.4	1.0	-0.1	-0.1
		2	12:03:30.1	12:03:36.8	00:00:06.7	12:03:19.9		56.7			0.7	0.3	0.8	-0.2	
		pkt	12:03:27.9	12:03:33.9	00:00:06.0	12:03:18.7		51.3			34.2	7.2	34.9	1.4	

Table E.1: (continued)

Event	Date	Stn.	P-arrival T.	S-arrival T.	Delta(S-P)	Origin T.	Origin T.(ave)	Dist.	long	lat	Amp.(E)	Amp.(N)	Amp.(ave)	MI	MI (highest)
			hh:mm:ss.0	hh:mm:ss.0	hh:mm:ss.0	hh:mm:ss.0	hh:mm:ss.0	hh:mm:ss.0	(km)	(East)	(North)	(nm)	(nm)	(nm)	
100	21/3/2005	1	00:50:03.0	00:50:18.1	00:00:15.1	00:49:39.9	00:49:39.8	128.3	99.496	7.867	1.0	0.7	1.2	0.6	0.9
		2	00:49:59.9	00:50:13.2	00:00:13.3	00:49:39.6		112.9			1.8	2.4	3.0	0.9	
		pkt	00:50:03.0	00:50:18.0	00:00:15.0	00:49:40.1		127.1				1.7	0.6	1.8	0.7
101	21/3/2005	1	03:53:50.2	03:53:52.3	00:00:02.1	03:53:47.0	03:53:46.0	17.7	98.470	8.585	2.0	1.6	2.6	-0.3	0.6
		2	03:53:48.7	03:53:51.2	00:00:02.5	03:53:44.9		20.9			15.0	8.2	17.1	0.6	
		pkt	03:54:02.5	03:54:11.7	00:00:09.2	03:53:48.5		77.9				2.2	2.2	3.1	0.6
102	21/3/2005	1	06:14:37.6	06:14:52.3	00:00:14.7	06:14:15.1	06:14:15.1	125.1	98.441	9.553	0.6	0.4	0.7	0.3	0.5
		2	06:14:35.4	06:14:48.7	00:00:13.3	06:14:15.1		112.9			0.8	1.1	1.4	0.5	
		pkt	06:14:45.5	06:15:07.8	00:00:22.3	06:14:14.8		185.0				3.4	1.3	3.6	1.3
103	21/3/2005	1	10:39:12.0	10:39:16.2	00:00:04.2	10:39:05.6	10:39:06.6	35.6	98.614	8.126	1.2	0.5	1.3	-0.2	-0.2
		2	10:39:16.2	10:39:21.9	00:00:05.7	10:39:07.5		48.3			0.6	0.3	0.7	-0.3	
		pkt	10:39:15.0	10:39:19.6	00:00:04.6	10:39:08.0		39.0				17.8	8.4	19.7	1.0
104	21/3/2005	1	23:37:53.0	23:38:01.1	00:00:08.1	23:37:40.7	23:37:41.4	68.4	98.896	7.952	9.8	7.0	12.0	1.2	1.4
		2	23:37:55.4	23:38:04.0	00:00:08.6	23:37:42.2		73.4			20.3	4.6	20.8	1.4	
		pkt	23:37:54.0	23:38:01.2	00:00:07.2	23:37:43.0		61.0				5.2	5.2	7.4	0.9
106	22/3/2005	1	05:04:06.4	05:04:12.5	00:00:06.1	05:03:57.0	05:03:57.0	52.2	98.077	8.617	2.0	1.2	2.3	0.3	0.3
		2	05:04:08.6	05:04:16.2	00:00:07.6	05:03:57.0		64.6			0.3	0.1	0.3	-0.5	
		pkt	05:04:12.9	05:04:23.1	00:00:10.2	05:03:57.4		86.3				7.7	1.0	7.8	1.1
107	22/3/2005	1	06:00:31.2	06:00:33.1	00:00:01.9	06:00:28.3	06:00:28.3	16.1	98.402	8.333	0.6	1.6	1.7	-0.5	-0.1
		2	06:00:35.0	06:00:39.5	00:00:04.5	06:00:28.2		37.8			1.2	0.6	1.3	-0.1	
		pkt	06:00:38.0	06:00:43.8	00:00:05.8	06:00:29.1		49.5				21.4	15.6	26.5	1.3
109	23/3/2005	1	04:19:22.2	04:19:24.3	00:00:02.1	04:19:19.0	04:19:20.0	17.7	98.621	8.316	0.7	0.3	0.8	-0.8	-0.7
		2	04:19:26.0	04:19:29.2	00:00:03.2	04:19:21.1		27.4			0.5	0.3	0.6	-0.7	
		pkt	04:19:30.2	04:19:36.8	00:00:06.6	04:19:20.2		55.8				8.3	2.3	8.6	0.9
110	23/3/2005	1	08:52:30.9	08:52:35.4	00:00:04.5	08:52:24.1	08:52:23.1	37.8	98.820	8.288	0.8	0.3	0.9	-0.3	0.5
		2	08:52:28.4	08:52:32.5	00:00:04.1	08:52:22.1		35.1			6.4	2.3	6.8	0.5	
		pkt	08:52:35.0	08:52:43.0	00:00:08.0	08:52:22.8		67.9				3.1	10.3	10.8	1.1
111	23/3/2005	1	10:25:16.8	10:25:17.8	00:00:01.0	10:25:15.2	10:25:15.4	8.9	98.531	8.508	6.1	2.7	6.7	-0.2	-0.2
		2	10:25:18.3	10:25:20.1	00:00:01.8	10:25:15.5		15.3			1.6	1.3	2.1	-0.4	
		pkt	10:25:25.9	10:25:34.4	00:00:08.5	10:25:12.9		72.2				1.9	0.6	2.0	0.4
113	24/3/2005	1	09:53:32.0	09:53:33.2	00:00:01.2	09:53:30.1	09:53:30.1	10.5	98.519	8.522	0.9	0.8	1.2	-0.9	-0.7
		2	09:53:32.9	09:53:34.8	00:00:01.9	09:53:30.0		16.1			0.7	0.7	1.0	-0.7	
		pkt	09:53:46.6	09:53:55.2	00:00:08.6	09:53:33.5		72.9				1.6	0.7	1.7	0.4
114	26/3/2005	1	14:12:01.9	14:12:06.9	00:00:05.0	14:11:54.3	14:11:54.2	42.3	98.603	8.061	0.7	0.2	0.7	-0.3	-0.3
		2	14:12:04.2	14:12:10.8	00:00:06.6	14:11:54.2		55.8			0.2	0.2	0.3	-0.6	
		pkt	14:11:59.4	14:12:03.3	00:00:03.9	14:11:53.4		33.3				2.4	0.8	2.5	0.1
115	26/3/2005	1	16:36:56.0	16:37:03.0	00:00:07.0	16:36:45.3	16:36:45.4	59.4	98.612	7.907	0.9	0.4	1.0	0.0	0.0
		2	16:36:58.5	16:37:07.1	00:00:08.6	16:36:45.4		72.9			0.6	0.5	0.8	0.0	
		pkt	16:36:48.6	16:36:52.0	00:00:03.4	16:36:43.4		29.0				0.8	2.1	2.2	-0.1
116	26/3/2005	1	17:30:28.5	17:30:42.9	00:00:14.4	17:30:06.5	17:30:05.5	122.5	99.568	8.100	0.9	0.4	1.0	0.5	0.5
		2	17:30:24.9	17:30:38.2	00:00:13.3	17:30:04.6		112.9			0.4	0.4	0.6	0.2	
		pkt	17:30:28.9	17:30:44.9	00:00:16.0	17:30:04.5		135.5				1.5	0.2	1.5	0.7
117	26/3/2005	1	17:49:15.8	17:49:22.8	00:00:07.0	17:49:05.1	17:49:05.2	59.4	98.084	8.757	0.5	0.3	0.6	-0.2	-0.1
		2	17:49:17.4	17:49:25.3	00:00:07.9	17:49:05.3		67.1			0.6	0.4	0.7	-0.1	
		pkt	17:49:21.8	17:49:33.7	00:00:11.9	17:49:03.7		100.8				1.1	0.5	1.2	0.4

Table E.1: (continued)

Event	Date	Stn.	P-arrival T.	S-arrival T.	Delta(S-P)	Origin T.	Origin T.(ave)	Dist. (km)	long (East)	lat (North)	Amp.(E) (nm)	Amp.(N) (nm)	Amp.(ave) (nm)	MI	MI (highest)
			hh:mm:ss.0	hh:mm:ss.0	hh:mm:ss.0	hh:mm:ss.0	hh:mm:ss.0								
118	26/3/2005	1	19:23:34.7	19:23:41.0	00:00:06.3	19:23:25.1	19:23:25.5	53.1	98.696	7.988	1.1	0.5	1.2	0.0	0.2
		2	19:23:37.3	19:23:44.8	00:00:07.5	19:23:25.8		63.7			1.2	0.6	1.3	0.2	
		pkt	19:23:30.2	19:23:35.0	00:00:04.8	19:23:22.9		40.5			1.2	0.7	1.4	-0.1	
119	27/3/2005	1	02:29:56.3	02:29:59.6	00:00:03.3	02:29:51.2	02:29:50.8	28.2	98.428	8.189	1.0	0.4	1.1	-0.4	-0.1
		2	02:29:59.1	02:30:04.8	00:00:05.7	02:29:50.4		48.6			0.9	0.5	1.0	-0.1	
		pkt	02:29:54.6	02:29:58.6	00:00:04.0	02:29:48.4		34.2			2.5	1.8	3.1	0.2	
120	27/3/2005	1	09:56:36.3	09:56:37.6	00:00:01.3	09:56:34.3	09:56:34.7	11.3	98.606	8.465	1.0	0.6	1.2	-0.8	-0.8
		2	09:56:37.3	09:56:38.7	00:00:01.4	09:56:35.1		12.1			1.0	0.5	1.1	-0.8	
		pkt	09:56:45.0	09:56:53.2	00:00:08.2	09:56:32.5		69.6			15.5	28.9	32.8	1.6	
121	29/3/2005	1	00:23:44.0	00:23:48.2	00:00:04.2	00:23:37.6	00:23:36.0	35.5	98.218	8.888	0.6	0.3	0.7	-0.5	0.2
		2	00:23:45.6	00:23:53.0	00:00:07.4	00:23:34.3		62.9			1.2	0.7	1.4	0.2	
		pkt	no					no							
123	30/3/2005	1	09:01:47.0	09:01:49.4	00:00:02.4	09:01:43.3	09:01:42.4	20.5	98.694	8.417	0.5	0.3	0.6	-0.8	0.0
		2	09:01:44.4	09:01:46.4	00:00:02.0	09:01:41.4		16.6			5.2	1.5	5.4	0.0	
		pkt	no					no							
124	30/3/2005	1	23:53:44.2	23:53:59.1	00:00:14.9	23:53:21.4	23:53:21.2	126.8	98.116	9.504	0.5	0.4	0.6	0.3	0.6
		2	23:53:42.7	23:53:56.9	00:00:14.2	23:53:21.0		120.7			1.1	1.0	1.5	0.6	
		pkt	-	-	-	-		-			-	-	-	-	
125	31/3/2005	1	10:37:14.9	10:37:15.9	00:00:01.0	10:37:13.3	10:37:13.1	8.9	98.582	8.420	3.1	1.5	3.4	-0.5	-0.5
		2	10:37:16.3	10:37:18.5	00:00:02.2	10:37:13.0		18.5			0.8	0.5	0.9	-0.7	
		pkt	-	-	-	-		-			-	-	-	-	
128	6/4/2005	1	11:32:49.4	11:33:07.9	00:00:18.5	11:32:23.7	11:32:23.9	146.0	97.196	8.241	1.4	0.5	1.5	0.8	0.9
		2	11:32:52.3	11:33:12.7	00:00:20.4	11:32:24.2		164.9			1.4	0.5	1.5	0.9	
		pkt	11:32:47.9	11:33:03.6	00:00:15.7	11:32:24.0		132.9			3.2	0.4	3.2	1.0	
129	6/4/2005	1	16:08:57.2	16:09:01.7	00:00:04.5	16:08:50.3	16:08:49.6	38.1	98.164	8.443	0.7	0.3	0.8	-0.4	-0.3
		2	16:08:59.0	16:09:05.6	00:00:06.6	16:08:48.9		56.0			0.5	0.1	0.5	-0.3	
		pkt	16:09:02.0	16:09:09.6	00:00:07.6	16:08:50.4		64.7			1.4	0.3	1.4	0.2	
132	8/4/2005	1	08:58:26.2	08:58:37.7	00:00:11.5	08:58:08.7	08:58:09.1	97.3	98.961	7.685	2.2	2.1	3.0	0.8	0.9
		2	08:58:28.1	08:58:40.3	00:00:12.2	08:58:09.5		103.4			3.0	2.6	4.0	0.9	
		pkt	08:58:23.4	08:58:31.8	00:00:08.4	08:58:10.6		71.2			4.4	1.5	4.6	0.8	
133	8/4/2005	1	10:55:41.2	10:55:44.1	00:00:02.9	10:55:36.7	10:55:35.8	25.0	98.528	8.655	0.4	0.3	0.5	-0.8	-0.3
		2	10:55:38.1	10:55:40.2	00:00:02.1	10:55:34.9		17.7			1.7	1.3	2.1	-0.3	
		pkt	10:55:52.6	10:56:02.9	00:00:10.3	10:55:36.9		87.1			12.7	19.5	23.3	1.6	
134	8/4/2005	1	20:35:50.0	20:35:59.0	00:00:09.0	20:35:36.3	20:35:36.7	76.3	98.782	7.842	0.6	0.5	0.8	0.0	0.2
		2	20:35:51.9	20:36:01.6	00:00:09.7	20:35:37.1		82.1			0.9	0.3	0.9	0.2	
		pkt	-	-	-	-		-			-	-	-	-	
136	9/4/2005	1	09:21:26.1	09:21:33.9	00:00:07.8	09:21:14.2	09:21:14.6	66.0	98.115	8.884	0.6	0.3	0.7	-0.1	0.1
		2	09:21:27.5	09:21:35.7	00:00:08.2	09:21:15.0		69.7			1.0	0.3	1.0	0.1	
		pkt	-	-	-	-		-			-	-	-	-	
137	9/4/2005	1	22:27:44.5	22:27:52.6	00:00:08.1	22:27:32.2	22:27:32.9	68.4	98.145	8.943	0.8	0.3	0.9	0.0	0.2
		2	22:27:46.2	22:27:54.4	00:00:08.2	22:27:33.7		69.7			1.1	0.5	1.2	0.2	
		pkt	-	-	-	-		-			-	-	-	-	
138	10/4/2005	1	09:35:47.5	09:35:50.6	00:00:03.1	09:35:42.7	09:35:42.6	26.6	98.539	8.668	0.8	0.2	0.8	-0.5	0.0
		2	09:35:45.6	09:35:47.7	00:00:02.1	09:35:42.4		17.7			4.7	2.1	5.1	0.0	
		pkt	09:36:01.4	09:36:11.9	00:00:10.5	09:35:45.4		88.8			3.5	3.6	5.0	0.9	

Table E.1: (continued)

