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Swedish National Seismic Network (SNSN)

A short report on recorded earthquakes during the second quarter of the year 2004

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August 2004

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Keywords: Seismic network, Earthquakes.

This report concerns a study which was conducted for SKB. The conclusions and viewpoints presented in the report are those of the author and do not necessarily coincide with those of the client.

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Abstract

According to an agreement with Swedish Nuclear Fuel and Waste Management Company (SKB) and Uppsala University, the Department of Earth Sciences has continued to carry out observation and additional construction of new seismic stations within the Swedish National Seismic Network (SNSN). This report gives some information about the recorded seismicity during April through June 2004.

The Swedish National Seismic Network consists of 45 stations and all of them are now in operation. During the period April through June, 1,792 events were located whereof 126 are estimated as real earthquakes, 1,466 are estimated as explosions and 200 events are still considered as uncertain but these are mainly outside the network.

The largest earthquake with magnitude 3.2 occurred on April 7th in Norway only 104 km NW of Arvika. The second two largest local earthquakes recorded during this period occurred on April 8th and May 20th in Lappland with magnitudes of 2.3. An earthquake with magnitude 2.0 was located in Bottenviken, 112 km East of Skellefteå on April 2nd. Additional 13 earthquakes were located with magnitudes above or of 1.0. The range of the hypocentral depth varies between 0.2 and 43.2 km.

Sammanfattning

Enligt avtal mellan Svensk Kärnbränslehantering AB (SKB) och Uppsala Universitet, Institutionen för Geovetenskaper, fortsätter Uppsala Universitet att driva och bygga ut seismiska mätstationer i det svenska seismiska nätet (SNSN). Denna rapport ger information om registrerade händelser under tidsperioden april till juni, 2004.

Det seismiska nätet består av 45 stationer och alla stationer är nu i drift. Under perioden april till juni, 2004 var det 1 792 registrerade händelser varav 126 bedömdes som äkta jordskalv, 1 466 bedömdes vara förorsakade av explosioner eller sprängningar samt 200 var osäkra händelser, men dessa var i huvudsak lokaliserade utanför det seismiska nätet.

Det största jordskalvet med en magnitud på 3.2 inträffade den 7 april i Norge, ca 104 km NV om Arvika. De två näst största jordskalven inträffade den 8 april respektive 20 maj i Lappland med en magnitud på 2.3. Ett jordskalv med en magnitud på 2.0 lokaliserades till Bottenviken, 112 km öster om Skellefteå den 2 april. Ytterligare 13 jordskalv med en magnitud överstigande eller lika med 1.0 inträffade under perioden. Djupet till hypocentrum, där skalven genereras, varierar från 0.2 upp till 43.2 km.

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1 Introduction

This document reports the seismic events recorded by the Swedish National Seismic Network (SNSN) for the second quarter of the year 2004. The work was carried out in accordance with activity plan AP TD F73-01-013. In Table 1-1 controlling document for performing this activity is listed. The activity plan is an SKB internal controlling document.

