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Swedish National Seismic Network (SNSN)

A short report on recorded earthquakes during the fourth quarter of the year 2005

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January 2006

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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 October through December 2005.

The Swedish National Seismic Network consists of 48 stations in operation and additional twelve under construction. During October through December, 960 events were located whereof 114 are estimated as real earthquakes, 752 are estimated as explosions and 94 events are still considered as uncertain but these are mainly outside the network.

The largest earthquake M_L =2.8 occurred on October 28 outside Sweden in Skagerrak 250 km west of Smögen. An earthquake with magnitude M_L =2.6 was located 5.5 km east of Laimoluokta in Lappland. Additionally five earthquakes reached magnitudes between M_L =2.0 and M_L =2.3 during the period.

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 oktober till december 2005.

Det seismiska nätet består av 48 stationer som är nu i drift. Ytterligare 12 stationer är under uppbyggnad. Under perioden oktober till december, 2005 var det 960 registrerade händelser varav 114 bedömdes som äkta jordskalv, 752 bedömdes vara förorsakade av explosioner eller sprängningar samt 94 var osäkra händelser, men dessa var i huvudsak lokaliserade utanför det seismiska nätet.

Det största jordskalvet med en magnitud på 2,8 inträffade utanför Sverige i Skagerrak 250 km väster om Smögen. Ett jordskalv med magnitud 2,6 inträffade 5,5 km öster om Laimoluokta in Lappland. Ytterligare fem jordskalv nådde magnituder mellan 2,0 och 2,3 under perioden.

Contents

1 Introduction

This document reports the seismic events recorded by the Swedish National Seismic Network (SNSN) for the fourth quarter of the year 2005. 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 48 stations are in operation. Additional twelve stations are under construction, 10 in SW part of Sweden and two in the North.

