Norwegian National Seismic Network

Technical Report No. 31

Processing data for the ScanARRAY for events in Finnmark

Prepared by

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1. Introduction

In the Finnmark area of Northern Norway, there are postglacial faults (Figure 1). These faults are seen in the seismicity recorded in the NNSN data base. The NNSN database contains 597 events from the area (Figure 2). However, there are few seismic stations nearby limiting the accuracy of the epicenters.

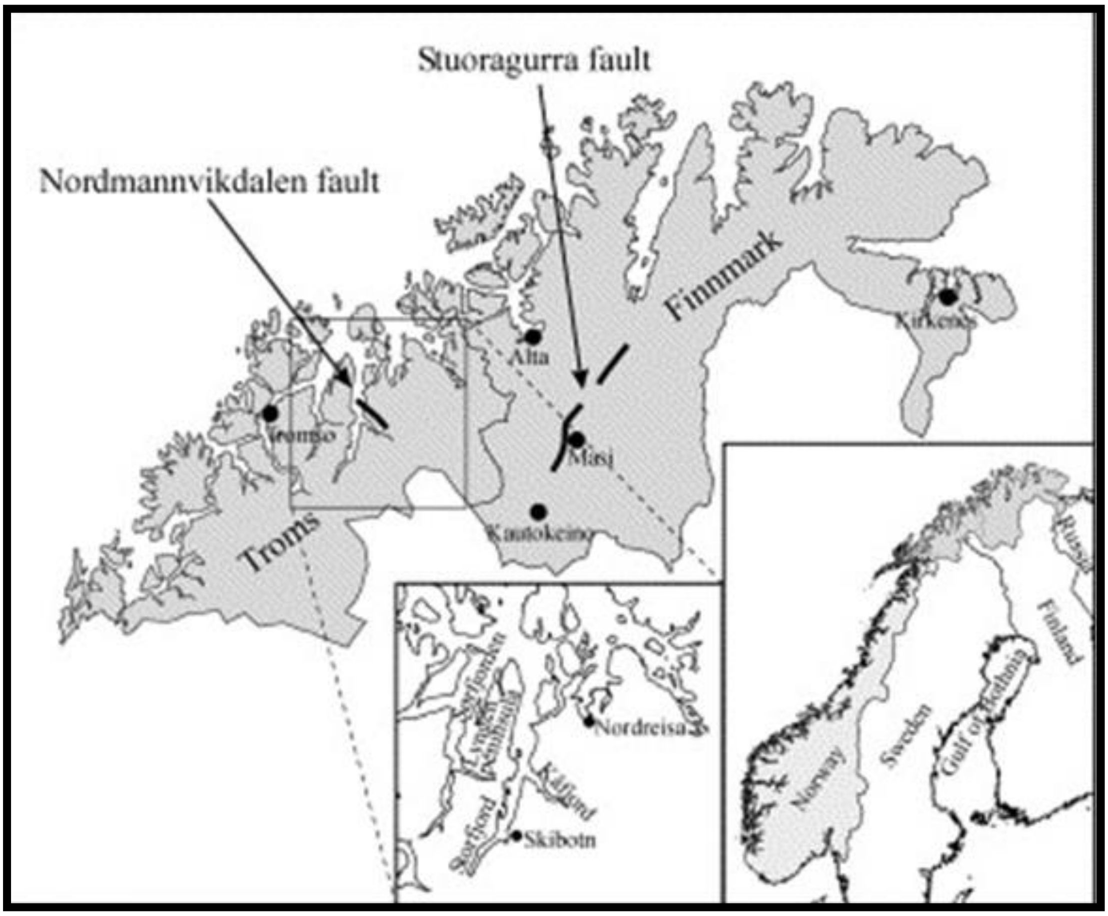

Figure 1: Location of the Nordmannvikdalen and Stuoragurra postglacial faults in northern Norway. (*Dehls et al., 2000*).

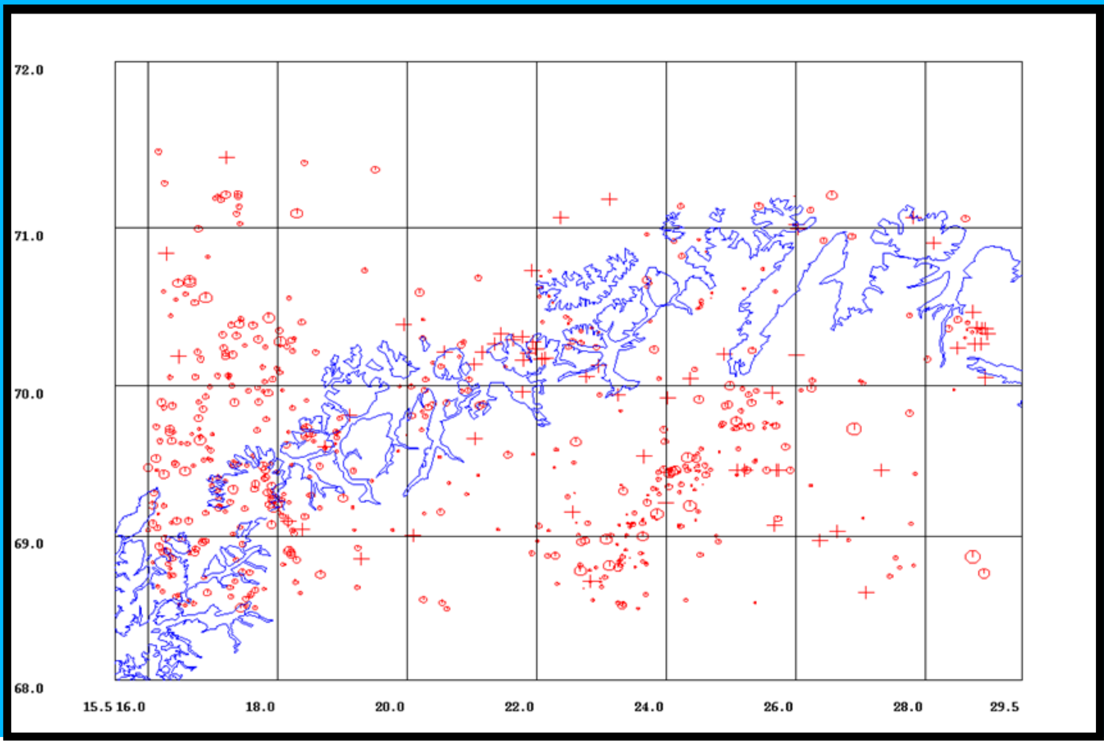

Figure 2: 597 NNSN events in Northern Norway area from 1980 to 2019. Explosions and probable explosions are excluded.

From June, 2013 to end of 2016, the ScanARRAY (*Thybo et al., 2012)* temporary stations operated in Northern Norway (Figure 3). The purpose of this study is to complement the NNSN data base with readings from the ScanARRAY to better define the seismicity in the area.

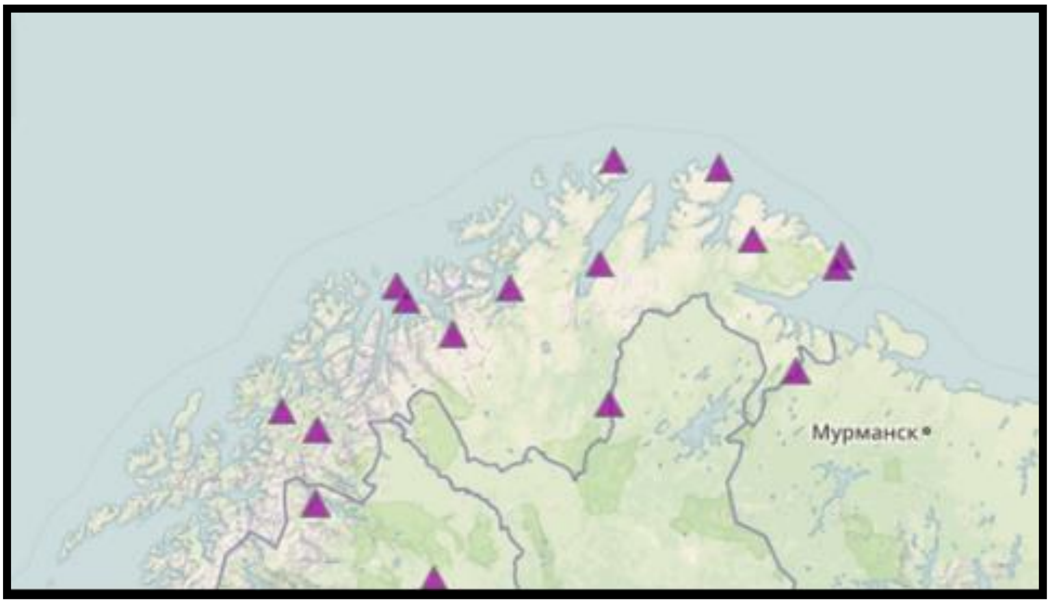

Figure 3: ScanArray seismic stations in Finnmark *(Thybo et al., 2012)*

The ScanARRAY operated between the dates June, 2013 and the end of 2016. The area was selected to be studied was 68.5-71.5° N and 16-32° E (Figure 4).