Event	Date	Stn.	P-arrival T.	S-arrival T.	Delta(S-P)	Origin T.	Origin T.(ave)	Dist.	long	lat	Amp.(E)	Amp.(N)	Amp.(ave)	MI	MI (highest)
			hh:mm:ss.0	hh:mm:ss.0	hh:mm:ss.0	hh:mm:ss.0	hh:mm:ss.0								
139	11/4/2005	1	04:53:11.5	04:53:13.7	00:00:02.2	04:53:08.2	04:53:07.6	18.6	98.504	8.597	2.9	1.1	3.1	-0.2	0.8
		2	04:53:10.1	04:53:12.1	00:00:02.0	04:53:07.1		16.9			27.7	10.2	29.5	0.8	
		pkt	04:53:19.7	04:53:29.1	00:00:09.4	04:53:05.4		79.6				3.7	1.5	4.0	0.8
140	12/4/2005	1	03:51:28.0	03:51:30.1	00:00:02.1	03:51:24.8	03:51:24.6	17.8	98.546	8.588	2.9	0.7	3.0	-0.2	0.4
		2	03:51:26.6	03:51:28.1	00:00:01.5	03:51:24.3		12.7			11.8	10.1	15.5	0.4	
		pkt	-	-	-	-		-			-	-	-	-	
141	13/4/2005	1	05:43:39.9	05:43:42.7	00:00:02.8	05:43:35.6	05:43:36.8	23.7	98.694	8.338	0.6	0.4	0.7	-0.7	-0.6
		2	05:43:42.2	05:43:45.0	00:00:02.8	05:43:37.9		23.7			0.8	0.2	0.8	-0.6	
		pkt	-	-	-	-		-			-	-	-	-	
142	15/4/2005	1	09:46:33.8	09:46:38.4	00:00:04.6	09:46:26.7	09:46:25.0	39.4	98.096	8.842	1.7	0.2	1.7	0.0	0.0
		2	09:46:35.6	09:46:43.7	00:00:08.1	09:46:23.3		68.4			0.7	0.4	0.8	0.0	
		pkt	-	-	-	-		-			-	-	-	-	
143	15/4/2005	1	14:41:41.9	14:41:49.2	00:00:07.3	14:41:30.7	14:41:31.4	62.2	98.943	8.019	2.1	0.8	2.2	0.4	0.6
		2	14:41:43.7	14:41:51.3	00:00:07.6	14:41:32.1		64.7			2.3	2.4	3.3	0.6	
		pkt	-	-	-	-		-			-	-	-	-	
145	17/4/2005	1	22:28:50.0	22:28:55.2	00:00:05.2	22:28:42.1	22:28:41.6	44.1	98.800	8.699	1.1	0.3	1.1	-0.1	-0.1
		2	22:28:45.2	22:28:47.9	00:00:02.7	22:28:41.1		22.6			0.9	0.8	1.2	-0.5	
		pkt	-	-	-	-		-			-	-	-	-	
146	17/4/2005	1	22:46:10.4	22:46:17.0	00:00:06.6	22:46:00.3	22:46:00.6	56.0	98.178	8.862	0.9	0.2	0.9	-0.1	-0.1
		2	22:46:12.0	22:46:19.3	00:00:07.3	22:46:00.8		62.2			0.7	0.4	0.8	-0.1	
		pkt	-	-	-	-		-			-	-	-	-	
147	17/4/2005	1	23:23:07.7	23:23:15.5	00:00:07.8	23:22:55.8	23:22:55.6	66.0	98.252	8.976	0.8	0.3	0.9	0.0	0.3
		2	23:23:08.1	23:23:16.4	00:00:08.3	23:22:55.3		70.9			1.4	0.8	1.6	0.3	
		pkt	-	-	-	-		-			-	-	-	-	
148	17/4/2005	1	23:39:37.6	23:39:45.1	00:00:07.5	23:39:26.1	23:39:27.2	63.7	98.225	8.929	0.4	0.3	0.5	-0.3	-0.2
		2	23:39:39.6	23:39:47.0	00:00:07.4	23:39:28.3		62.9			0.5	0.3	0.6	-0.2	
		pkt	-	-	-	-		-			-	-	-	-	
149	18/4/2005	1	02:29:05.8	02:29:13.4	00:00:07.6	02:28:54.2	02:28:54.8	64.7	98.166	8.916	0.7	0.3	0.8	-0.1	0.0
		2	02:29:07.3	02:29:15.1	00:00:07.8	02:28:55.4		66.0			0.7	0.6	0.9	0.0	
		pkt	-	-	-	-		-			-	-	-	-	
151	18/4/2005	1	09:59:16.2	09:59:17.5	00:00:01.3	09:59:14.2	09:59:14.1	11.0	98.606	8.417	1.9	1.1	2.2	-0.6	-0.6
		2	09:59:17.1	09:59:19.2	00:00:02.1	09:59:13.9		17.8			1.2	0.5	1.3	-0.6	
		pkt	-	-	-	-		-			-	-	-	-	
152	18/4/2005	1	14:02:48.7	14:02:56.9	00:00:08.2	14:02:36.2	14:02:36.5	69.7	98.053	8.875	0.7	0.6	0.9	0.1	0.3
		2	14:02:50.3	14:02:59.1	00:00:08.8	14:02:36.9		74.6			1.5	0.6	1.6	0.3	
		pkt	-	-	-	-		-			-	-	-	-	
153	18/4/2005	1	15:06:30.1	15:06:36.9	00:00:06.8	15:06:19.7	15:06:20.1	57.6	98.095	8.751	1.6	1.0	1.9	0.2	0.4
		2	15:06:32.3	15:06:40.0	00:00:07.7	15:06:20.5		65.4			2.0	0.8	2.2	0.4	
		pkt	-	-	-	-		-			-	-	-	-	
154	18/4/2005	1	17:29:53.0	17:30:00.2	00:00:07.2	17:29:42.0	17:29:42.3	61.2	98.765	7.937	1.5	0.5	1.6	0.2	0.4
		2	17:29:55.3	17:30:03.6	00:00:08.3	17:29:42.6		70.4			1.7	0.7	1.8	0.4	
		pkt	-	-	-	-		-			-	-	-	-	
155	18/4/2005	1	23:05:48.9	23:05:57.0	00:00:08.1	23:05:36.6	23:05:36.9	68.4	98.078	8.894	-	-	-	-	
		2	23:05:50.5	23:05:59.1	00:00:08.6	23:05:37.3		73.4			1.8	0.8	2.0	0.4	0.4
		pkt	-	-	-	-		-			-	-	-	-	

Table E.1: (continued)

Event	Date	Stn.	P-arrival T.	S-arrival T.	Delta(S-P)	Origin T.	Origin T.(ave)	Dist.	long	lat	Amp.(E)	Amp.(N)	Amp.(ave)	MI	MI (highest)
			hh:mm:ss.0	hh:mm:ss.0	hh:mm:ss.0	hh:mm:ss.0	hh:mm:ss.0								
156	19/4/2005	1	00:16:04.1	00:16:11.5	00:00:07.4	00:15:52.8	00:15:53.6	62.9	98.195	8.902	0.9	0.3	0.9	0.0	0.2
		2	00:16:05.9	00:16:13.4	00:00:07.5	00:15:54.5		63.5			1.6	0.4	1.6	0.2	
		pkt	-	-	-	-		-			-	-	-	-	
158	19/4/2005	1	04:55:55.0	04:56:03.0	00:00:08.0	04:55:42.8	04:55:43.8	67.9	99.015	8.079	1.7	0.2	1.7	0.3	0.3
		2	04:55:56.7	04:56:04.5	00:00:07.8	04:55:44.8		66.2			0.2	0.2	0.3	-0.5	
		pkt	-	-	-	-		-			-	-	-	-	
159	19/4/2005	1	09:54:34.2	09:54:35.4	00:00:01.2	09:54:32.3	09:54:32.2	10.5	98.510	8.526	2.4	4.8	5.4	-0.2	-0.2
		2	09:54:35.1	09:54:37.1	00:00:02.0	09:54:32.1		16.9			1.7	0.9	1.9	-0.4	
		pkt	-	-	-	-		-			-	-	-	-	
165	25/4/2005	1	23:47:43.2	23:47:47.7	00:00:04.5	23:47:36.4	23:47:36.7	37.8	98.193	8.563	0.5	0.4	0.6	-0.5	-0.2
		2	23:47:46.1	23:47:52.0	00:00:05.9	23:47:37.0		50.4			0.7	0.3	0.8	-0.2	
		pkt	-	-	-	-		-			-	-	-	-	
166	26/4/2005	1	10:19:22.8	10:19:23.8	00:00:01.0	10:19:21.2	10:19:21.3	8.9	98.591	8.432	4.6	1.4	4.8	-0.3	-0.3
		2	10:19:24.2	10:19:26.1	00:00:01.9	10:19:21.3		16.1			0.9	0.3	0.9	-0.7	
		pkt	-	-	-	-		-			-	-	-	-	
167	28/4/2005	1	-	-	-	-	-	-	98.326	8.149	-	-	-	-	
		2	16:46:45.5	16:46:52.4	00:00:06.9	16:46:35.0	16:46:36.8	58.5			0.9	0.3	0.9	0.0	0.0
		pkt	16:46:43.9	16:46:47.3	00:00:03.4	16:46:38.7		29.0			5.1	0.5	5.1	0.3	
168	28/4/2005	1	-	-	-	-	-	-	98.115	8.616	-	-	-	-	
		2	18:03:59.8	18:04:06.9	00:00:07.1	18:03:49.0	18:03:49.2	60.3			0.9	0.3	0.9	0.0	0.0
		pkt	18:04:04.5	18:04:14.4	00:00:09.9	18:03:49.4		83.8			1.1	0.2	1.1	0.3	
169	29/4/2005	1	-	-	-	-	-	-	97.605	8.457	-	-	-	-	
		2	04:03:35.5	04:03:49.2	00:00:13.7	04:03:14.6	04:03:13.4	116.4			4.8	3.2	5.8	1.2	1.2
		pkt	04:03:30.9	04:03:43.1	00:00:12.2	04:03:12.3		103.4			8.9	4.8	10.1	1.3	
170	29/4/2005	1	-	-	-	-	-	-	98.598	8.427	-	-	-	-	
		2	12:26:03.5	12:26:11.1	00:00:07.6	12:25:51.9	12:25:51.8	64.5			0.7	0.2	0.7	-0.1	-0.1
		pkt	12:25:54.6	12:25:56.5	00:00:01.9	12:25:51.7		16.1			0.9	0.5	1.0	-0.7	
171	29/4/2005	1	-	-	-	-	-	-	98.823	8.219	-	-	-	-	
		2	12:31:38.7	12:31:43.7	00:00:05.0	12:31:31.1	12:31:31.4	42.3			4.8	0.2	4.8	0.5	0.5
		pkt	12:31:43.2	12:31:50.7	00:00:07.5	12:31:31.7		63.7			1.0	0.8	1.3	0.1	
172	30/4/2005	1	-	-	-	-	-	-	98.561	8.659	-	-	-	-	
		2	04:01:21.5	04:01:23.3	00:00:01.8	04:01:18.7	04:01:17.2	15.3			2.4	1.2	2.7	-0.3	-0.3
		pkt	04:01:31.7	04:01:42.2	00:00:10.5	04:01:15.7		88.8			3.8	2.3	4.4	0.9	
173	2/5/2005	1	-	-	-	-	-	-	98.596	8.429	-	-	-	-	
		2	04:00:50.2	04:00:52.1	00:00:01.9	04:00:47.3	04:00:47.8	16.1			0.9	0.6	1.1	-0.7	-0.7
		pkt	04:01:00.1	04:01:07.8	00:00:07.7	04:00:48.3		65.4			1.4	0.3	1.4	0.2	
174	3/5/2005	1	-	-	-	-	-	-	98.815	8.900	-	-	-	-	
		2	08:52:11.2	08:52:16.1	00:00:04.9	08:52:03.8	08:52:03.8	41.4			0.5	0.4	0.6	-0.4	-0.4
		pkt	08:52:26.0	08:52:40.5	00:00:14.5	08:52:03.8		123.3			2.5	1.3	2.8	0.9	
175	6/5/2005	1	-	-	-	-	-	-	98.616	8.467	-	-	-	-	
		2	04:03:44.2	04:03:45.5	00:00:01.3	04:03:42.2	04:03:42.6	11.3			2.2	1.2	2.5	-0.5	-0.5
		pkt	04:03:55.7	04:04:03.9	00:00:08.2	04:03:43.1		70.0			2.5	6.0	6.5	0.9	
176	9/5/2005	1	-	-	-	-	-	-	98.601	8.426	-	-	-	-	
		2	04:03:52.4	04:03:54.3	00:00:01.9	04:03:49.5	04:03:49.4	16.1			1.1	0.8	1.4	-0.6	-0.6
		pkt	04:04:01.0	04:04:08.7	00:00:07.7	04:03:49.2		65.4			6.4	2.0	6.7	0.9	

Table E.1: (continued)

Event	Date	Stn.	P-arrival T.	S-arrival T.	Delta(S-P)	Origin T.	Origin T.(ave)	Dist.	long	lat	Amp.(E)	Amp.(N)	Amp.(ave)	MI	MI (highest)
			hh:mm:ss.0	hh:mm:ss.0	hh:mm:ss.0	hh:mm:ss.0	hh:mm:ss.0								
177	10/5/2005	1	-	-	-	-	-	-	98.487	8.788	-	-	-	-	-
		2	14:10:21.6	14:10:25.2	00:00:03.6	14:10:16.1	14:10:16.2	30.6			1.0	0.5	1.1	-0.3	-0.3
		pkt	14:10:34.4	14:10:46.3	00:00:11.9	14:10:16.3		100.8			10.8	0.4	10.8	1.4	
178	11/5/2005	1	-	-	-	-	-	-	98.590	8.613	-	-	-	-	-
		2	03:55:30.9	03:55:32.0	00:00:01.1	03:55:29.2	03:55:29.1	9.7			4.3	3.2	5.4	-0.2	-0.2
		pkt	03:55:44.2	03:55:54.2	00:00:10.0	03:55:29.0		84.6			21.8	4.9	22.3	1.6	
179	13/5/2005	1	-	-	-	-	-	-	98.594	8.462	-	-	-	-	-
		2	09:59:51.2	09:59:52.7	00:00:01.5	09:59:48.9	09:59:48.9	12.9			2.4	1.3	2.7	-0.4	-0.4
		pkt	-	-	-	-	-	-			-	-	-	-	-
180	14/5/2005	1	-	-	-	-	-	-	98.802	8.457	-	-	-	-	-
		2	10:24:52.8	10:24:55.1	00:00:02.3	10:24:49.3	10:24:49.4	19.3			1.5	1.1	1.9	-0.4	-0.4
		pkt	-	-	-	-	-	-			-	-	-	-	-
181	18/5/2005	1	04:05:11.9	04:05:13.9	00:00:02.0	04:05:08.9	04:05:07.7	16.9	98.470	8.570	-	-	-	-	-
		2	04:05:10.4	04:05:13.0	00:00:02.6	04:05:06.5		21.8			1.5	1.0	1.8	-0.3	-0.3
		pkt	-	-	-	-	-	-			-	-	-	-	-
183	24/5/2005	1	06:45:06.9	06:45:09.2	00:00:02.3	06:45:03.4	06:45:05.0	19.3	98.684	8.403	1.8	0.2	1.8	-0.4	-0.4
		2	06:45:09.7	06:45:11.8	00:00:02.1	06:45:06.5		17.7			1.1	0.5	1.2	-0.6	-0.6
		pkt	-	-	-	-	-	-			-	-	-	-	-
184	24/5/2005	1	11:09:15.3	11:09:17.6	00:00:02.3	11:09:11.8	11:09:13.2	19.3	98.489	8.603	-	-	-	-	-
		2	11:09:18.0	11:09:20.3	00:00:02.3	11:09:14.5		19.3			0.3	0.3	0.4	-1.0	-1.0
		pkt	-	-	-	-	-	-			-	-	-	-	-
187	27/5/2005	1	04:22:28.8	04:22:30.9	00:00:02.1	04:22:25.6	04:22:25.0	17.7	98.509	8.590	3.0	0.7	3.1	-0.2	0.1
		2	04:22:27.4	04:22:29.4	00:00:02.0	04:22:24.4		16.9			4.5	3.4	5.6	0.1	
		pkt	-	-	-	-	-	-			-	-	-	-	-
191	30/5/2005	1	09:05:28.7	09:05:31.5	00:00:02.8	09:05:24.3	09:05:23.5	24.2	98.720	8.368	0.7	0.2	0.7	-0.6	-0.6
		2	09:05:26.8	09:05:29.5	00:00:02.7	09:05:22.7		22.6			0.6	0.4	0.7	-0.7	-0.7
		pkt	-	-	-	-	-	-			-	-	-	-	-
193	31/5/2005	1	12:28:26.1	12:28:32.0	00:00:05.9	12:28:17.0	12:28:17.5	50.4	98.780	8.064	3.0	0.4	3.0	0.4	0.4
		2	12:28:28.2	12:28:34.9	00:00:06.7	12:28:18.0		56.7			1.3	0.4	1.4	0.1	
		pkt	-	-	-	-	-	-			-	-	-	-	-
194	5/6/2005	1	11:41:25.7	11:41:30.7	00:00:05.0	11:41:18.1	11:41:19.2	42.3	98.810	8.192	1.6	0.4	1.6	0.0	0.0
		2	11:41:28.3	11:41:33.5	00:00:05.2	11:41:20.4		44.1			1.4	0.5	1.5	0.0	
		pkt	-	-	-	-	-	-			-	-	-	-	-
195	9/6/2005	1	10:09:04.1	10:09:05.1	00:00:01.0	10:09:02.5	10:09:02.3	8.9	98.588	8.410	3.3	1.2	3.5	-0.5	-0.5
		2	10:09:05.5	10:09:07.7	00:00:02.2	10:09:02.2		18.5			0.5	0.4	0.6	-0.8	-0.8
		pkt	-	-	-	-	-	-			-	-	-	-	-
197	11/6/2005	1	09:57:28.5	09:57:29.7	00:00:01.2	09:57:26.6	09:57:26.0	10.5	98.454	8.507	0.6	1.6	1.7	-0.7	-0.4
		2	09:57:29.5	09:57:32.3	00:00:02.8	09:57:25.3		23.4			1.1	0.7	1.3	-0.4	-0.4
		pkt	-	-	-	-	-	-			-	-	-	-	-
198	11/6/2005	1	10:43:43.4	10:43:45.7	00:00:02.3	10:43:39.9	10:43:40.0	19.3	98.506	8.256	2.4	1.3	2.7	-0.2	-0.2
		2	10:43:46.8	10:43:51.3	00:00:04.5	10:43:40.0		37.8			0.6	0.3	0.7	-0.4	-0.4
		pkt	-	-	-	-	-	-			-	-	-	-	-
199	15/6/2005	1	22:28:44.8	22:28:52.3	00:00:07.5	22:28:33.3	22:28:34.1	63.7	98.183	8.915	0.6	0.5	0.8	-0.1	-0.1
		2	22:28:46.5	22:28:54.1	00:00:07.6	22:28:34.9		64.6			0.5	0.3	0.6	-0.2	-0.2
		pkt	-	-	-	-	-	-			-	-	-	-	-

