P-04-248

Swedish National Seismic Network (SNSN)

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

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October 2004

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ISSN 1651-4416
SKB P-04-248

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Keywords: Seismic network, Earthquakes.

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 short report gives some information about the recorded seismicity during July through September 2004.

The Swedish National Seismic Network consists of 45 stations and all of them are now in operation. During July through September, 1,950 events were located whereof 130 are estimated as real earthquakes, 1,427 are estimated as explosions and 391 events are still considered as uncertain but these are mainly outside the network.

The largest earthquake with magnitude 5.2 occurred on September 21th in Kaliningrad only 260 km SE of Barshageudd on Gotland. This earthquake was preceded by a fore-shock with magnitude 4.7 and one aftershock reaching magnitude 3.0. The main-shock and the fore-shock were felt in large parts of southern Sweden. The largest earthquake located within the network was located 9.3 km SE of Gällivare with magnitude 2.2 on September 29th.

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 juli till september 2004.

Det seismiska nätet består av 45 stationer och all stationer är nu i drift. Under perioden juli till september, 2004 var det 1 950 registrerade händelser varav 130 bedömdes som äkta jordskalv, 1 427 bedömdes vara förorsakade av explosioner eller sprängningar samt 391 var osäkra händelser, men dessa var i huvudsak lokaliserade utanför det seismiska nätet.

Det största jordskalvet med en magnitud på 5,2 inträffade den 21 september i Kaliningrad, 260 km SO om Barshageudd på Gotland. Ett förskalv på 4,7 samt ett efterskalv på 3,0 registrerades. Huvudskalvet samt förskalvet kändes över stora delar av södra Sverige. Största skalvet som lokaliserades inom nätverket var på 2,2 och inträffade 29 september 9,3 km SO om Gällivare.

Contents

1 Introduction

This document reports the seismic events recorded by the Swedish National Seismic Network (SNSN) for the third 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, 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	