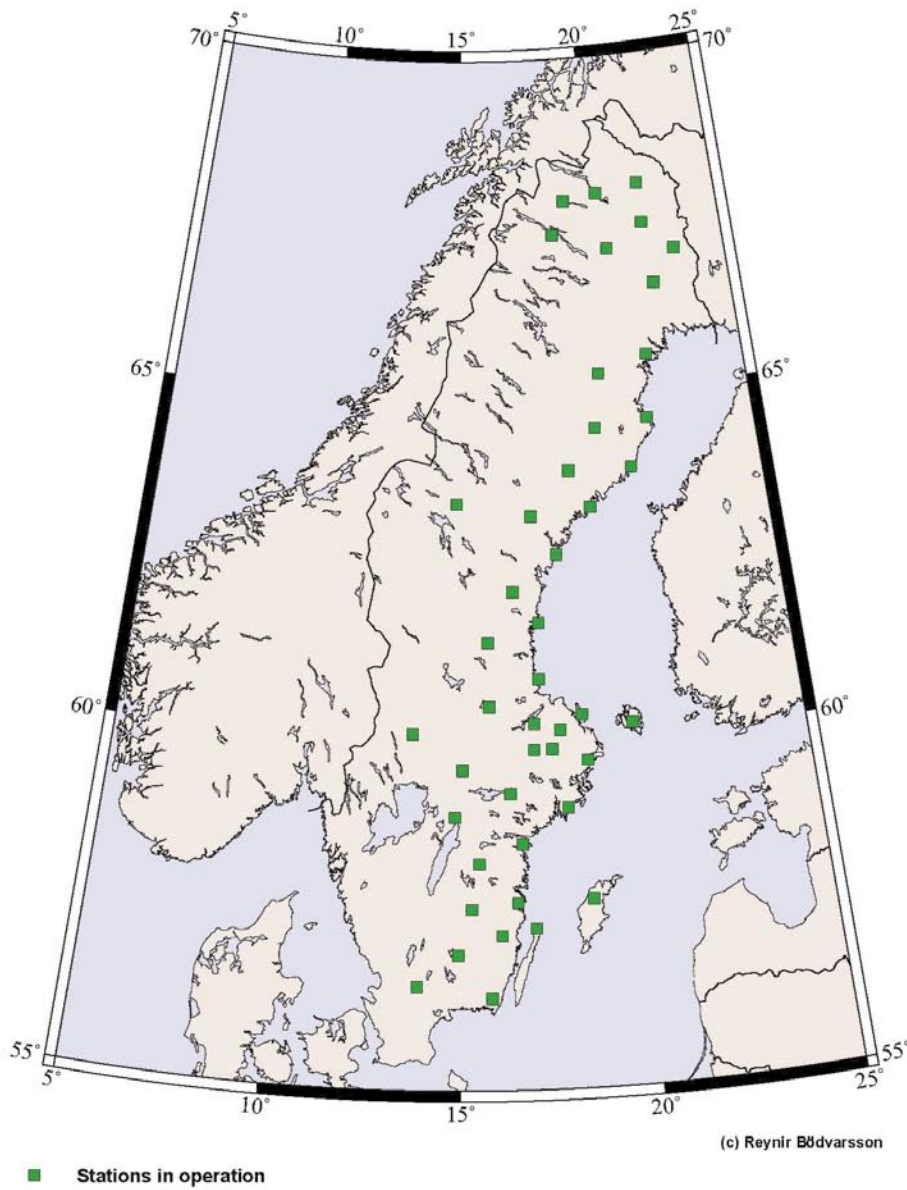
At present 45 stations are in operation which means that all stations that have been funded are now in operation.

The report includes fundamental information about the seismic events, including origin time and hypocenter location. Information about the source parameters is not included in the present report but is delivered as separate ASCII-text. This report is a preliminary report including only the automatic and the brief interactive analysis done on the routine bases at SNSN.

Table 1-1. Controlling documents for the performance of the activity.

Activity plan	Number	Version
Drift av seismologiskt nät längs Östersjöns kust	AP TD F73-01-013	

Swedish National Seismic Network June 2004



Figur 1-1. The present Swedish National Seismic Network (SNSN).

2 Objective and scope

According to an agreement with Swedish Nuclear Fuel and Waste Management Company (SKB) and Uppsala University, the Department of Earth Sciences continues to carry out observation and additional construction of new seismic stations within the Swedish National Seismic Network (SNSN).

The goal is to complement the existing regional seismic network to establish a local seismic network that also permits registration of small earthquakes in order to obtain relatively long time series and thereby gain a better understanding of the causes of seismic events in the site investigation areas.

Fundamental information about the seismic events, including origin time, hypocenter location and information about the source parameters will be given after every three month period.

The sensitivity of the network allows for complete recordings of all earthquakes down to a magnitude of lower than 0.5 within the network and down to magnitude 0.0 near the proposed nuclear waste deposit sites.

3 Recorded earthquakes during the second quarter of 2004

Figure 3-1 shows the recorded events in Sweden during April through June 2004. During this period there were 1,792 located events. Out of these 1,466 are explosions, 126 are true earthquakes (which are shown in Figure 3-2) and 200 are still uncertain but most of these are mainly outside the network.

The largest earthquake ML = 3.2 occurred on April 7th in Norway only 104 km NW of Arvika. The second two largest local earthquake recorded during this period occurred on April 8th and on May 20th in Lapland with magnitude ML = 2.3. An earthquake with magnitude ML = 2.0 was located in Bottenviken, 112 km East of Skellefteå on April 2nd. Additional 13 earthquakes were located during this period with magnitudes above or of 1.0. Event lists for April through June 2004 are given in sections 3.1 through 3.3.