Table E.1: (continued)

Event	Date	Stn.	P-arrival T. hh:mm:ss.0	S-arrival T. hh:mm:ss.0	Delta(S-P) hh:mm:ss.0	Origin T. hh:mm:ss.0	Origin T.(ave) hh:mm:ss.0	Dist. (km)	long (East)	lat (North)	Amp.(E) (nm)	Amp.(N) (nm)	Amp.(ave) (nm)	MI	MI (highest)
200	16/6/2005	1	02:26:10.4	02:26:18.9	00:00:08.5	02:25:57.4	02:25:59.0	72.1	98.249	9.031	1.3	0.4	1.4	0.2	0.3
		2	02:26:12.9	02:26:21.0	00:00:08.1	02:26:00.5		68.7			1.5	1.0	1.8	0.3	
		pkt	-	-	-	-						-	-	-	-
201	21/6/2005	1	01:51:46.0	01:52:08.3	00:00:22.3	01:51:15.4	01:51:17.2	184.6	97.457	7.139	5.7	3.3	6.6	1.6	1.6
		2	01:51:52.4	01:52:16.9	00:00:24.5	01:51:19.0		206.2			5.0	3.1	5.9	1.6	
		pkt	-	-	-	-						-	-	-	-
202	21/6/2005	1	17:42:09.4	17:42:16.2	00:00:06.8	17:41:59.0	17:41:59.0	57.6	98.045	8.318	0.6	0.3	0.7	-0.2	-0.1
		2	17:42:12.1	17:42:20.7	00:00:08.6	17:41:59.0		72.9			0.6	0.3	0.7	-0.1	
		pkt	-	-	-	-						-	-	-	-
203	22/6/2005	1	19:24:56.2	19:25:02.6	00:00:06.4	19:24:46.5	19:24:46.4	54.0	98.035	8.553	0.6	0.4	0.7	-0.2	0.2
		2	19:24:58.7	19:25:06.8	00:00:08.1	19:24:46.3		68.7			1.1	0.7	1.3	0.2	
		pkt	-	-	-	-						-	-	-	-
204	22/6/2005	1	21:27:03.1	21:27:09.6	00:00:06.5	21:26:53.2	21:26:54.0	54.9	98.754	8.014	0.7	1.1	1.3	0.1	0.1
		2	21:27:06.1	21:27:13.5	00:00:07.4	21:26:54.8		62.9			0.5	0.3	0.6	-0.2	
		pkt	-	-	-	-						-	-	-	-
205	23/6/2005	1	04:58:50.5	04:58:52.0	00:00:01.5	04:58:48.2	04:58:48.0	12.9	98.545	8.541	0.6	0.4	0.7	-1.0	-0.9
		2	04:58:50.1	04:58:51.6	00:00:01.5	04:58:47.8		12.9			0.8	0.5	0.9	-0.9	
		pkt	-	-	-	-						-	-	-	-
206	24/6/2005	1	-	-	-	-	-	-	98.516	8.721	-	-	-	-	-
		2	08:37:19.0	08:37:21.8	00:00:02.8	08:37:14.6	08:37:14.7	24.2			1.3	0.7	1.5	-0.3	-0.3
		pkt	-	-	-	-						-	-	-	-
207	26/6/2005	1	-	-	-	-	-	-	98.892	8.049	-	-	-	-	-
		2	23:32:34.4	23:32:41.7	00:00:07.3	23:32:23.2	23:32:23.4	62.1			0.8	0.3	0.9	-0.1	-0.1
		pkt	-	-	-	-						-	-	-	-
208	27/6/2005	1	-	-	-	-	-	-	98.561	8.767	-	-	-	-	-
		2	09:08:31.9	09:08:34.9	00:00:03.0	09:08:27.3	09:08:27.3	25.8			3.1	1.5	3.4	0.1	0.1
		pkt	-	-	-	-						-	-	-	-
209	29/6/2005	1	-	-	-	-	-	-	98.514	8.747	-	-	-	-	-
		2	09:05:29.1	09:05:32.2	00:00:03.1	09:05:24.3	09:05:24.4	26.6			3.1	0.8	3.2	0.0	0.0
		pkt	-	-	-	-						-	-	-	-
210	30/6/2005	1	-	-	-	-	-	-	98.410	8.834	-	-	-	-	-
		2	11:32:41.3	11:32:46.2	00:00:04.9	11:32:33.9	11:32:34.0	41.4			0.7	0.3	0.8	-0.3	-0.3
		pkt	-	-	-	-						-	-	-	-

Table E.2

Event	Date	Time	Stn.	Dist. (km)	Amp. in count			Azimuth	Distance from station		Location	
					E	N	Z	AZI = arctan(AE/AN) degree	E (degree)	N (degree)	Degree E	Degree N
179	13/5/2005	09:59:48.9	2	12.9	E (-)	N (-)	Z (-)					
					52.6	75.5		34.8645	0.0664	0.0953	98.594	8.462
180	14/5/2005	10:24:49.4	2	19.3	E (+)	N (-)	Z (-)					
					46.0	32.9		54.4270	0.1413	0.1010	98.802	8.457
206	24/6/2005	08:37:14.7	2	24.2	E (-)	N (+)	Z (-)					
					64.6	73.2		41.4288	0.1441	0.1633	98.516	8.721
207	26/6/2005	23:32:23.4	2	62.1	E (-)	N (+)	Z (+)					
					62.1	136.2		24.5105	0.2319	0.5085	98.892	8.049
208	27/6/2005	09:08:27.3	2	25.8	E (-)	N (+)	Z (-)					
					62.3	131.3		25.3837	0.0995	0.2098	98.561	8.767
209	29/6/2005	09:05:24.4	2	26.6	E (-)	N (+)	Z (-)					
					108.8	140.6		37.7337	0.1465	0.1893	98.514	8.747
210	30/6/2005	11:32:34.0	2	41.4	E (-)	N (+)	Z (-)					
					59.0	65.2		42.1422	0.2500	0.2763	98.410	8.834

Table E.3

Event	Day	Date	Station	Component	Origin time	P-wave arrival	S-wave arrival	delta-time	Distance	Amplitude	Amplitude(Ave)	Distance	MI	MI (highest)
		dd/mm/yy			hh:mm:ss.ss	hh:mm:ss.ss	hh:mm:ss.ss	hh:mm:ss.ss	(km)	(nm)	(nm)	(km)		
			2	Z	03:54:31.70	03:54:33.27	03:54:34.30	00:00:01.03	8.746			8.746		
				E	03:54:31.51	03:54:33.28	03:54:34.44	00:00:01.16	9.850	4	4.35	9.850	-0.3	-0.3
1	Fr	14/01/05		N	03:54:31.49	03:54:33.28	03:54:34.45	00:00:01.17	9.935	1.7		9.935		
				Z	03:54:32.65	03:54:34.68	03:54:36.01	00:00:01.33	11.294			11.294		
			1	E	03:54:32.73	03:54:34.72	03:54:36.02	00:00:01.30	11.039	0.2	0.22	11.039	-1.6	
				N	03:54:32.57	03:54:34.74	03:54:36.16	00:00:01.42	12.058	0.1		12.058		
				Z	04:11:31.24	04:11:33.03	04:11:34.20	00:00:01.17	9.935			9.935		
			2	E	04:11:31.31	04:11:33.04	04:11:34.17	00:00:01.13	9.596	4.1	4.44	9.596	-0.3	-0.3
14	Th	20/01/05		N	04:11:31.19	04:11:33.02	04:11:34.22	00:00:01.20	10.190	1.7		10.190		
				Z	04:11:32.54	04:11:34.51	04:11:35.80	00:00:01.29	10.954			10.954		
			1	E	04:11:32.45	04:11:34.45	04:11:35.76	00:00:01.31	11.124	0.3	0.32	11.124	-1.4	
				N	04:11:32.47	04:11:34.47	04:11:35.78	00:00:01.31	11.124	0.1		11.124		
				Z	04:07:34.54	04:07:36.27	04:07:37.40	00:00:01.13	9.596			9.596		
			2	E	04:07:34.52	04:07:36.29	04:07:37.45	00:00:01.16	9.850	1.4	2.20	9.850	-0.6	-0.6
17	Sa	22/01/05		N	04:07:34.36	04:07:36.27	04:07:37.52	00:00:01.25	10.615	1.7		10.615		
				Z	04:07:36.02	04:07:37.82	04:07:39.00	00:00:01.18	10.020			10.020		
			1	E	04:07:35.90	04:07:37.82	04:07:39.08	00:00:01.26	10.699	0.2	0.36	10.699	-1.4	
				N	04:07:34.96	04:07:37.43	04:07:39.05	00:00:01.62	13.756	0.3		13.756		
				Z	04:08:32.15	04:08:34.04	04:08:35.28	00:00:01.24	10.530			10.530		
			2	E	04:08:32.15	04:08:34.03	04:08:35.26	00:00:01.23	10.445	3.9	4.38	10.445	-0.3	-0.3
23	Tu	01/03/05		N	04:08:32.18	04:08:34.10	04:08:35.36	00:00:01.26	10.699	2		10.699		
				Z	04:08:33.56	04:08:35.53	04:08:36.82	00:00:01.29	10.954			10.954		
			1	E	04:08:33.47	04:08:35.53	04:08:36.88	00:00:01.35	11.464	0.7	0.71	11.464	-1.0	
				N	04:08:33.46	04:08:35.54	04:08:36.90	00:00:01.36	11.549	0.1		11.549		
				Z	04:14:23.49	04:14:25.37	04:14:26.60	00:00:01.23	10.445			10.445		
			2	E	04:14:23.52	04:14:25.37	04:14:26.58	00:00:01.21	10.275	3.8	4.60	10.275	-0.3	-0.3
28	We	02/03/05		N	04:14:23.45	04:14:25.39	04:14:26.66	00:00:01.27	10.784	2.6		10.784		
				Z	04:14:24.91	04:14:26.86	04:14:28.14	00:00:01.28	10.869			10.869		
			1	E	04:14:24.97	04:14:26.92	04:14:28.20	00:00:01.28	10.869	0.5	0.54	10.869	-1.2	
				N	04:14:24.85	04:14:26.94	04:14:28.31	00:00:01.37	11.634	0.2		11.634		
				Z	04:13:41.70	04:13:43.49	04:13:44.66	00:00:01.17	9.935			9.935		
			2	E	04:13:41.67	04:13:43.49	04:13:44.68	00:00:01.19	10.105	3.5	3.54	10.105	-0.4	-0.4
37	Th	03/03/05		N	04:13:41.66	04:13:43.48	04:13:44.67	00:00:01.19	10.105	0.5		10.105		
				Z	04:13:42.91	04:13:44.94	04:13:46.27	00:00:01.33	11.294			11.294		
			1	E	04:13:42.90	04:13:44.92	04:13:46.24	00:00:01.32	11.209	0.3	0.42	11.209	-1.3	
				N	04:13:43.35	04:13:45.09	04:13:46.23	00:00:01.14	9.680	0.3		9.680		
				Z	04:02:00.09	04:02:01.94	04:02:03.15	00:00:01.21	10.275			10.275		
			2	E	04:02:00.06	04:02:01.94	04:02:03.17	00:00:01.23	10.445	1.7	1.71	10.445	-0.7	
59	Su	06/03/05		N	04:02:00.17	04:02:01.99	04:02:03.18	00:00:01.19	10.105	0.2		10.105		
				Z	04:02:01.49	04:02:03.43	04:02:04.70	00:00:01.27	10.784			10.784		
			1	E	04:02:01.34	04:02:03.42	04:02:04.78	00:00:01.36	11.549	1.7	1.75	11.549	-0.6	-0.6
				N	04:02:01.31	04:02:03.40	04:02:04.77	00:00:01.37	11.634	0.4		11.634		
				Z	03:56:33.09	03:56:34.91	03:56:36.10	00:00:01.19	10.105			10.105		
			2	E	03:56:33.17	03:56:34.94	03:56:36.10	00:00:01.16	9.850	2.4	3.32	9.850	-0.4	-0.4
86	Tu	15/03/05		N	03:56:33.15	03:56:34.98	03:56:36.18	00:00:01.20	10.190	2.3		10.190		
				Z	03:56:34.42	03:56:36.41	03:56:37.71	00:00:01.30	11.039			11.039		
			1	E	03:56:34.38	03:56:36.43	03:56:37.77	00:00:01.34	11.379	0.2	0.22	11.379	-1.5	
				N	03:56:34.40	03:56:36.43	03:56:37.76	00:00:01.33	11.294	0.1		11.294		
				Z	04:04:17.39	04:04:19.19	04:04:20.37	00:00:01.18	10.020			10.020		
			2	E	04:04:17.36	04:04:19.19	04:04:20.39	00:00:01.20	10.190	0.5	1.49	10.190	-0.8	-0.8
88	We	16/03/05		N	04:04:17.38	04:04:19.21	04:04:20.41	00:00:01.20	10.190	1.4		10.190		
				Z	04:04:18.57	04:04:20.60	04:04:21.93	00:00:01.33	11.294			11.294		
			1	E	04:04:18.64	04:04:20.66	04:04:21.98	00:00:01.32	11.209	0.4	0.41	11.209	-1.3	
				N	04:04:18.59	04:04:20.58	04:04:21.88	00:00:01.30	11.039	0.1		11.039		

Table E.3: (continued)