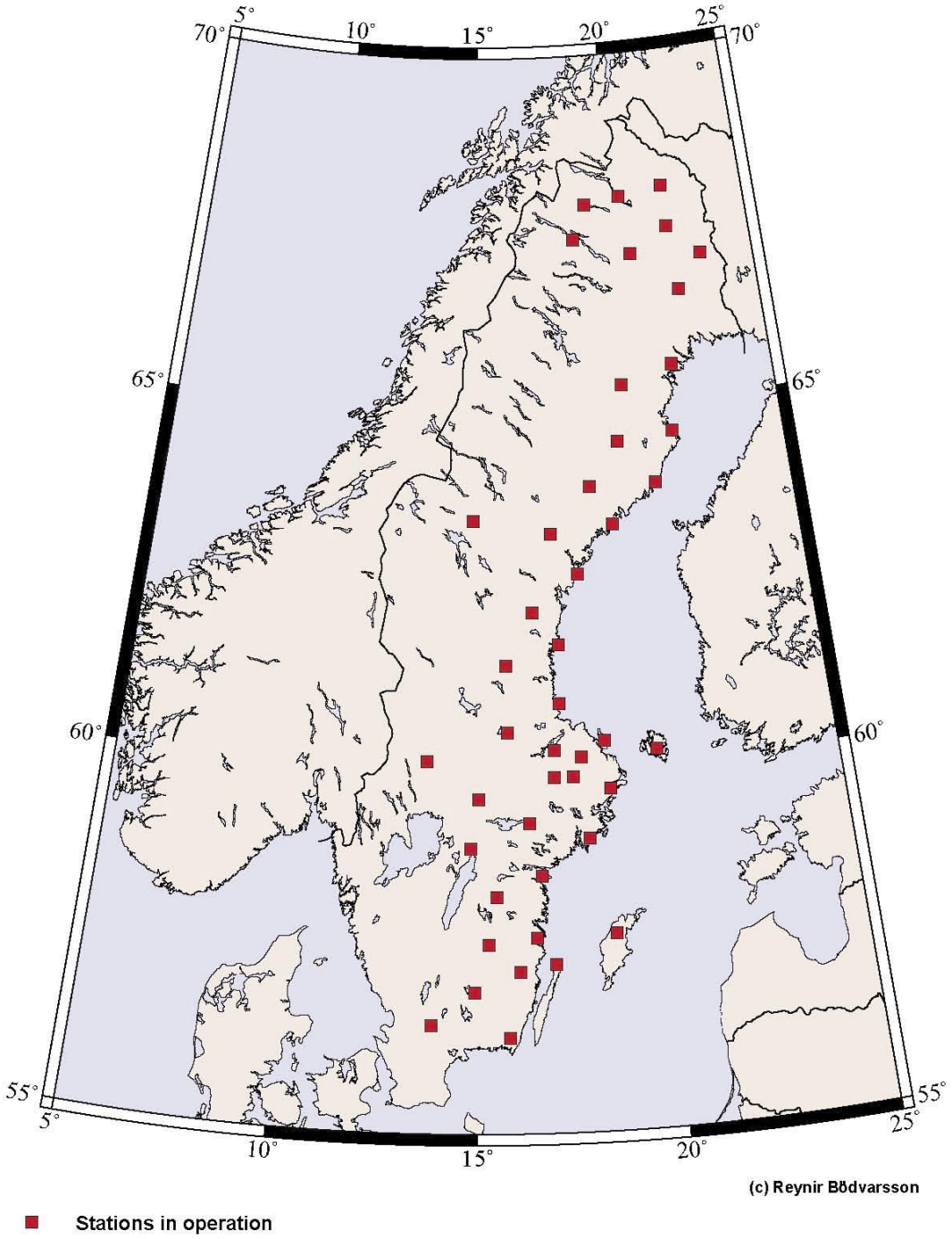

Figure 1-1. *The present Swedish National Seismic Network (SNSN).*

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 third quarter of 2004

Figure 3-1 shows the recorded events in Sweden during July through September 2004. During this period there were 1,950 events were located whereof 130 are estimated as real earthquakes (which are shown in Figure 3-2). 1,427 are estimated as explosions and 391 events are still considered as uncertain but these are mainly outside the network.

The largest earthquake with magnitude 5.2 occurred on September 21th in Kaliningrad only 260 km SE of Barshageudd on Gotland. This earthquake was preceded by a fore-shock with magnitude 4.7 and one aftershock reaching magnitude 3.0. The main-shock and the fore-shock were felt in large part of southern Sweden. The largest earthquake located within the network was located 9.3 km SE of Gällivare with magnitude 2.2 on September 29th. Event lists for July through September 2004 are given in sections 3.1 through 3.3.

3.1 July

Event list for July is given in Table 3-1 with date, time (UTC), latitude, longitude, X (RT90), Y (RT90), depth and local magnitude (M_L). In July 46 events were located whereof one with magnitude of 2.0 and additional 8 larger or equal to 1.0. The depth range of the events varies between 3.3 and 29.8 km.

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

Date	Time (UTC)	Latitude	Longitude	X RT90 Km	Y RT90 Km	Depth km	M_L Local Magnitude
20040701	065149.5	59.775	14.578	6,628.9	1,430.9	20.9	0.7
20040701	171139.5	56.276	13.535	6,241.0	1,359.2	10.7	1.6
20040703	141242.5	65.943	23.436	7,336.8	1,846.4	10.1	1.2
20040704	034407.1	66.340	21.851	7,373.1	1,770.3	9.5	0.7
20040704	082458.8	64.545	20.839	7,169.4	1,741.1	20.5	0.8
20040704	192801.3	64.496	20.533	7,162.8	1,726.9	8.0	0.4
20040706	040038.6	62.499	17.629	6,933.2	1,593.8	20.7	0.3
20040706	163520.2	59.912	15.034	6,643.8	1,456.7	20.4	0.8
20040707	081250.4	64.785	20.126	7,193.6	1,705.2	19.8	1.0
20040709	134441.0	64.154	20.265	7,123.9	1,716.7	29.8	–0.2
20040709	194906.0	67.450	24.146	7,507.7	1,856.0	22.9	2.0
20040710	062801.7	63.862	17.922	7,085.4	1,603.9	19.7	0.4
20040711	114029.5	62.846	18.612	6,973.6	1,642.8	18.8	1.0
20040711	155328.1	63.150	20.608	7,013.4	1,741.8	16.0	0.6
20040712	072321.0	66.023	23.418	7,345.6	1,844.5	9.2	0.7
20040712	155514.1	62.646	18.919	6,952.0	1,659.5	14.1	0.7
20040713	162649.4	64.414	21.135	7,156.0	1,756.5	20.2	0.2
20040714	214611.2	62.800	18.131	6,967.5	1,618.5	12.3	–0.1
20040715	035233.1	63.400	19.090	7,036.4	1,663.9	3.5	0.2
20040715	163327.0	68.119	20.033	7,564.4	1,675.6	21.3	0.9
20040715	194313.9	58.672	15.469	6,505.5	1,480.3	20.4	0.6