Figure 4: The coordinates of study area.

In the NNSN data base, there were 148 earthquakes in the study period and area. Notice the alienation of the fault (Figure 5,6 and 7).

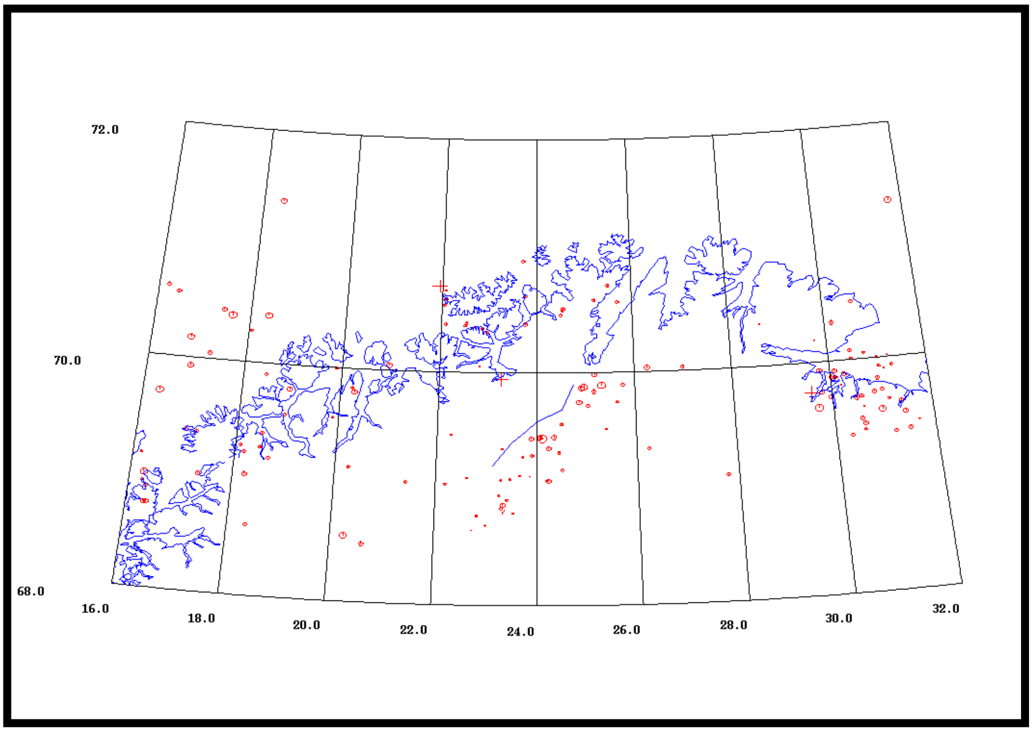

Figure 5: Earthquake locations for the study area and time period. Explosions and probable explosions are not included. Alienation of Stuoragurra fault (blue line).

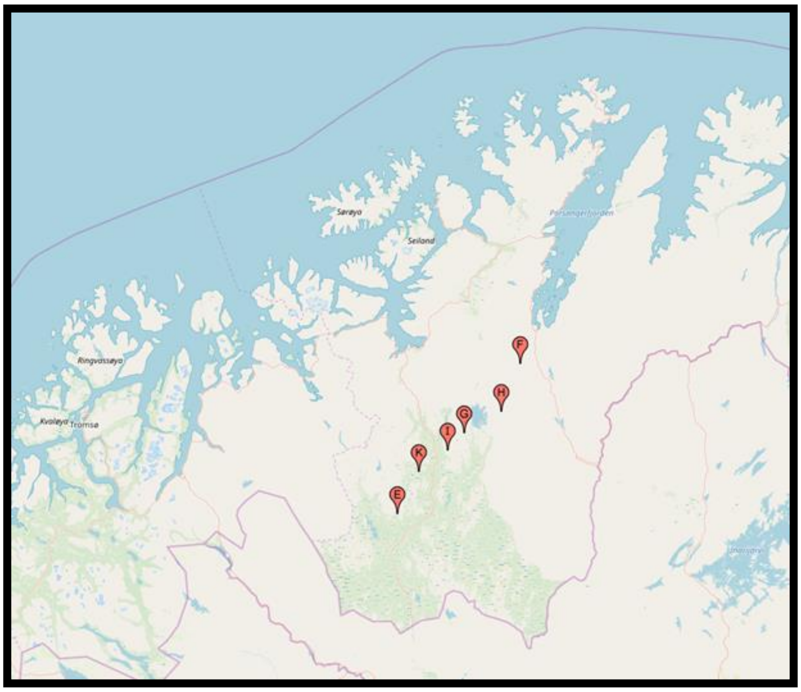

Figure 6: The digitized points on Stuoragurra fault line. (**E**: 69.20° N-32.12° E, **K**:69.40° N-23.50° E, **I**: 69.50° N-23.78° E, **G**: 69.58° N-24° E, **H**: 69.68° N-24.50° E, **F**: 69.90° N-24.75° E)

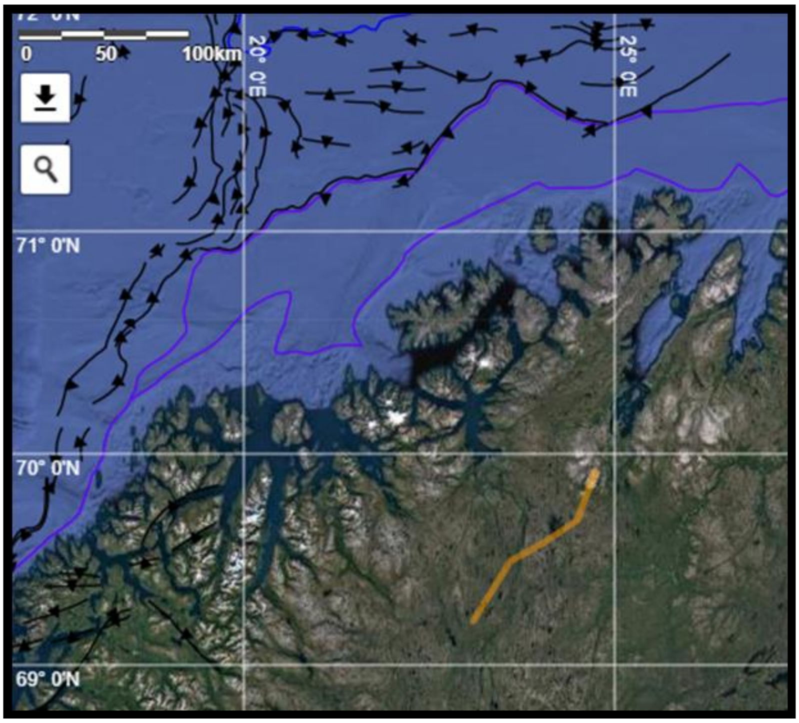

Figure 7: Stuoragurra fault (yellow line).

Since many of the earthquakes were very small and unlikely to be recorded on the noisy field stations, we started to check only the events with magnitude larger than or equal to 1.5, see Figure 8.

