

Swedish National Seismic Network (SNSN)

A short report on recorded earthquakes during the fourth quarter of the year 2007

Reynir Böðvarsson
Uppsala University, Department of Earth Sciences

January 2008

Svensk Kärnbränslehantering AB

Swedish Nuclear Fuel
and Waste Management Co
Box 250, SE-101 24 Stockholm
Tel +46 8 459 84 00



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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.

Data in SKB's database can be changed for different reasons. Minor changes in SKB's database will not necessarily result in a revised report. Data revisions may also be presented as supplements, available at www.skb.se.

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Abstract

According to an agreement between the 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 October through December 2007.

The Swedish National Seismic Network consists of 59 stations in operation and additional two under construction. During October through December, 765 events were located whereof 61 are estimated as real earthquakes, 564 are estimated as explosions, 46 are induced earthquakes in the vicinity of the mines in Kiruna and Malmberget, and 94 events are still considered as uncertain, but these are mainly located outside the network.

The largest earthquake $M_L=1.7$ occurred on October 7th located 41 km west of Värnamo.

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 Nationella Seismiska Nätet (SNSN). Denna rapport ger information om registrerade händelser under tidsperioden oktober till december 2007.

Det seismiska nätet består av 59 stationer som nu är i drift. Ytterligare två stationer är under uppbyggnad. Under perioden oktober till december, 2007 var det 765 registrerade händelser varav 61 bedömdes som äkta jordskalv, 564 förorsakade av explosioner eller sprängningar, 46 är inducerade skalv i närheten av gruvorna i Kiruna och Malmberget samt 94 var osäkra händelser, men dessa var i huvudsak lokaliserade utanför det seismiska nätet.

Det största jordskalvet med en magnitud på 1.7 inträffade väster om Värnamo den 7 oktober.

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1 Introduction

This document reports the seismic events recorded by the Swedish National Seismic Network (SNSN) for the fourth quarter of the year 2007. The work was carried out in accordance with activity plan AP PU 400-06-004. In Table 1-1 controlling document for performing this activity is listed. The activity plan is an SKB internal controlling document.

At present 59 stations are in operation, Figure 1-1. Additional two stations are under construction in southern Sweden.