Date	Time (UTC)	Latitude	Longitude	X RT90 Km	Y RT90 Km	Depth km	M_L Local Magnitude
20040716	175713.2	68.425	20.184	7,598.9	1,679.5	3.5	1.3
20040717	020733.4	64.464	18.780	7,154.1	1,642.9	26.6	0.3
20040717	141729.7	67.141	22.616	7,465.4	1,794.7	28.7	0.2
20040717	143821.9	65.413	22.449	7,272.9	1,808.0	7.7	0.2
20040717	213621.8	55.531	12.261	6,161.4	1,276.1	18.7	1.6
20040718	021857.2	61.587	16.475	6,830.3	1,535.4	18.7	–0.2
20040718	171101.2	62.831	19.532	6,974.3	1,689.7	9.9	0.1
20040720	065223.7	64.512	21.119	7,166.8	1,754.8	4.5	–0.3
20040721	011619.8	64.718	21.404	7,190.9	1,766.4	20.7	0.8
20040722	000838.7	64.042	19.125	7,108.0	1,662.0	21.2	–0.3
20040722	024303.9	61.852	17.525	6,860.9	1,590.4	21.1	0.1
20040724	113410.1	64.633	21.105	7,180.2	1,753.0	3.3	0.2
20040724	181008.2	64.552	21.120	7,171.3	1,754.5	4.2	0.3
20040724	231803.8	64.287	20.508	7,139.5	1,727.4	21.6	–0.2
20040725	073937.7	64.282	20.502	7,138.9	1,727.2	8.3	0.4
20040725	095942.6	64.456	21.343	7,161.6	1,766.1	29.5	0.2
20040725	202535.1	64.393	20.344	7,150.7	1,718.7	29.8	–0.3
20040726	052215.8	65.254	20.874	7,248.4	1,736.5	20.9	1.8
20040726	055423.5	65.242	20.881	7,247.1	1,736.9	20.9	1.7
20040727	161732.7	63.424	16.263	7,035.0	1,522.7	20.6	0.9
20040728	221755.5	64.114	20.563	7,120.4	1,731.5	6.0	–0.5
20040729	031515.1	64.749	20.617	7,191.3	1,728.8	25.7	–0.2
20040729	202127.3	65.009	20.957	7,221.5	1,742.6	18.9	0.6
20040730	155602.7	64.869	21.118	7,206.5	1,751.4	19.9	–0.0
20040731	183713.4	64.470	20.935	7,161.5	1,746.4	8.0	–0.3

3.2 August

Event list for August is given in Table 3-2 with date, time (UTC), latitude, longitude, X (RT90), Y (RT90), depth and local magnitude (M_L). In August 34 events were located whereof one with magnitude of 1.8 in Lappland and only additional 4 larger or equal to 1.0. The depth range of the events varies between 0.1 and 26.6 km.