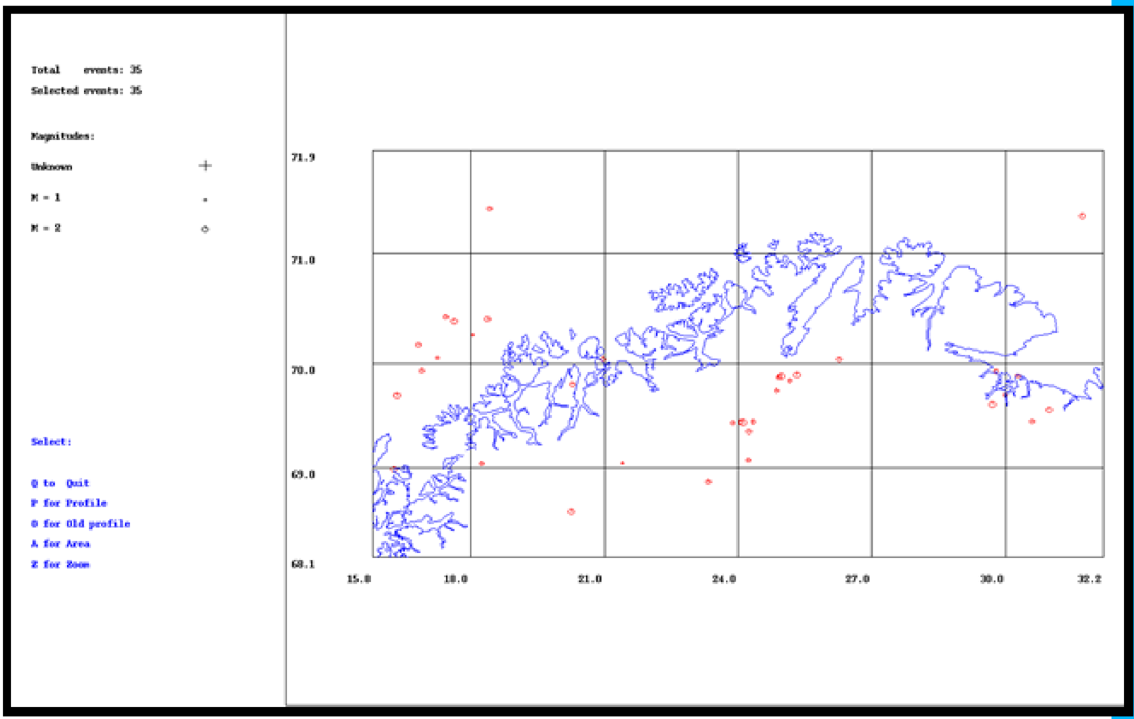

Figure 8: Earthquake locations for the study area from June 2013 to end of 2016 with magnitude ≥1.5.

Waveforms for the 35 events were extracted from the ScanARRAY archive at the GFZ. The events were picked with P and S waves and amplitudes were read. Magnitudes (M_L) were calculated and the events were located together with the NNSN readings. The table below illustrates the old data which was already registered in NNSN and the combined version of the old data with ScanARRAY data.

Table 1: Combination of NNSN and ScanARRAY data (1st line of each hypocenter pair) and old NNSN (2nd line) location. Abbreviations are: lat: latitude, lon: longitude,agen: agency, SN: number of stations, mag1,23,: Magnitudes.

```
1
 2013   8  1 0313 16.3 L   68.510   20.202 18.0   BER 30 1.2 2.1LBER 2.8WBER 2.8LNAO
 OLD:   8  1  313 17.0 L   68.563   20.261 22.5   BER 18 .90 2.0LBER          2.8LNAO
2
 2013   816 1601 36.2 LQ 70.293   17.943 12.2   BER 12 0.6 1.1LBER          2.0LNAO
 OLD:   816 1601 37.2 LQ 70.262   18.043 15.0   BER 10 0.6 0.9LBER          2.0LNAO
3
 2013 1013 1852 17.1 LQ 69.864   24.917 13.0F BER 30 0.9 2.4LBER          2.7LNAO
 OLD: 1013 1852 16.7 LQ 69.878   24.966 13.0F BER 22 0.8 2.2LBER          2.7LNAO
4
 2013 12  6 1927 59.6 LQ 70.145   16.717  2.6   BER 34 0.9 1.9LBER 2.8WBER 2.5LNAO
 OLD: 12  6 1927 59.6 LQ 70.172   16.820 1.90   BER 20 .50 1.9LBER          2.5LNAO
5
 2014  118 1859 29.9 LQ 69.867   25.261  0.5   BER 35 0.6 2.4LBER 3.1WBER 2.8LNAO
 OLD:  118 1859 29.9 LQ 69.889   25.319 4.50   BER 24 .60 2.3LBER          2.8LNAO
```

```
6
 2014  325 0412 46.8 LQ 69.456  24.298 11.0F BER 18 1.2 1.5LBER         1.6LHEL
 OLD:  325  412 46.9 LQ 69.444  24.341 11.0F BER 11 .90 1.5LBER         1.6LHEL
7
 2014  514 2204 36.5 LQ 70.379  17.674 12.1  BER 12 0.4 1.4LBER
 OLD:  514 22 4 37.1 LQ 70.428  17.441 31.0  BER  5 .20 1.6LBER
8
 2014  819 1500 20.4 L  69.647  29.909  0.0  BER 11 0.8 1.6LBER         2.5LNAO
 OLD:  819 1500 22.1 L  69.609  29.706  0.0  BER  5 0.5                 2.5LNAO
9
 2014  829 0255 50.4 L  69.068  21.557  0.0  BER 17 1.2 1.8LBER         1.5LHEL
 OLD:  829 0255 50.2 L  69.045  21.406 12.1  BER 10 0.7 0.9LBER         1.5LHEL
10
 2014  9 3 2258 47.9 L  69.036  18.251 15.0  BER 23 1.6 1.5LBER         1.5LHEL
 OLD:  9 3 2258 47.8 L  69.040  18.238 15.0  BER 16 1.8 1.5LBER         1.5LHEL
11
 2014 1121 1208 46.3 L  69.679  30.093  0.0  BER  8 1.1 1.4LBER 1.7WBER
 OLD: 1121 12 8 47.4 L  69.882  30.283 15.0  BER  4 .80 1.5LBER
12
 2014 1223 1925 52.7 LQ 69.743  24.883 12.7  BER 23 0.3 1.6LBER 2.0WBER 1.7LHEL
 OLD: 1223 1925 52.7 LQ 69.742  24.863 13.1  BER 18 .30 1.5LBER         1.7LHEL
13
 2015  4 3 1850 15.7 L  69.415  30.650 15.0  BER 19 1.6 1.6LBER         1.9LHEL
 OLD:  4 3 1850 15.5 L  69.449  30.602 15.0  BER 13 1.0 1.5LBER         1.9LHEL
14
 2015  6 1 0842 21.0 LQ 70.396  18.373 15.0  BER 22 0.7 2.1LBER         2.5LNAO
 OLD:  6 1 0842 20.7 LQ 70.408  18.379 15.0  BER 12 0.5 1.9LBER         2.5LNAO
15
 2015  625 2315 57.6 L  69.446  31.007  0.0  BER 23 1.0 2.1LBER
 OLD:  625 2315 57.1 L  69.559  30.977 0.00  BER 13 .60 2.1LBER
16
 2015  720 0236 54.8 LQ 68.853  23.335  8.8  BER 22 0.3 1.7LBER         2.0LNAO
 OLD:  720 0236 54.7 LQ 68.860  23.330 11.1  BER 16 0.2 1.6LBER         2.0LNAO
17
 2015  721 0656 49.7 L  69.649  29.994  0.0  BER 18 0.9 1.8LBER         2.4LNAO
 OLD:  721 0656 50.9 L  69.699  29.998 15.0  BER  9 0.6 1.5LBER         2.4LNAO
18
 2015  731 1727 58.8 LQ 69.348  24.238  6.0  BER 17 0.6 1.7LBER         1.5LHEL
 OLD:  731 1727 58.7 LQ 69.349  24.237  6.1  BER 14 0.6 1.6LBER         1.5LHEL
19
 2015  8 1 1142 43.1 LQ 69.439  24.112 15.0  BER 71 1.4 2.7LBER         2.8LHEL
 OLD:  8 1 1142 42.7 LQ 69.435  24.106 15.0  BER 37 .80 2.7LBER 2.8WBER 2.8LHEL
20
 2015  814 1128 56.2 L  69.669  29.872  0.0  BER  9 1.2 1.7LBER
 OLD:  814 1128 55.4 L  69.925  29.792  0.0  BER  5 0.7 1.6LBER
21
 2015  922 1101  8.9 LQ 69.954  21.071  0.0  BER 26 0.9 1.8LBER 2.0WBER 1.8LHEL
 OLD:  922 1101  8.3 LQ 70.040  20.965  7.2  BER 17 0.6 1.7LBER 2.0WBER 1.8LHEL
22
 2015  930 2331 12.6 LQ 69.432  23.879  0.0  BER 24 0.5 1.6LBER 1.9WBER 1.7LHEL
 OLD:  930 2331 12.5 LQ 69.431  23.887  2.0  BER 18 0.5 1.4LBER 1.9WBER 1.7LHEL
23
 2015 1024 1312 16.0 L  69.829  20.492  0.0  BER 23 0.9 1.7LBER         2.4LNAO
 OLD: 1024 1312 16.9 L  69.801  20.286 15.0  BER 18 0.5 1.6LBER         2.4LNAO
24
 2015 1026 0449 14.7 LQ 69.453  24.061 15.0  BER 16 0.5 1.5LBER         1.8LNAO
 OLD: 1026 0449 14.8 LQ 69.444  24.055 15.0  BER 12 0.5 1.5LBER         1.8LNAO
25
 2015 1027 2034 52.8 LQ 69.839  25.122  0.0  BER 16 0.4 1.5LBER         1.6LHEL
 OLD: 1027 2034 52.9 LQ 69.837  25.162  8.2  BER 12 0.5 1.4LBER         1.6LHEL
26
 2015 1117 1614  6.7 LQ 68.980  16.280 16.2  BER 49 0.7 2.6LBER 2.3WBER 2.1LHEL
 OLD: 1117 1614  6.7 LQ 68.983  16.275 16.6  BER 46 .70 2.2LBER 2.3WBER 2.1LHEL
27
 2015 1120 1543 19.6 LQ 71.306  31.779 15.0  BER 14 0.9 2.3LBER         2.4LNAO
 OLD: 1120 1543 18.8 LQ 71.333  31.724 12.1  BER 10 .60 2.1LBER         2.4LNAO
28
 2015 1126 2359  1.8 LQ 69.924  16.913 15.0  BER 13 0.4 1.6LBER         1.6LHEL
```

```
 OLD: 1126 2359  1.5 LQ 69.930  16.893 12.1  BER 11 0.3 1.6LBER          1.6LHEL
29
 2015 12 4 0425 57.4 LQ 69.070  24.219  4.8  BER 32 0.7 1.7LBER 1.9WBER 1.6LHEL
 OLD: 12 4 0425 57.3 LQ 69.068  24.230  4.4  BER 28 0.7 1.5LBER 1.9WBER 1.6LHEL
30
 2016  316 0436  5.8 LQ 69.869  24.907  0.1  BER 20 0.7 1.8LBER          1.8LHEL
 OLD:  316 0436  5.8 LQ 69.868  24.908  0.1  BER 14 0.7 1.8LBER          1.8LHEL
31
 2016  421 0054 27.5 LQ 69.714  16.279 15.0  BER 31 0.9 2.3LBER          2.6LHEL
 OLD:  421 0054 28.1 LQ 69.697  16.341 18.1  BER 19 0.5 2.1LBER          2.6LHEL
32
 2016  625 0123 39.0 LQ 70.007  17.290  0.0  BER 17 0.7 1.2LBER          1.5LHEL
 OLD:  625 0123 38.7 LQ 70.049  17.253  0.4  BER 15 0.4 1.1LBER          1.5LHEL
33
 2016  715 0406 48.7 LQ 70.055  26.205 15.3  BER 15 0.7 1.5LBER          1.8LHEL
 OLD:  715 0406 48.7 LQ 70.034  26.264 21.1  BER 13 0.7 1.6LBER          1.8LHEL
34
 2016  722 0502 43.6 LQ 71.398  18.408 15.0F BER 21 0.5 1.6LBER          2.6LNAO
 OLD:  722 0502 43.5 LQ 71.398  18.421 15.0F BER 20 0.5 1.6LBER          2.6LNAO
35
 2016 1218 1242 14.0 LQ 70.388  17.624 15.0  BER 17 0.8 2.1LBER          2.1LHEL
 OLD: 1218 1242 14.0 LQ 70.389  17.624 15.0  BER 16 0.8 2.2LBER          2.1LHEL
```

