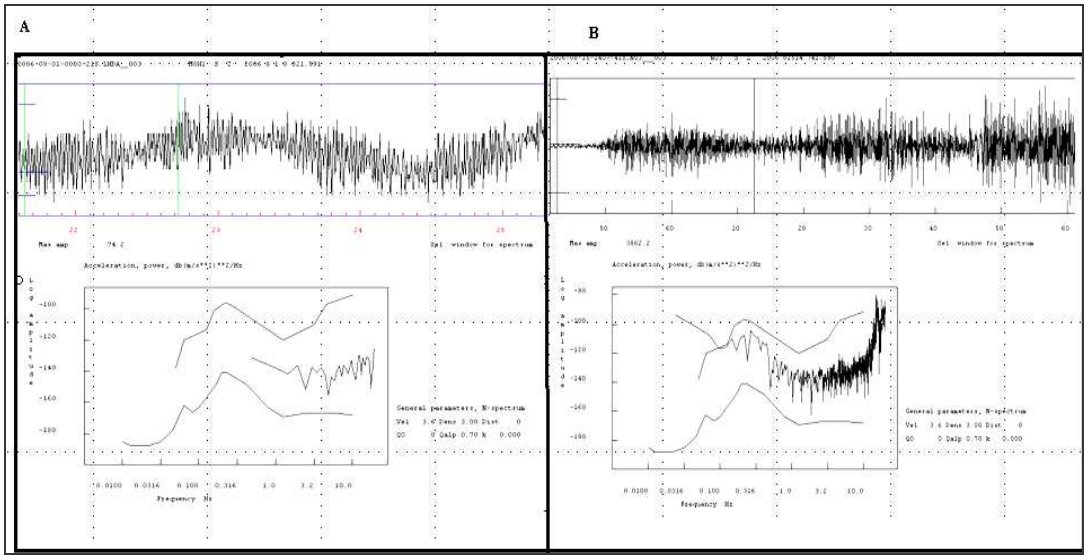
Appendix A: Station Non-operation chart

Operational statistics chart for the LHWP seismic stations from 2002 to 2006. Blank boxes mean stations were functional; L means stations were malfunctioning due to lightening, V due to vandalism, O/F means stations were on and off, N means stations were not functional due to other reasons and U means there are uncertainties in the causes of stations' failure.

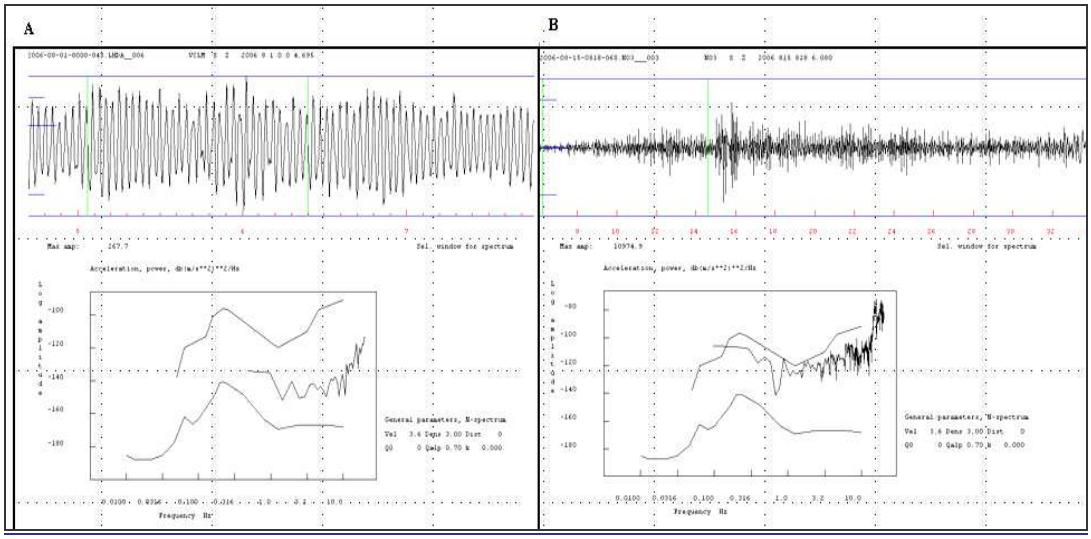
Period	KTS1	SOIK	SUAK	MAPK	MHUK	MOH1	MHLM	VCLM	MTBM	KPRM	RPKM
Jan-02											
Feb-02											
Mar-02											
Apr-02											
May-02											
Jun-02	N										
Jul-02											
Aug-02			N		N						
Sep-02											
Oct-02	N	N	N	N	N						
Nov-02											
Dec-02						L					V
Jan-03						N	N	N	N	N	V
Feb-03							N	U	U	N	
Mar-03							N	U	U	N	
Apr-03							N	U	U	N	
May-03											
Jun-03											
Jul-03											
Aug-03											
Sep-03			N		N		N				
Oct-03											
Nov-03			O/F		O/F	N	N				
Dec-03		U	O/F		N	N	N				
Jan-04	O/F		O/F		N	N	N				
Feb-04	O/F						N				
Mar-04							N				
Apr-04							N				
May-04		N	N		N	N	N				
Jun-04						N	N				

Jul-04					N		N					
Aug-04		N	N									
Sep-04												
Oct-04												
Nov-04												
Dec-04									N		N	
Jan-05												
Feb-05												
Mar-05												
Apr-05	N	N	N	N	N							
May-05	N	N	N	N	N	N	N	N	N	N		
Jun-05	N	N	N	N	N							
Jul-05			N	N	N		N					
Aug-05							N			N		
Sep-05	L	N			N							
Oct-05							N	N				
Nov-05							N					
Dec-05			N		N	N	N	L			O/F	
Jan-06			N									
Feb-06			N									
Mar-06	N	N	N	N	N	N	N			N		
Apr-06	N	N	N	N	N	N	N			N		
May-06	N	N	N	N	N	N	N			N		
Jun-06	N	N	N	N	N		N			N		
Jul-06	N	N	N	N	N		N			N		
Aug-06	N	N	N	N	N		N			N		
Sep-06	N	N	N	N	N	N	N	N	N	N		
Oct-06	N	N	N	N	N	N	N	N	N	N		
Nov-06	N	N	N	N	N		N			N		
Dec-06	N	N	N	N	N		N		N	N		