3.1 April

Event list for April is given in Table 3-1 with date, time (UTC), latitude, longitude, X (RT90), Y (RT90), depth and local magnitude (ML). In April 51 events were located whereof one with magnitude 3.2 was located in Norway, 104 km NW of Arvika and another earthquake with magnitude 2.3 was located 3 km SE of Kiruna. An additional earthquake with magnitude 2.0 was located in Bottenviken 112 km E of Skellefteå. Only 4 additional earthquakes with magnitude above or of 1.0 were located. The depth range of the events varies between 0.2 and 43.2 km.

Table 3-1. Date, time (UTC), latitude, longitude, X (RT90), Y (RT90), depth and local magnitude (ML) of recorded earthquakes in April.

Date	Time (UTC)	Latitude	Longitude	X RT90 km	Y RT90 km	Depth km	ML Local magnitude
20040401	014441.4	64.362	20.882	7,149.3	1,744.8	21.0	0.2
20040401	172059.9	61.643	16.510	6,836.6	1,537.2	17.5	0.3
20040402	003704.0	67.559	19.035	7,499.5	1,637.4	17.8	0.6
20040402	122038.6	64.344	20.705	7,146.5	1,736.4	19.6	0.9
20040402	122710.2	64.968	23.344	7,228.3	1,855.2	4.0	2.0
20040404	020527.3	64.272	20.681	7,138.5	1,735.9	24.4	0.1
20040406	022733.2	62.630	18.251	6,948.8	1,625.3	16.4	0.2
20040406	060723.9	62.562	18.018	6,940.8	1,613.6	17.2	0.3
20040406	060729.3	62.559	18.019	6,940.4	1,613.7	13.1	0.2
20040406	061417.2	62.561	18.030	6,940.7	1,614.2	15.3	0.1
20040406	061523.2	62.559	18.016	6,940.5	1,613.5	12.9	0.1
20040406	061539.9	62.557	17.992	6,940.1	1,612.3	18.2	0.1
20040406	062050.4	64.438	20.816	7,157.5	1,741.0	14.5	-0.1
20040406	210725.8	63.839	18.017	7,083.0	1,608.7	28.4	0.4
20040406	221036.5	67.188	20.651	7,462.7	1,709.4	0.6	0.8

Date	Time (UTC)	Latitude	Longitude	X RT90 km	Y RT90 km	Depth km	ML Local magnitude
20040407	005027.4	63.348	17.985	7,028.3	1,608.9	21.6	0.1
20040407	054258.5	67.307	18.795	7,470.9	1,628.6	9.1	0.1
20040407	085318.3	60.493	11.795	6,715.0	1,279.5	0.2	3.2
20040408	025638.5	65.194	22.453	7,248.6	1,810.7	17.3	0.3
20040408	091035.4	67.790	20.289	7,528.5	1,688.9	0.5	2.3
20040408	151808.9	63.494	22.317	7,059.1	1,823.8	9.5	0.3
20040408	170703.6	67.941	18.915	7,541.7	1,630.2	19.6	0.3
20040408	191625.3	62.667	14.402	6,951.3	1,427.9	10.4	0.6
20040409	061212.9	63.700	16.782	7,066.1	1,548.1	13.1	1.5
20040410	012954.5	62.607	17.496	6,944.9	1,586.6	29.9	0.4
20040410	190402.3	61.787	17.028	6,853.0	1,564.4	16.5	0.2
20040410	235333.2	63.157	18.371	7,007.7	1,629.1	22.3	0.4
20040411	015332.8	63.760	18.432	7,075.0	1,629.4	15.9	0.5
20040411	024745.1	62.172	16.573	6,895.6	1,539.8	24.7	-0.3
20040416	120139.7	63.566	17.908	7,052.4	1,604.3	22.9	0.5
20040417	015613.9	62.648	18.223	6,950.8	1,623.8	13.7	-0.3
20040417	215656.4	62.678	18.226	6,954.1	1,623.8	14.9	0.3
20040418	082343.1	58.636	17.549	6,502.8	1,601.1	22.0	0.7
20040418	132927.2	62.200	16.546	6,898.7	1,538.4	18.3	-0.2
20040420	024941.8	63.672	25.544	7,099.2	1,980.5	38.0	1.0
20040420	114658.4	64.160	20.508	7,125.3	1,728.5	3.0	0.7
20040423	064709.7	64.052	20.074	7,111.9	1,708.2	2.7	0.1
20040424	024208.3	61.924	17.429	6,868.8	1,585.1	22.9	0.0
20040426	045126.5	67.710	19.651	7,517.8	1,662.6	21.9	0.0
20040426	110721.6	66.590	22.460	7,403.5	1,794.5	10.3	0.2
20040426	193525.7	67.817	20.112	7,530.9	1,681.3	0.5	-0.7
20040426	234214.9	67.840	20.189	7,533.8	1,684.3	0.6	0.8
20040427	015950.4	68.279	21.070	7,585.4	1,717.1	16.5	0.8
20040428	154707.6	61.628	16.904	6,835.3	1,558.1	20.5	0.8
20040429	031856.1	66.452	22.163	7,386.8	1,783.0	13.2	0.7
20040429	095858.1	62.688	18.109	6,955.0	1,617.8	14.5	1.0
20040429	211741.7	67.783	19.552	7,525.7	1,657.9	8.3	0.7
20040430	003155.1	67.003	21.291	7,444.4	1,738.9	9.2	1.3
20040430	024016.7	66.723	22.649	7,419.2	1,801.2	19.0	-0.1
20040430	175146.3	63.724	17.743	7,069.8	1,595.6	43.2	0.5
20040430	180057.5	61.229	18.882	6,794.2	1,665.0	6.0	0.6