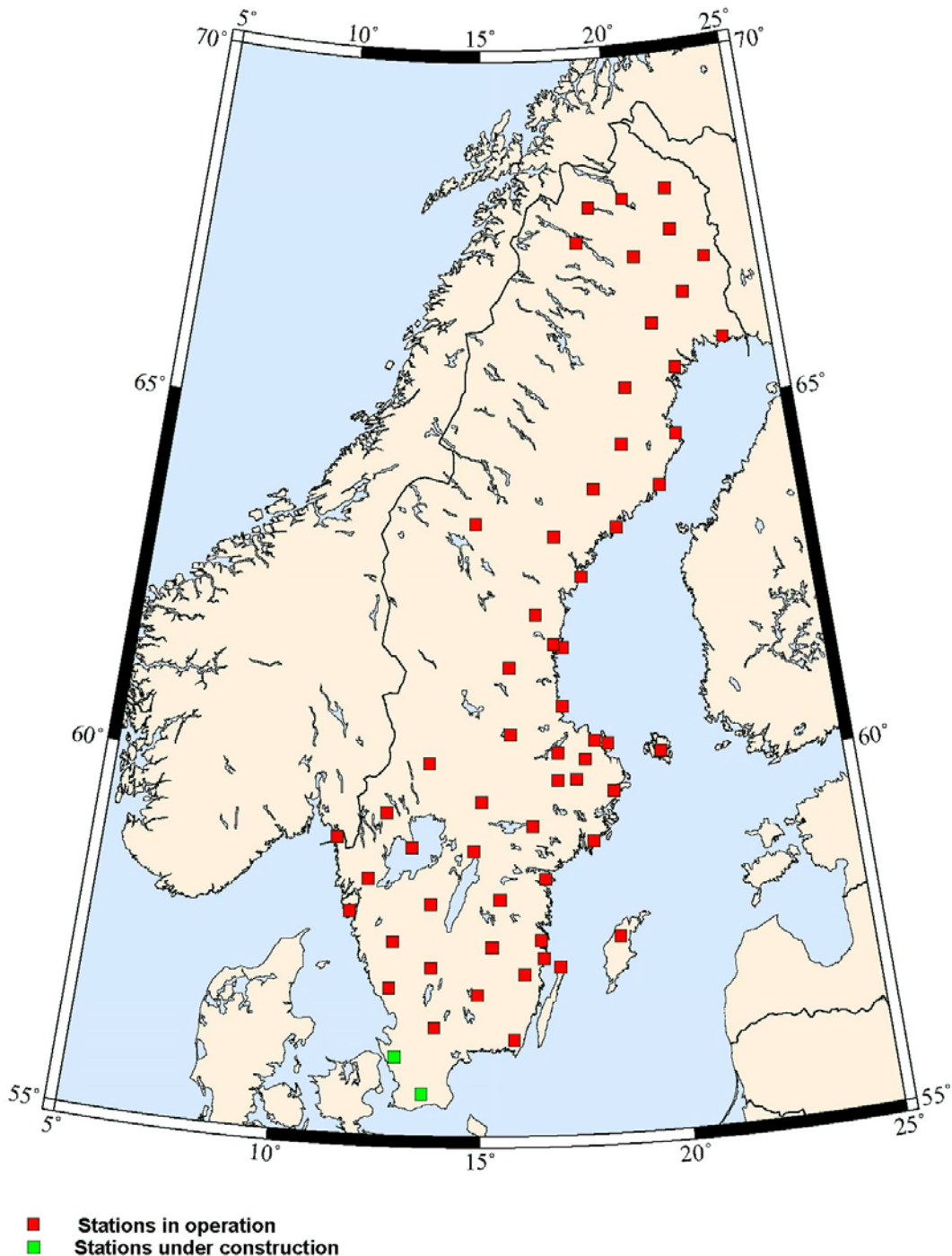


Figure 1-1. The present Swedish National Seismic Network (SNSN).

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

Activity plan	Number	Version
Drift av seismologiskt nät i Sverige	AP PU 400-06-004	1.0

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.

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 observations 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 recording 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 fourth quarter of 2007

Figure 3-1 shows the recorded events in Sweden during October through December. During the period 765 events were located whereof 61 are estimated as real earthquakes (which are shown in Figure 3-2). 564 are estimated as explosions, 46 are induced earthquakes in the vicinity of the mines in Kiruna and Malmberget and 94 are still considered as uncertain but are most probably explosions and are mainly located outside the network. The event classified as induced earthquakes in the vicinity of the mines have been excluded from the figures and the lists.

Event lists for October through December 2007 are given in sections 3.1 through 3.3.

3.1 October

An event list for October is given in Table 3-1 with date, time longitude, latitude, X (RT90 km), Y (RT90 km), depth and local magnitude (M_L). In October 22 events were located whereof one with magnitude 1.7 located 41 km W of Värnamo and two with magnitude 1.5, one located 34 km NW of Pajala and the other located 26 km ENE of Örnsköldsvik. The remaining 19 earthquakes had magnitudes equal to or below 1.0. The depth range of the events varies between 0.1 and 30.0 km.