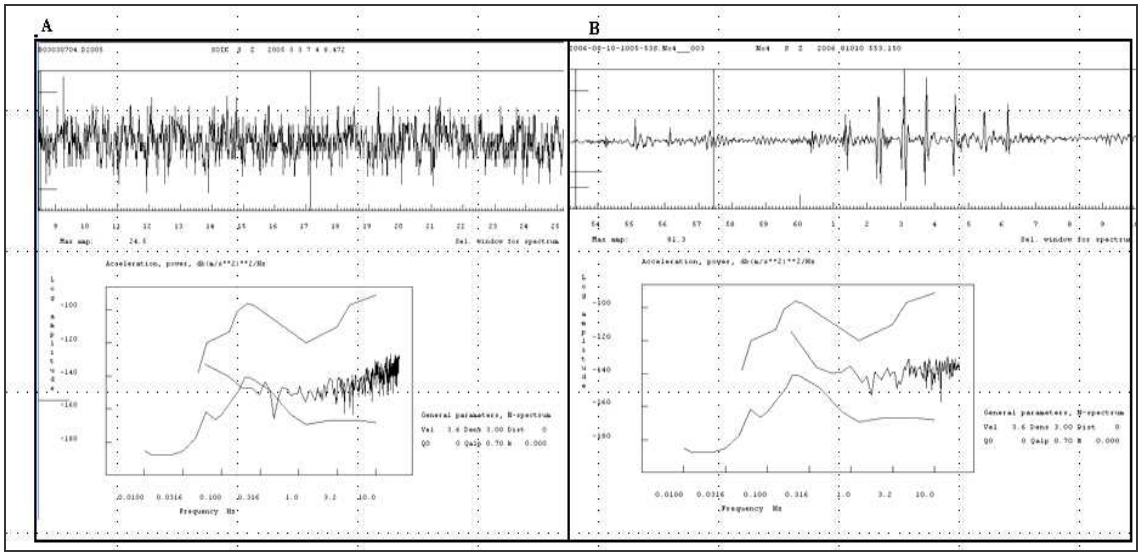
Appendix B: Noise Spectra Comparison



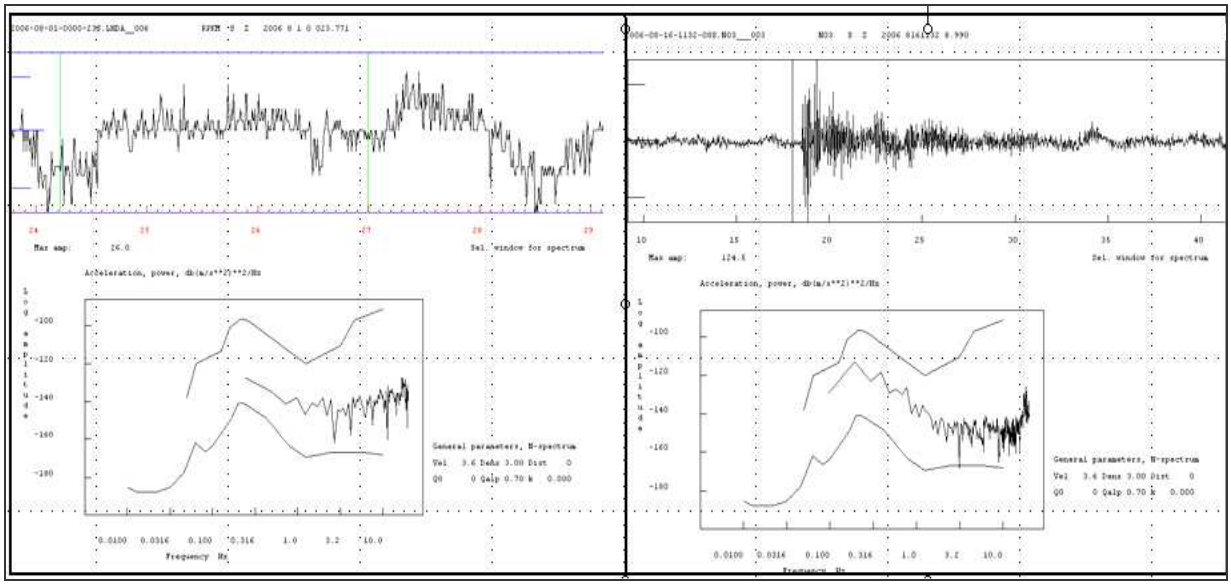
Noise spectra from the for station MOH1. A is the permanents station's signal and B is the GBV's signal



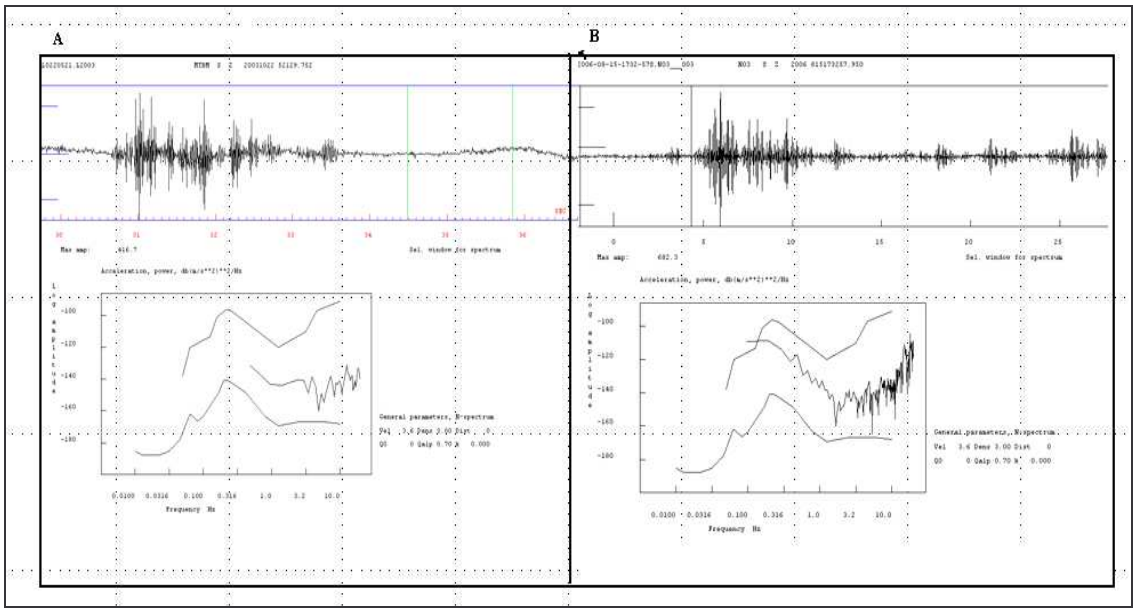
Noise Spectra from station VCLM. A is the permanent station's signal and B is the GBV'ssignal



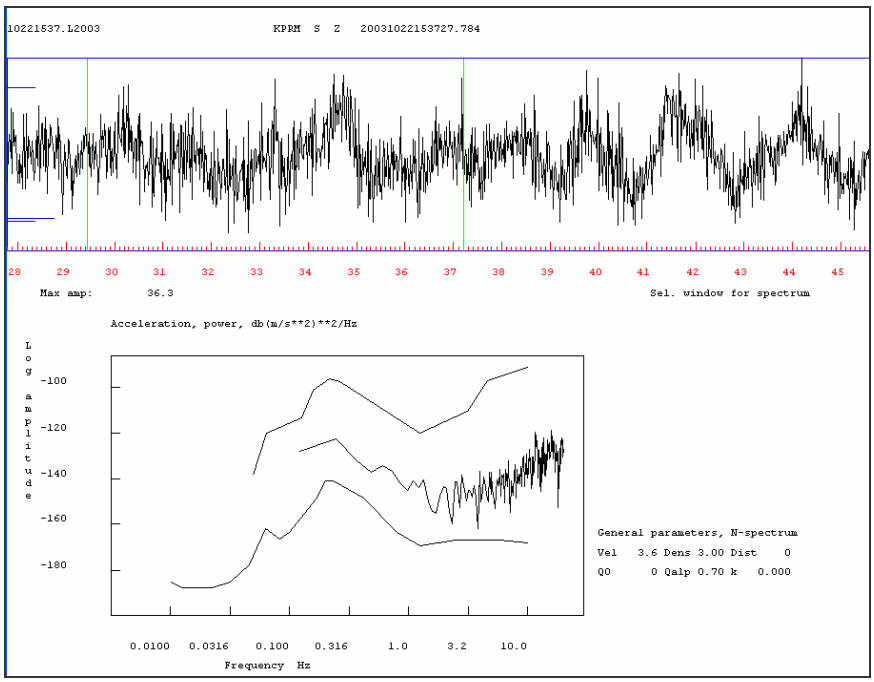
Noise Spectra from station SOIK. A is froma signal from the permanent station and B is a signal from the GBV.



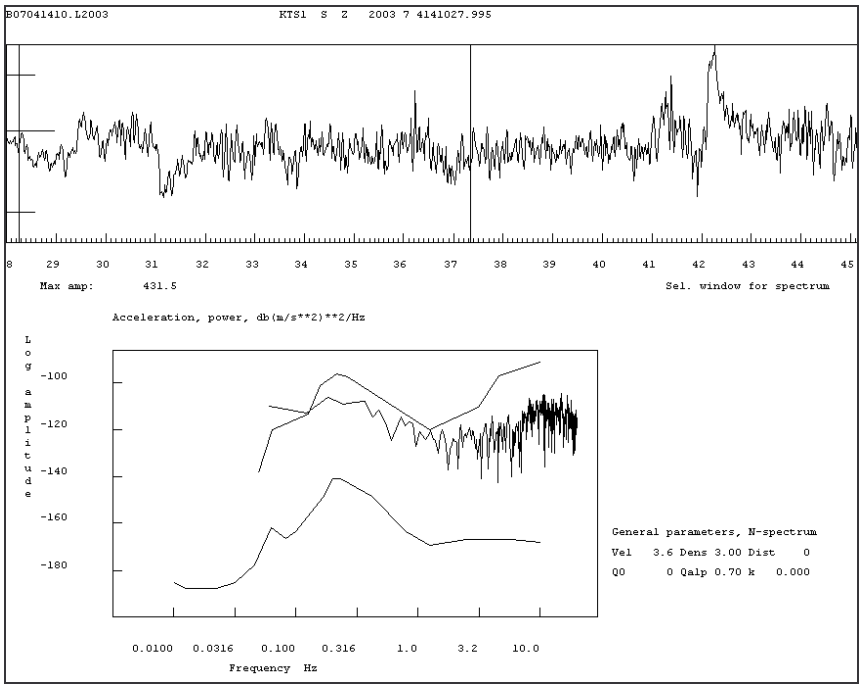
Noise Spectra for RPKM. A is signal from permanent station while B is signal from GBV.