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	

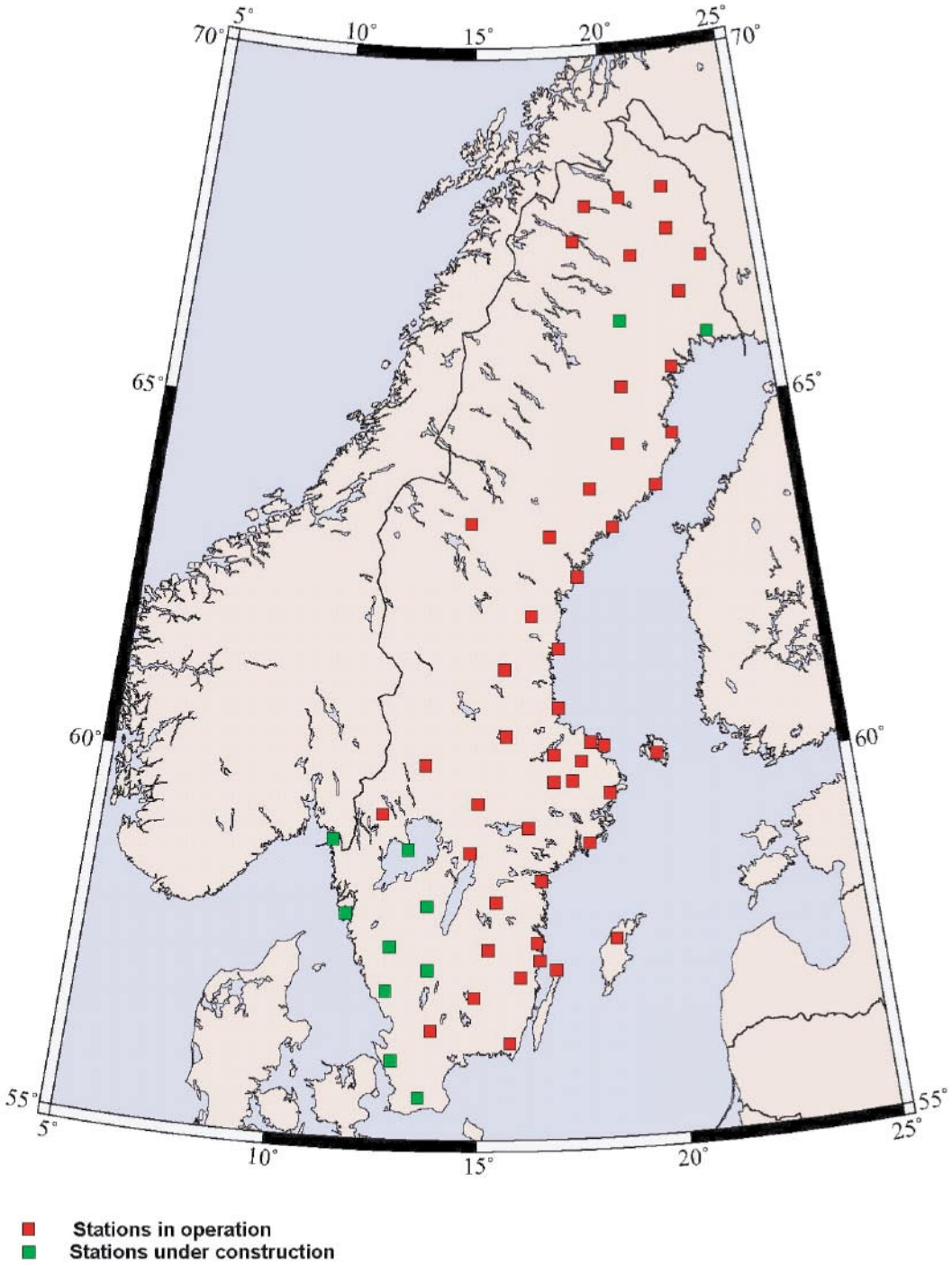

Figure 1-1. *The present Swedish National Seismic Network (SNSN).*

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 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 sides.

3 Recorded earthquakes during the fourth quarter of 2005

Figure 3-1 shows the recorded events in Sweden during October through December. During the period, 960 events were located whereof 114 are estimated as real earthquakes, 752 are estimated as explosions and 94 events are still considered as uncertain but these are mainly outside the network.

The largest earthquake M_L =2.8 occurred on October 28 outside Sweden in Skagerrak 250 km west of Smögen. An earthquake with magnitude M_L =2.6 was located 5.5 km east of Laimoluokta in Lappland. Additionally five earthquakes reached magnitudes between M_L =2.0 and M_L =2.3 during the period.

Event lists for October through December 2005 are given in sections 3.1 through 3.3.

3.1 October

Event list for October is given in Table 3-1 with date, time (UTC), latitude, longitude, X (RT90 km), Y (RT90 km), depth and local magnitude (M_L). In October 42 events were located whereof one with magnitude 2.8 located outside Sweden, in Skagerrak 250 km west of Smögen. One earthquake with magnitude 2.3 was located 12 km W of Gislaved October. 29. Additional two earthquakes had magnitudes of 2.0 and 2.1 and 11 had magnitudes equal to or above 1.0. The depth range of the events varies between 0 and 40.6 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
20051002	095219.6	59.640	13.259	6,616.0	1,356.3	4.1	1.2
20051002	102605.8	67.910	18.936	7,538.3	1,631.2	17.1	0.7
20051002	114149.0	64.470	21.264	7,162.8	1,762.2	21.1	0.8
20051002	160433.7	64.326	20.328	7,143.2	1,718.4	20.1	-0.1
20051003	053132.7	67.438	22.691	7,498.8	1,794.3	23.2	1.1
20051003	213502.0	58.831	16.131	6,523.2	1,518.6	21.8	1.0
20051004	033357.4	62.749	18.014	6,961.6	1,612.7	18.2	1.5