35 events which are combination of both data sources were located (Figure 9). Notice that all events were recorded on the ScanARRAY, but some with only a few stations.

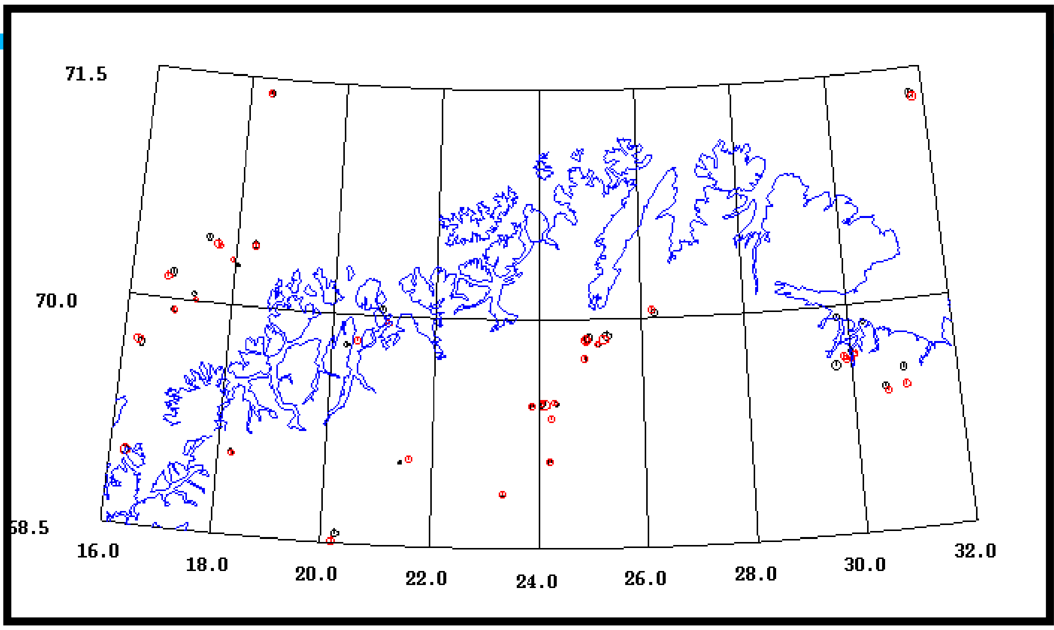

Figure 9: New and old locations of the events with $M_L \geq 1.5$. The old locations are black and new red. Notice the alienation in central Finnmark.

The mapped fault does not correspond to the epicenters. This was also observed in earlier studies, see Figure 10.

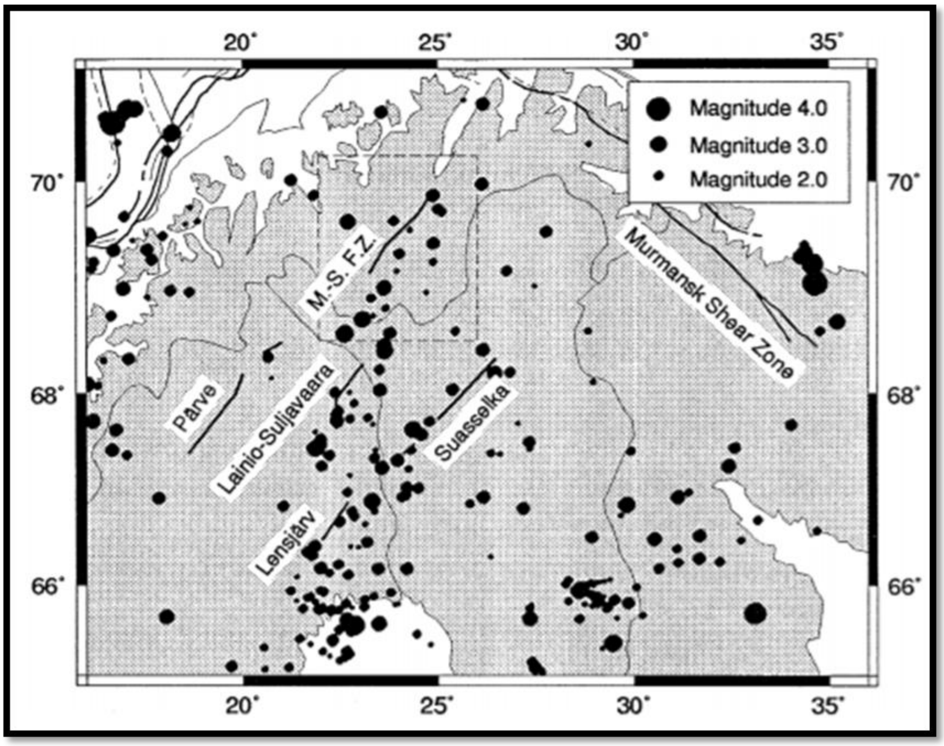

Figure 10: Distribution of the earthquakes along the fault line. (*Bungum and Lindholm, 1996*)

The average difference between old and new locations was calculated, see Table 2.

Table 2: Differences between new and old locations. The compared content is origin time, RMS, hypocenter and magnitudes. For each parameter, the average difference with standard deviations is calculated.

	Origin time	RMS	Lat	Lon	Depth	Ml
Average diff	0.1	-0.2	0.025	-0.012	3.6	0.0
Standard dev	0.6	0.2	0.060	0.086	5.7	0.0
Number of values				35	31	35

Fault Plane Solution

The event with largest number of readings in the area is the event with magnitude M_L= 2.7, August 1, 2015. This was also the largest event in this data set. The event was relocated with stations less than 150 km distance (xnear=50, xfar=150). A new depth of 9 km was obtained. Depth was then fixed to 9 km. The fault plane solution was made with polarity. The solutions with FOCMEC (blue), PINV (green) and FPFIT (red) are shown in Figure 11. All had one polarity error and degree increment (spacing in the grid search) is 2 degrees.