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

Date	Time (UTC)	Latitude	Longitude	X RT90 Km	Y RT90 Km	Depth Km	M_L Local Magnitude
20071002	031720.8	61.840	17.504	6,859.6	1,589.3	16.2	0.9
20071003	054027.5	61.834	17.602	6,859.0	1,594.5	20.3	0.7
20071003	122640.2	67.435	22.787	7,498.9	1,798.4	24.2	1.5
20071003	123904.6	64.769	21.234	7,195.9	1,757.9	21.0	0.5
20071006	202132.2	62.690	14.698	6,953.6	1,443.2	0.1	0.6
20071007	022521.0	57.050	13.406	6,327.4	1,354.2	6.6	1.7
20071011	134601.6	56.769	12.862	6,297.4	1,319.9	9.5	1.0
20071011	151113.5	64.491	20.895	7,163.7	1,744.3	1.2	-0.2
20071011	154832.0	65.693	18.838	7,291.2	1,639.1	3.0	0.9
20071012	081354.3	59.328	13.421	6,580.9	1,364.1	27.2	0.1
20071020	165937.6	65.256	22.551	7,255.9	1,814.5	4.8	0.8
20071021	041253.6	63.217	18.973	7,015.7	1,659.1	17.3	-0.3
20071024	034839.9	59.037	12.359	6,551.2	1,302.1	3.2	0.9
20071026	001047.0	64.436	21.294	7,159.1	1,764.0	25.2	0.2
20071026	030804.7	61.895	17.592	6,865.8	1,593.8	30.0	0.0
20071027	182512.8	58.605	13.068	6,501.2	1,340.8	20.2	0.4
20071028	043158.7	62.668	18.277	6,953.1	1,626.5	4.1	0.3
20071028	111109.6	58.504	13.141	6,489.9	1,344.5	16.4	0.2
20071029	142620.3	63.356	19.230	7,031.9	1,671.2	3.2	1.5
20071029	145625.8	64.374	20.685	7,149.8	1,735.2	15.5	0.3
20071029	164634.0	63.387	19.134	7,035.1	1,666.2	5.4	0.1
20071029	202704.1	62.719	17.951	6,958.1	1,609.6	11.5	0.2

3.2 November

An event list for November is given in Table 3-2 with date, time (UTC), latitude, longitude, X (RT90 km), Y (RT90 km), depth and local magnitude (M_L). In November 18 events were located whereof one with magnitude 1.7 located 21 km SE of Nikkaluokta. One earthquake with magnitude 1.5 was located offshore 24 km E of Oxelösund. Additional 4 earthquakes had magnitudes of 1.0 or above. The depth range of the events varies between 1.0 and 19.3 km.

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

Date	Time (UTC)	Latitude	Longitude	X RT90 Km	Y RT90 Km	Depth Km	M_L Local Magnitude
20071105	093130.1	55.950	13.894	6,204.0	1,380.4	16.4	1.3
20071105	161021.8	63.963	20.963	7,105.2	1,752.3	1.1	0.3
20071110	063705.8	58.726	17.518	6,512.7	1,599.0	1.1	1.5
20071111	040727.3	56.494	12.830	6,266.9	1,316.6	14.6	1.0
20071112	082800.3	62.021	17.444	6,879.6	1,585.6	4.4	0.8
20071112	120054.5	61.747	17.096	6,848.7	1,568.0	11.2	0.0
20071114	090124.6	66.212	22.001	7,359.4	1,778.4	15.9	1.1
20071117	053346.7	62.008	16.343	6,877.2	1,528.0	19.3	0.2
20071118	044930.4	63.461	19.261	7,043.7	1,672.1	2.2	-0.1
20071120	163227.4	60.959	17.245	6,761.1	1,577.8	12.4	1.1
20071123	111224.7	67.787	19.460	7,525.9	1,654.0	13.9	1.7
20071124	034956.9	60.246	16.936	6,681.3	1,562.4	18.1	0.1
20071125	031843.1	68.210	20.046	7,574.5	1,675.5	13.6	0.2
20071127	165137.9	64.566	20.973	7,172.3	1,747.4	1.2	-0.3
20071128	195111.6	68.196	20.704	7,574.9	1,702.8	1.0	0.1
20071130	014541.4	61.916	17.402	6,867.9	1,583.7	3.7	0.9
20071130	033629.6	67.694	19.276	7,515.0	1,646.9	16.4	-0.3
20071130	074741.6	62.845	18.069	6,972.4	1,615.1	2.7	0.4