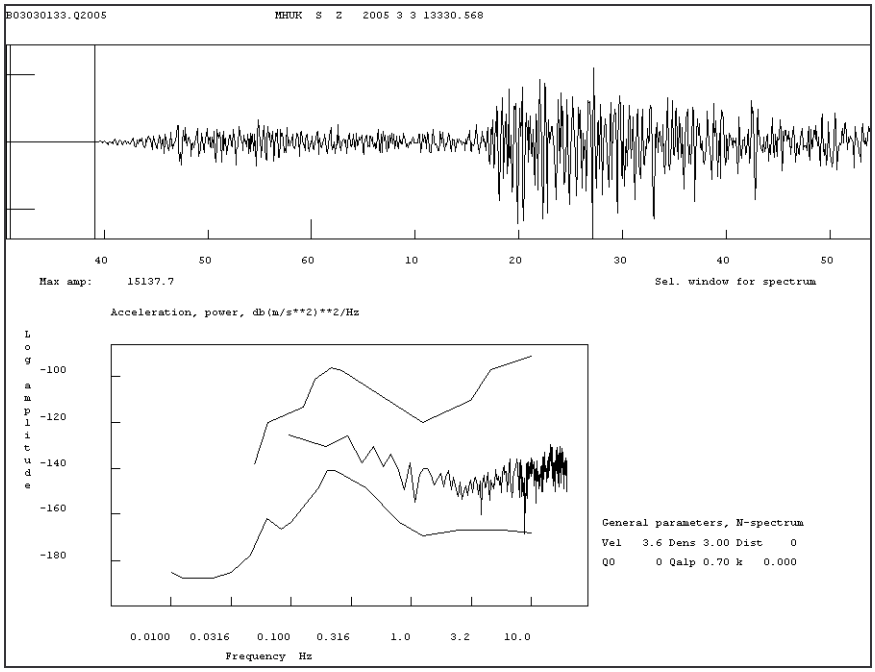
Noise spectra from MTBM. A is from permanent station and B is from GBV.



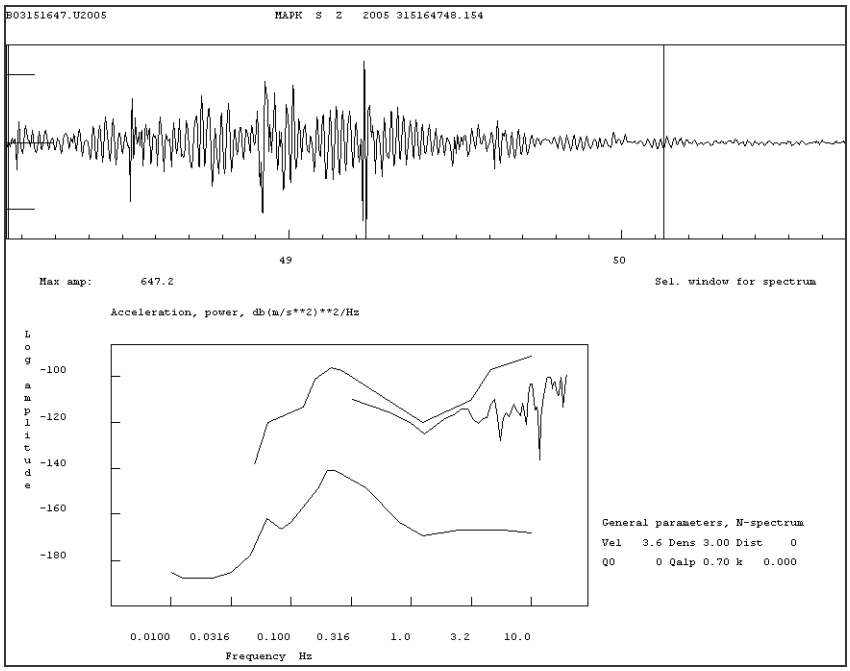
Noise Spectra from KPRM permanent station. No comparison was made for this station.



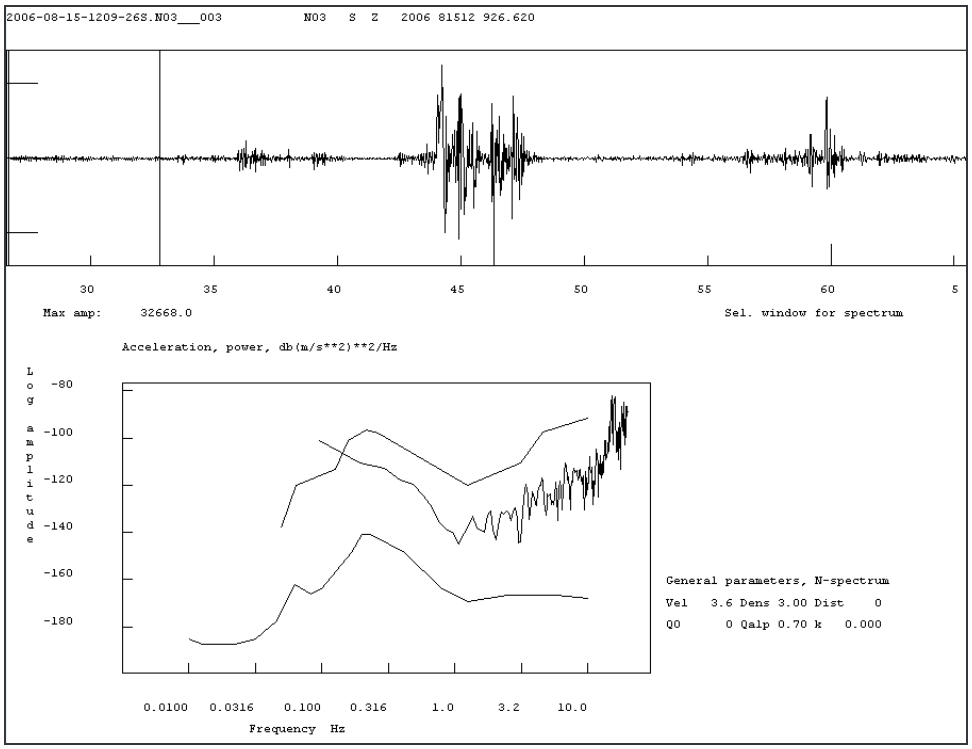
Noise Spectra for KTS. No comparison for this station.



Noise spectra from MHUK.



Noise spectra from MAPK permanent station



Noise from MHLM station recorded by the GBV.

Appendix C: Programs used

Compilation of catalogues and calculations of the seismic hazard are done by use of **SEISAN** software(Havskov, 2003). A brief description of the programs used and files yielded by using this software is given below.