20051005	173536.5	68.121	20.128	7,564.9	1,679.6	10.8	0.1
20051007	003821.9	67.838	19.415	7,531.5	1,651.8	8.9	0.9
20051007	145229.4	61.933	17.287	6,869.6	1,577.7	14.4	0.5
20051008	092212.2	64.446	21.088	7,159.4	1,754.0	23.6	0.3
20051009	155320.3	67.549	21.995	7,508.0	1,763.4	5.5	0.6
20051009	161436.1	64.476	20.932	7,162.1	1,746.2	14.3	0.9
20051010	085725.9	64.481	20.935	7,162.7	1,746.3	9.7	1.6
20051011	014156.9	64.527	24.492	7,186.4	1,915.8	11.5	1.3
20051011	014429.9	64.490	24.511	7,182.4	1,917.3	15.1	2.0
20051011	173753.8	67.331	24.642	7,497.5	1,879.0	8.5	0.5
20051012	042259.8	67.556	19.672	7,500.7	1,664.6	19.0	–0.0
20051012	173831.9	64.424	19.107	7,150.5	1,658.9	17.4	0.7
20051013	101656.7	64.406	20.886	7,154.1	1,744.6	25.7	0.3
20051013	134904.3	63.966	20.526	7,103.8	1,730.9	13.8	0.6
20051016	170544.4	60.115	16.167	6,666.3	1,519.9	15.1	0.6
20051019	231636.5	62.894	18.418	6,978.5	1,632.7	15.5	1.2
20051021	000912.0	65.173	20.919	7,239.5	1,739.3	27.8	0.6
20051021	041112.2	64.438	21.268	7,159.3	1,762.7	22.0	0.0
20051021	205343.9	60.797	15.348	6,742.2	1,475.0	14.1	0.8
20051022	025306.2	67.063	19.811	7,446.2	1,674.0	19.5	0.3
20051022	205443.0	66.793	22.956	7,428.5	1,813.8	17.2	0.8
20051024	110108.3	67.118	19.594	7,451.7	1,664.2	20.4	1.7
20051024	160559.9	67.115	19.804	7,451.9	1,673.4	20.3	0.3
20051025	020743.5	67.221	21.109	7,468.0	1,728.9	40.6	0.4
20051026	092448.5	61.705	16.700	6,843.7	1,547.1	22.9	0.8
20051028	072227.7	57.559	7.261	6,413.7	989.2	38.1	2.8
20051029	032827.5	64.239	20.496	7,134.1	1,727.3	12.3	0.6
20051029	060304.2	58.533	13.772	6,491.8	1,381.4	5.2	1.4
20051029	075145.8	63.647	21.711	7,073.2	1,792.1	11.2	0.5
20051029	093503.5	57.271	13.358	6,352.1	1,352.2	15.8	2.3
20051030	051737.3	60.790	12.207	6,746.8	1,303.9	15.9	2.1
20051030	082250.5	59.087	13.945	6,553.2	1,393.2	4.1	1.2
20051030	230630.1	67.812	19.543	7,528.9	1,657.4	11.2	0.5
20051031	124732.2	56.159	13.271	6,228.5	1,342.4	0.0	1.8
20051031	184732.3	62.076	17.164	6,885.5	1,570.8	23.4	0.0