3.2 May

Event list for May is given in Table 3-2 with date, time (UTC), latitude, longitude, X (RT90), Y (RT90), depth and local magnitude (ML). In May 38 events were located whereof one with magnitude 2.3 located 60.8 km NE of Gällivare. One earthquake with magnitude 1.8 was located 26 km E of Nikkaluokta. Additional six earthquakes were located with magnitude above or of 1.0. The depth range of the events varies between 3.0 and 25.1 km.

Table 3-2. Date, time (UTC), latitude, longitude, X (RT90), Y (RT90), depth and local magnitude (ML) of recorded earthquakes in May.

Date	Time (UTC)	Latitude	Longitude	X RT90 km	Y RT90 km	Depth km	ML Local magnitude
20040502	164037.2	64.470	21.058	7,161.9	1,752.3	25.0	0.3
20040502	183445.8	65.729	22.570	7,308.5	1,809.8	17.3	1.0
20040502	205228.1	61.748	16.543	6,848.3	1,538.8	17.5	-0.1
20040503	065606.7	68.349	20.668	7,591.9	1,700.0	10.8	0.5
20040504	191741.2	67.357	19.002	7,476.9	1,637.2	11.5	-0.2
20040505	150822.7	67.813	19.618	7,529.1	1,660.5	12.5	1.8
20040507	101019.5	64.123	20.451	7,121.1	1,726.0	17.8	-0.2
20040507	141110.0	66.441	22.331	7,386.4	1,790.6	15.3	-0.1
20040508	222958.6	64.025	20.810	7,111.4	1,744.3	14.5	1.0
20040509	041515.3	63.281	18.817	7,022.5	1,650.9	12.9	0.2
20040509	224706.7	67.374	18.919	7,478.6	1,633.5	10.8	-0.1
20040510	050123.5	64.190	20.553	7,128.9	1,730.4	3.0	0.1
20040511	023045.4	63.932	21.184	7,102.6	1,763.4	18.8	1.1
20040511	121141.8	67.663	19.293	7,511.7	1,647.7	4.8	0.1
20040511	183101.6	64.512	21.214	7,167.3	1,759.4	21.3	0.3
20040512	234442.6	61.850	17.542	6,860.7	1,591.3	15.9	0.0
20040515	035617.3	66.502	22.637	7,394.7	1,803.4	24.8	0.3
20040516	173220.0	57.854	16.397	6,414.5	1,535.0	18.5	0.2
20040518	155904.0	60.865	17.713	6,751.3	1,603.5	3.0	0.9
20040519	044159.2	64.395	20.809	7,152.6	1,741.0	21.7	0.4
20040519	102707.6	67.492	19.062	7,492.1	1,639.0	12.4	1.1
20040520	104032.6	67.330	22.137	7,484.2	1,771.9	5.9	2.3
20040520	124029.7	64.461	21.044	7,160.9	1,751.7	22.9	0.0
20040520	193858.5	64.389	20.677	7,151.5	1,734.7	7.0	0.8
20040520	204003.5	61.551	17.070	6,826.8	1,567.1	5.3	-0.6
20040522	052957.9	67.106	23.956	7,468.6	1,853.0	5.4	-0.2
20040522	135256.7	67.124	24.006	7,470.9	1,854.9	5.1	0.5
20040524	030448.8	64.555	20.632	7,169.8	1,731.1	18.5	-0.4
20040524	064727.5	64.388	20.641	7,151.2	1,733.0	3.0	0.1
20040525	121242.8	61.762	16.664	6,850.0	1,545.2	11.8	1.2
20040526	025428.9	68.156	20.139	7,568.8	1,679.7	13.1	0.6
20040527	152228.1	61.767	17.050	6,850.9	1,565.5	25.1	0.1
20040528	000556.5	64.020	20.553	7,110.0	1,731.8	16.5	0.3
20040528	021647.4	64.214	20.863	7,132.7	1,745.2	19.0	-0.4
20040528	113329.6	62.773	17.932	6,964.1	1,608.4	23.1	1.9
20040529	220728.1	64.500	20.699	7,163.8	1,734.8	3.4	0.4
20040530	205023.3	62.939	17.755	6,982.3	1,598.8	20.4	0.4
20040531	193040.6	62.672	18.234	6,953.4	1,624.3	15.5	-0.4