SELECT

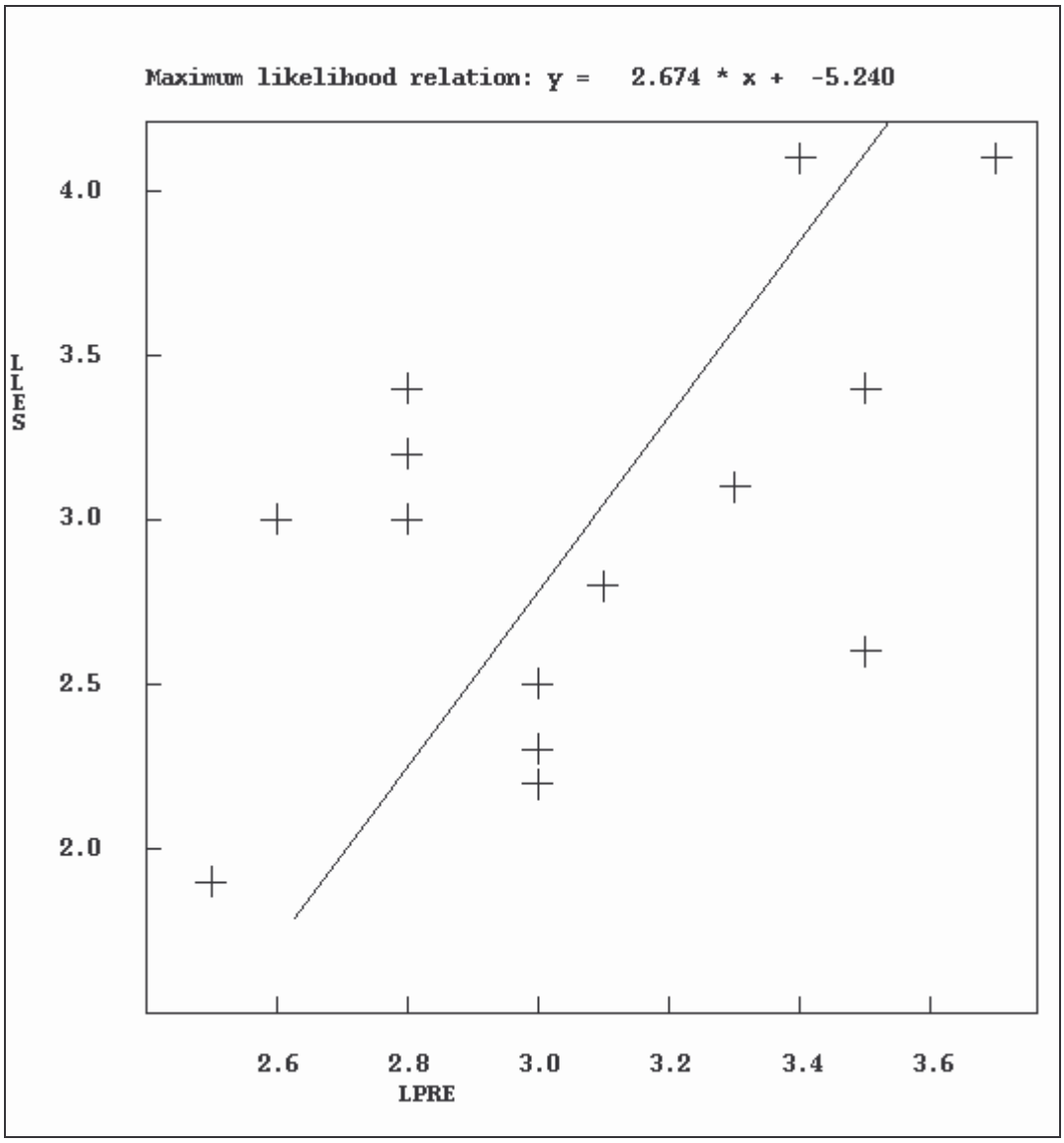
This program selects a subset of earthquake data according to a given criteria. Earthquakes were selected from all three databases mentioned in the thesis and put into one catalogue. First the LHWP data for the period 2002 to 2006 was re-analyzed and a database was created. The CGS data was split into two parts due to the fact that one data file is from 1620 to 1899 and the other from 1902 to 1971, then the ISC data, which is from 1904 to 2006 was merged. The LHWP data, which covers the period 1995 to 2001, was also merged and it can be seen that there was an overlap of data with the PDE. This overlap was dealt with by use of other programs whose descriptions will follow. The SELECT program produces a file; **select.out,** which contains the compiled catalogue which can be changed to a name of meaning to the analyst. It is then possible to specify the the particular details that one is interested in (e.g. an area in terms of coordinate limits, magnitude types, hypocenter agency etc)and work on that portion of data. As a result, this program is used several times during this thesis work.

SPLIT

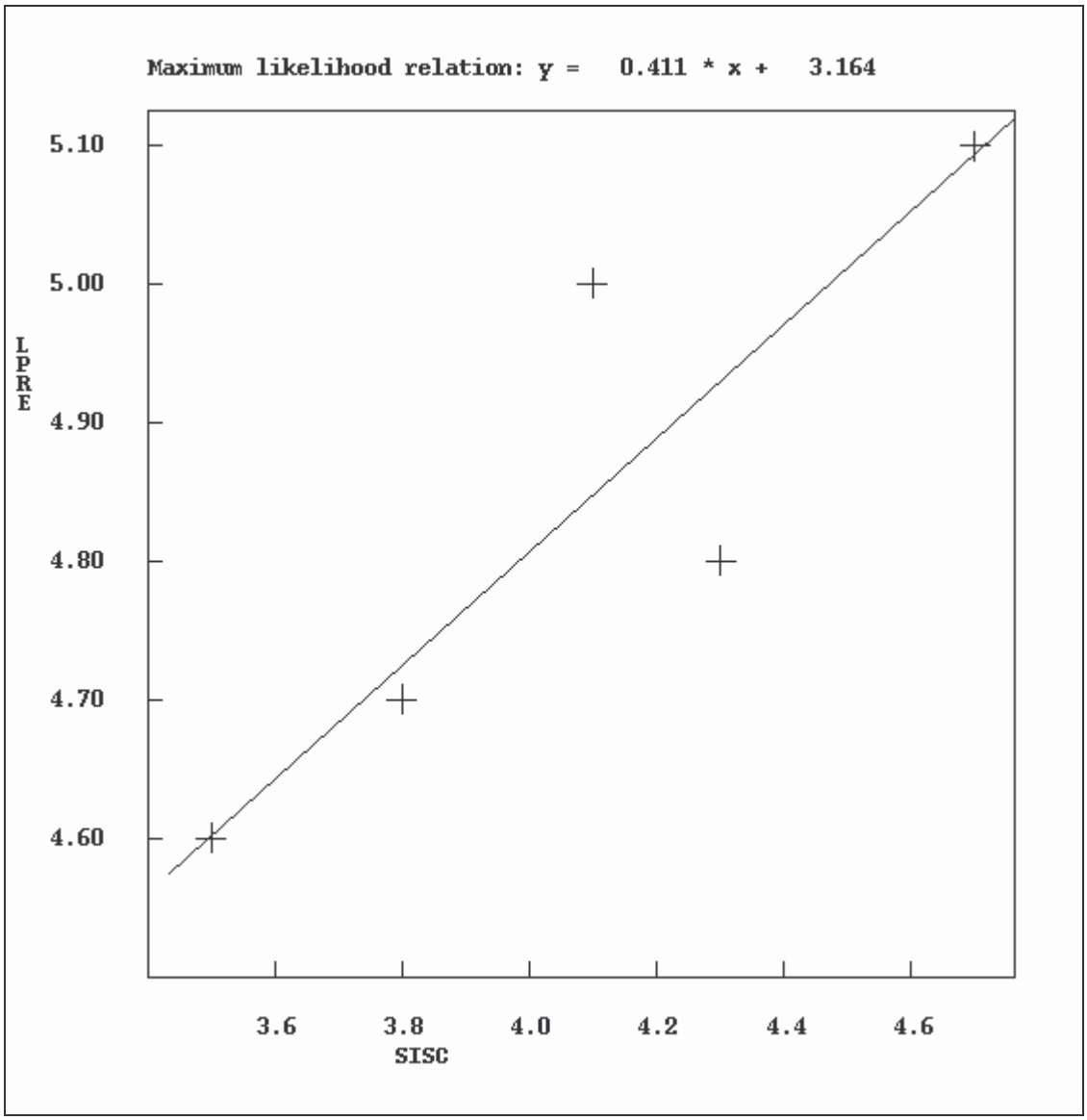
This is run together with **EEV** in order to create an alternative identity for duplicate events. In the case of events that overlapped, these programs were run and the duplicates were appended, by using option "**s**" which indicates which events are duplicates the an option "**a**" is used to associate/ append the event such that the event appears once in the

database. **SPLIT** is an important tool when merging catalogues. In a way the catalogue was “cleaned”.