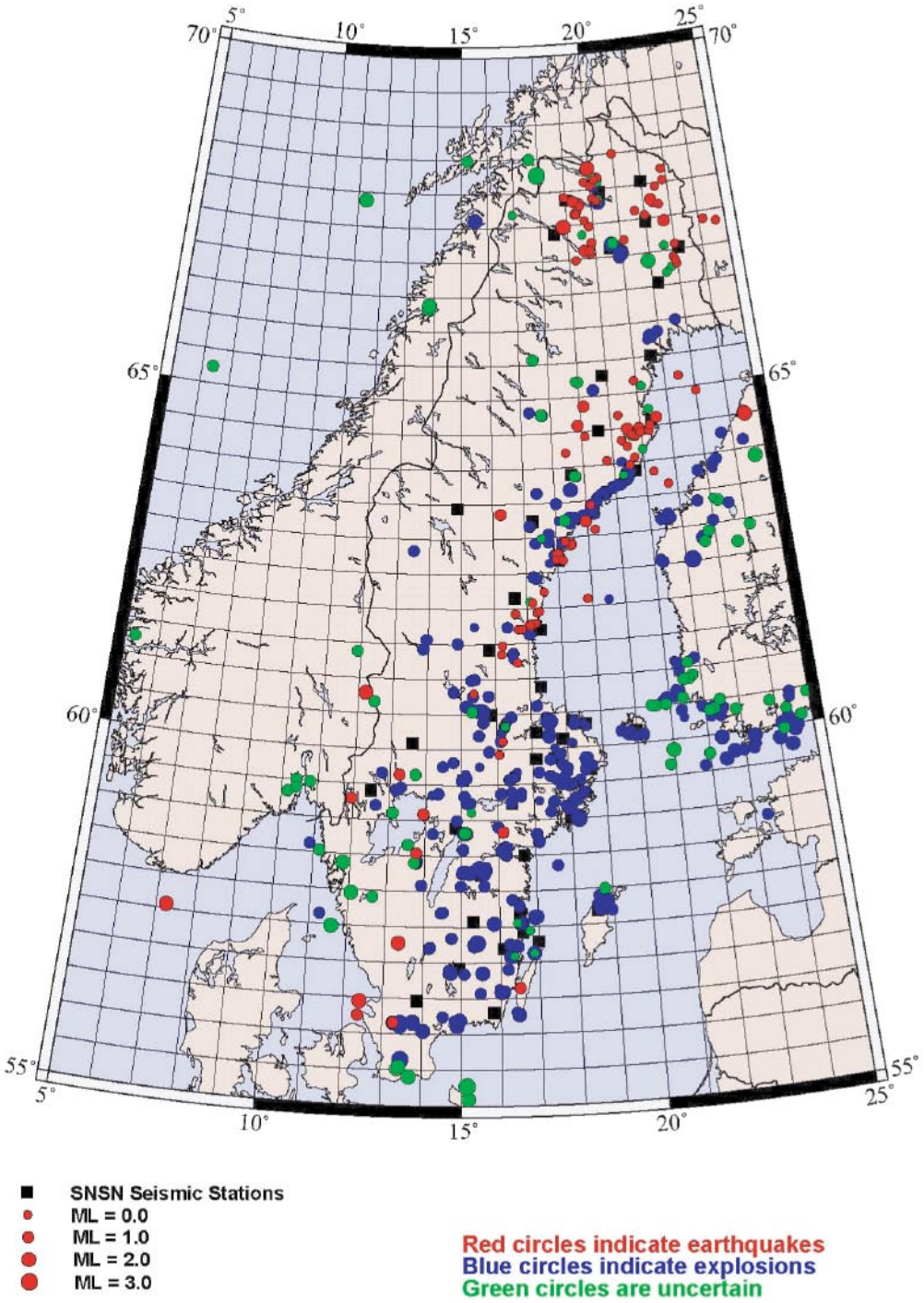

Figure 3-1. Recorded events including explosions in the SNSN network during the period October through December 2005.

3.2 November

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 31 events were located whereof one with magnitude 2.3, 8 km W of Hallands Vederö, and additional 7 had a magnitude larger or equal to 1.0. The depth range of the events varies between 1.5 and 29.6 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
20051102	040623.5	67.712	22.351	7,527.6	1,776.6	19.7	0.7
20051102	231848.3	59.929	16.072	6,645.5	1,514.8	19.3	0.1
20051103	003959.5	63.841	21.283	7,092.9	1,769.1	26.2	0.1
20051103	045033.6	67.467	19.830	7,491.2	1,671.9	19.4	0.2
20051105	144547.0	64.055	19.788	7,111.3	1,694.2	29.6	0.7
20051106	043552.3	61.223	16.655	6,789.9	1,545.5	15.6	0.1
20051106	213556.1	62.685	17.963	6,954.4	1,610.3	16.2	0.7
20051109	005444.0	67.842	19.285	7,531.5	1,646.3	2.0	1.1
20051109	014557.9	56.446	12.409	6,262.8	1,290.4	16.0	2.3
20051109	150508.3	64.071	20.705	7,116.2	1,738.8	17.6	0.6
20051109	194303.5	65.177	22.472	7,246.8	1,811.8	21.5	0.7
20051110	023919.8	59.282	11.955	6,579.7	1,280.5	8.6	1.2
20051111	033856.1	61.474	16.221	6,817.7	1,522.0	9.5	0.9
20051111	153144.2	62.666	18.165	6,952.7	1,620.8	17.7	0.3
20051115	052016.2	61.759	17.077	6,850.0	1,567.0	17.4	1.0
20051117	222138.4	61.788	17.238	6,853.4	1,575.4	18.9	0.2
20051118	034442.1	68.118	19.768	7,563.5	1,664.6	16.4	–0.2
20051118	073034.8	67.228	19.884	7,464.8	1,676.0	19.0	0.5
20051119	071311.7	64.591	18.901	7,168.6	1,648.1	21.0	1.7
20051122	110135.4	67.702	19.423	7,516.4	1,653.0	1.5	0.6
20051123	025956.7	56.249	12.375	6,240.9	1,287.3	18.4	1.9
20051124	134123.5	64.363	20.778	7,149.0	1,739.8	24.7	0.7
20051124	200351.7	67.658	19.310	7,511.1	1,648.5	19.6	0.2
20051125	012959.5	56.643	16.496	6,279.7	1,542.2	17.8	1.7
20051125	093242.5	61.954	17.356	6,872.0	1,581.2	18.1	0.5
20051126	233558.8	62.892	18.460	6,978.4	1,634.8	10.7	0.7
20051127	023333.3	68.080	20.090	7,560.2	1,678.3	15.3	–0.2
20051129	164352.5	68.056	19.994	7,557.2	1,674.5	9.1	0.1
20051129	185236.7	68.165	20.302	7,570.2	1,686.4	15.4	0.7
20051130	031427.6	64.383	20.800	7,151.3	1,740.7	17.7	0.4
20051130	225617.6	63.354	16.246	7,027.2	1,521.9	18.8	1.3