Event	Day	Date	Station	Component	Origin time	P-wave arrival	S-wave arrival	delta-time	Distance	Amplitude	Amplitude(Ave)	Distance	MI	MI (highest)
					hh:mm:ss.ss	hh:mm:ss.ss	hh:mm:ss.ss	hh:mm:ss.ss						
91	Fr	18/03/05	2	Z	04:06:21.95	04:06:23.80	04:06:25.01	00:00:01.21	10.275			10.275		
				E	04:06:21.98	04:06:23.80	04:06:24.99	00:00:01.19	10.105	4.2	5.10	10.105	-0.2	-0.2
				N	04:06:22.03	04:06:23.82	04:06:24.99	00:00:01.17	9.935	2.9		9.935		
				Z	04:06:23.24	04:06:25.24	04:06:26.55	00:00:01.31	11.124			11.124		
				E	04:06:23.30	04:06:25.24	04:06:26.51	00:00:01.27	10.784	0.4	0.41	10.784	-1.3	
				N	04:06:23.41	04:06:25.29	04:06:26.52	00:00:01.23	10.445	0.1		10.445		
96	Sa	19/03/05	2	Z	04:10:18.72	04:10:20.61	04:10:21.85	00:00:01.24	10.530			10.530		
				E	04:10:18.81	04:10:20.63	04:10:21.82	00:00:01.19	10.105	2.6	2.86	10.105	-0.5	-0.5
				N	04:10:18.81	04:10:20.63	04:10:21.82	00:00:01.19	10.105	1.2		10.105		
				Z	04:10:19.73	04:10:21.94	04:10:23.39	00:00:01.45	12.313			12.313		
				E	04:10:19.81	04:10:21.92	04:10:23.30	00:00:01.38	11.718	0.5	0.51	11.718	-1.2	
				N	04:10:19.72	04:10:21.90	04:10:23.33	00:00:01.43	12.143	0.1		12.143		
97	Su	20/03/05	2	Z	04:04:01.99	04:04:03.93	04:04:05.20	00:00:01.27	10.784			10.784		
				E	04:04:02.15	04:04:03.95	04:04:05.13	00:00:01.18	10.020	1.9	2.55	10.020	-0.6	-0.6
				N	04:04:02.14	04:04:03.99	04:04:05.20	00:00:01.21	10.275	1.7		10.275		
				Z	04:04:03.43	04:04:05.40	04:04:06.69	00:00:01.29	10.954			10.954		
				E	04:04:03.49	04:04:05.40	04:04:06.65	00:00:01.25	10.615	0.3	0.42	10.615	-1.3	
				N	04:04:03.50	04:04:05.41	04:04:06.66	00:00:01.25	10.615	0.3		10.615		
105	Tu	22/03/05	2	Z	04:12:02.27	04:12:04.12	04:12:05.33	00:00:01.21	10.275			10.275		
				E	04:12:02.33	04:12:04.13	04:12:05.31	00:00:01.18	10.020	1.1	1.42	10.020	-0.8	-0.8
				N	04:12:02.27	04:12:04.15	04:12:05.38	00:00:01.23	10.445	0.9		10.445		
				Z	04:12:03.50	04:12:05.59	04:12:06.96	00:00:01.37	11.634			11.634		
				E	04:12:03.56	04:12:05.59	04:12:06.92	00:00:01.33	11.294	0.2	0.20	11.294	-1.6	
				N	04:12:03.53	04:12:05.59	04:12:06.94	00:00:01.35	11.464	0		11.464		
108	We	23/03/05	2	Z	04:09:28.19	04:09:30.02	04:09:31.22	00:00:01.20	10.190			10.190		
				E	04:09:28.38	04:09:30.03	04:09:31.11	00:00:01.08	9.171	3.8	4.16	9.171	-0.4	-0.4
				N	04:09:28.36	04:09:30.02	04:09:31.11	00:00:01.09	9.256	1.7		9.256		
				Z	04:09:29.47	04:09:31.49	04:09:32.81	00:00:01.32	11.209			11.209		
				E	04:09:29.40	04:09:31.49	04:09:32.86	00:00:01.37	11.634	0.3	0.32	11.634	-1.4	
				N	04:09:29.40	04:09:31.49	04:09:32.86	00:00:01.37	11.634	0.1		11.634		
112	Th	24/03/05	2	Z	04:10:56.14	04:10:57.94	04:10:59.12	00:00:01.18	10.020			10.020		
				E	04:10:56.16	04:10:57.96	04:10:59.14	00:00:01.18	10.020	1.5	4.93	10.020	-0.3	-0.3
				N	04:10:56.09	04:10:57.97	04:10:59.20	00:00:01.23	10.445	4.7		10.445		
				Z	04:10:57.41	04:10:59.40	04:11:00.70	00:00:01.30	11.039			11.039		
				E	04:10:57.30	04:10:59.41	04:11:00.79	00:00:01.38	11.718	0.4	0.45	11.718	-1.2	
				N	04:10:57.29	04:10:59.41	04:11:00.80	00:00:01.39	11.803	0.2		11.803		
122	We	30/03/05	2	Z	04:08:58.26	04:09:00.12	04:09:01.34	00:00:01.22	10.360			10.360		
				E	04:08:58.24	04:09:00.12	04:09:01.35	00:00:01.23	10.445	2.7	2.85	10.445	-0.5	-0.5
				N	04:08:58.59	04:09:00.18	04:09:01.22	00:00:01.04	8.831	0.9		8.831		
				Z	04:08:59.65	04:09:01.62	04:09:02.91	00:00:01.29	10.954			10.954		
				E	04:08:59.57	04:09:01.62	04:09:02.96	00:00:01.34	11.379	0.4	0.64	11.379	-1.1	
				N	04:08:59.53	04:09:01.62	04:09:02.99	00:00:01.37	11.634	0.5		11.634		
126	Su	03/04/05	2	Z	03:58:18.80	03:58:20.65	03:58:21.86	00:00:01.21	10.275			10.275		
				E	03:58:18.84	03:58:20.66	03:58:21.85	00:00:01.19	10.105	0.5	0.64	10.105	-1.1	-1.1
				N	03:58:18.88	03:58:20.68	03:58:21.86	00:00:01.18	10.020	0.4		10.020		
				Z	03:58:20.10	03:58:22.10	03:58:23.41	00:00:01.31	11.124			11.124		
				E	03:58:20.09	03:58:22.11	03:58:23.43	00:00:01.32	11.209	0.4	0.40	11.209	-1.3	
				N	03:58:20.03	03:58:22.11	03:58:23.47	00:00:01.36	11.549	0		11.549		
127	We	06/04/05	2	Z	04:13:25.24	04:13:26.98	04:13:28.12	00:00:01.14	9.680			9.680		
				E	04:13:25.23	04:13:27.00	04:13:28.16	00:00:01.16	9.850	2.8	2.91	9.850	-0.5	-0.5
				N	04:13:25.19	04:13:27.02	04:13:28.22	00:00:01.20	10.190	0.8		10.190		
				Z	04:13:26.58	04:13:28.46	04:13:29.69	00:00:01.23	10.445			10.445		
				E	04:13:26.64	04:13:28.53	04:13:29.77	00:00:01.24	10.530	0.3	0.36	10.530	-1.4	
				N	04:13:26.60	04:13:28.51	04:13:29.76	00:00:01.25	10.615	0.2		10.615		

Table E.3: (continued)

Event	Day	Date	Station	Component	Origin time	P-wave arrival	S-wave arrival	delta-time	Distance	Amplitude	Amplitude(Ave)	Distance	MI	MI (highest)
		dd/mm/yy			hh:mm:ss.ss	hh:mm:ss.ss	hh:mm:ss.ss	hh:mm:ss.ss	(km)	(nm)	(nm)	(km)		
				Z	04:05:58.42	04:06:00.21	04:06:01.38	00:00:01.17	9.935			9.935		
130	Th	07/04/05	2	E	04:05:58.37	04:06:00.20	04:06:01.40	00:00:01.20	10.190	4.6	4.87	10.190	-0.3	-0.3
				N	04:05:58.49	04:06:00.26	04:06:01.42	00:00:01.16	9.850	1.6		9.850		
			1	Z	04:05:59.85	04:06:01.71	04:06:02.93	00:00:01.22	10.360			10.360		
				E	04:05:59.71	04:06:01.71	04:06:03.02	00:00:01.31	11.124	0.4	0.41	11.124	-1.3	
			N	04:05:59.70	04:06:01.72	04:06:03.04	00:00:01.32	11.209	0.1		11.209			
				Z	04:19:33.08	04:19:34.85	04:19:36.01	00:00:01.16	9.850			9.850		
131	Fr	08/04/05	2	E	04:19:33.12	04:19:34.88	04:19:36.03	00:00:01.15	9.765	2.4	3.26	9.765	-0.5	-0.5
				N	04:19:32.98	04:19:34.84	04:19:36.06	00:00:01.22	10.360	2.2		10.360		
			1	Z	04:19:34.34	04:19:36.34	04:19:37.65	00:00:01.31	11.124			11.124		
				E	04:19:34.40	04:19:36.37	04:19:37.66	00:00:01.29	10.954	0.1	0.14	10.954	-1.8	
			N	04:19:34.35	04:19:36.35	04:19:37.66	00:00:01.31	11.124	0.1		11.124			
				Z	04:03:20.87	04:03:22.63	04:03:23.78	00:00:01.15	9.765			9.765		
135	Sa	09/04/05	2	E	04:03:20.81	04:03:22.63	04:03:23.82	00:00:01.19	10.105	5.5	6.74	10.105	-0.1	-0.1
				N	04:03:20.71	04:03:22.63	04:03:23.89	00:00:01.26	10.699	3.9		10.699		
			1	Z	04:03:22.13	04:03:24.12	04:03:25.42	00:00:01.30	11.039			11.039		
				E	04:03:22.04	04:03:24.12	04:03:25.48	00:00:01.36	11.549	0.5	0.58	11.549	-1.1	
			N	04:03:22.07	04:03:24.12	04:03:25.46	00:00:01.34	11.379	0.3		11.379			
				Z	04:05:51.76	04:05:53.62	04:05:54.84	00:00:01.22	10.360			10.360		
144	Sa	16/04/05	2	E	04:05:51.87	04:05:53.64	04:05:54.80	00:00:01.16	9.850	1.9	1.94	9.850	-0.7	-0.7
				N	04:05:51.92	04:05:53.66	04:05:54.80	00:00:01.14	9.680	0.4		9.680		
			1	Z	04:05:53.02	04:05:55.05	04:05:56.38	00:00:01.33	11.294			11.294		
				E	04:05:53.07	04:05:55.07	04:05:56.38	00:00:01.31	11.124	0.2	0.36	11.124	-1.4	
			N	04:05:53.01	04:05:55.07	04:05:56.42	00:00:01.35	11.464	0.3		11.464			
				Z	04:13:41.14	04:13:42.91	04:13:44.07	00:00:01.16	9.850			9.850		
150	Mo	18/04/05	2	E	04:13:41.11	04:13:42.91	04:13:44.09	00:00:01.18	10.020	3	3.01	10.020	-0.5	-0.5
				N	04:13:41.23	04:13:42.96	04:13:44.09	00:00:01.13	9.596	0.2		9.596		
			1	Z	04:13:42.38	04:13:44.35	04:13:45.64	00:00:01.29	10.954			10.954		
				E	04:13:42.36	04:13:44.36	04:13:45.67	00:00:01.31	11.124	0.3	0.32	11.124	-1.4	
			N	04:13:42.34	04:13:44.37	04:13:45.70	00:00:01.33	11.294	0.1		11.294			
				Z	04:19:18.24	04:19:20.09	04:19:21.30	00:00:01.21	10.275			10.275		
157	Tu	19/04/05	2	E	04:19:18.22	04:19:20.07	04:19:21.28	00:00:01.21	10.275	0.3	0.32	10.275	-1.4	-1.4
				N	04:19:18.36	04:19:20.13	04:19:21.29	00:00:01.16	9.850	0.1		9.850		
			1	Z	04:19:19.57	04:19:21.54	04:19:22.83	00:00:01.29	10.954			10.954		
				E	04:19:19.48	04:19:21.54	04:19:22.89	00:00:01.35	11.464	0.2	0.22	11.464	-1.5	
			N	04:19:19.51	04:19:21.53	04:19:22.85	00:00:01.32	11.209	0.1		11.209			
				Z	04:03:15.79	04:03:17.65	04:03:18.87	00:00:01.22	10.360			10.360		
160	We	20/04/05	2	E	04:03:15.86	04:03:17.66	04:03:18.84	00:00:01.18	10.020	7.9	8.95	10.020	0.0	0.0
				N	04:03:15.89	04:03:17.68	04:03:18.85	00:00:01.17	9.935	4.2		9.935		
			1	Z	04:03:17.06	04:03:19.09	04:03:20.42	00:00:01.33	11.294			11.294		
				E	04:03:17.05	04:03:19.10	04:03:20.44	00:00:01.34	11.379	0.7	0.81	11.379	-1.0	
			N	04:03:17.06	04:03:19.11	04:03:20.45	00:00:01.34	11.379	0.4		11.379			
				Z	03:50:54.41	03:50:56.21	03:50:57.39	00:00:01.18	10.020			10.020		
161	Fr	22/04/05	2	E	03:50:54.59	03:50:56.22	03:50:57.29	00:00:01.07	9.086	2.9	3.26	9.086	-0.5	-0.5
				N	03:50:54.52	03:50:56.26	03:50:57.40	00:00:01.14	9.680	1.5		9.680		
			1	Z	03:50:55.68	03:50:57.67	03:50:58.97	00:00:01.30	11.039			11.039		
				E	03:50:55.63	03:50:57.68	03:50:59.02	00:00:01.34	11.379	0.3	0.32	11.379	-1.4	
			N	03:50:55.61	03:50:57.67	03:50:59.02	00:00:01.35	11.464	0.1		11.464			
				Z	04:05:10.54	04:05:12.36	04:05:13.55	00:00:01.19	10.105			10.105		
162	Sa	23/04/05	2	E	04:05:10.58	04:05:12.38	04:05:13.56	00:00:01.18	10.020	4.1	4.56	10.020	-0.3	-0.3
				N	04:05:10.64	04:05:12.40	04:05:13.55	00:00:01.15	9.765	2		9.765		
			1	Z	04:05:11.70	04:05:13.76	04:05:15.11	00:00:01.35	11.464			11.464		
				E	04:05:11.85	04:05:13.82	04:05:15.11	00:00:01.29	10.954	0.3	0.36	10.954	-1.4	
			N	04:05:11.80	04:05:13.82	04:05:15.14	00:00:01.32	11.209	0.2		11.209			

Table E.3: (continued)