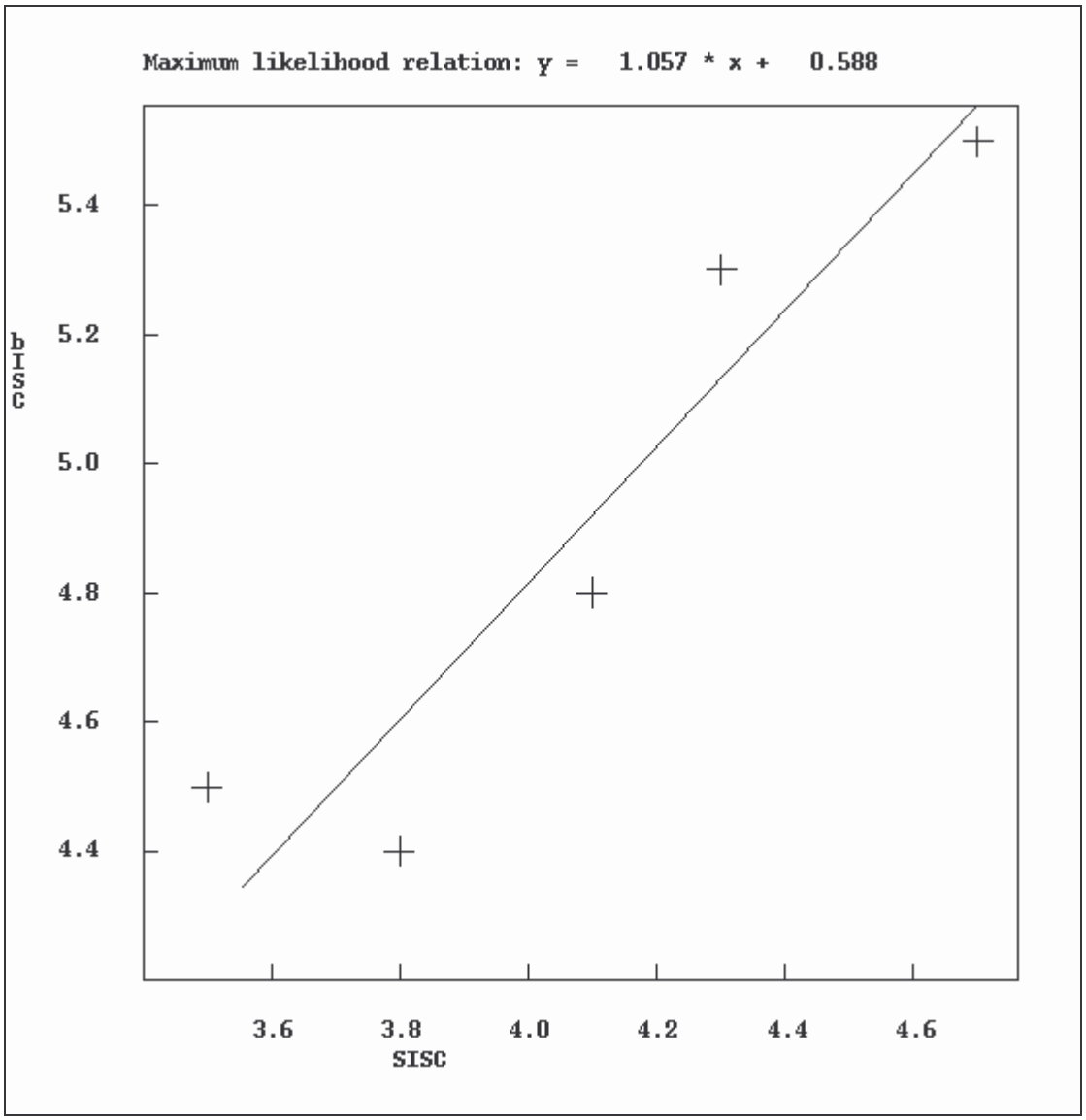
Appendix D: Impractical magnitude unification plots



Plot between M_L and M_W.



Plot between M_L and M_S



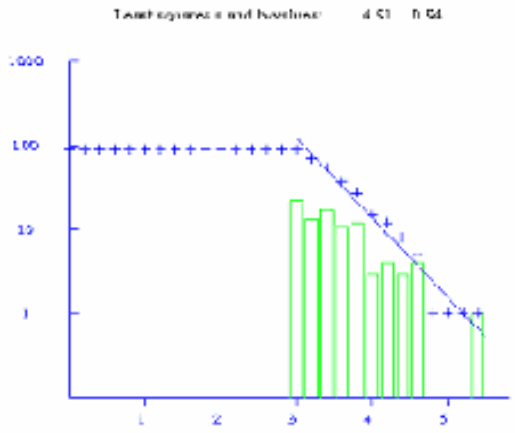
Plot of M_b and M_S

Appendix E: b-value plots

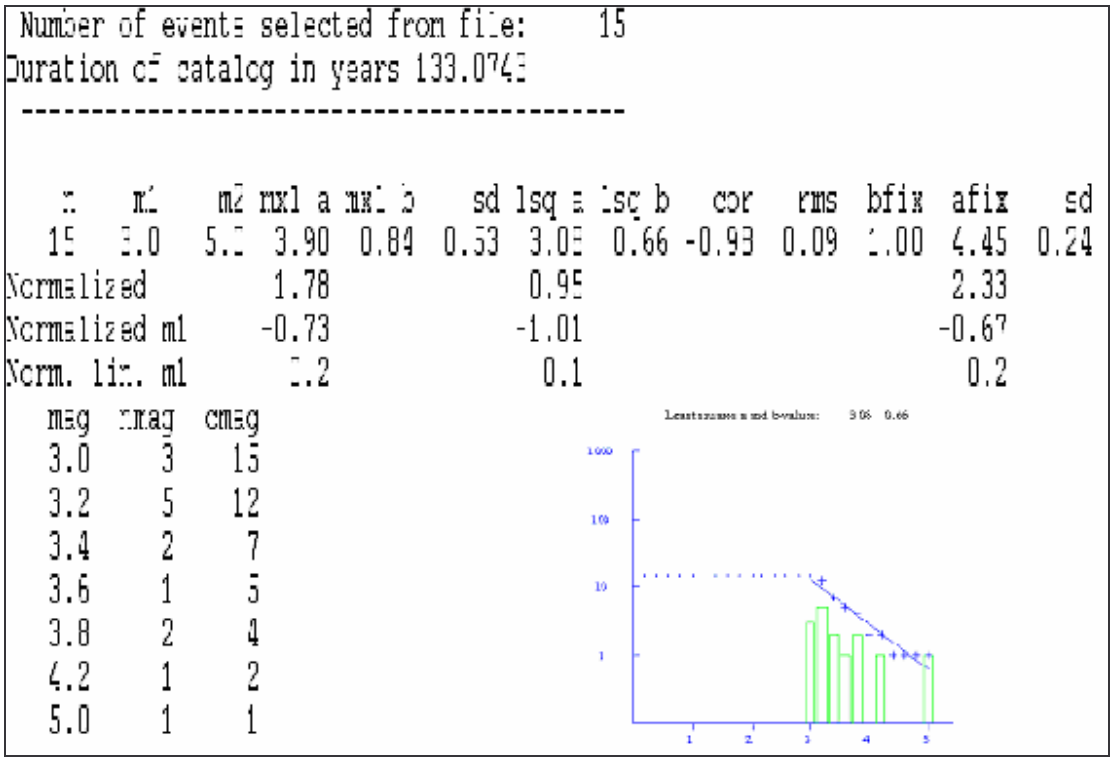
Number of events selected from file: 90
Duration of catalog in years 122.4159

n	m1	m2	mxl a	mxl b	sd	lsq a	lsq b	cor	rms	bfix	afix	sd
90	3.0	6.0	4.44	0.79	0.50	4.91	0.94	-0.97	0.15	1.00	5.15	0.16
Normalized			2.35			2.83					3.07	
Normalized m1			-0.03			0.00					0.07	
Norm. lin. m1			0.9			1.0					1.2	

mag	rmag	cmag
3.0	22	90
3.2	13	68
3.4	17	55
3.6	11	38
3.8	12	27
4.0	3	15
4.2	4	12
4.4	3	8
4.6	4	5
5.4	1	1



b-value parameters together with plot for Senqu zone.



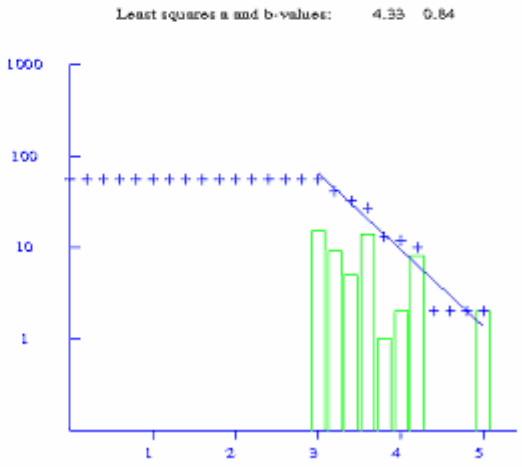
```
 Number of events selected from file:     15
Duration of catalog in years 133.0743
 ----------------------------------------


    n    m1    m2 mxl a mxl b    sd lsq a lsq b   cor   rms  bfix  afix    sd
   15   3.0   5.2  3.90  0.84  0.53  3.08  0.66 -0.93  0.09  1.00  4.45  0.24
Normalized        1.78          0.95                          2.33
Normalized m1    -0.73         -1.01                         -0.67
Norm. lim. m1     1.2           0.1                           0.2
   mag  nmag  cmag
   3.0     3    15
   3.2     5    12
   3.4     2     7
   3.6     1     5
   3.8     2     4
   4.2     1     2
   5.0     1     1
```

b-value parameters together with plot for North Lesotho.

```
 Number of events selected from file:      56
Duration of catalog in years 145.7927
 ----------------------------------------

    n     m1     m2  mxl a  mxl b     sd  lsq a  lsq b   cor    rms   bfix   afix     sd
   56    3.0    5.0   4.22   0.78   0.51   4.33   0.84 -0.96   0.14   1.00   4.97   0.18
Normalized          2.06                 2.17                               2.81
Normalized m1      -0.28                -0.35                              -0.19
Norm. lin. m1        0.5                  0.4                                0.6
   mag   nmag   cmag
   3.0     15     56
   3.2      9     41
   3.4      5     32
   3.6     14     27
   3.8      1     13
   4.0      2     12
   4.2      8     10
   5.0      2      2
```