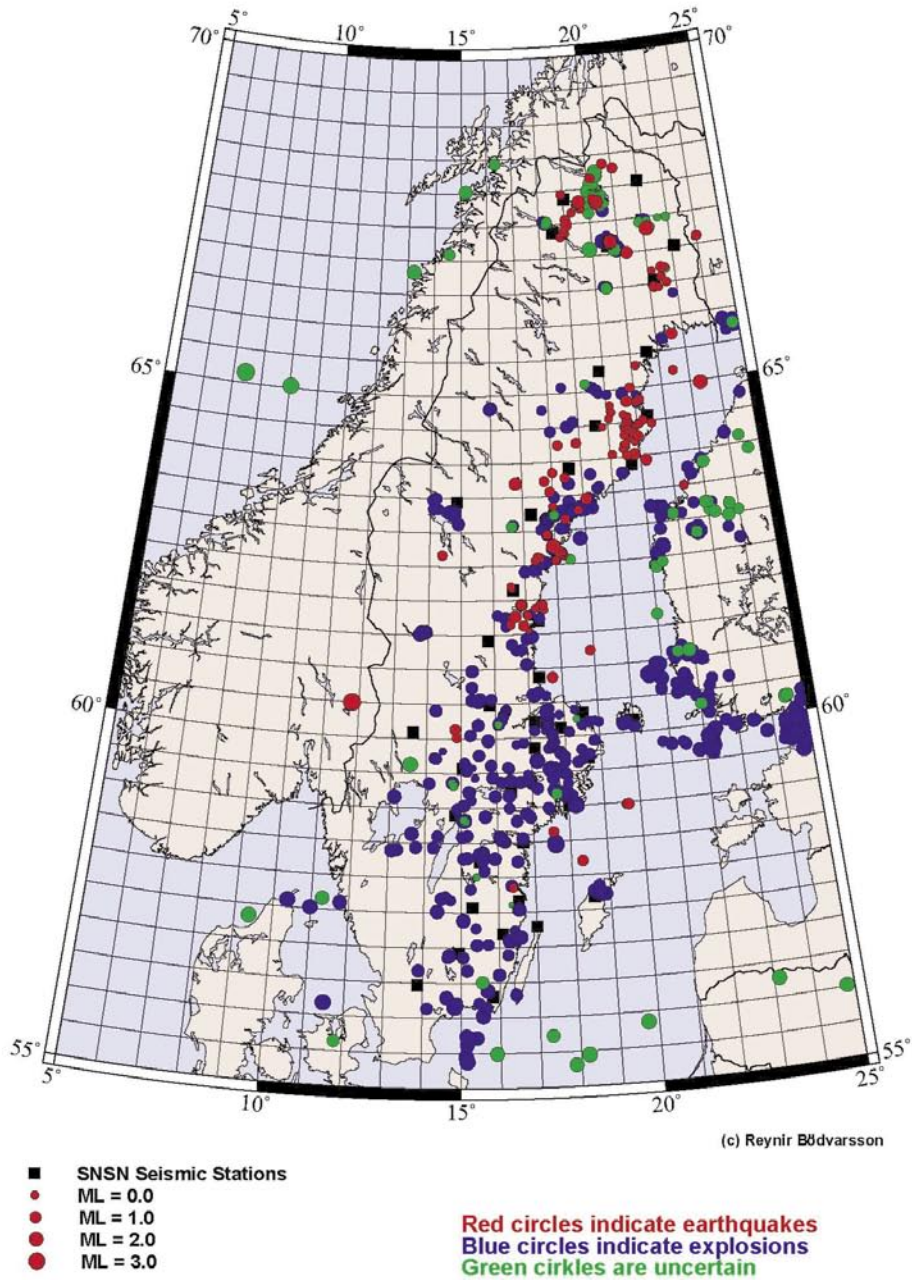
3.3 June

Event list for June is given in Table 3-3 with date, time (UTC), latitude, longitude, X (RT90), Y (RT90), depth and local magnitude (ML). In June 37 events were located, the largest with magnitude 1.7 located 8 km NW of Gällivare. Additional 3 earthquakes were located with magnitude above or of 1.0. The depth range of the events varies between 0.3 and 29.1 km.

Table 3-3. Date, time (UTC), latitude, longitude, X (RT90), Y (RT90), depth and local magnitude (ML) of recorded earthquakes in June.