Event	Day	Date	Station	Component	Origin time	P-wave arrival	S-wave arrival	delta-time	Distance	Amplitude	Amplitude(Ave)	Distance	MI	MI (highest)
163	Su	24/04/05	2	Z	04:14:17.49	04:14:19.32	04:14:20.52	00:00:01.20	10.190			10.190		
				E	04:14:17.51	04:14:19.33	04:14:20.52	00:00:01.19	10.105	0.2	0.36	10.105	-1.4	-1.4
				N	04:14:17.48	04:14:19.36	04:14:20.59	00:00:01.23	10.445	0.3		10.445		
			1	Z	04:14:18.81	04:14:20.78	04:14:22.07	00:00:01.29	10.954			10.954		
				E	04:14:18.80	04:14:20.79	04:14:22.09	00:00:01.30	11.039	0.2	0.22	11.039	-1.6	
				N	04:14:18.72	04:14:20.77	04:14:22.11	00:00:01.34	11.379	0.1		11.379		
164	Mo	25/04/05	2	Z	04:14:16.65	04:14:18.33	04:14:19.43	00:00:01.10	9.341			9.341		
				E	04:14:16.50	04:14:18.33	04:14:19.53	00:00:01.20	10.190	0.8	0.89	10.190	-1.0	-1.0
				N	04:14:16.50	04:14:18.36	04:14:19.58	00:00:01.22	10.360	0.4		10.360		
			1	Z	04:14:17.76	04:14:19.76	04:14:21.07	00:00:01.31	11.124			11.124		
				E	04:14:17.79	04:14:19.78	04:14:21.08	00:00:01.30	11.039	0.3	0.32	11.039	-1.4	
				N	04:14:17.71	04:14:19.77	04:14:21.12	00:00:01.35	11.464	0.1		11.464		
182	Tu	24/05/05	2	Z	04:14:37.46	04:14:39.14	04:14:40.24	00:00:01.10	9.341			9.341		
				E	04:14:37.45	04:14:39.13	04:14:40.35	00:00:01.22	10.360	1	1.17	10.360	-0.9	-0.9
				N	04:14:37.44	04:14:39.18	04:14:40.32	00:00:01.14	9.680	0.6		9.680		
			1	Z	04:14:38.55	04:14:40.58	04:14:41.91	00:00:01.33	11.294			11.294		
				E	04:14:38.68	04:14:40.63	04:14:41.91	00:00:01.28	10.869	0.5	0.58	10.869	-1.2	
				N	04:14:38.55	04:14:40.61	04:14:41.96	00:00:01.35	11.464	0.3		11.464		
185	We	25/05/05	2	Z	04:04:44.55	04:04:46.38	04:04:47.58	00:00:01.20	10.190			10.190		
				E	04:04:44.63	04:04:46.40	04:04:47.56	00:00:01.16	9.850	0.8	0.94	9.850	-1.0	-1.0
				N	04:04:44.65	04:04:46.42	04:04:47.58	00:00:01.16	9.850	0.5		9.850		
			1	Z	04:04:45.86	04:04:47.85	04:04:49.15	00:00:01.30	11.039			11.039		
				E	04:04:45.84	04:04:47.83	04:04:49.13	00:00:01.30	11.039	0.7	0.76	11.039	-1.0	
				N	04:04:45.93	04:04:47.88	04:04:49.16	00:00:01.28	10.869	0.3		10.869		
186	Th	26/05/05	2	Z	04:00:30.10	04:00:31.87	04:00:33.03	00:00:01.16	9.850			9.850		
				E	04:00:30.06	04:00:31.86	04:00:33.04	00:00:01.18	10.020	2.5	2.69	10.020	-0.5	-0.5
				N	04:00:30.02	04:00:31.87	04:00:33.08	00:00:01.21	10.275	1		10.275		
			1	Z	04:00:31.30	04:00:33.30	04:00:34.61	00:00:01.31	11.124			11.124		
				E	04:00:31.32	04:00:33.32	04:00:34.63	00:00:01.31	11.124	0.7	0.81	11.124	-1.0	
				N	04:00:31.27	04:00:33.30	04:00:34.63	00:00:01.33	11.294	0.4		11.294		
188	Sa	28/05/05	2	Z	04:04:12.55	04:04:14.35	04:04:15.53	00:00:01.18	10.020			10.020		
				E	04:04:12.30	04:04:14.35	04:04:15.69	00:00:01.34	11.379	1.2	1.63	11.379	-0.7	-0.7
				N	04:04:12.55	04:04:14.37	04:04:15.56	00:00:01.19	10.105	1.1		10.105		
			1	Z	04:04:13.82	04:04:15.81	04:04:17.11	00:00:01.30	11.039			11.039		
				E	04:04:13.86	04:04:15.83	04:04:17.12	00:00:01.29	10.954	0.1	0.14	10.954	-1.8	
				N	04:04:13.80	04:04:15.83	04:04:17.16	00:00:01.33	11.294	0.1		11.294		
189	Su	29/05/05	2	Z	04:11:25.37	04:11:27.17	04:11:28.35	00:00:01.18	10.020			10.020		
				E	04:11:25.34	04:11:27.16	04:11:28.35	00:00:01.19	10.105	0.3	0.32	10.105	-1.5	
				N	04:11:25.44	04:11:27.21	04:11:28.37	00:00:01.16	9.850	0.1		9.850		
			1	Z	04:11:26.61	04:11:28.60	04:11:29.90	00:00:01.30	11.039			11.039		
				E	04:11:26.62	04:11:28.62	04:11:29.93	00:00:01.31	11.124	0.7	0.76	11.124	-1.0	-1.0
				N	04:11:26.57	04:11:28.62	04:11:29.96	00:00:01.34	11.379	0.3		11.379		
190	Mo	30/05/05	2	Z	03:56:05.87	03:56:07.63	03:56:08.78	00:00:01.15	9.765			9.765		
				E	03:56:05.79	03:56:07.59	03:56:08.77	00:00:01.18	10.020	0.5	0.78	10.020	-1.1	-1.1
				N	03:56:05.86	03:56:07.66	03:56:08.84	00:00:01.18	10.020	0.6		10.020		
			1	Z	03:56:07.14	03:56:09.11	03:56:10.40	00:00:01.29	10.954			10.954		
				E	03:56:07.09	03:56:09.09	03:56:10.40	00:00:01.31	11.124	0.4	0.41	11.124	-1.3	
				N	03:56:07.13	03:56:09.12	03:56:10.42	00:00:01.30	11.039	0.1		11.039		
192	Tu	31/05/05	2	Z	04:08:36.96	04:08:38.78	04:08:39.97	00:00:01.19	10.105			10.105		
				E	04:08:36.92	04:08:38.77	04:08:39.98	00:00:01.21	10.275	1.1	1.70	10.275	-0.7	-0.7
				N	04:08:36.93	04:08:38.78	04:08:39.99	00:00:01.21	10.275	1.3		10.275		
			1	Z	04:08:38.31	04:08:40.26	04:08:41.54	00:00:01.28	10.869			10.869		
				E	04:08:38.20	04:08:40.23	04:08:41.56	00:00:01.33	11.294	0.5	0.51	11.294	-1.2	
				N	04:08:38.20	04:08:40.25	04:08:41.59	00:00:01.34	11.379	0.1		11.379		

APPENDIX F

SINKHOLES

Table F.1: Sinkholes that occurred in Southern Thailand from June 1995 to 22 June 2005 (DMR, 2005).

Number	Date	Location
1	_/6/95	Muang District, Satun Province
2	_/10/96	La Ngu District, Satun Province
3	_/7/98	HuiYord District, Trang Province
4	_/5/02	Muang District, Krabi Province
5	_/10/04	Aowluk District, Krabi Province
6	26/12/04	Aowluk District, Krabi Province
7	26/12/04	Muang District, Trang Province
8	27/12/04	Manag Subdistrict, Satun Province
9	29/12/04	Kao Panom District, Krabi Province
10	29/12/04	Muang District, Trang Province
11	30/12/04	HuiYord District, Trang Province
12	31/12/04	La Ngu District, Satun Province
13	3/01/05	Aowluk District, Krabi Province
14	3/01/05	Tong Yai District, Nakornsritammarat Province
15	6/01/05	Kanchanadit District, Surathanee Province
16	6/01/05	Tapput District, Phang Nga Province
17	9/01/05	Kuandon District, Satun Province
18	9/01/05	Srinakkarin District, Pattalung Province
19	11/01/05	Cha Aoud District, Nakornsritammarat Province
20	21/01/05	Kanchanadit District, Surathanee Province
21	21/01/05	Kanchanadit District, Surathanee Province
22	21/01/05	Keancha District, Surathanee Province
23	26/01/05	Nayong District, Trang Province
24	31/01/05	Palean District, Trang Province
25	9/02/05	Tam Panna District, Nakornsritammarat Province
26	11/02/05	Muang District, Chumporn Province
27	9/03/05	Praipraya District, Krabi Province
28	6/04/05	Donsak District, Surathanee Province
29	6/04/05	Donsak District, Surathanee Province
30	6/04/05	Prasang District, Surathanee Province
31	9/05/05	La Ngu District, Satun Province
32	13/05/05	Panom District, Surathanee Province
33	15/05/05	Kuandon District, Satun Province
34	30/05/05	Vang vised District, Trang Province
35	6/06/05	Aowluk District, Krabi Province
36	7/06/05	Praipraya District, Krabi Province
37	8/06/05	Kraburi District, Ranong Province

APPENDIX G

PUBLICATIONS

1. Dangmuan, S., Lohawijarn, W., Duerrast, H., Nuannin, P., and Yongsiriwith, P. 2005. Seismicity of Southern Thailand after the 26 December 2004 Andaman Earthquake. In: The Conference on Management of Natural Disasters. 26-29 December 2005 Phuket, Thailand, 212-223.
2. Dangmuan, S., Lohawijarn, W., Duerrast, H., Nuannin, P., and Yongsiriwith, P. 2006. Seismicity of Southern Thailand after the 26 December 2004 Andaman Sumatra Earthquake, In: First European Conference on Earthquake Engineering and Seismology. 3-8 September 2006, Geneva, Switzerland.
3. Dangmuan, S., Lohawijarn, W., Duerrast, H., Nuannin, P., and Yongsiriwith, P. 2006. Seismicity of Southern Thailand after the 26 December 2004 Andaman Sumatra Earthquake, In: Sixth General Assembly of Asian Seismological Commission (ASC): Symposium on Earthquake and Tsunami Disaster Preparedness and Mitigation. 7-10 November 2006 Bangkok, Thailand, 111.
4. Duerrast, H., Dangmuan, S. and Lohawijarn, W. 2007. Khlong Marui and Ranong Fault Zones in Southern Thailand re-activated by the 26 December 2004 Mw 9.3 Sumatra-Andaman Earthquake?, In: Proceeding of the International Conference on Geology of Thailand: Towards Sustainable Development and Sufficiency Economy. 21-22 November 2007 Bangkok, Thailand, 141-144.

แผ่นดินไหวในภาคใต้ของประเทศไทย ภายหลังเหตุการณ์แผ่นดินไหวในทะเลอันดามัน
เมื่อ 26 ธันวาคม 2547

Seismicity of Southern Thailand after the 26 December 2004 Andaman Earthquake

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บทคัดย่อ

หน่วยวิจัยธรณีฟิสิกส์ มหาวิทยาลัยสงขลานครินทร์ ได้ติดตั้งเครื่องมือตรวจวัดคลื่นแผ่นดินไหวในบริเวณรอยเลื่อนคลองมะรุ่ยซึ่งครอบคลุมพื้นที่ของจังหวัดภูเก็ต กระบี่ และพังงา ในภาคใต้ของประเทศไทย ภายหลังจากเกิดเหตุการณ์แผ่นดินไหวในทะเลอันดามัน ขนาด 9.3 เมื่อวันที่ 26 ธันวาคม พ.ศ.2547 เพื่อตรวจวัดเหตุการณ์แผ่นดินไหวในบริเวณรอยเลื่อนดังกล่าว

ผลการตรวจวัดพบว่าภายในระยะเวลาหกเดือน มีเหตุการณ์แผ่นดินไหวเกิดขึ้นจำนวน 162 เหตุการณ์ ด้วยขนาดความแรง (MI) สูงสุดไม่เกิน 4.5 ในพื้นที่ซึ่งมีอาณาเขตรหว่างละติจูด 7.25 องศาเหนือ ถึง 10.12 องศาเหนือ และลองจิจูด 97.26 องศาตะวันออก ถึง 99.69 องศาตะวันออก ตามแนวรอยเลื่อนคลองมะรุ่ย แนวรอยเลื่อนระนอง และรอยเลื่อนอื่นๆที่วางตัวในทิศตะวันออกเฉียงเหนือ-ตะวันตกเฉียงใต้

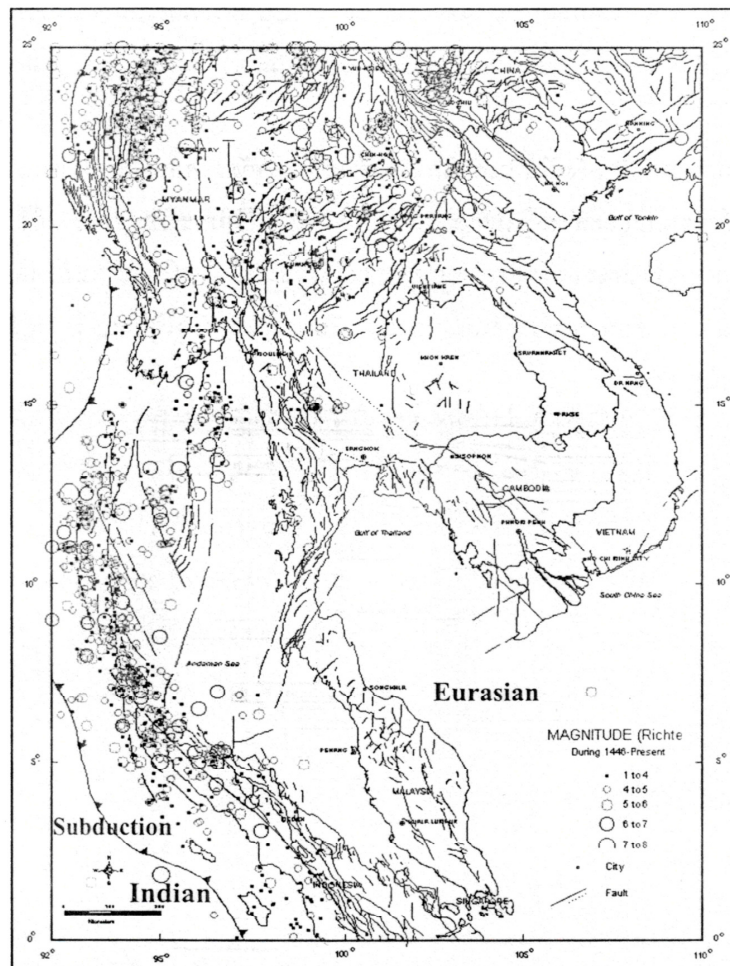
Abstract

Geophysics Group of Prince of Songkla University installed a set of short period seismograph system within the Klong Marui Fault Zone (Phuket, Krabi, Pangnga Province) in the Southern part of Thailand, after the 9.3 magnitude earthquake on 26 December 2004 in Andaman Sea, in order to monitor possible earthquake events generated in the fault zones.

Over a period of six months, 162 earthquake-events with a maximum local magnitude (MI) of 4.5 occurred in the area bounded by longitude 7.25° N to 10.12° N and latitude 97.26° E to 99.69° E along Klong Marui Fault Zone, Ranong Fault Zone and other fault zones oriented parallel NE-SW direction.

บทนำ

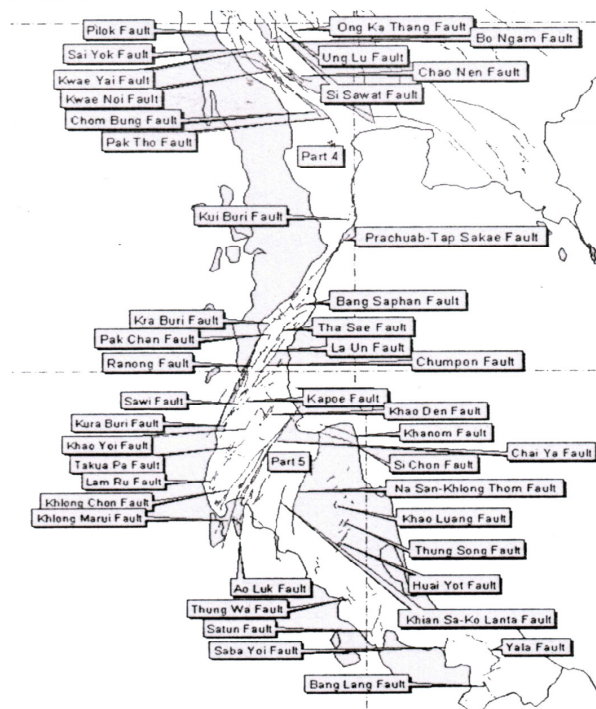
จากเหตุการณ์แผ่นดินไหวครั้งใหญ่เมื่อวันที่ 26 ธันวาคม พ.ศ.2547 โดยมีศูนย์กลางแผ่นดินไหวอยู่ในทะเลอันดามัน (รูปที่ 1) วัดขนาดความแรงได้เท่ากับ 9.3 หรือ Mw=9 (USGS reported Mw = 9) ส่งผลให้เกิดคลื่นสึนามิเข้าถล่มชายฝั่งด้านตะวันตกของประเทศไทยเกิดความเสียหายแก่ชีวิตและทรัพย์สินมากมาย นอกจากนี้ยังทำให้เกิดแผ่นดินยุบตัว แผ่นดินถล่ม (กรมทรัพยากรธรณี, 2548) และอาจส่งผลให้รอยเลื่อนทางภาคใต้ของประเทศไทยมีการเคลื่อนตัว ซึ่งจะ มีผลกระทบต่ออาคารหรือสิ่งปลูกสร้างพื้นฐานต่าง ๆ ในบริเวณนี้