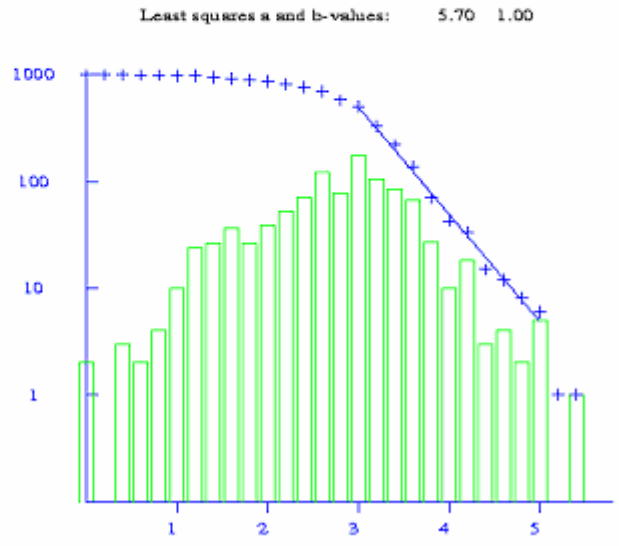


b-value parameters together with plot for Drakensberg zone

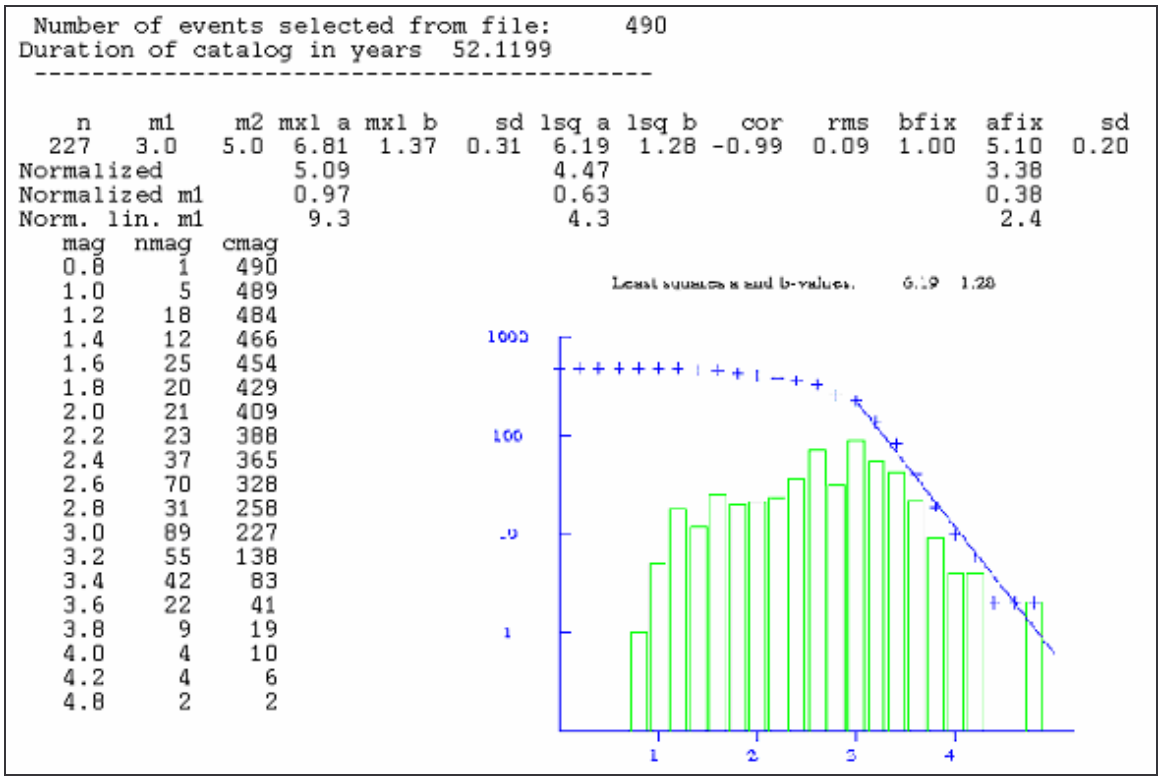
Number of events selected from file: 990
Duration of catalog in years 152.3636

n	m1	m2	mxl a	mxl b	sd	lsq a	lsq b	cor	rms	bfix	afix	sd
496	3.0	5.0	6.37	1.12	0.39	5.70	1.00	-1.00	0.05	1.00	5.69	0.05
Normalized			4.18			3.52					3.51	
Normalized m1			0.81			0.51					0.51	
Norm. lin. m1			6.5			3.3					3.2	

mag	nmag	cmag
0.0	2	990
0.4	3	988
0.6	2	985
0.8	4	983
1.0	10	979
1.2	24	969
1.4	26	945
1.6	36	919
1.8	26	883
2.0	39	857
2.2	53	818
2.4	70	765
2.6	120	695
2.8	77	575
3.0	172	498
3.2	106	326
3.4	84	220
3.6	66	136
3.8	27	70
4.0	10	43
4.2	18	33
4.4	3	15
4.6	4	12
4.8	2	8
5.0	5	6
5.4	1	1



b-value parameters together with plot for Study region.



```
 Number of events selected from file:     490
Duration of catalog in years  52.1199
 ------------------------------------------

    n     m1     m2 mxl a mxl b     sd lsq a lsq b    cor    rms  bfix  afix     sd
  227    3.0    5.0  6.81   1.37  0.31  6.19   1.28 -0.99   0.09  1.00  5.10  0.20
Normalized          5.09                 4.47                              3.38
Normalized m1       0.97                 0.63                              0.38
Norm. lin. m1        9.3                  4.3                               2.4
   mag   nmag   cmag
   0.8      1    490
   1.0      5    489
   1.2     18    484
   1.4     12    466
   1.6     25    454
   1.8     20    429
   2.0     21    409
   2.2     23    388
   2.4     37    365
   2.6     70    328
   2.8     31    258
   3.0     89    227
   3.2     55    138
   3.4     42     83
   3.6     22     41
   3.8      9     19
   4.0      4     10
   4.2      4      6
   4.8      2      2
```


Figure 6: b-value parameters together with plot for SA-Mines.

```
| Number of events selected from file:     129
Duration of catalog in years 123.2426
 ----------------------------------------

    n     m1     m2 mxl a mxl b     sd lsq a lsq b    cor    rms  bfix  afix     sd
   80    3.0    5.5  4.45  0.81   0.51  4.74  0.91 -0.97   0.14  1.00  5.12  0.16
Normalized           2.36                2.65                          3.03
Normalized m1       -0.05               -0.08                          0.03
Norm. lin. m1         0.9                 0.8                           1.1
   mag   nmag   cmag
   0.6      1    129
   1.2      3    128
   1.4      4    125
   1.6      3    121
   1.8      3    118
   2.0      2    115
   2.2     10    113
   2.4      4    103
   2.6      8     99
   2.8     11     91
   3.0     20     80
   3.2     13     60
   3.4     15     47
   3.6     10     32
   3.8      8     22
   4.0      3     14
   4.2      4     11
   4.4      2      7
   4.6      4      5
   5.4      1      1
```

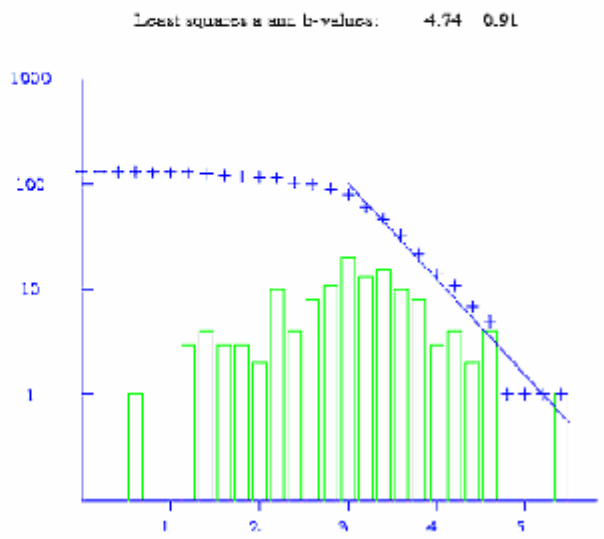


Figure 7: b-value parameters together with plot for Senqu.