3.3 December

An event list for December is given in Table 3-3 with date, time (UTC), latitude, longitude, X (RT90 km), Y (RT90 km), depth and local magnitude (M_L). In December 21 events were located. The largest two events had magnitude 1.1 and were located 47 km W of Skellefteå and 43 km SE of Luleå. Additional two earthquakes had magnitudes of 1.0. The depth range of the events was between 0.6 and 35.3 km.

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

Date	Time (UTC)	Latitude	Longitude	X RT90 Km	Y RT90 Km	Depth Km	M_L Local Magnitude
20071201	025621.7	58.729	18.189	6,514.3	1,637.9	21.8	0.0
20071203	125641.0	67.342	18.924	7,475.0	1,633.9	1.2	-0.2
20071204	194615.7	67.735	19.433	7,520.0	1,653.2	1.3	0.5
20071206	090523.8	61.341	16.726	6,803.1	1,549.1	12.5	0.5
20071206	090523.9	61.343	16.723	6,803.3	1,549.0	17.4	0.3
20071206	185929.4	67.503	20.012	7,495.8	1,679.4	3.0	0.5
20071206	223317.1	59.535	18.693	6,605.1	1,663.2	3.0	0.3
20071208	115957.8	68.361	20.404	7,592.4	1,689.0	8.7	1.0
20071209	161738.2	59.669	13.176	6,619.4	1,351.7	35.3	0.0
20071209	174149.2	60.110	15.711	6,665.7	1,494.6	2.9	0.1
20071210	191449.4	64.712	20.057	7,185.3	1,702.4	21.4	1.1
20071213	123817.3	67.878	19.602	7,536.3	1,659.4	3.0	0.3
20071213	175243.3	62.619	17.877	6,946.9	1,606.2	3.5	0.2
20071215	125043.0	61.904	17.774	6,867.1	1,603.3	23.8	0.7
20071222	211023.5	67.309	23.099	7,486.4	1,813.4	12.1	-0.1
20071229	220446.8	59.142	14.903	6,558.2	1,448.2	11.1	1.0
20071230	194322.2	62.857	18.506	6,974.6	1,637.3	9.7	0.8
20071230	223018.4	65.252	22.488	7,255.2	1,811.6	0.6	1.1
20071231	024141.5	65.173	22.638	7,247.2	1,819.6	17.1	0.2
20071231	025800.3	65.171	22.598	7,246.8	1,817.7	7.2	0.5
20071231	211642.9	61.643	16.914	6,836.9	1,558.6	3.0	-0.1