รูปที่ 1 Epicenters and magnitudes of earthquake in Thailand and adjacent areas before 2004 (กรมทรัพยากรธรณี, 2548)

รอยเลื่อนระนองและรอยเลื่อนคลองมะรุ่ยเป็นรอยเลื่อนที่สำคัญในภาคใต้ของประเทศไทย (รูปที่ 2) ซึ่งวางตัวอยู่ในแนวตะวันออกเฉียงเหนือ-ตะวันตกเฉียงใต้ โดยรอยเลื่อนคลองมะรุ่ยเป็นรอยเลื่อนเลื่อนข้าง (Strike-slip) มีแนวเลื่อนวางตัวอยู่ในแนวตะวันออกเฉียงเหนือ-ตะวันตกเฉียงใต้ ซึ่งขนานกับรอยเลื่อนระนองโดยพาดผ่านอำเภอบ้านตาขุน อำเภอพนม จังหวัดสุราษฎร์ธานี อำเภอทับปุด อำเภอเมือง จังหวัดพังงา และเลยลงไปในทะเลอันดามันระหว่างอำเภอเมือง จังหวัดภูเก็ตกับอำเภอเกาะยาว จังหวัดพังงา มีความยาว 150 กิโลเมตร รอยเลื่อนระนองเป็นรอยเลื่อนเลื่อนข้างเช่นเดียวกับรอยเลื่อนคลองมะรุ่ย ประกอบด้วยรอยเลื่อนต่าง ๆ แผ่กระจายเป็นบริเวณกว้างขนานกันไปจากทะเลอันดามัน จังหวัดระนอง ไปยังอ่าวไทยในทิศตะวันออกเฉียงเหนือที่บริเวณจังหวัดประจวบคีรีขันธ์ และจังหวัดชุมพร มีความยาวประมาณ 300 กิโลเมตร (Garson *et al.*, 1970)

การศึกษาวิจัยในครั้งนี้ได้ทำการติดตั้งเครื่องมือตรวจวัดคลื่นแผ่นดินไหวจำนวน 3 สถานีวัดในจังหวัดภูเก็ต กระบี่ และพังงา เป็นเวลา 6 เดือนตั้งแต่เดือนมกราคม 2548 ถึงเดือนมิถุนายน 2548 เพื่อตรวจหาตำแหน่ง และหาขนาดความรุนแรงของแผ่นดินไหวในบริเวณรอยเลื่อนโดยคาดว่า จะใช้เป็นข้อมูลหนึ่งสำหรับการวางแผนป้องกัน หรือการตัดสินใจเกี่ยวกับโครงสร้างพื้นฐานในบริเวณที่ใกล้กับรอยเลื่อน



รูปที่ 2 Fault zones in South of Thailand (Fungkajone, 1997)

1. วัตถุประสงค์ และวิธีการทดลอง

1.1 ติดตั้งเครื่องมือวัดแผ่นดินไหวประเภท Short period จำนวน 4 ตำแหน่งบริเวณรอยเลื่อนคลองมะรุ่ย โดยสถานีวัดที่ 1 ตั้งอยู่ที่ศูนย์โทรคมนาคมเขาหัวช้าง อำเภอเมือง จังหวัดพังงา (8.43°N , 98.51°E) สถานีวัดที่ 2 ตั้งอยู่ที่ อำเภอทับปุด จังหวัดพังงา (8.56°N , 98.66°E) สถานีวัดที่ 3 ตั้งอยู่ที่อุทยานแห่งชาติธารโบกขรณี อำเภออ่าวลึก จังหวัดกระบี่ (8.39°N , 98.74°E) และ สถานีวัดที่ 4 ตั้งอยู่หน้าหอพักอาจารย์ มหาวิทยาลัยสงขลานครินทร์ อำเภอเกาะกูด จังหวัดภูเก็ต (7.89°N , 98.35°E)

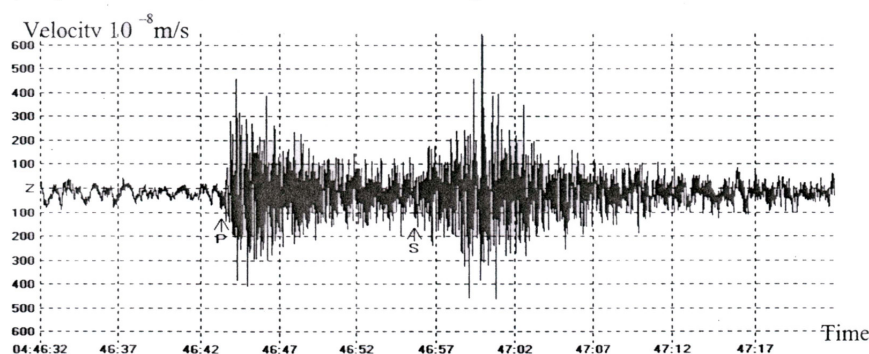
1.2 เครื่องมือวัดแผ่นดินไหวที่ทำการติดตั้ง ประกอบด้วยห้ววัด (Nanometrics) เครื่องบันทึกสัญญาณแผ่นดินไหว (Orion Seismograph) ฮาร์ดดิสก์สำหรับเก็บข้อมูล และอุปกรณ์อ่านพิกัดภูมิศาสตร์ (GPS)

1.3 เก็บข้อมูลแผ่นดินไหวจากสถานีวัดแผ่นดินไหวทั้ง 4 สถานี ทุก ๆ สัปดาห์ เป็นระยะเวลา 6 เดือนโดยการเปลี่ยนถ่ายข้อมูลจากฮาร์ดดิสก์สู่คอมพิวเตอร์

1.4 ใช้โปรแกรม Winquake วิเคราะห์ข้อมูลหาขนาด และตำแหน่งของเหตุการณ์แผ่นดินไหว

2. การวิเคราะห์หาตำแหน่งที่เกิดแผ่นดินไหว (Epicenter)

ตำแหน่งที่เกิดแผ่นดินไหวหาได้จาก ค่าความแตกต่างของเวลาที่คลื่นแผ่นดินไหวเดินทางมาถึงสถานีวัดแต่ละสถานีวัด โดยกำหนดตำแหน่งของเวลาที่คลื่นปฐมภูมิ (Primary wave: P) และคลื่นทุติยภูมิ (Secondary wave: S) ที่เดินทางมาถึง (รูปที่ 3)

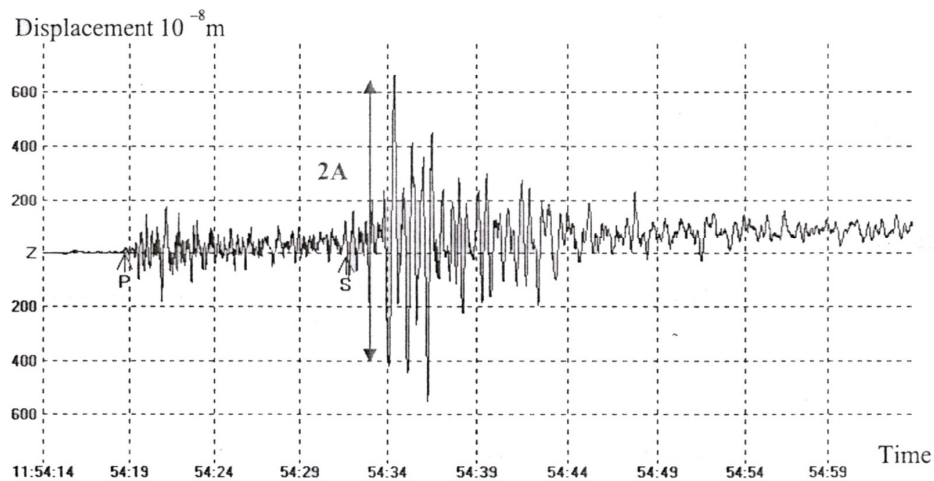


รูปที่ 3 Short period seismogram record of the vertical component showing velocity versus time (hh:mm:ss). Recorded on the 2nd March 2005 at Station 2 and a distance of 106.9 km from epicenter.

โดยเวลาที่คลื่นปฐมภูมิและคลื่นทุติยภูมิมายังถึงต่างกันในแต่ละสถานีวัด จะนำไปคำนวณหา ระยะห่างระหว่างจุดกำเนิดแผ่นดินไหวกับเครื่องบันทึก และสามารถกำหนดตำแหน่งของ แผ่นดินไหว (Epicenter) ได้โดยใช้สถานีวัดอย่างน้อย 3 สถานี

3. การวิเคราะห์ค่าแมกนิจูด (MI)

แปลงสัญญาณที่บันทึกในหน่วยของความเร็ว (Velocity) เป็นหน่วยการกระจัด (displacement) เพื่อหาแอมพลิจูดสูงสุด (รูปที่ 4)



รูปที่ 4 Short period seismogram record of the vertical component showing velocity versus time (hh:mm:ss). Recorded on the 3rd March 2005 at Station 2 and a distance of 128.5 km from epicenter. 2A: two times amplitude used for magnitude calculation.

คำนวณขนาดของคลื่นแผ่นดินไหว(MI) โดยสมการ (Bullen and Bolt, 1985)

$$MI = \log_{10} A + 2.56 \log_{10} \Delta - 1.67$$

โดยที่ A คือ ค่าแอมพลิจูดสูงสุดของสัญญาณ หน่วย 10^{-6} เมตร

Δ คือ ระยะทางจากจุดที่เกิดแผ่นดินไหว (Epicenter) ถึงสถานีวัด

หน่วยกิโลเมตร ($10 < \Delta < 600$ กม.)

สมการนี้ใช้สำหรับหาขนาดของแผ่นดินไหว (MI) ซึ่งใช้เฉพาะกับคลื่นแผ่นดินไหวที่ได้จากการบันทึกของเครื่องมือวัดแผ่นดินไหว Wood Anderson seismometers ซึ่งมี gain ที่แน่นอน ดังนั้นขนาดของแผ่นดินไหวที่คำนวณได้นี้ เป็นขนาดที่ได้จากการคำนวณในชั้นต้น ซึ่งอาจจะมีค่าสูงกว่าความเป็นจริง (จาก Stein and Wysession, 2003)

4. ผลการศึกษา

1) ในระหว่างวันที่ 14 มกราคม 2548 ถึง 30 มิถุนายน 2548 ตรวจวัดและบันทึกคลื่นแผ่นดินไหวได้ จำนวน 162 เหตุการณ์โดยหลังเหตุการณ์แผ่นดินไหวเมื่อวันที่ 26 ธันวาคม 2547 จำนวนเหตุการณ์ที่เกิดขึ้นและลดน้อยลงจนถึงวันที่ 28 กุมภาพันธ์ 2548 ในช่วงเหตุการณ์แผ่นดินไหวในทะเลอันดามันเมื่อวันที่ 28 มีนาคม 2548 จำนวนเหตุการณ์ที่บันทึกได้ เกิดเพิ่มขึ้นอย่างรวดเร็วและค่อย ๆ ลดลง ดังรูปที่ 5

2) เหตุการณ์แผ่นดินไหวที่ตรวจวัดได้ มีขนาดความแรง (MI) สูงสุด 4.5 ในวันที่ 3 มีนาคม 2548 ดังรูปที่ 6

3) จำนวนเหตุการณ์แผ่นดินไหวที่เกิดขึ้นไม่สัมพันธ์กับค่าแมกนิจูด

4) เหตุการณ์แผ่นดินไหวที่เกิดขึ้นจำนวน 162 เหตุการณ์ โดยส่วนใหญ่จะมีค่าแมกนิจูดอยู่ในช่วง 2.1 ถึง 2.5 และมีจำนวนลดน้อยลงเมื่อค่าแมกนิจูดสูงขึ้น ดังรูปที่ 7

5) ตำแหน่งที่เกิดแผ่นดินไหวมีอาณาเขตรหว่างละติจูด 7.25 องศาเหนือ ถึง 10.12 องศาเหนือ และลองจิจูด 97.26 องศาตะวันออก ถึง 99.69 องศาตะวันออก ตามแนวรอยเลื่อนคลองมะรุ่ย แนวรอยเลื่อนระนอง และรอยเลื่อนอื่นๆที่วางตัวในทิศตะวันออกเฉียงเหนือ-ตะวันตกเฉียงใต้ ดังรูปที่ 8

6) เหตุการณ์แผ่นดินไหวที่มีแมกนิจูดน้อยกว่าหรือเท่ากับ 2.5 ตำแหน่งที่เกิดจะกระจายตัวดัง รูปที่ 9A และ 9B และที่ค่าแมกนิจูดมากกว่า 2.5 จะมีตำแหน่งที่เกิดตามแนวรอยเลื่อนระนอง รอยเลื่อนคลองมะรุ่ย และรอยที่วางตัวในแนวตะวันออกเฉียงเหนือ-ตะวันตกเฉียงใต้ ดัง รูปที่ 9C และ 9D

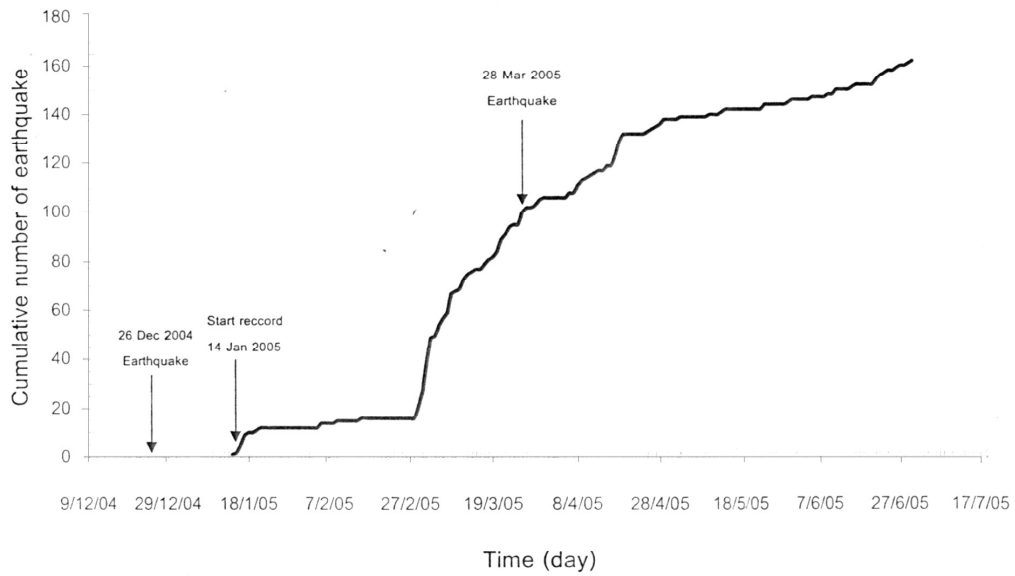
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การประชุมวิชาการเรื่อง "การจัดการภัยธรรมชาติ"