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

Date	Time (UTC)	Latitude	Longitude	X RT90 Km	Y RT90 Km	Depth Km	M_L Local Magnitude
20040801	122641.2	61.839	17.629	6,859.6	1,595.9	26.1	0.3
20040802	225850.9	64.389	21.132	7,153.2	1,756.6	21.5	–0.3
20040807	093910.3	64.504	21.128	7,166.0	1,755.3	18.5	–0.2
20040807	202418.1	62.629	17.936	6,948.1	1,609.1	8.4	0.1
20040808	041907.5	62.836	18.256	6,971.7	1,624.7	18.6	0.1
20040808	111011.2	64.790	20.381	7,195.0	1,717.2	23.9	0.4
20040810	071346.0	57.883	15.241	6,417.7	1,466.3	6.1	0.9
20040811	013301.4	61.776	16.828	6,851.7	1,553.8	8.7	0.5
20040811	055534.4	62.956	19.024	6,986.9	1,663.1	18.3	0.5
20040811	132317.6	64.471	21.242	7,162.7	1,761.1	21.5	0.2

Date	Time (UTC)	Latitude	Longitude	X RT90 Km	Y RT90 Km	Depth Km	M_L Local Magnitude
20040813	052114.7	61.627	16.898	6,835.2	1,557.8	16.3	0.2
20040813	151724.3	61.627	16.898	6,835.2	1,557.8	19.0	1.1
20040814	092212.6	62.055	17.367	6,883.4	1,581.5	17.4	–0.1
20040816	131808.1	67.400	22.170	7,492.1	1,772.5	6.0	–0.6
20040816	145834.9	62.407	17.538	6,922.7	1,589.4	17.6	0.5
20040817	142756.4	67.989	19.188	7,547.7	1,641.3	3.0	1.1
20040817	152045.6	61.803	17.048	6,854.9	1,565.3	22.2	0.0
20040819	013010.9	65.272	22.818	7,259.1	1,826.7	18.4	0.4
20040820	070733.9	61.784	17.093	6,852.8	1,567.8	18.3	0.4
20040821	063829.2	62.095	16.461	6,886.9	1,534.1	20.8	0.5
20040823	103447.9	67.830	20.096	7,532.4	1,680.5	0.5	0.0
20040824	074035.9	64.311	20.723	7142.9	1,737.6	10.8	0.1
20040824	172735.9	67.472	22.390	7,501.2	1,781.0	20.5	0.5
20040824	232125.6	67.831	20.103	7,532.5	1,680.8	0.1	1.8
20040825	215800.8	61.693	16.872	6,842.4	1,556.3	19.6	0.2
20040825	231140.1	63.416	19.082	7,038.2	1,663.5	4.5	0.9
20040827	081529.9	67.087	22.865	7,460.7	1,806.1	12.8	–0.5
20040829	152642.6	62.174	16.655	6,895.8	1,544.1	2.4	–1.5
20040829	161634.5	64.386	20.704	7,151.3	1,736.0	21.5	0.4
20040829	225551.5	67.549	19.232	7,498.8	1,645.9	11.3	0.7
20040830	040712.3	62.867	18.247	6,975.2	1,624.1	9.0	–0.1
20040831	190306.5	68.213	21.539	7,579.9	1,737.1	26.6	0.6
20040831	194116.1	67.850	20.130	7,534.7	1,681.7	0.2	1.0
20040831	234648.9	63.959	20.759	7,103.9	1,742.4	7.9	1.2

3.3 September

Event list for September is given in Table 3-3 with date, time (UTC), latitude, longitude, X (RT90), Y (RT90), depth and local magnitude (M_L). In September 50 events were located whereof one with magnitude 5.2 in Kaliningrad with one fore-shock with magnitude 4.7 and one aftershock with magnitude 3.0. The fore-shock and the main-shock were felt in large parts of southern Sweden, even in Uppsala and Karlstad. One earthquake of magnitude 3.0 was recorded in west Poland, 168 km SSE of Ystad and one earthquake with magnitude 2.2 was recorded 9.3 km SE of Gällivare. Additional one earthquake had a magnitude of 2.0 and 13 earthquakes had magnitudes above 1.0. Also recorded but not included in this report were 191 induced earthquakes with magnitudes between 0.0 and 2.8 located in a mine in Malmberget.