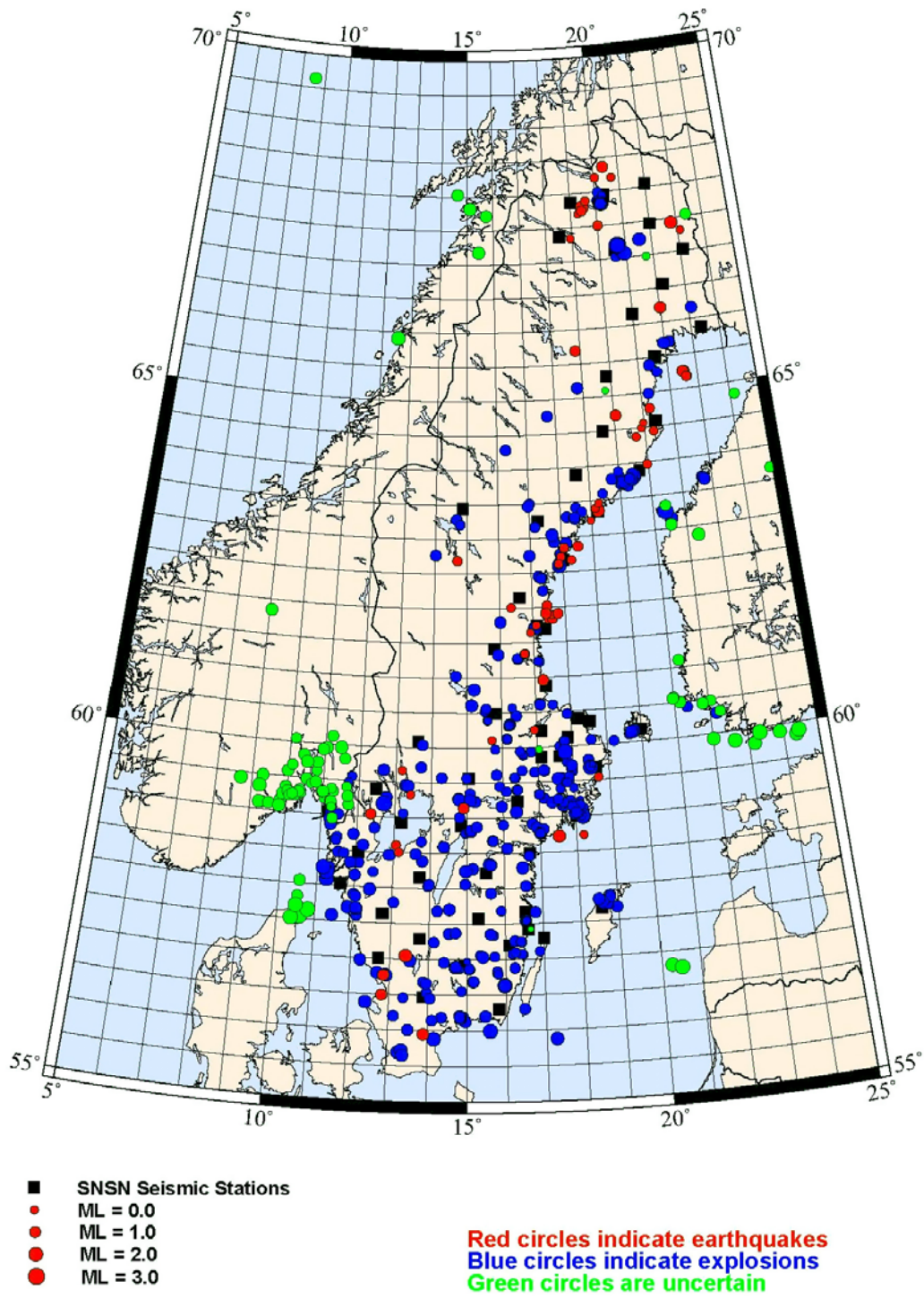


Figure 3-1. Recorded events including explosions in the SNSN network during the period October through December 2007.