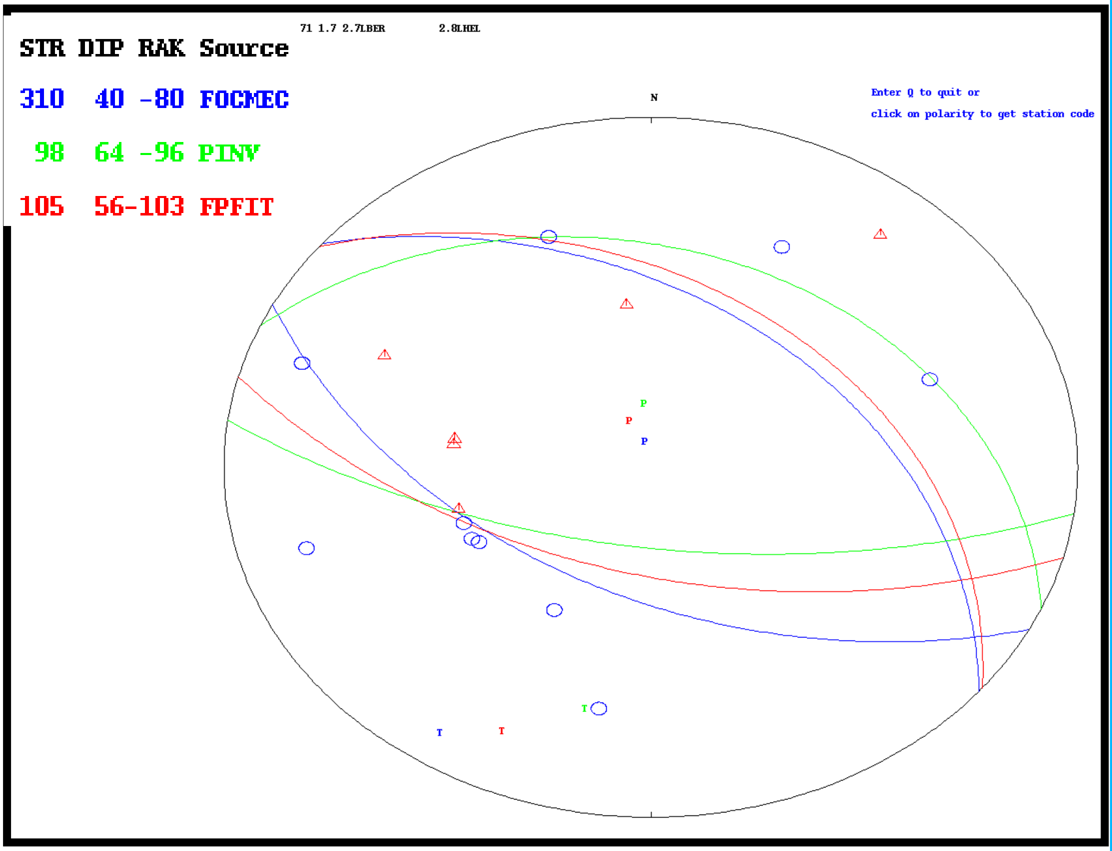

Figure 11: Fault plane solution with 16 polarities and one error. All 3 solutions are similar.

The error was on KTK1 but it is a very clear dilatational signal, see Figure 12.

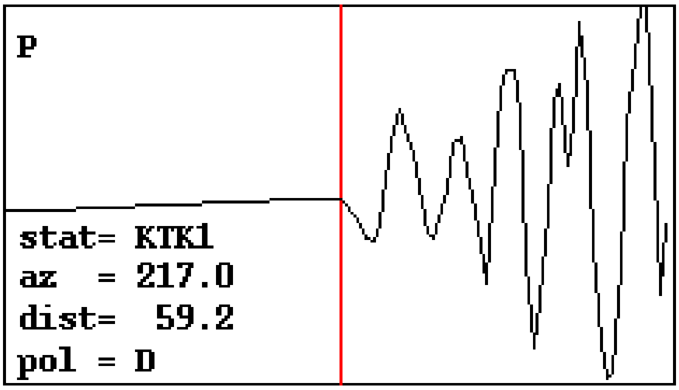

Figure 12: First motion on station KTK1.

The fault plane solution was also made with depths 5 and 15km (Figure 13, 14) and the solutions were very similar to the solution at 9 km. The solutions at 9 km were kept as the final solution.

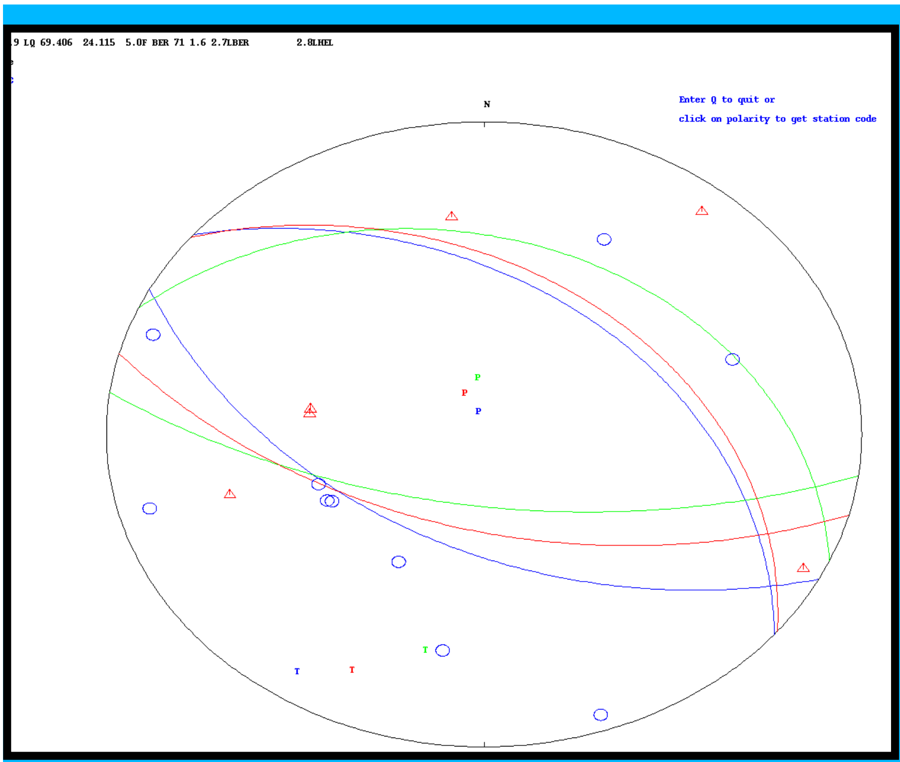

Figure 13: Fault plane solutions for depth fixed to 5 km.

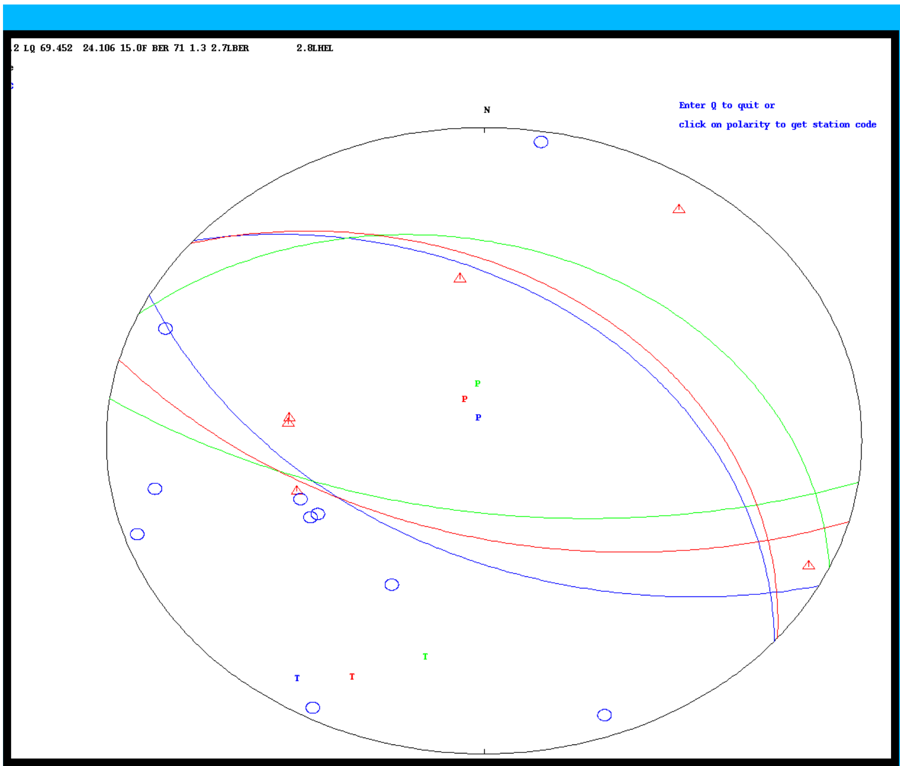

Figure 14: Fault plane solutions for depth fixed to 15km.