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

Date	Time (UTC)	Latitude	Longitude	X RT90 Km	Y RT90 Km	Depth Km	M_L Local Magnitude
20040902	032214.4	64.086	21.072	7,119.3	1,756.5	20.3	0.3
20040902	091817.0	61.296	16.442	6,798.0	1,533.9	21.5	0.1
20040903	062904.4	64.467	21.166	7,162.0	1,757.5	19.3	0.1
20040903	083451.1	61.865	17.271	6,862.0	1,577.0	21.3	0.3
20040903	122958.3	67.711	18.959	7,516.2	1,633.3	19.1	–0.8

Date	Time (UTC)	Latitude	Longitude	X RT90 Km	Y RT90 Km	Depth Km	M_L Local Magnitude
20040903	152843.7	65.328	22.684	7,264.7	1,819.8	8.1	1.3
20040904	071739.8	67.694	22.258	7,525.1	1,772.9	16.6	0.8
20040906	022504.9	63.333	15.403	7,024.9	1,479.7	6.8	1.2
20040906	104542.9	67.562	18.570	7,498.9	1,617.6	5.0	–0.2
20040907	050012.9	67.047	23.798	7,461.1	1,847.0	30.0	–0.0
20040907	185635.4	65.960	23.698	7,340.2	1,858.0	11.9	0.8
20040909	123719.5	64.465	20.835	7,160.5	1,741.6	10.5	1.3
20040910	011626.1	64.465	20.808	7,160.4	1,740.4	9.3	–0.2
20040912	232419.0	64.276	20.639	7,138.8	1,733.8	20.7	1.2
20040913	043006.8	63.943	20.468	7,101.1	1,728.3	4.7	0.5
20040913	112243.0	57.184	13.445	6,342.3	1,357.1	8.9	2.0
20040914	075616.3	67.506	22.226	7,504.2	1,773.7	13.4	0.6
20040915	234433.1	61.909	16.771	6,866.5	1,550.6	3.4	0.1
20040916	033311.4	64.380	20.297	7,149.1	1,716.5	17.1	–0.1
20040916	223609.7	64.317	20.645	7,143.3	1,733.8	9.3	0.1
20040917	031654.1	66.824	22.990	7,432.2	1,814.9	9.7	–0.3
20040917	042306.5	60.118	15.968	6,666.5	1,508.9	19.1	0.3
20040917	043026.9	65.525	21.325	7,280.2	1,754.8	3.1	1.6
20040919	010727.6	60.620	16.486	6,722.6	1,537.1	19.0	–0.3
20040919	020120.1	54.005	14.652	5,986.5	1,424.2	8.0	3.0
20040919	042339.3	64.421	21.082	7,156.6	1,753.9	21.5	0.2
20040919	190947.9	64.481	21.287	7,164.1	1,763.2	20.1	0.9
20040920	012846.6	65.164	21.133	7,239.4	1,749.4	22.1	1.4
20040920	044157.9	66.429	20.963	7,379.4	1,729.9	3.3	1.5
20040920	062056.9	61.816	17.206	6,856.4	1,573.6	11.6	1.8
20040920	122650.7	56.721	12.873	6,292.0	1,320.3	4.5	1.8
20040920	163108.8	64.525	21.184	7,168.6	1,757.8	21.8	0.3
20040921	110506.5	54.738	19.819	6,074.8	1,758.2	15.0	4.7
20040921	133233.2	54.754	19.792	6,076.5	1,756.4	15.0	5.2
20040921	133634.7	54.759	19.776	6,077.0	1,755.4	15.4	3.0
20040922	010046.5	61.712	16.979	6,844.6	1,561.9	13.6	0.5
20040922	044548.9	62.723	18.226	6,959.1	1,623.6	17.9	–0.0
20040923	024714.7	64.036	20.465	7,111.4	1,727.4	5.3	–0.7
20040923	062206.2	61.823	16.973	6,857.0	1,561.4	20.0	0.4
20040925	093212.0	63.969	20.930	7,105.7	1,750.7	9.3	0.3
20040925	120934.3	66.914	20.631	7,432.2	1,710.9	23.7	1.1
20040925	221219.2	64.906	20.789	7,209.3	1,735.6	18.5	0.2
20040925	221958.8	65.086	20.349	7,227.8	1,713.4	9.8	1.5
20040926	010059.6	64.896	20.767	7,208.1	1,734.6	9.3	1.6
20040927	091856.9	56.976	20.055	6,324.6	1,758.1	7.2	1.8
20040927	234425.5	61.916	16.849	6,867.3	1,554.7	11.5	–0.1
20040928	193905.7	60.808	15.929	6,743.3	1,506.6	16.0	0.1
20040929	194337.5	67.065	20.943	7,450.1	1,723.1	0.5	2.2
20040930	210915.5	61.810	17.148	6,855.7	1,570.6	5.6	–0.3
20040930	230922.2	61.444	16.149	6,814.3	1,518.2	14.4	0.3