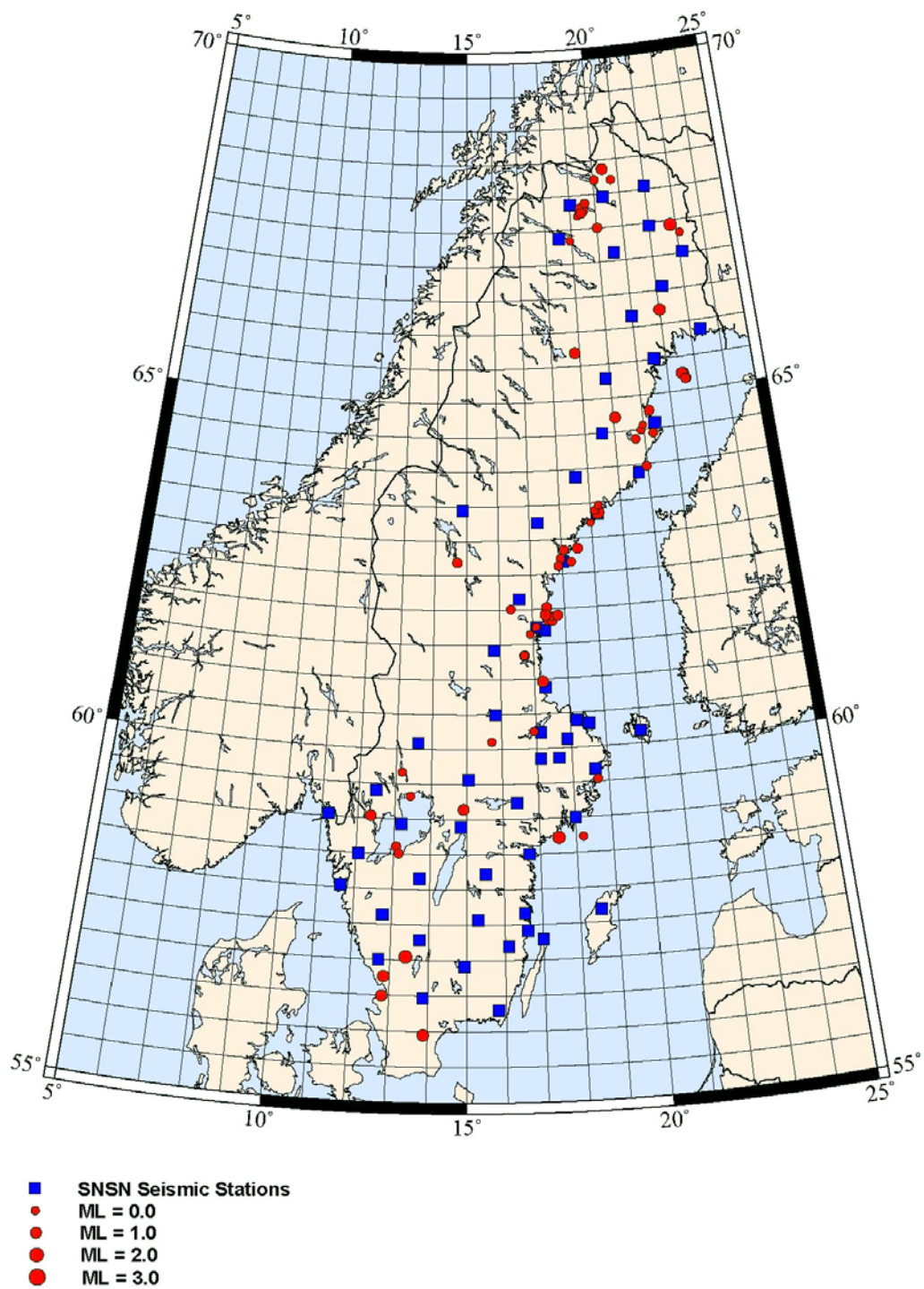