Events near the fault were selected with magnitude smaller than 1.5 in central Finnmark area in order to check if reading were possible for those smaller events (Figure 15). Consequently, 33 events were found (Table 2).

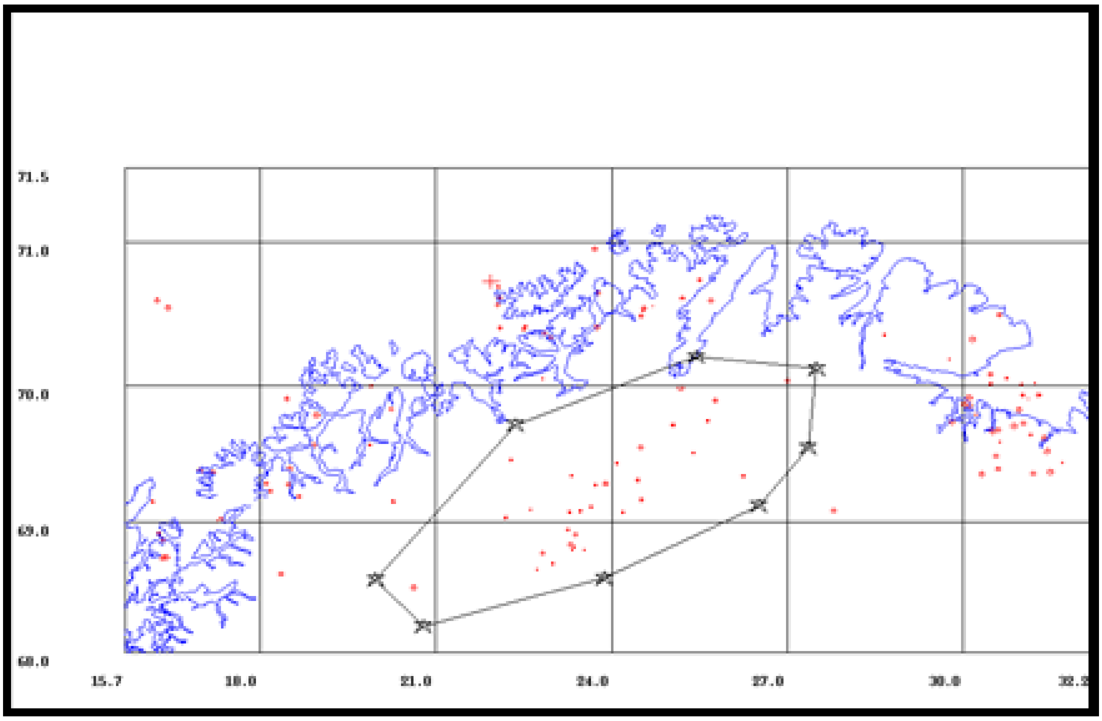

Figure 15: Location of the data with magnitude smaller than 1.5 in central Finnmark. The 33 events selected are inside the polygon.

Table 3: 33 events magnitude smaller than 1.5 in central Finnmark. Combination of NNSN and ScanARRAY data (1st line of each hypocenter pair) and old NNSN (2nd line) location. New means a new event was found. There are 14 events which does not have a new phases. Abbreviations are: lat: latitude, lon: longitude,agen: agency, SN: number of stations, mag1,23,: Magnitudes.