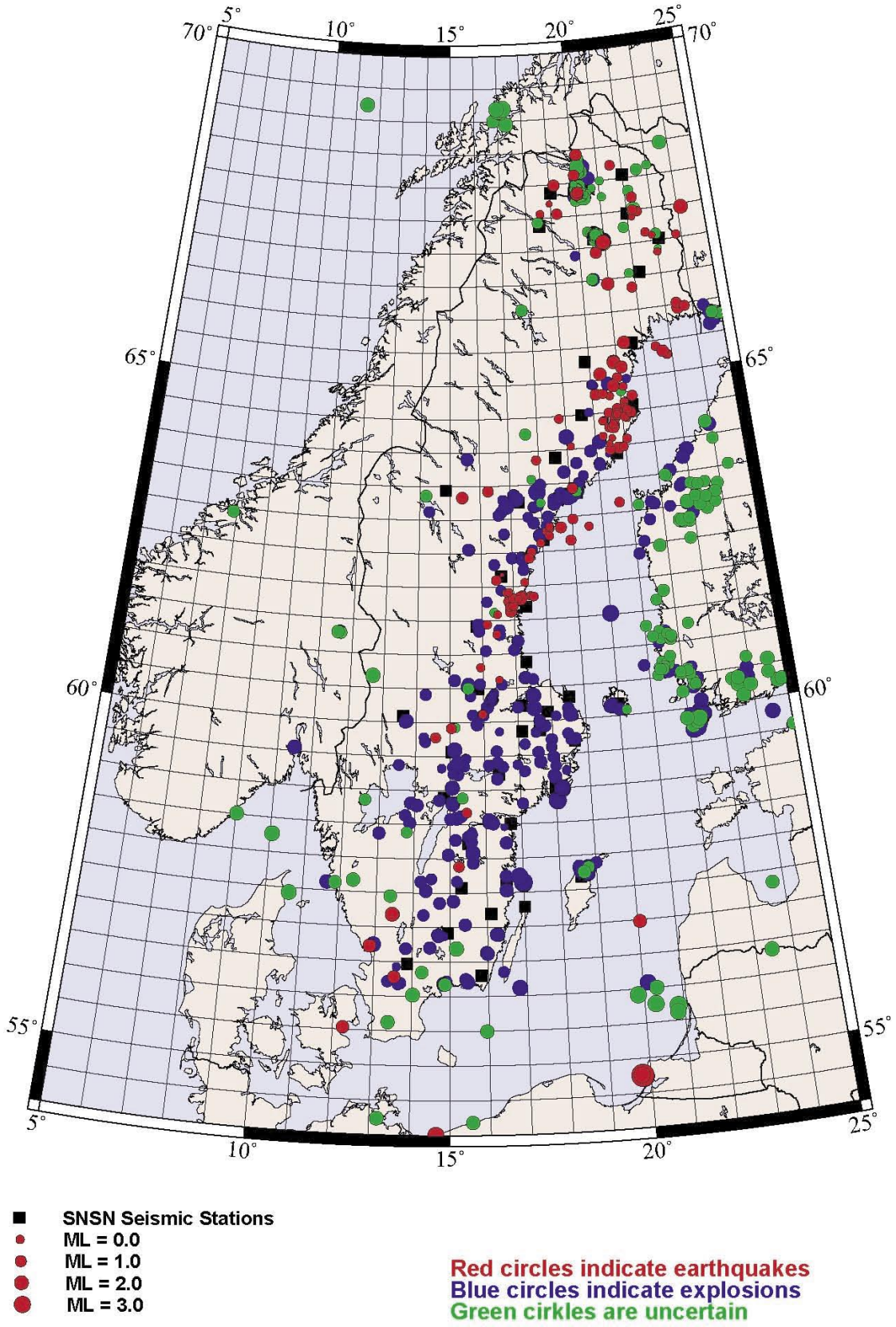

Figure 3-1. *Recorded events including explosions in the SNSN network during the period July through September 2004.*