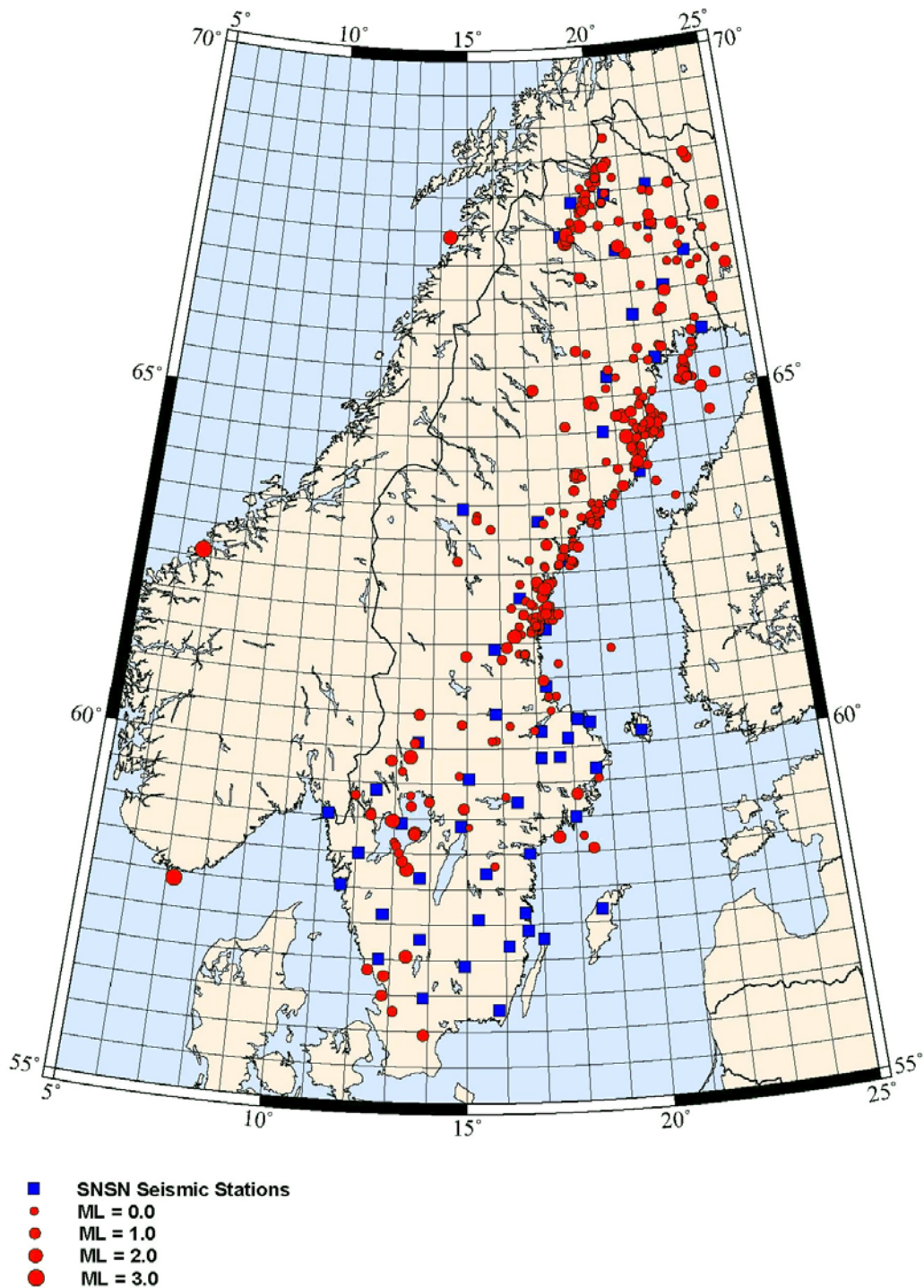