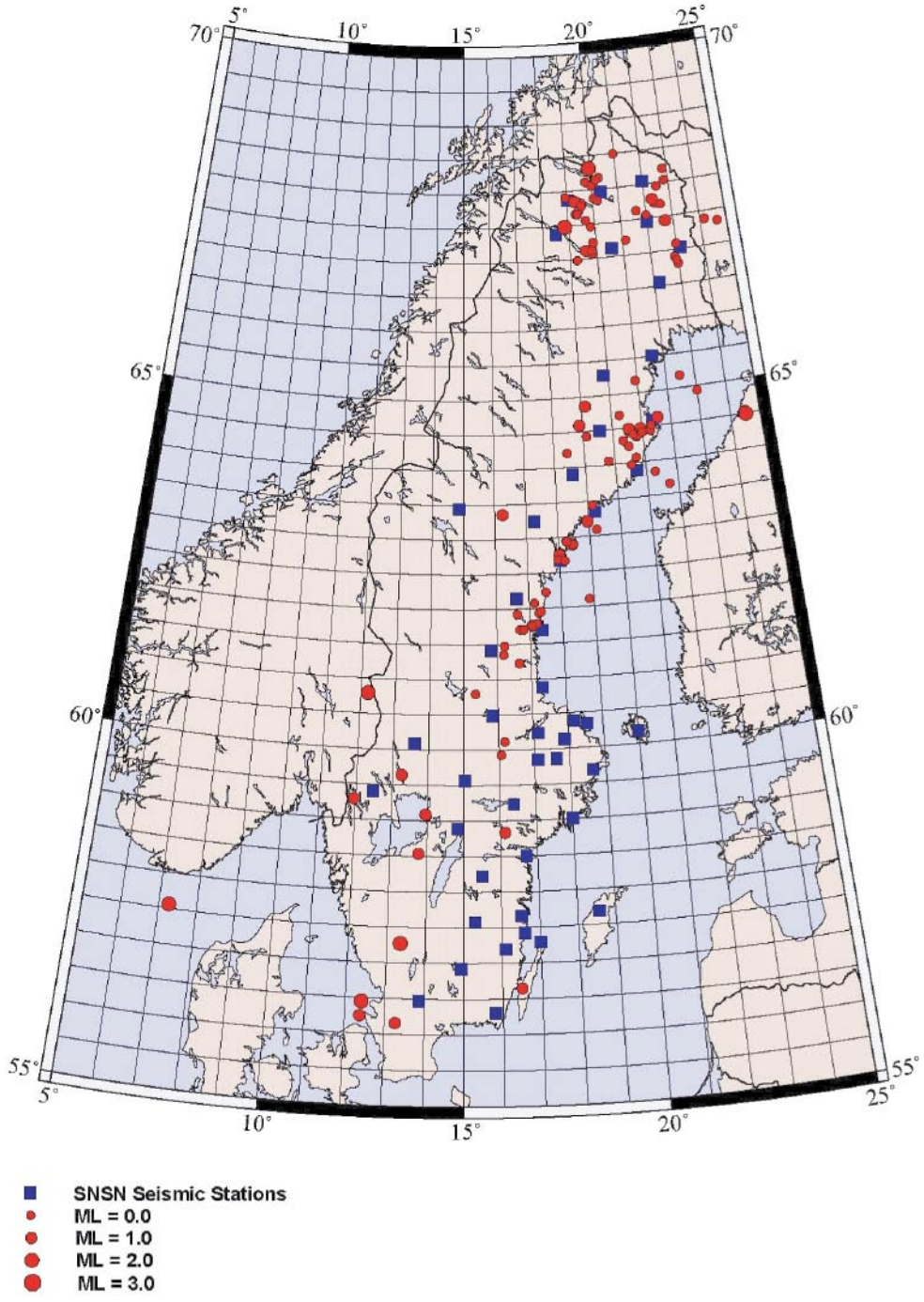

Figure 3-2. *Earthquake activity in Sweden during October through December 2005.*