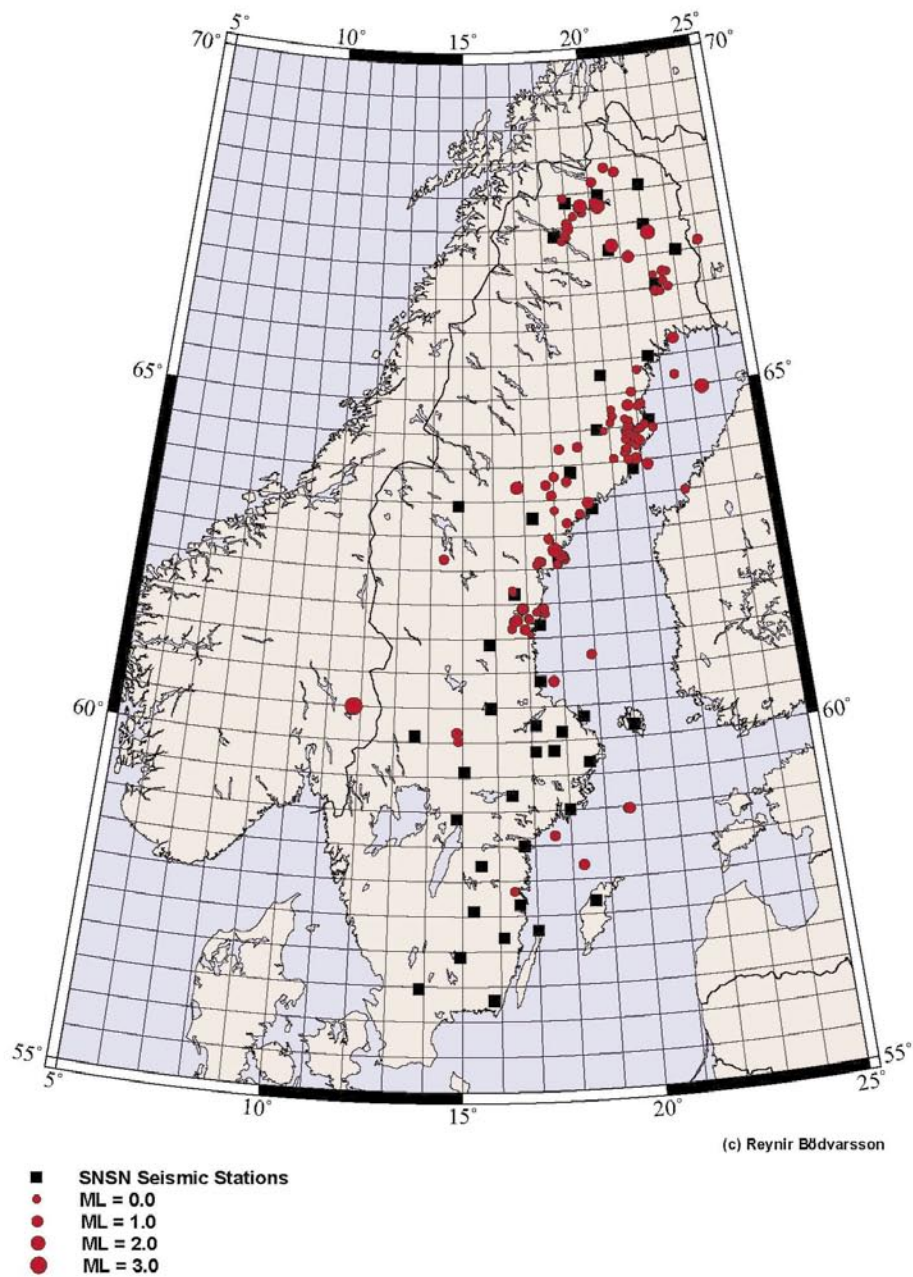
Date	Time (UTC)	Latitude	Longitude	X RT90 km	Y RT90 km	Depth km	ML Local Magnitude
20040601	064417.3	64.767	20.116	7191.6	1704.9	26.5	-0.1
20040601	133732.2	64.467	19.800	7157.2	1691.9	25.5	-0.3
20040602	080905.0	61.932	16.858	6869.1	1555.1	13.0	1.2
20040603	202512.1	64.415	20.568	7154.0	1729.2	29.1	0.2
20040603	212243.6	66.693	22.136	7413.6	1779.1	9.2	-0.1
20040604	064647.4	64.578	20.043	7170.3	1702.8	21.7	-0.1
20040605	194910.7	64.374	20.713	7149.9	1736.6	19.8	0.5
20040606	132045.9	64.821	21.145	7201.3	1753.2	10.5	0.6
20040607	030053.0	60.134	14.824	6668.7	1445.3	10.6	0.9
20040608	122854.3	63.437	19.102	7040.6	1664.3	8.3	1.0
20040609	011832.2	64.514	20.663	7165.3	1733.0	20.1	0.5
20040609	033835.0	58.205	18.305	6456.2	1646.7	8.8	0.9
20040611	001511.3	60.018	14.873	6655.8	1447.8	21.4	0.4
20040612	052905.8	64.352	20.685	7147.4	1735.4	18.8	0.1
20040612	053533.9	64.343	20.827	7146.9	1742.3	5.3	-0.2
20040612	222702.7	64.587	20.712	7173.6	1734.7	24.0	-0.5
20040613	015230.6	61.876	17.277	6863.3	1577.3	18.2	-0.2
20040613	025746.6	65.009	20.875	7221.1	1738.7	10.2	0.4
20040613	081659.8	65.327	21.157	7257.6	1749.0	21.4	0.0
20040613	142403.5	64.323	20.541	7143.7	1728.7	21.1	0.3