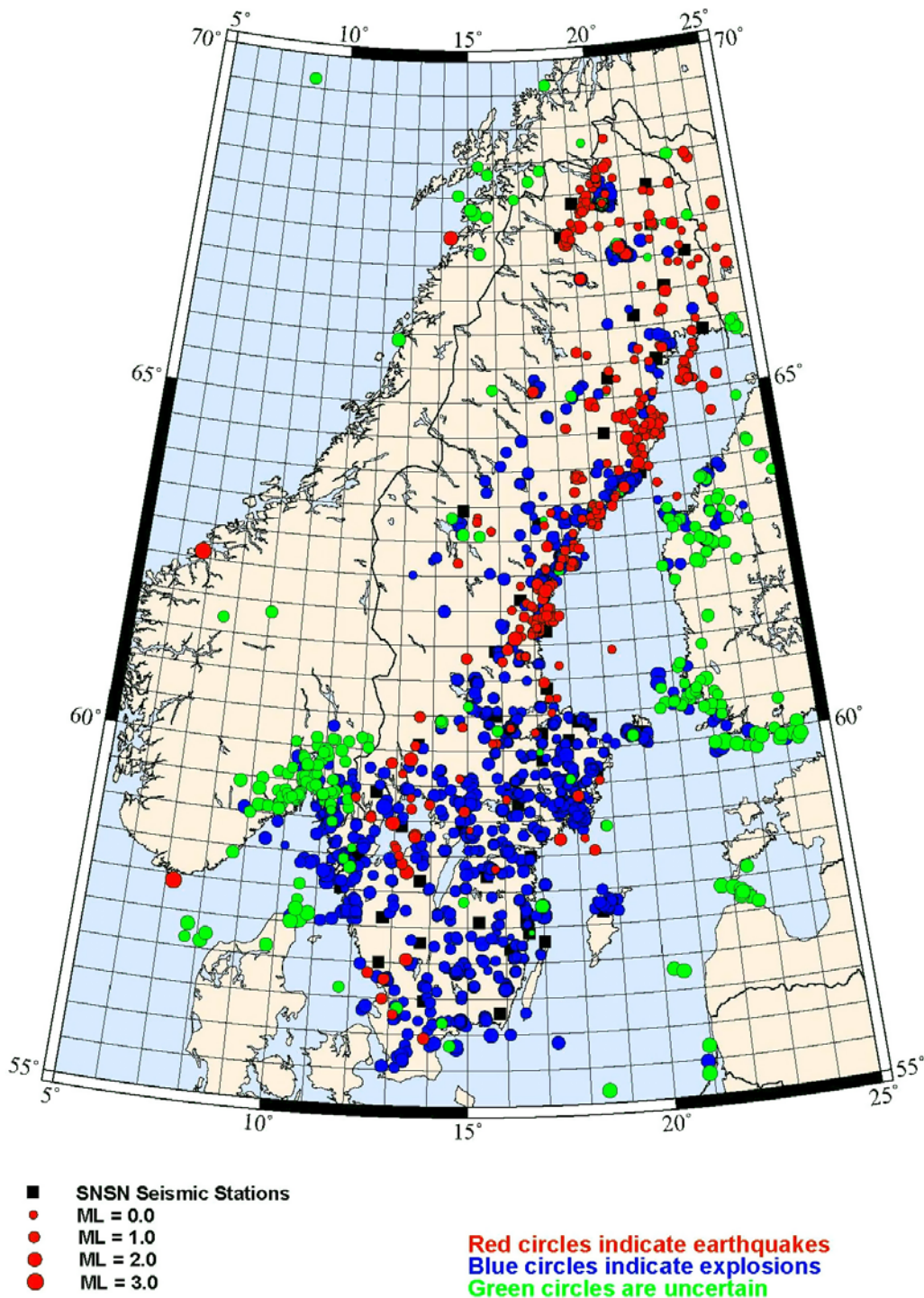
Figure 3-2. Earthquake activity in Sweden during October through December 2007.

4 Recorded earthquakes during the year 2007

Figure 4-1 shows the earthquake activity in Sweden during the year 2007. During 2007 there were 3,966 located events, Figure 4-2. Out of these 3,347 are explosions, 335 are true earthquakes and 284 events, mainly located outside the network, are still uncertain. Additionally 531 induced earthquakes in the vicinity of the mines in Kiruna, Malmberget and Zinkgruvan, were located. These are not shown in the figure.



Figur 4-1. Recorded earthquakes during the year 2007.



Figur 4-2. Recorded events including explosions in the SNSN during the year 2007.

The largest earthquake located in Sweden was the $M_L=2.7$ earthquake that occurred on February 28th, 12 km south of Skara. Two earthquakes with magnitude $M_L=2.4$ occurred on January 11th, located 34 km north of Keino and on January 13th, located 75 km S of Arvidsjaur. Additionally 8 earthquakes with magnitude $M_L=2.0$ or above occurred during the year 2007.