3.3 December

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 41 events were located whereof one with magnitude 2.6 located 5.5 km E of Laimoluokta, 51 km N of Kiruna. One earthquake with magnitude 2.0 was located 16.2 km NE of Saltoluokta. Additional 5 earthquakes had magnitudes equal too or above 1.0. The depth range was between 2 and 29.2 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
20051201	121609.8	67.867	20.051	7,536.4	1,678.3	12.5	0.1
20051202	014125.6	62.228	17.532	6,902.9	1,589.6	6.4	0.9
20051202	220331.5	61.759	17.078	6,850.0	1,567.1	14.0	0.7
20051203	172122.9	67.651	19.366	7,510.5	1,650.9	2.9	0.6
20051204	162350.7	67.768	22.287	7,533.5	1,773.2	29.2	1.0
20051207	151827.1	64.617	21.556	7,180.4	1,774.7	18.4	1.0
20051208	062308.2	64.694	20.278	7,184.0	1,713.1	18.4	–0.2
20051208	094318.3	68.196	22.837	7,583.5	1,790.9	8.9	0.4
20051212	164558.2	67.385	24.166	7,500.7	1,857.8	7.9	0.7
20051212	231142.5	68.494	20.963	7,608.9	1,710.8	5.7	0.7
20051214	082647.3	64.492	20.546	7,162.4	1,727.6	20.1	1.4
20051214	214138.0	68.311	19.955	7,585.5	1,671.0	3.0	2.6
20051215	041232.7	62.890	18.466	6,978.1	1,635.1	17.4	0.4
20051215	093257.7	67.685	22.578	7,525.6	1,786.4	13.9	0.5
20051215	133349.5	68.138	20.164	7,566.8	1,681.0	19.7	0.3
20051216	055822.6	67.774	19.544	7,524.6	1,657.7	19.5	0.2
20051216	232022.2	61.346	16.187	6,803.4	1,520.3	16.6	0.2
20051217	231840.2	66.985	19.247	7,436.0	1,650.0	20.3	0.4
20051218	075657.1	62.102	18.850	6,891.3	1,658.8	26.7	0.4
20051219	165943.3	67.911	18.951	7,538.5	1,631.9	12.1	0.3
20051220	011228.8	62.947	18.232	6,984.0	1,623.0	13.0	0.1
20051220	032825.9	64.404	20.677	7,153.2	1,734.6	18.5	–0.1
20051222	053914.0	61.705	16.823	6,843.8	1,553.7	17.5	0.0
20051222	144736.5	63.210	18.955	7,015.0	1,658.2	16.5	1.4
20051222	155542.2	64.432	20.989	7,157.4	1,749.3	25.2	0.4
20051222	190813.5	66.901	22.871	7,440.1	1,808.7	17.9	0.4
20051222	230737.5	67.481	18.861	7,490.4	1,630.5	2.9	2.0
20051223	060407.5	61.926	16.632	6,868.2	1,543.3	23.3	0.5
20051223	125048.1	67.832	20.183	7,532.9	1,684.1	2.4	0.0
20051224	084303.7	64.209	18.440	7,125.1	1,627.8	23.9	0.1
20051224	085222.4	67.630	21.630	7,515.5	1,747.0	16.7	–0.1
20051226	061306.6	63.438	19.148	7,040.8	1,666.6	11.8	0.3
20051226	212202.0	67.953	22.520	7,555.1	1,780.8	19.5	0.0
20051227	013123.4	68.030	22.835	7,565.1	1,792.9	2.0	0.6
20051227	054035.2	66.845	22.933	7,434.2	1,812.2	15.2	0.8
20051227	102230.8	64.863	19.137	7,199.4	1,657.7	6.4	1.2
20051227	225928.5	63.086	19.226	7,001.8	1,672.6	15.9	0.7
20051228	005640.3	64.518	21.319	7,168.4	1,764.4	21.8	0.1
20051228	011021.4	67.084	22.980	7,460.9	1,811.1	17.3	0.5
20051229	002341.3	64.932	23.005	7,222.3	1,839.8	17.8	0.6
20051231	040632.3	62.934	18.252	6,982.7	1,624.1	13.9	0.6

4 Recorded earthquakes during the year 2005

Figure 4-1 shows earthquake activity in Sweden during the year 2005. During 2005 there were 4,526 located events, Figure 4-2. Out of these 3,354 are explosions, 476 are true earthquakes and 696 are still uncertain.