Number of events selected from file: 70
Duration of catalog in years 146.2585

n	m1	m2	mxl a	mxl b	sd	lsq a	lsq b	cor	rms	bfix	afix	sd
57	3.0	5.0	4.28	0.79	0.51	4.34	0.84	-0.96	0.14	1.00	4.97	0.18
Normalized			2.11			2.17					2.81	
Normalized m1			-0.27			-0.35					-0.19	
Norm. lin. m1			0.5			0.4					0.6	

mag	nmag	cmag
0.4	1	70
0.6	1	69
1.6	1	68
2.0	1	67
2.2	3	66
2.4	1	63
2.6	4	62
2.8	1	58
3.0	16	57
3.2	9	41
3.4	5	32
3.6	14	27
3.8	1	13
4.0	2	12
4.2	8	10
5.0	2	2

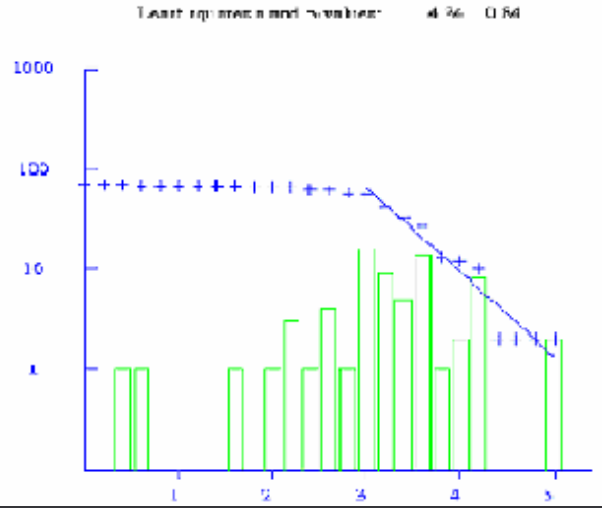


Figure 8: b-value parameters together with plot for Drakensberg.

```
 Number of events selected from file:      53
Duration of catalog in years 136.3915
 ------------------------------------------

    n     m1     m2 mxl a mxl b     sd lsq a lsq b    cor    rms  bfix  afix     sd
   24    3.0    5.0  3.72  0.75   0.42  3.96  0.84 -0.97   0.14  1.00  4.59   0.19
Normalized          1.58               1.83                          2.45
Normalized m1      -0.67              -0.70                         -0.55
Norm. lin. m1        0.2                0.2                           0.3
   mag   nmag   cmag
   0.0      1     53
   0.4      1     52
   0.8      3     51
   1.0      4     48
   1.4      2     44
   1.6      4     42
   2.0      4     38
   2.2      1     34
   2.4      3     33
   2.6      2     30
   2.8      4     28
   3.0      3     24
   3.2      3     21
   3.4      8     18
   3.6      2     10
   3.8      6      8
   4.2      1      2
   5.0      1      1
```

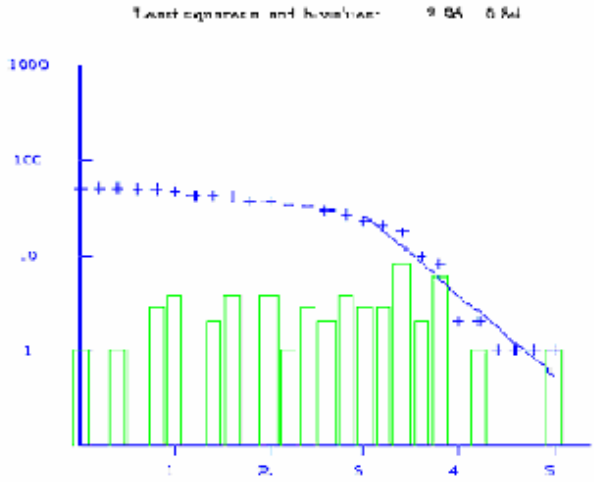


Figure 9: b-value parameters together with plot for North Lesotho.

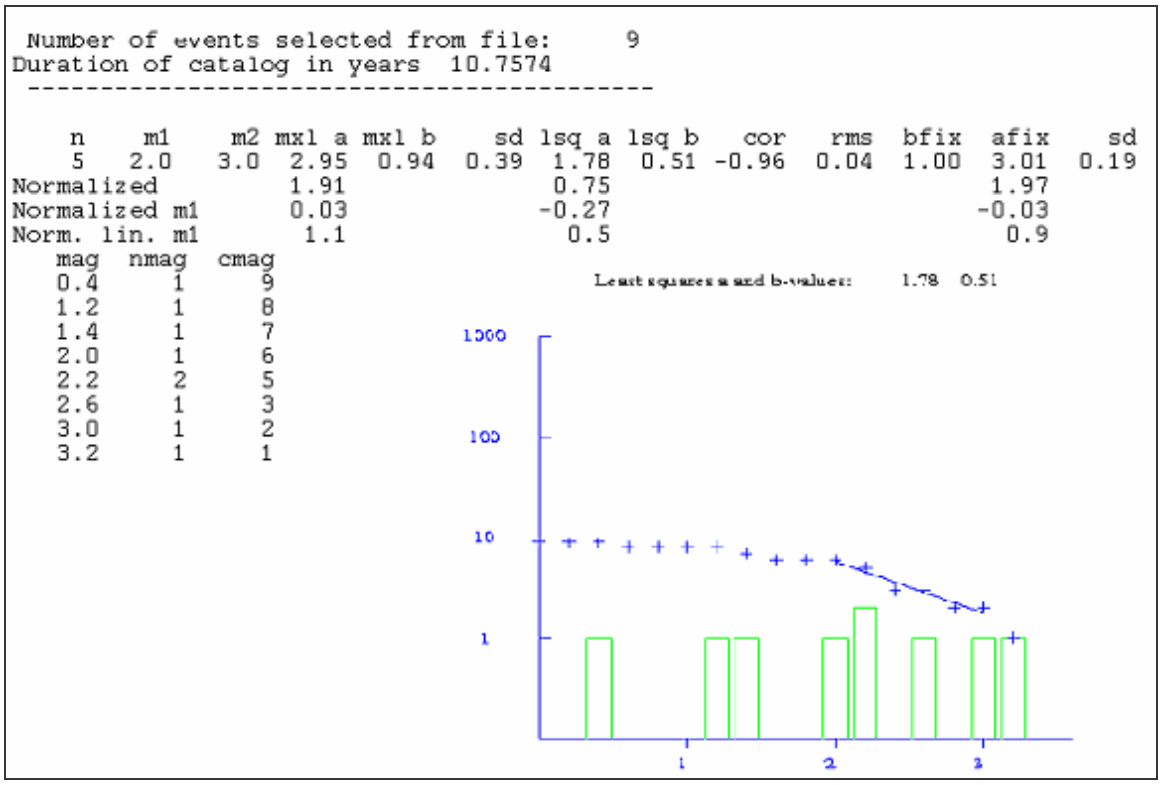


Figure 9: b-value parameters together with plot for Katse Dam.