1														
2013	919	1824	25.3	LQ	69.891	25.786	2.3	BER	10	0.7	1.0LBER	2.0WBER	1.3LHEL	
OLD:	919	1824	25.3	LQ	69.891	25.763	1.0	BER	8	0.6	1.2LBER		1.3LHEL	
2														
2013	**1026**	**1722**	**51.6**	**LQ**	**68.894**	**23.385**	**9.7**	**BER**	**15**	**0.8**	**0.9LBER**			
OLD:	**1026**	**1722**	**51.7**	**LQ**	**68.907**	**23.380**	**11.9**	**BER**	**13**	**0.9**	**0.9LBER**			
3														
2013	1030	1229	4.5	LQ	68.498	20.573	0.0	BER	18	0.9	1.4LBER			
OLD:	1030	1229	6.0	LQ	68.502	20.620	13.6	BER	13	0.9	1.4LBER			
4														
2013	**11 5**	**2140**	**57.5**	**LQ**	**68.785**	**23.542**	**15.0**	**BER**	**6**	**0.4**	**0.5LBER**		**0.3LHEL**	
OLD:	**11 5**	**2140**	**57.6**	**LQ**	**68.790**	**23.527**	**12.7**	**BER**	**6**	**0.3**	**0.5LBER**		**0.3LHEL**	
5														
2014	2 5	1431	53.1	LQ	69.331	26.258	0.0	BER	8	0.5	1.0LBER		1.0LHEL	
OLD:	2 5	1431	53.2	LQ	69.342	26.244	3.4	BER	7	0.5	0.9LBER		1.0LHEL	
6														
2014	**223**	**2335**	**4.6**	**LQ**	**69.039**	**22.201**	**14.8**	**BER**	**8**	**0.7**	**0.6LBER**		**0.7LHEL**	
OLD:	**223**	**2335**	**4.5**	**LQ**	**69.037**	**22.190**	**16.1**	**BER**	**7**	**0.7**	**0.7LBER**		**0.7LHEL**	
7														
2014	623	1456	42.2	L	68.768	22.825	0.0	BER	9	0.6	0.7LBER		1.0LHEL	

```
 OLD:  623 1456 42.2 L  68.767  22.821  0.0  BER  7 0.6 0.8LBER         1.0LHEL
8
 2015  214 0145 22.6 LQ 69.076  23.279  3.0  BER 10 0.5 0.7LBER         0.8LHEL
 OLD:  214 0145 22.6 LQ 69.076  23.279  3.0  BER 10 0.5 0.7LBER         0.8LHEL
9
 2015  4 5 1120 55.9 LQ 69.084  23.467  7.5  BER 10 0.6 0.8LBER         1.0LHEL
 OLD:  4 5 1120 55.9 LQ 69.084  23.463  7.4  BER  9 0.6 0.7LBER         1.0LHEL
10
 2015  415 2236 28.3 LQ 70.046  27.211  3.2  BER 14 0.6 0.9LBER         1.0LHEL
 OLD:  415 2236 29.4 LQ 70.033  26.997  1.3  BER 10 0.5 0.9LBER         1.0LHEL
11
 2015  5 1 1207 16.4 LQ 68.833  23.307  6.1  BER 16 0.6 1.1LBER         1.2LHEL
 OLD:  5 1 1207 16.3 LQ 68.834  23.295  3.8  BER 14 0.5 1.0LBER         1.2LHEL
12
 2015  610 1344 16.4 L  68.687  22.992  0.0  BER  3 0.6 0.5LBER
 OLD:  610 1344 16.4 L  68.687  22.992  0.0  BER  3 0.6 0.5LBER
13
 2015  715 1720 25.9 LQ 69.957  25.147 13.3  BER 13 0.6 1.4LBER         1.2LHEL
 OLD:  715 1720 25.7 LQ 69.981  25.182 15.9  BER  9 0.6 1.4LBER         1.2LHEL
14
 2015  715 2307 12.8 LQ 68.944  23.250  4.0  BER 10 0.4 0.7LBER         0.8LHEL
 OLD:  715 2307 12.8 LQ 68.944  23.250  4.0  BER 10 0.4 0.7LBER         0.8LHEL
15
 2015  719 2250 54.5 LQ 69.310  23.847  0.0  BER 21 0.7 1.2LBER         1.0LHEL
 OLD:  719 2250 55.4 LQ 69.286  23.898 15.0  BER 15 0.6 1.1LBER         1.0LHEL
16
 2015  729 2321 21.4 LQ 69.567  24.471 15.0  BER 13 0.6 0.9LBER         0.9LHEL
 OLD:  729 2321 21.5 LQ 69.556  24.495 15.0  BER 11 0.6 1.0LBER         0.9LHEL
17
 2015  812 1240 23.8 LQ 69.722  25.010  2.6  BER 12 0.7 1.1LBER         1.1LHEL
 OLD:  812 1240 23.8 LQ 69.716  25.037  3.0  BER  9 0.7 0.9LBER         1.1LHEL
18
 2015  921 2127 13.2 LQ 69.074  24.190 12.9  BER 10 0.7 0.5LBER         0.7LHEL
 OLD:  921 2127 13.2 LQ 69.074  24.190 12.9  BER 10 0.7 0.5LBER         0.7LHEL
19
 2015  923 1251 29.5 LQ 69.514  25.393  8.7  BER  8 0.9 0.6LBER         0.9LHEL
 OLD:  923 1251 29.5 LQ 69.514  25.393  8.7  BER  8 0.9 0.6LBER         0.9LHEL
20
 2015 1012 1732 16.6 LQ 69.745  25.635 14.9  BER  5 0.7 0.6LBER         0.5LHEL
 OLD: 1012 1732 16.6 LQ 69.745  25.635 14.9  BER  5 0.7 0.6LBER         0.5LHEL
21- New, probably an explosion
 2015 1013 2324 50.6 LP 67.702  20.745  0.0  BER 11 0.9 1.5LBER 2.1WBER
 OLD: 1013 2322 44.0 LP                      BER  2
22- New, probably an explosion
 2015 1013 2328 53.4 LP 67.832  20.373  0.0  BER 21 1.5 2.2LBER 2.4WBER
 OLD: 1013 2328 21.0 LP                      BER  2
23
 2016  115 0416 14.9 LQ 69.191  24.431 10.0  BER 10 0.5 1.0LBER
 OLD:  115 0416 14.7 LQ 69.167  24.503 10.2  BER  8 0.4 1.0LBER
24- New, probably an explosion
 2016  115 0422 19.2 LP 66.447  14.494  0.0  BER 17 1.8 1.0LBER 1.7WBER
 OLD:  115 0422 16.7 LE 66.410  14.745  0.0F BER  6 0.4 1.0LBER
25
 2016  726 1314  7.6 LQ 69.112  23.662  1.7  BER 11 0.7 0.6LBER         0.6LHEL
 OLD:  726 1314  7.6 LQ 69.114  23.649  3.1  BER  9 0.7 0.6LBER         0.6LHEL
26
 2016  821 1818 21.4 L  68.815  23.373  0.0  BER  9 0.6 0.2LBER         0.4LHEL
 OLD:  821 1818 21.4 L  68.816  23.364  0.0  BER  8 0.6 0.2LBER         0.4LHEL
27
 2016  822 0810  3.1 L  68.642  22.729  0.0  BER  9 0.8 0.2LBER         0.7LHEL
 OLD:  822 0810  3.1 L  68.642  22.729  0.0  BER  9 0.8 0.2LBER         0.7LHEL
28
 2016  9 2 1250 10.6 LQ 69.093  22.615 12.2  BER  5 0.3 0.4LBER
 OLD:  9 2 1250 10.6 LQ 69.093  22.615 12.2  BER  5 0.3 0.4LBER
29
 2016  919 1131 16.1 LQ 68.803  23.336  8.3  BER  9 0.5 0.2LBER         0.3LHEL
 OLD:  919 1131 16.1 LQ 68.803  23.336  8.3  BER  9 0.5 0.2LBER         0.3LHEL
30
```

```
 2016 10 5 2109   0.9 LQ 69.345  23.311   6.1  BER  7 0.8 0.6LBER
 OLD: 10 5 2109   0.9 LQ 69.345  23.311   6.1  BER  7 0.8 0.6LBER
31
 2016 10 8 0517   9.4 LQ 69.315  24.444 10.5  BER 12 0.6 0.8LBER          1.1LHEL
 OLD: 10 8 0517   9.4 LQ 69.313  24.442 10.4  BER 11 0.6 0.8LBER          1.1LHEL
32
 2016 1031 1032   6.2 LQ 69.459  22.283   2.4  BER  8 0.5 0.7LBER          0.7LHEL
 OLD: 1031 1032   6.2 LQ 69.462  22.281   3.1  BER  7 0.5 0.6LBER          0.7LHEL
33
 2016 11 2 0708  21.0 LQ 68.790  23.325 15.0  BER  6 0.4 0.2LBER          0.5LHEL
 OLD: 11 2 0708  21.0 LQ 68.790  23.325 15.0  BER  6 0.4 0.2LBER          0.5LHEL
34
 2016 1114 0601  47.2 LQ 69.276  23.719   3.4  BER  7 0.6 0.6LBER          0.6LHEL
 OLD: 1114 0601  47.2 LQ 69.276  23.719   3.4  BER  7 0.6 0.6LBER          0.6LHEL
35
 2016 1226 0715  44.2 LQ 69.109  23.856 19.1  BER  5 0.1 0.1LBER          0.6LHEL
 OLD: 1226 0715  44.2 LQ 69.109  23.855 19.1  BER  5 0.1 0.1LBER          0.6LHEL
```

There are not many new readings from ScanARRAY. The 3 new events were not new but explosions in the NNSN data base (#21, #22 and #24) (Figure 16).

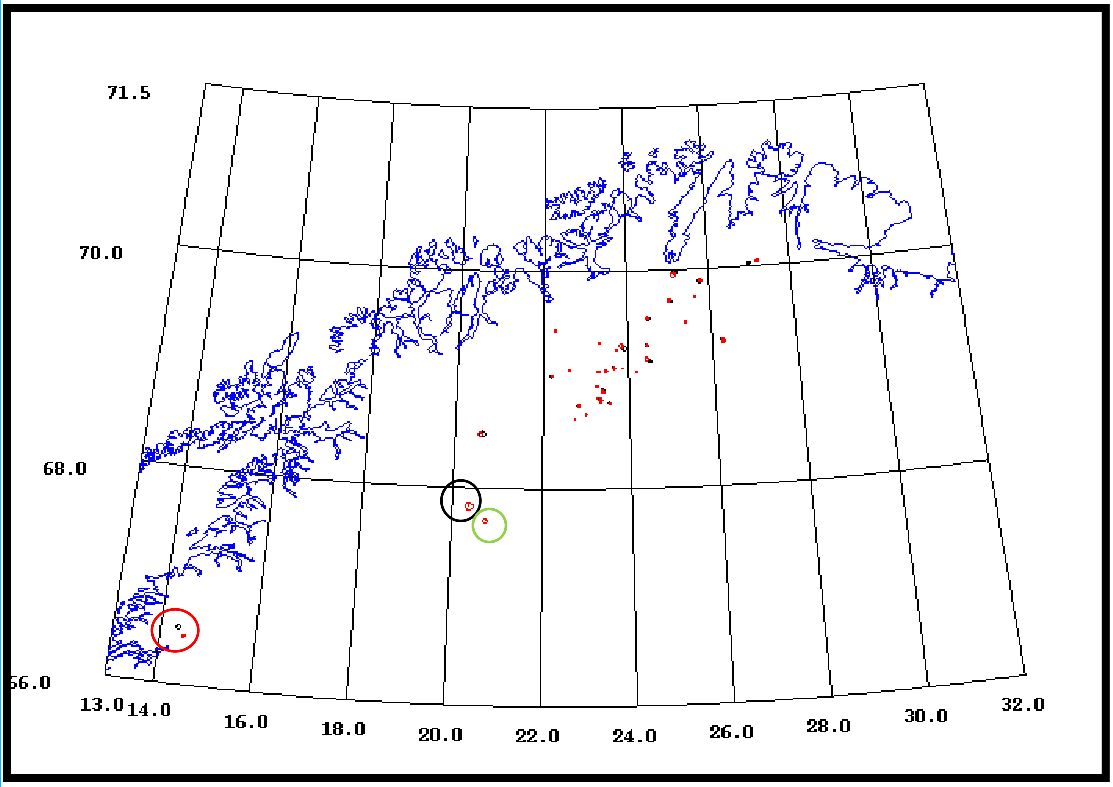

Figure 16: The old (black points) and new locations (red points) of the 33 events from ScanARRAY integrated with NNSN data. New events circled with blue colour (Circles with black, green, red refers to event number 22, 21 and 24 respectively).

Discussion and conclusion

Important contributors to the fault generating mechanisms are believed to be stress associated with spreading of the Mohns, Knipovich and Nansen Ridges and viscous drag underneath the lithosphere (*Olesen*, *1988*). Reverse faulting in response to horizontal NW–SE compression often observed. The thrust faulting is also consistent with the tectonic regime indicated by the other neotectonic faults in Sweden and Finland. (*Bungum and Lindholm, 1996*).