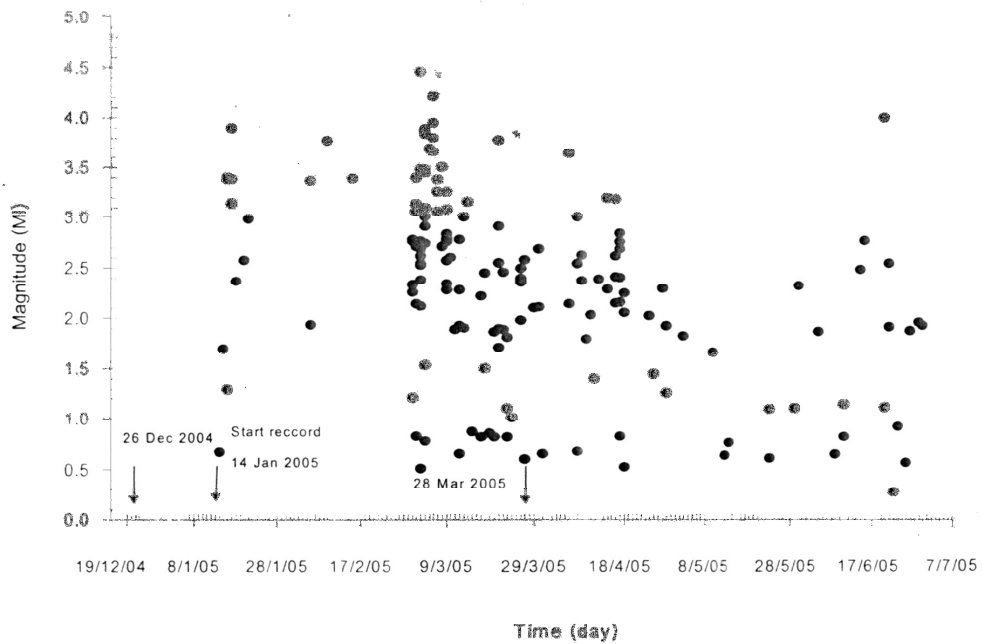
แผ่นดินไหวในภาคใต้ของประเทศไทย

26-28 ธันวาคม 2548 ณ โรงแรม รอยัลภูเก็ต ซิตี้ จังหวัดภูเก็ต

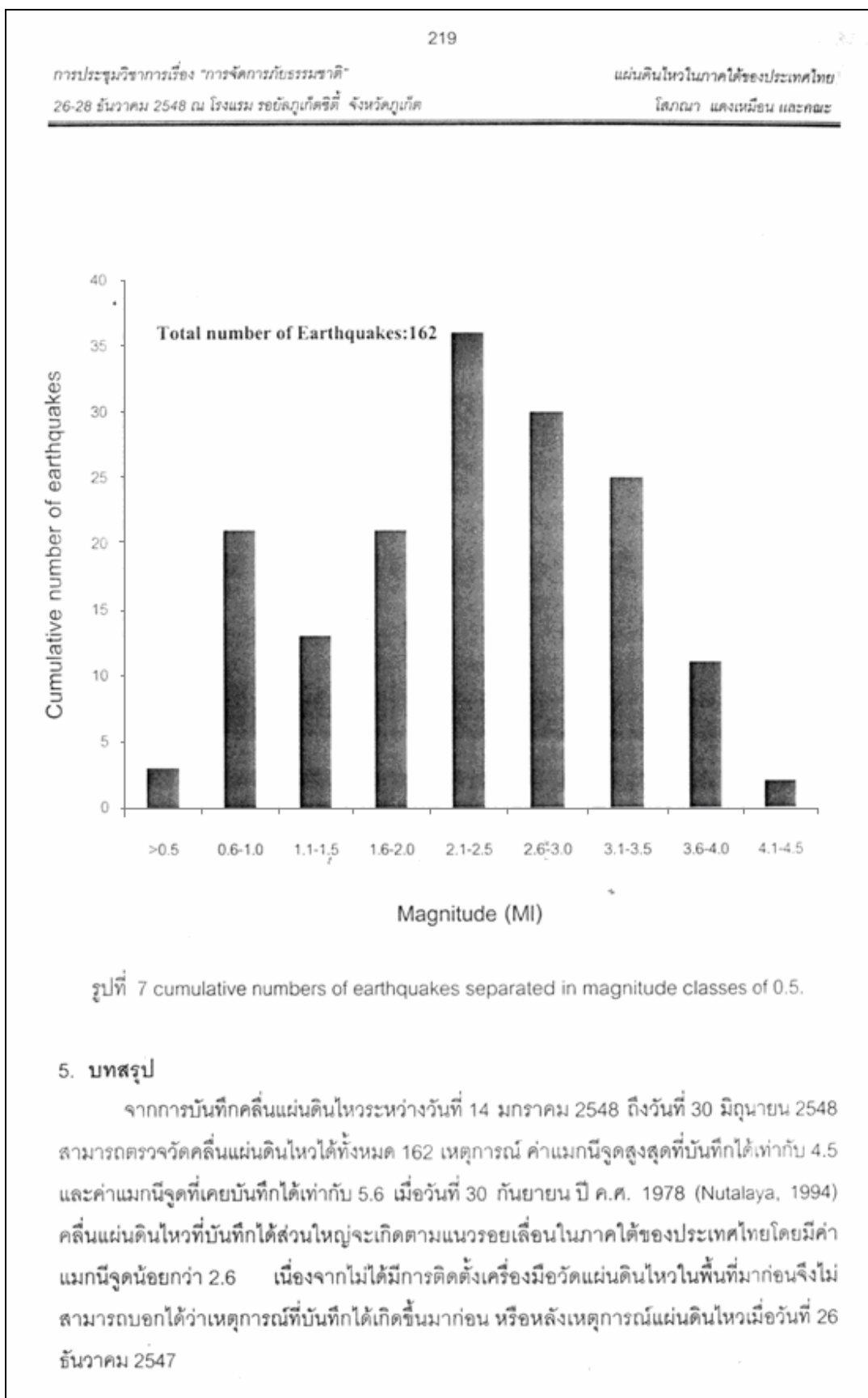
โสภณา แดงเหมือน และคณะ

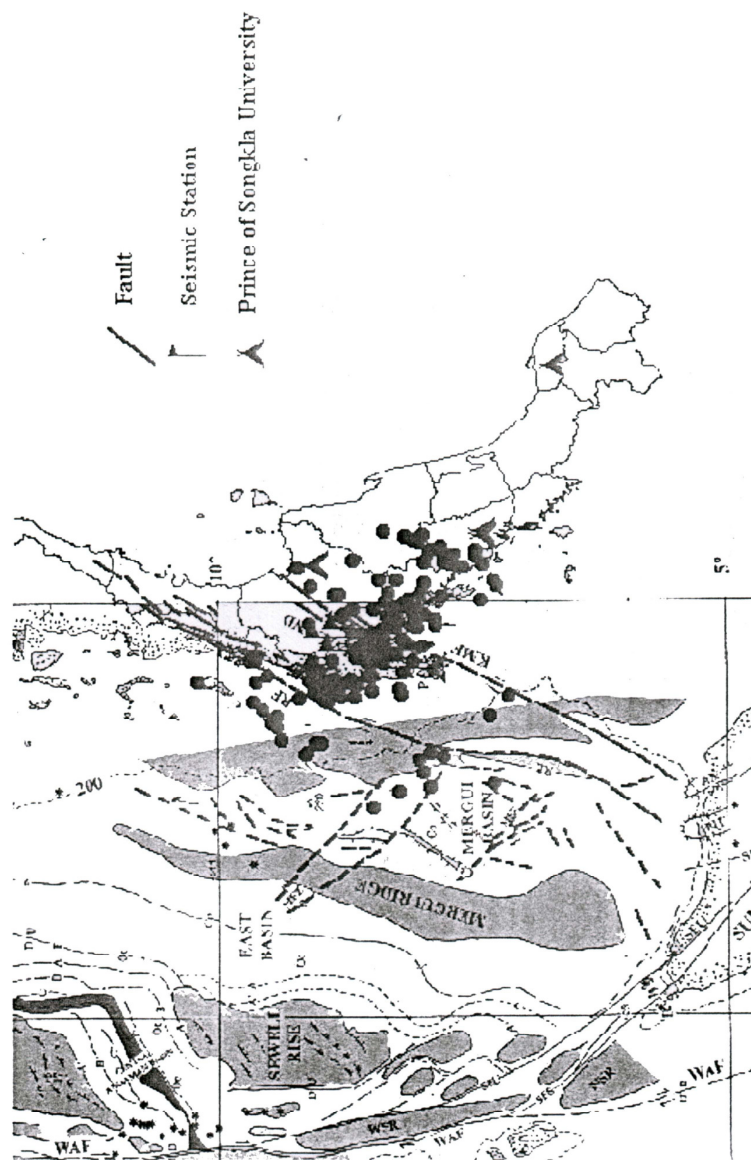


รูปที่ 5 Cumulative numbers of earthquakes versus time since 14th January 2005 to 30th June 2005



รูปที่ 6 Magnitude versus time from 14th January 2005 to 30th June 2005

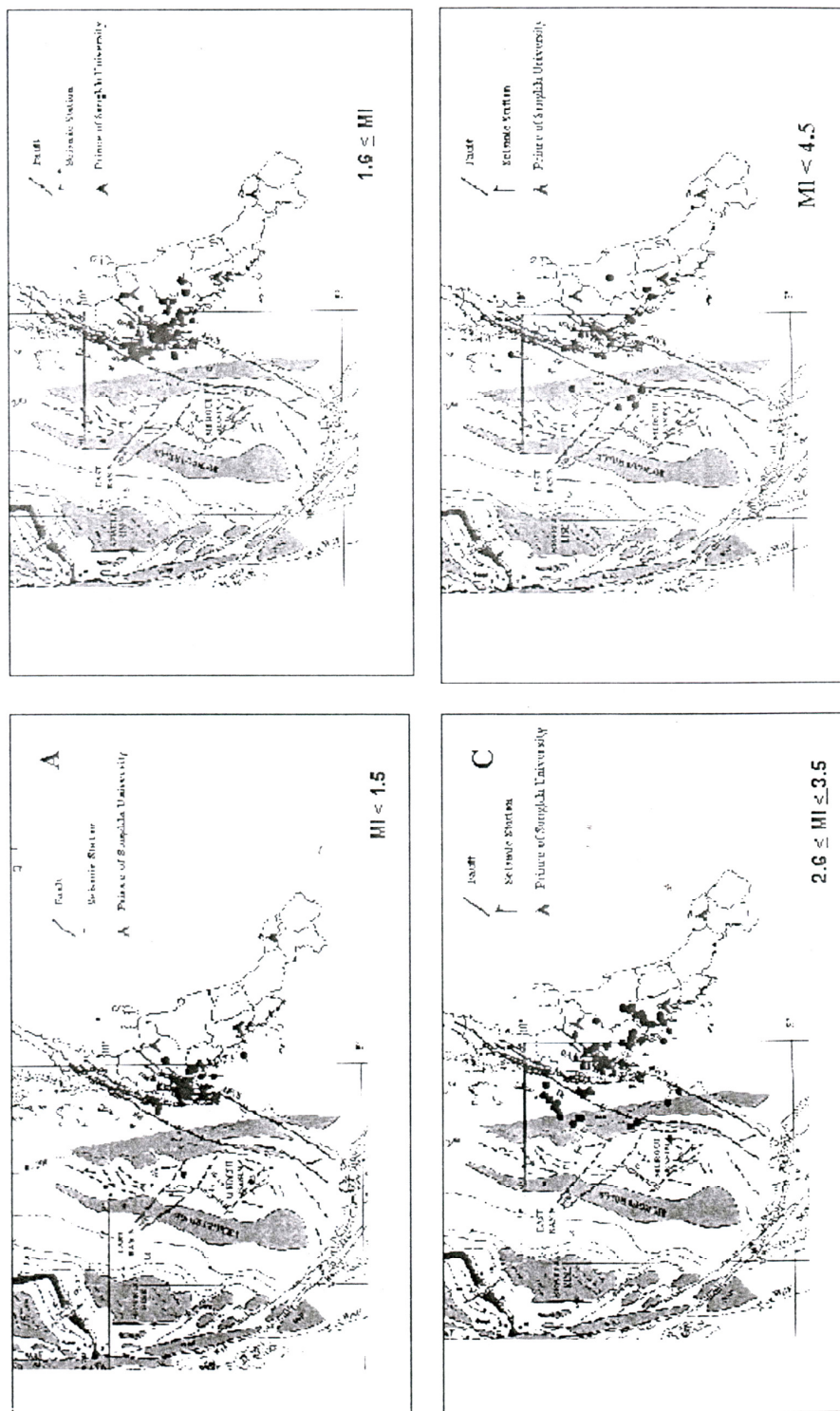




รูปที่ 8 Epicenter of earthquakes along Klong Marui Fault Zone, Ranong Fault Zone and other fault zones oriented parallel NE-SW direction. (Curray, 2005; some fault location from Figure 2)

การประชุมวิชาการเรื่อง "การจัดการภัยธรรมชาติ"
 26-28 ธันวาคม 2548 ณ โรงแรม รอยัลภูเก็ตซิตี้ จังหวัดภูเก็ต

แผ่นดินไหวในภาคใต้ของประเทศไทย
 โสภณา แดงเหมือน และคณะ



รูปที่ 9 Epicenter of earthquakes; A: $MI < 0.5$, B: $0.6 \leq MI < 2.5$, C: $2.6 \leq MI \leq 3.5$, D: $MI < 4.5$
 (map from Curray, 2005; some fault locations from Figure 2)

การตรวจวัดและบันทึกเหตุการณ์แผ่นดินไหวบริเวณรอยเลื่อนทางภาคใต้ของประเทศไทยสามารถพัฒนาไปสู่การทำแผนที่พื้นที่เสี่ยงภัยแผ่นดินไหวได้ในอนาคต และพัฒนาไปสู่ผลกระทบที่จะเกิดขึ้นกับผู้คน และสิ่งก่อสร้างในบริเวณนั้น จึงมีความจำเป็นอย่างยิ่งที่จะต้องทำการตรวจวัดและบันทึกเหตุการณ์แผ่นดินไหวในบริเวณนั้นต่อไป

6. กิตติกรรมประกาศ

ขอขอบคุณ มหาวิทยาลัยสงขลานครินทร์ และบัณฑิตวิทยาลัย สำหรับการสนับสนุนด้านเงินทุนวิจัย กรมทรัพยากรธรณีสำหรับการสนับสนุนด้านข้อมูลธรณีวิทยาและงานธรณีวิทยาในสนาม การประสานงานและการอำนวยความสะดวกในการเข้าพื้นที่ การจัดเตรียมพื้นที่ และการติดตั้งโครงสร้างพื้นฐานเพื่อวางเครื่องมือตรวจวัดคลื่นแผ่นดินไหวในเขตจังหวัดภูเก็ต พังงา และกระบี่ ขอขอบคุณองค์การโทรศัพท์แห่งประเทศไทย จังหวัดพังงา อุทยานแห่งชาติธารโบกขรณี อำเภออ่าวลึก จังหวัดกระบี่ และ ผู้ใหญ่บ้านและผู้ช่วยผู้ใหญ่บ้าน หมู่ที่ 8 ตำบลโคกเจริญ อำเภอทับปุด จังหวัดพังงา ศูนย์อุตุนิยมวิทยาภาคใต้ฝั่งตะวันตก และศูนย์อุตุนิยมวิทยาภาคใต้ฝั่งตะวันออก สำหรับการให้ความอนุเคราะห์ใช้พื้นที่ในการติดตั้งเครื่องมือตรวจวัดคลื่นแผ่นดินไหว และขอขอบคุณภาควิชาฟิสิกส์ คณะวิทยาศาสตร์ และสถาบัน International Science Programme (ISP) มหาวิทยาลัย Uppsala ประเทศสวีเดน สำหรับการสนับสนุนด้านเครื่องมือตรวจวัดคลื่นแผ่นดินไหวทั้งระบบ และยานพาหนะ

ขอขอบคุณ คุณสุวิทย์ โคสุวรรณ คุณสมชาย รุจาจรัสวงศ์ คุณประชา คุดติกุล คุณนพรัตน์ บุญกันภัย และทีมงานของกรมทรัพยากรธรณีทุกท่าน สำหรับงานธรณีวิทยาในสนามและการอำนวยความสะดวกทุกอย่าง ครูชำนาญการสมยศ วิชชุวัลญญ์ คุณเจริญพงษ์ ทั้งแก้วขาว คุณปราโมทย์ ย่องตีบ และนักศึกษาปริญญาโทและปริญญาตรีหลักสูตรฟิสิกส์และธรณีฟิสิกส์ มหาวิทยาลัยสงขลานครินทร์ สำหรับงานธรณีฟิสิกส์ในสนาม

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กรมทรัพยากรธรณี. 2544. ธรณีวิทยาประเทศไทยฉบับเฉลิมพระเกียรติพระบาทสมเด็จพระเจ้า

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**First European Conference on Earthquake Engineering and Seismology. 3-8
September 2006, Geneva, Switzerland**

**SEISMICITY OF SOUTHERN THAILAND AFTER THE 26
DECEMBER 2004 ANDAMAN SUMATRA EARTHQUAKE**

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After the magnitude 9.3 Andaman Sumatra Earthquake on 26 December 2004 and the subsequent aftershocks questions emerged about the impact of this major earthquake on fault zones in Southern Thailand, especially Klong Mauri (KMF) and Ranong Fault Zone (RFZ).