Appendix F: Hazard maps not shown in the thesis

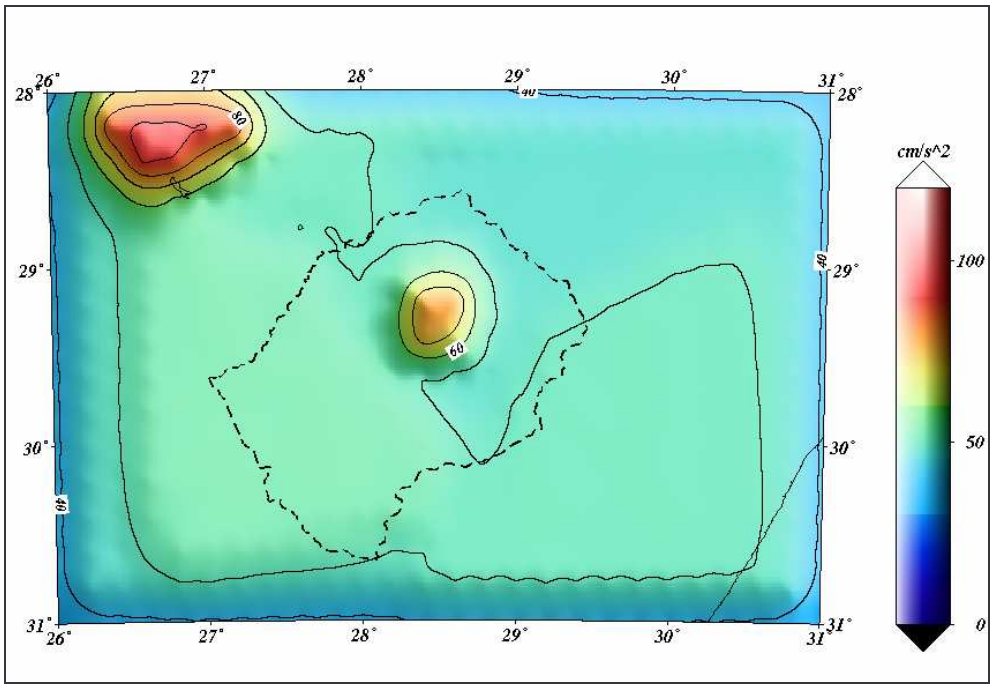


Figure 1Hazard map for 100 year return period

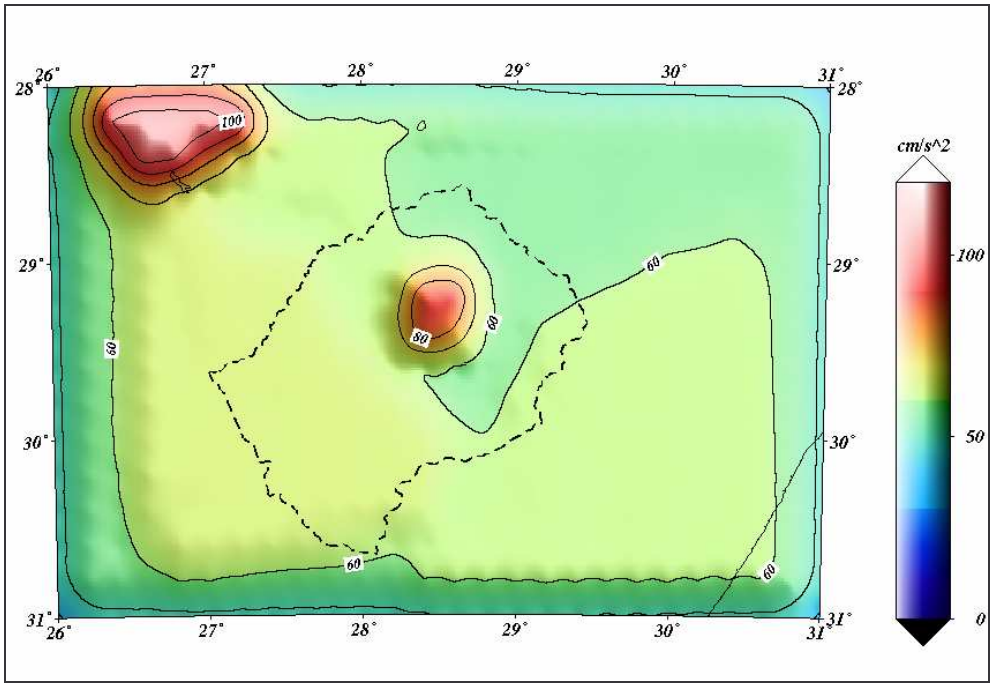


Figure 2: hazard for 200 yrs return period

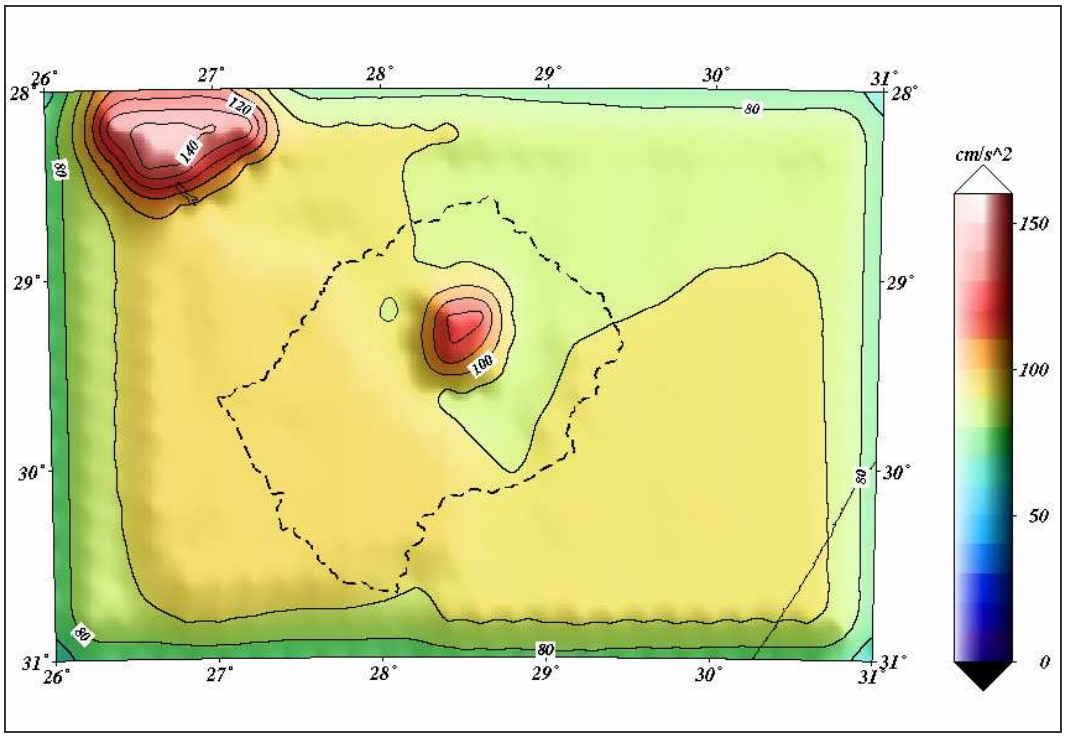


Figure 3: Hazard map for 1000 year return period

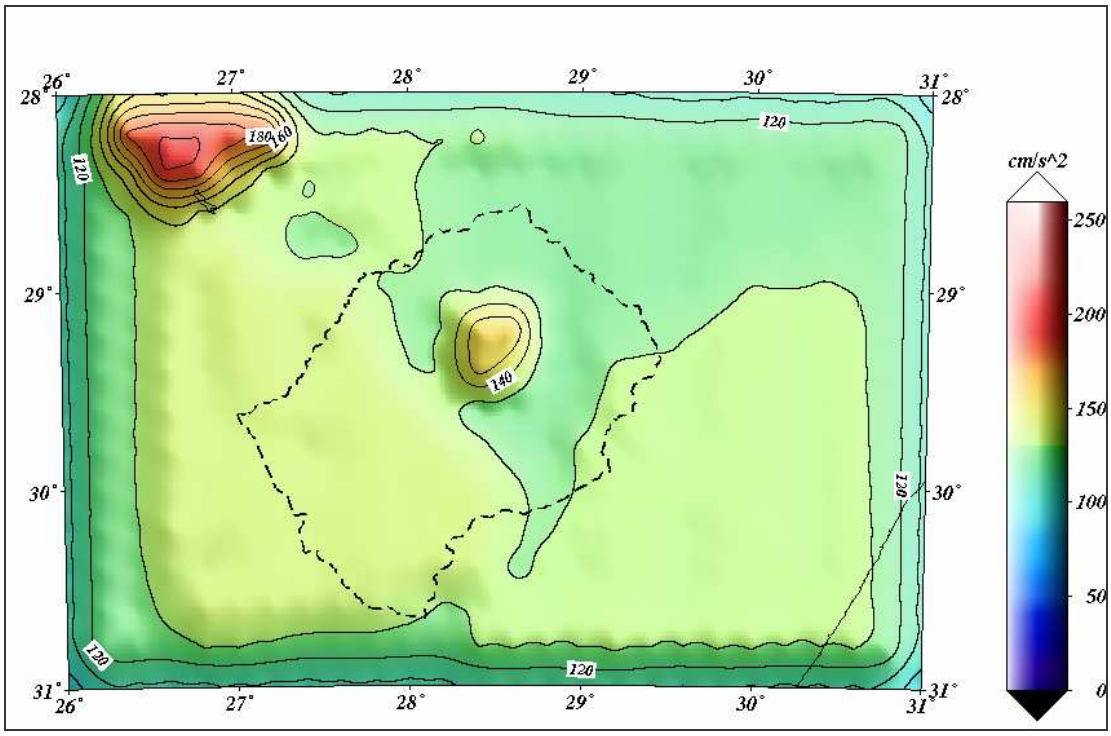


Figure 4: Hazard map for 5000-year return period