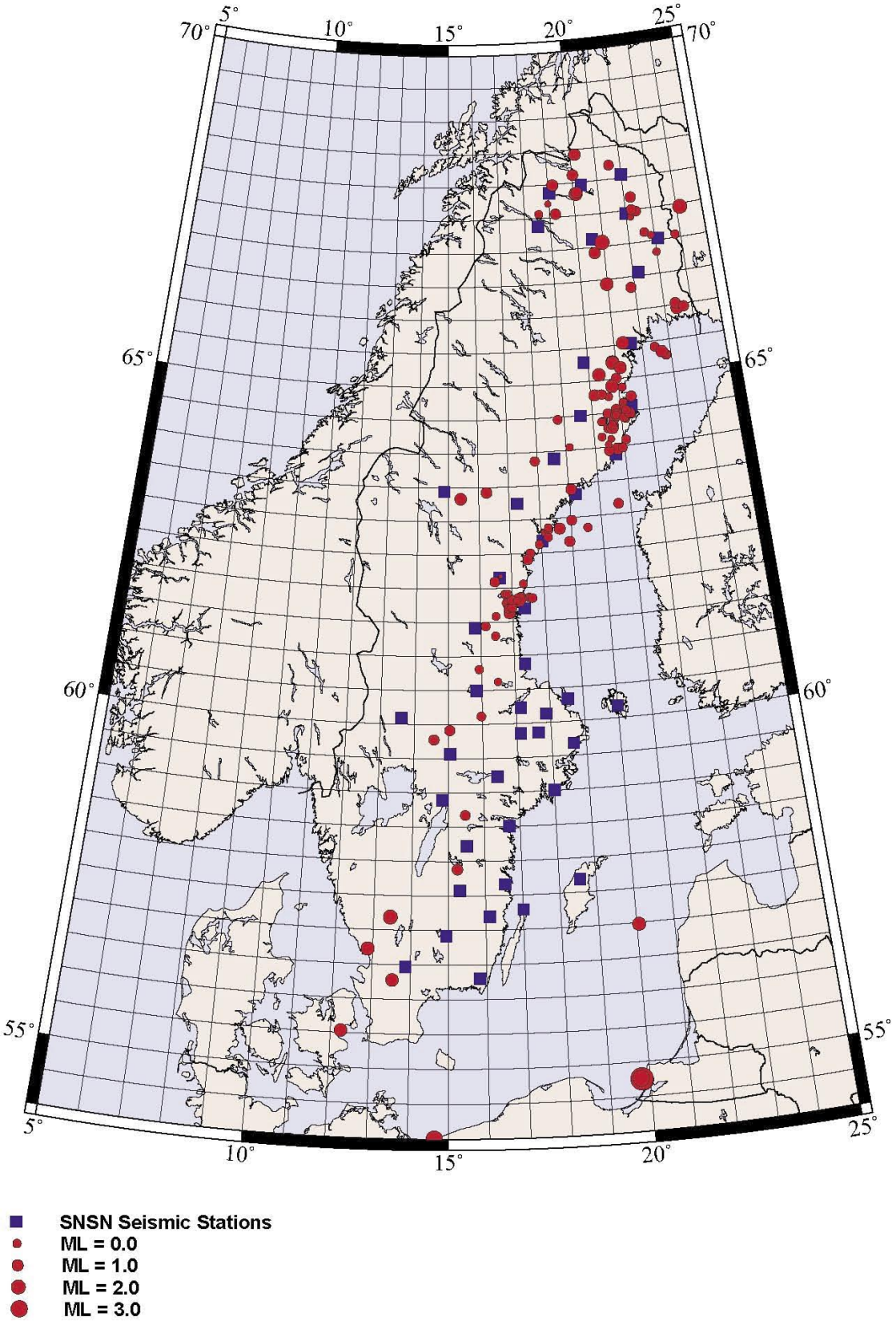

Figure 3-2. *Earthquake activity in Sweden during July through September 2004.*