In January 2005 the Geophysics Group installed short period seismographs in the provinces of Phuket, Krabi, PhangNga to monitor the seismicity. Over a period of about six months 157 earthquakes with $M_l < 2.5$ were recorded in an area between longitude 7.25 N to 10.12 N and latitude 97.26 E to 99.69 E. Several of these earthquakes are aligned parallel to the NE-SW trending fault zones, KMF and RFZ, indicating that they were seismically active; others occurred in clusters.

Before the 26 Dec 2004 earthquake the subduction zone in the Andaman area was locked and subsequently the Eurasian Plate with Thailand was moving towards East. The major earthquake unlocked this part of the subduction zone and lead to crustal deformation. This resulted to a westwards movement of the general Eurasian Plate in this region, documented by GPS measurements (Vigny et al, 2005).

However, the greater area around Phuket and PhangNga showed significantly higher movement rates to the West than areas further North or South. A possible explanation is that the existing faults in the Thai peninsula were activated by the crustal deformation of the 26 Dec 2004 earthquake resulting in a differential movement towards the West. Further, the crust in the area in between the activated faults experienced extensional forces through this differential movement, resulting in cluster like earthquake occurrences.

Vigny, C., Simons, W.J.F., Abu, S., Bamphenyu, R., Satirapod, C., Hoosakul, N., Subarya, C., Socquet, A., Omar, K., Abidin, H.Z. and Ambrosius, A.A.C., 2005 Insight into the 2004 Sumatra-Andaman earthquake from GPS measurements in Southeast Asia. *Nature*, Vol. 436, 201-206.

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O0212

**SEISMICITY OF SOUTHERN THAILAND AFTER THE 26 DECEMBER 2004
ANDAMAN SUMATRA EARTHQUAKE**

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After the magnitude Mw 9.3 Andaman Sumatra Earthquake on 26 December 2004 and the subsequent aftershocks questions emerged about the impact of this major earthquake on fault zones in Southern Thailand, especially Klong Mauri (KMF) and Ranong Fault Zone (RFZ). In January 2005 the Geophysics Group installed short period seismographs in the provinces of Phuket, Krabi, PhangNga to monitor the seismicity in this region. Over a period of about six months 157 earthquakes with $M_l < 2.5$ were recorded in an area between longitude 7.25 N to 10.12 N and latitude 97.26 E to 99.69 E. Several of these earthquakes are aligned parallel to the NE-SW trending fault zones, KMF and RFZ, indicating that they were seismically active; others occurred in clusters. Before the 26 December 2004 earthquake the subduction zone in the Andaman area was locked and subsequently the Eurasian Plate with Thailand was moving towards East. The major earthquake unlocked this part of the subduction zone and lead to crustal deformation. This resulted to a westwards movement of the general Eurasian Plate in this region, documented by GPS measurements (Vigny et al, 2005). However, the greater area around Phuket and PhangNga showed significantly higher movement rates to the West than areas further North or South. A possible explanation is that the existing faults in the Thai peninsula were activated by the crustal deformation of the 26 December 2004 earthquake resulting in a differential movement towards the West. Further, the crust in the area in between the activated faults experienced extensional forces through this differential movement, resulting in cluster like earthquake occurrences.

Reference: Vigny, C., Simons, W.J.F., Abu. S., Bamphenyu, R., Satirapod, C., Hoosakul, N., Subarya, C., Socquet, A., Omar, K., Abidin, H.Z, and Ambrosius, A.A.C., 2005 Insight into the 2004 Sumatra-Andaman earthquake from GPS measurements in Southeast Asia. *Nature*, Vol. 436, 201-206.

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O0213

**ADDRESSING THE POTENTIAL AND HAZARD FROM RESERVOIR-
TRIGGERED SEISMICITY IN THAILAND**

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KHLONG MARUI AND RANONG FAULT ZONES IN SOUTHERN THAILAND RE-ACTIVATED BY THE 26 DECEMBER 2004 MW 9.3 SUMATRA-ANDAMAN EARTHQUAKE?

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INTRODUCTION

The Mw 9.3 Sumatra-Andaman Earthquake occurred at 00:58:53 UTC (07:58:53 Thai time) on 26 December 2004 at 3.316°N and 95.854°E off the West coast of Northern Sumatra, Indonesia. The earthquake triggered a series of devastating tsunamis that spread throughout the Indian Ocean, killing people and inundating coastal communities across South and Southeast Asia, including parts of Indonesia, Sri Lanka, India, and Thailand. The United States Geological Survey reported the death toll more than 243,000 people, 14,100 missing, and 1,126,900 people displaced (USGS, 2005).

The earthquake occurred at the interface of the Indian and Burma Plate, a small plate south of the Eurasian Plate (Curry, 2005). According to the USGS report, this earthquake was caused by the release of stresses that develop as the India plate subducts beneath the overriding Burma plate. A sudden uplift of parts of the ocean bottom started the tsunami with devastating effects to Thailand west coast. The trench is the surface expression of the plate interface between the Australian and India Plate.

The Indian Plate is moving 61 mm per year in NNE direction relatively to the Burma Plate. This is part of the overall movement of the Indian plate northwards resulting in the collision with the Eurasian Plate and the formation of the Himalaya mountain range, and the Tibetan Plateau (USGS, 2005). The collision resulted in a mechanical overbalance of the area forcing the mass of the Southeast Asian area moving in southeast direction, associated with several major and minor fault and fault related structures.

In Southern Thailand, there are a series of faults, mainly the Ranong and Khlong Marui Fault Zones, which were so far identified as dormant by the Department of Mineral Resources (DMR). However, the 26 December 2004 Earthquake caused concerns among people and governmental agencies for possible (re)activation of these and other fault zones in Southern Thailand.

Shortly after the devastating earthquake, the Geophysics Research Group in the Department of

Physics at the Faculty of Science, Prince of Songkla University established in collaboration with the Department of Mineral Resources a seismic network in Southern Thailand in order to monitor possible earthquakes along the Ranong and Khlong Marui Fault Zones.

ESTABLISHMENT OF A SEISMIC NETWORK IN SOUTHERN THAILAND

In the end of December 2004, members and graduate students of the Geophysics Research Group went to Phang Nga, Krabi and Phuket provinces to set up a network of altogether four short-period, three-component seismometers. At that time, one station already existed on the Phuket Campus of the Prince of Songkla University in Khatu District. The site selection for the other three stations was done together with geologists from the Department of Mineral Resources, as the seismometers preferable should be located on hardrock in order to get high quality data. Two locations in Phang Nga and one location in Krabi were chosen for the seismic stations (Table 1).

Table 1: Locations of the short-period seismometer.

Station	Latitude	Longitude	Location
Station 1	98°30'E	8°26'N	near telecommunication station, Muang District, Phang Nga Province
Station 2	98°39'E	8°33'N	in Thap Put District, Phang Nga Province
Station 3	98°21'E	7°53'N	Prince of Songkla University, Phuket Campus, Khatu District, Phuket Province
Station 4	98°44'E	8°23'N	Tanbokkarae National Park, Ao Luek District, Krabi Province

where the data had to be transferred every two weeks to a computer. Therefore, members of the Geophysics Research Group had to visit all stations

every two weeks. Local residents nearby provided power for the equipment and looked after the station for safety reasons. Figure 1a shows a schematic diagram of Station 2 in Phang Nga Province and a

photo from the inside (Fig. 1b). The short-period seismic network was fully operating for nearly six months.

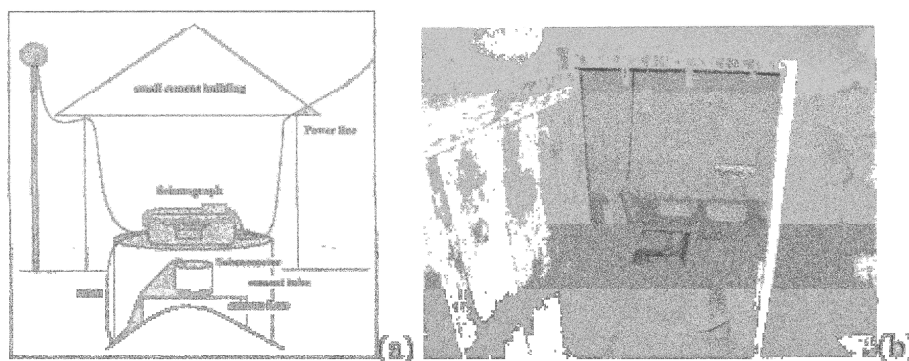


Figure 1: (a) Schematic diagram of the seismic station, with the seismometer covered by a concrete tube and the seismometer inside a small house. (b) Photo from the inside showing the seismograph sitting on the cover of the cement tube which is hosting the seismometer, see (a).

SEISMICITY IN SOUTHERN THAILAND AFTER THE 26 DECEMBER, 2004 EARTHQUAKE

From January 14 to June 30, 2005, the short-period seismic network of the Geophysics Research Group in Southern Thailand detected 210 local

earthquakes. They occurred in areas between 7.25°N and 10.12°N longitude and 97.26°E to 99.69°E latitude, with the local magnitude (MI) ranging from -1.4 to 2.2 Richter scale ($-1.4 < M_L < 2.2$). Figure 2 shows the distribution of the earthquakes in relation to the magnitude.

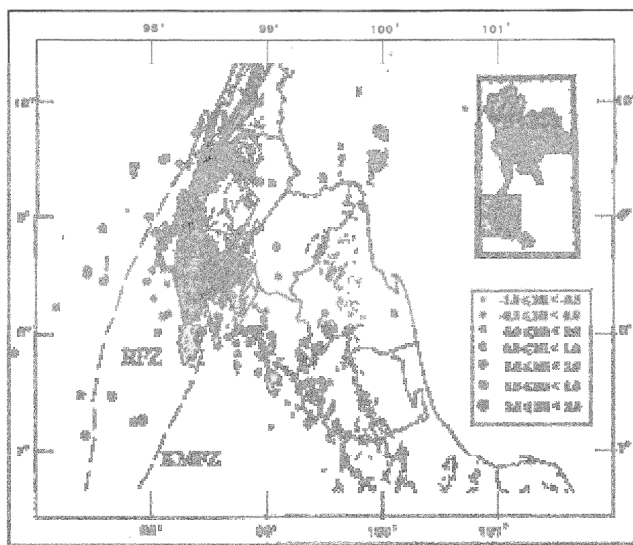


Figure 2: Earthquake locations in Southern Thailand in relation to their local magnitude (MI, in classes of 0.5) determined from 14 January to 30 June 2005. The known faults and fault zones (RFZ), KMFZ - Khlung Maevo Fault Zone, RPFZ - Rungyai Fault Zone.

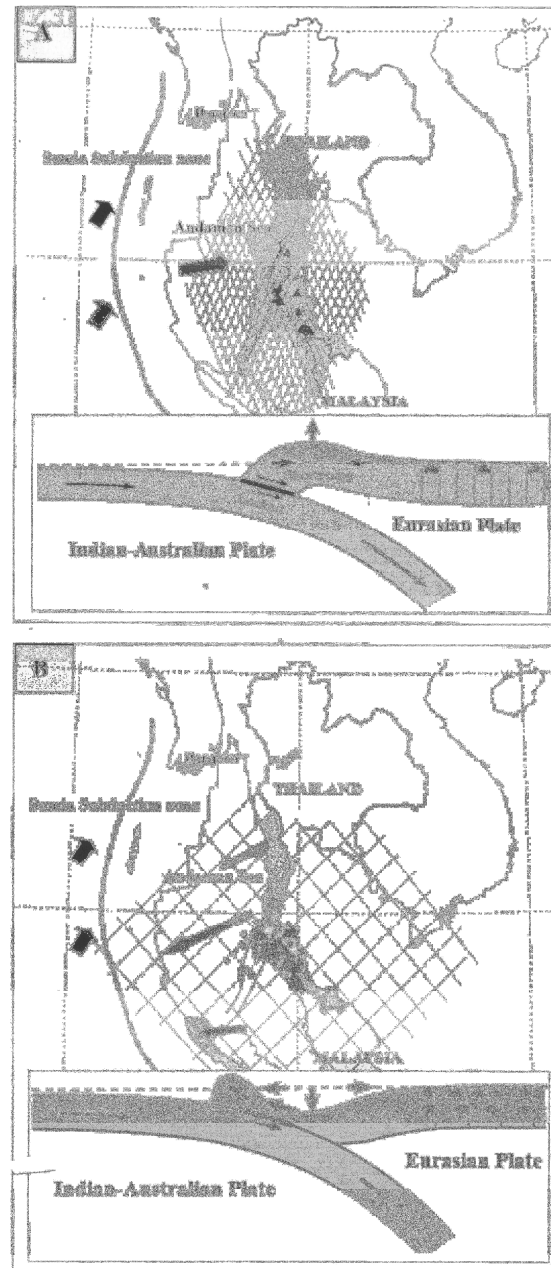


Figure 3: Schematic drawings of the geodynamic situation in Andaman Sea and Southern Thailand before (A) and during/after the 26 December 2004 Earthquake (B). The Indian-Australian and the Eurasian Plates with the smaller Burma Plate (not shown here) were locked and both moved to the East (A), resulting in a compressional state of the Burma Plate (close spaced shading). Some shallow (closed triangles) and earthquakes (closed circles) occurred in Southern Thailand. With and after the 26 December Earthquake (B) both plates were unlocked. The Eurasian Plate moved to the West. This caused an extension or crustal dilation in the Eurasian Plate (larger spaced shading) with an increase in shocks and earthquake occurrences. The lower figures in (A) and (B) are adopted from Hyndman and Wang 1993.

GEODYNAMIC SITUATION BEFORE AND AFTER THE 26 DECEMBER 2004 EARTHQUAKE

The analysis of the earthquake locations in figure 2 reveals that some earthquakes might follow a linear trend indicating that they generated by fault movement, as others do not show this kind of trend. The occurrence of these earthquakes in Southern Thailand can be directly linked with the movement of the Burma Plate during and after the 26 December 2004 Sumatra-Andaman Earthquake.

Before this major earthquake, the Indian and the Burma Plate were locked and the Indian Plate pushed the Burma Plate to the East, consequently both plates moved to the East. The 26 December 2004 Earthquake unlocked the plates and as a result, the Burma Plate moved to the West, while the Indian Plate still moved to the East, and still moving today. The stress relief and the West movement of the Burma Plate caused an expansion of the plate back and consequently the re-activation or activation of existing faults and fault zones, as observed in Southern Thailand and shown here. The GRACE gravity satellites also observed this expansion, respectively crustal dilatation, of the Burma Plate (Han et al., 2006).

Therefore, the earthquakes measured between 14 January and 30 June, 2005 occurred in an extensional stress regime, not in a compressional one, which explains their low magnitudes. After the 26 December 2004 Earthquake, there was a stress relief and not a stress build-up in the Burma Plate. The increased number of earthquakes also can be explained by the dilation.

The earthquake data are constrained by Global Positioning System (GPS) measurements at a Phuket site (Vigny et al., 2005). As the 26 December 2004 Earthquake caused a major movement of the Phuket site to the West, an increase in the earthquake activities in Southern Thailand could be also observed. However, the 28 March 2005 Earthquake did not cause any major movement of the Phuket site, and consequently there was not a significant increase of the earthquake activities in Southern Thailand (Dangman et al., 2006).

The ongoing GPS measurements will reveal that at one time, the Burma and Indian Plate will be locked again and consequently the Burma Plate then will be pushed back again to the Eastern direction as before the 26 December 2004 Earthquake. This will change the stress situation in the Burma Plate from extensional to compressional again. As a result, the existing fault zones might be reactivated again, but then in a compressional stress regime, increasing the probability of higher magnitude earthquake in Southern Thailand.

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List of Publications and Proceeding

Duerrast, H., Dangmuan, S. and Lohawijarn, W. 2007. Khlong Marui and Ranong Fault Zones in Southern Thailand re-activated by the 26 December 2004 Mw 9.3 Sumatra-Andaman Earthquake?, In: Proceeding of the International Conference on Geology of Thailand: Towards Sustainable Development and Sufficiency Economy. 21-22 November 2007 Bangkok, Thailand, 141-144.

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