The largest events located in Sweden were on May 13th, 16 km east of Sundsvall with magnitude M_L=3.1 and on February 4th , 10 km north of Piteå with magnitude M_L=2.6. Three events located in our neighbourhood, one with magnitude M_L=3.2, located in Norway, 188 km NW of Östersund on July 25th and one located in Skagerrak, 250 km west of Smögen on October 28th. This earthquake had a magnitude of M_L=2.8. The third with magnitude M_L=3.1 was located in Norway, 184 km west of Arjeplog on June 24th.

Additional 18 earthquakes had above or of magnitude M_L=2.0 during the year and 94 earthquakes with magnitude above or of M_L=1.0. The range of hypocentral depth varies from the surface to 40.6 km.

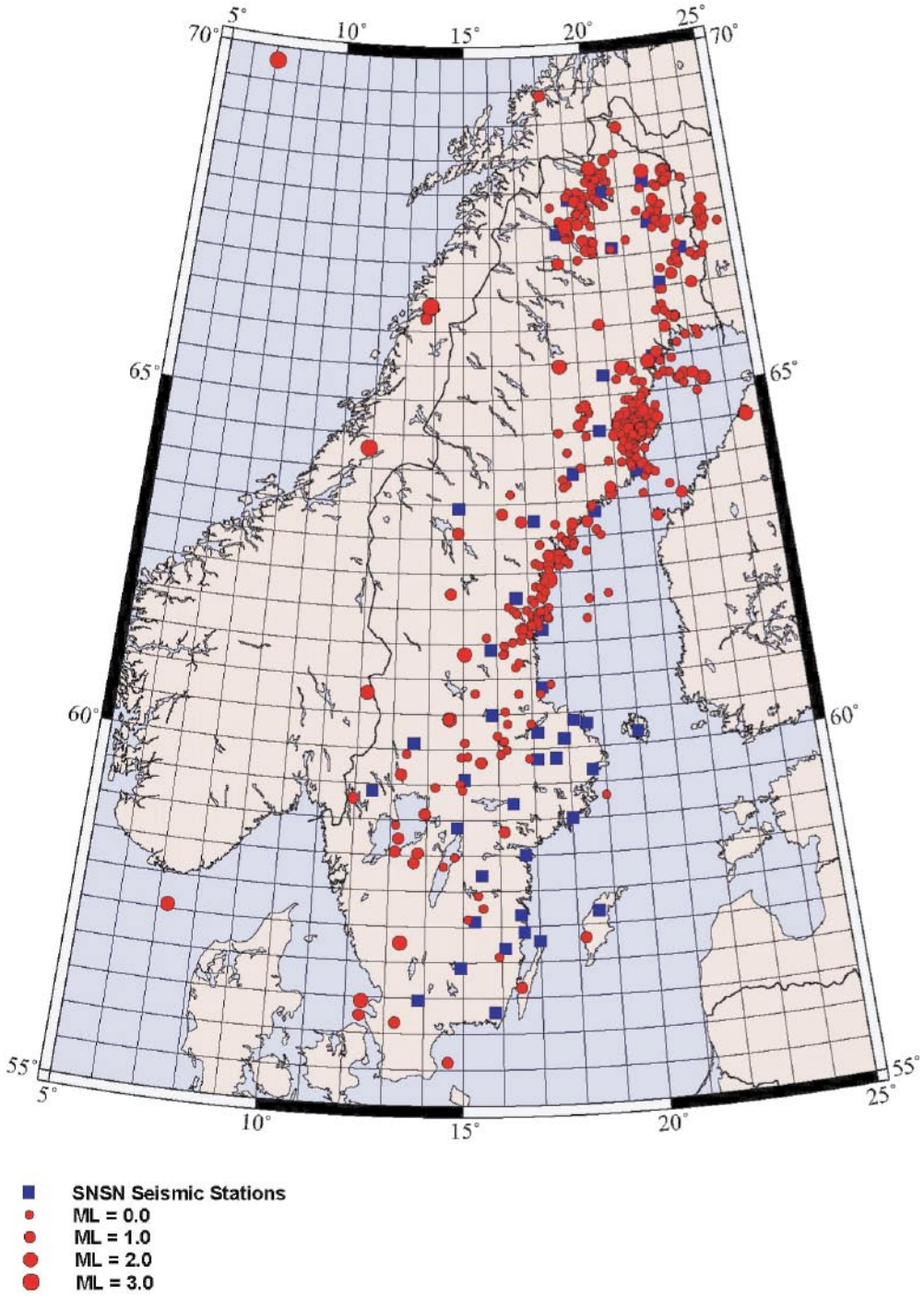

Figure 4- 1. *Earthquake activity in Sweden during the year 2005.*

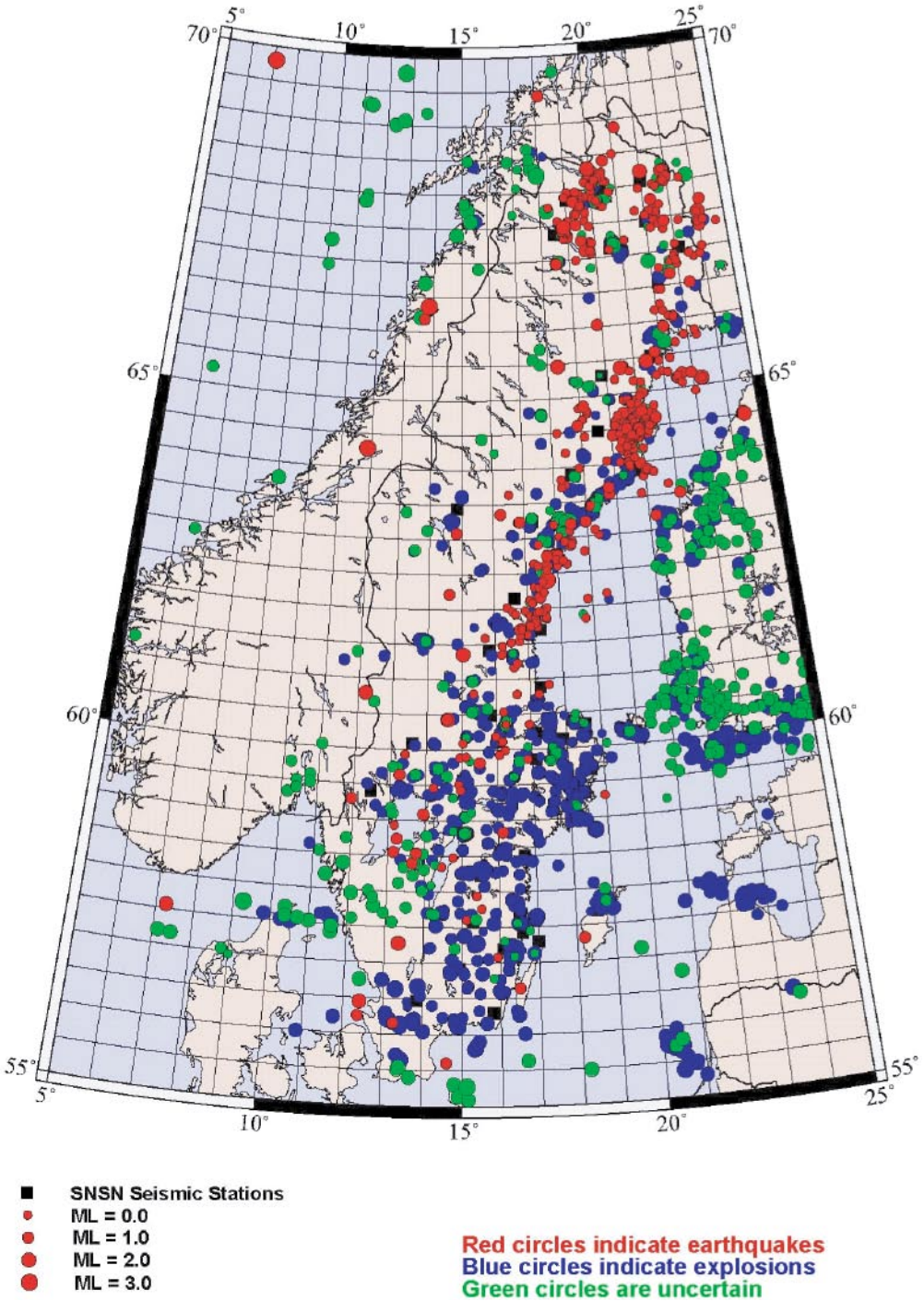

Figure 4-2. *Recorded events including explosions in the SNSN network during the year 2005.*