In Nordland, inversion of focal mechanisms of earthquakes indicates a coast-perpendicular extensional stress regime with shallow earthquakes (Figure 17), which is directly opposite to what is found along the margin farther offshore (*Hicks et al. 2000, Bungum et al. 2010*). There are, however, also some strike-slip earthquakes here, with coastparallel compressions. This anomalous stress field (contrasting with the regional one) appears to be associated with a locally enhanced uplift pattern and a related flexuring mechanism. This may in turn be related to remaining glacioisostatic adjustments, but since very recent erosion has taken place in Nordland, the crust there may be strongly flexed, which also would result in coast-perpendicular extension. (*Olesen et al., 2013*)

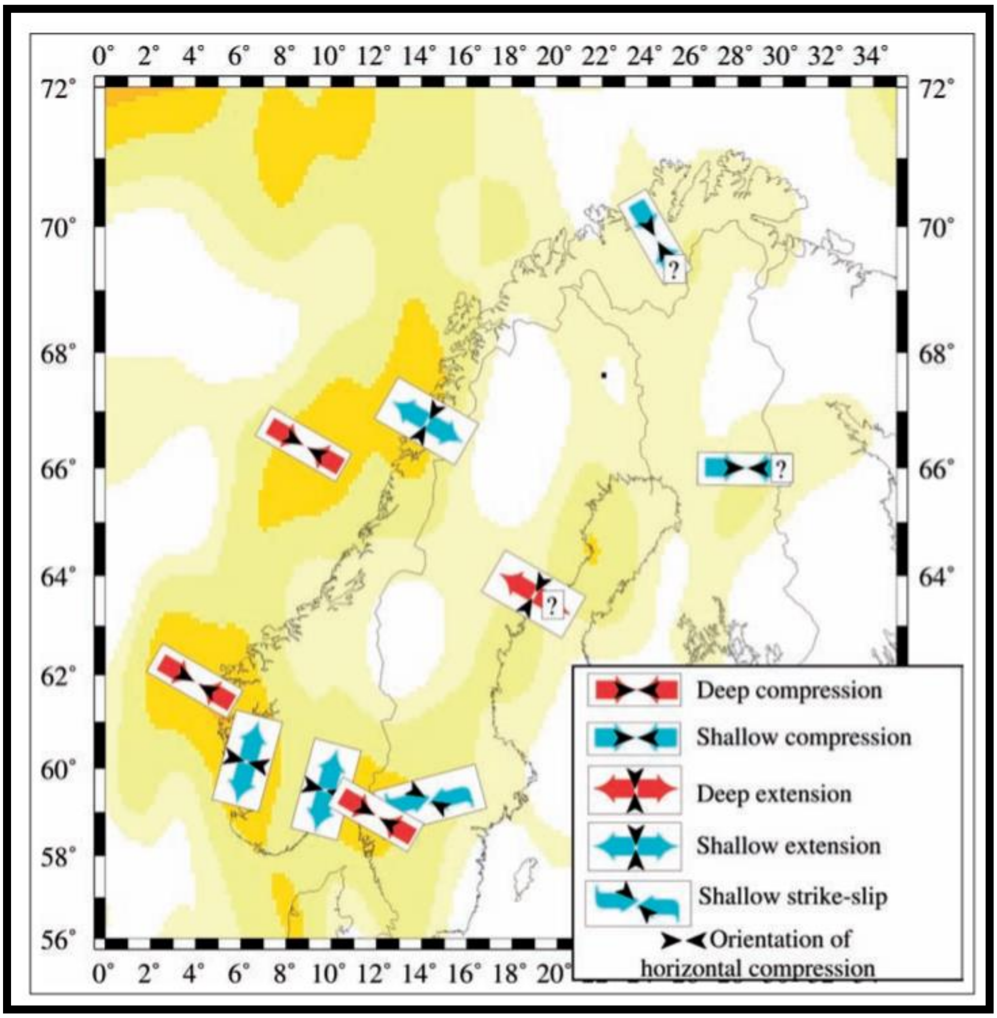

Figure 17: Stress orientations, type of faulting and focal depths synthesised from earthquake focal mechanisms and in situ stress measurements (from Fjeldskaar et al., 2000). Areas with sparse data are indicated with question marks. Intensity of yellow indicates intensity of seismicity. Note that offshore depocentres generally coincide with areas of dominating compressional events whereas the coastal areas have a predominantly extensional regime. (Olesen et al., 2013)

According to Olesen (1988) and Muir Wood (1989), "Stuoragurra fault occur along a physiographic border. The mountainous area to the northwest has an average higher elevation than the area to the southeast. The ice was consequently thickest in the southeastern area. This would have involved more depression during the period of maximum glaciation and consequently a greater contribution to the subsequent postglacial stress regime. The differential loading of ice across a prestressed zone of weakness might consequently be sufficient to have caused reactivation of the old zone, and so produce a fault scarp."

The added readings for the 2 data sets did not seem to make a significant difference in the alignment of the epicenters in Finnmark. However, the new data provides one fault plane solution. The fault plane solution is not aligned with the fault which could indicate an uncertain solution. This situation is very common at the level of lower magnitudes (lower than 3).

New fault plane solution (see Figures 18,19) shows a normal fault pattern with the strike, dip and slip of 310 40 -79, respectively.

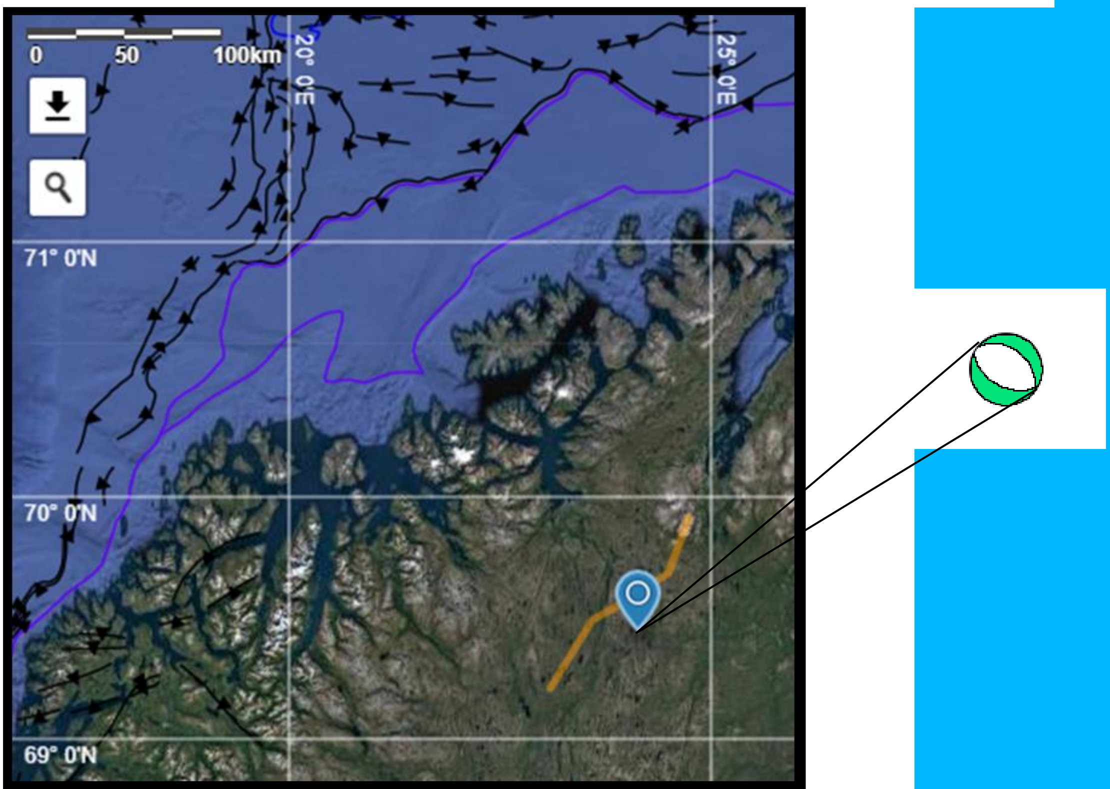

Figure 18: Location of the event with fault plane solution.

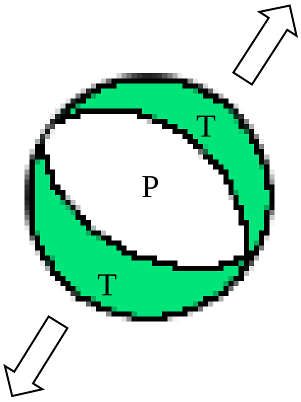

Figure 19: Forces that effect fault plane solution.

Acknowledgemets

Lars Ottemöller and Jens Havskov read this report and made valuable suggestions.

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