20040614	000306.0	58.975	19.625	6545.5	1719.4	15.2	0.7
20040614	000339.6	58.974	19.671	6545.5	1722.1	9.0	0.9
20040615	125801.6	64.461	21.499	7162.8	1773.6	20.7	0.3
20040618	183313.2	61.933	16.856	6869.2	1555.0	8.4	0.4
20040619	140440.0	64.261	18.872	7131.8	1648.5	8.3	0.5
20040621	094227.0	64.790	21.054	7197.4	1749.2	12.0	0.3
20040621	113909.5	62.619	17.424	6946.2	1582.9	14.1	0.2
20040622	043156.0	61.922	17.525	6868.7	1590.2	20.0	0.2
20040624	183508.4	62.565	17.347	6940.1	1579.1	19.0	0.1
20040625	022060.0	66.731	22.505	7419.4	1794.8	14.8	0.5
20040625	165324.3	64.392	20.661	7151.8	1733.9	19.9	0.3
20040626	130728.3	64.666	20.153	7180.4	1707.4	23.0	-0.1
20040628	211537.6	64.238	18.249	7127.9	1618.4	18.3	0.6
20040630	025814.3	64.624	20.550	7177.2	1726.7	5.3	-0.3
20040630	043512.9	64.814	20.708	7198.8	1732.5	4.6	1.0
20040630	043940.7	64.286	21.010	7141.3	1751.7	18.3	0.4
20040630	221049.7	67.186	20.695	7462.6	1711.3	0.3	1.7

SNSN recorded events April through June 2004



Figur 3-1. Recorded events including explosions in the SNSN network during the period April through June 2004.

SNSN recorded earthquakes April through June 2004



Figur 3-2. Earthquake activity in Sweden during April through June 2004.