

Swedish National Seismic Network (SNSN)

A short report on recorded earthquakes during the first quarter of the year 2008

Reynir Böðvarsson
Uppsala University, Department of Earth Sciences

April 2008

Svensk Kärnbränslehantering AB

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



Swedish National Seismic Network (SNSN)

A short report on recorded earthquakes during the first quarter of the year 2008

Reynir Böðvarsson

Uppsala University, Department of Earth Sciences

April 2008

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.

A pdf version of this document can be downloaded from www.skb.se.

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 brief information about the recorded seismicity during January through March 2008.

The Swedish National Seismic Network consists of 61 stations. During January through March, 1,322 events were located whereof 74 are estimated as real earthquakes, 993 are estimated as explosions, 159 are induced earthquakes in the vicinity of the mines in Kiruna and Malmberget and 96 events are still considered as uncertain but these are most likely explosions and are mainly located outside the network.

Four earthquakes had magnitudes above $M_L = 2.0$. In January one with magnitude of $M_L = 2.3$ was located in Finland 22 km east of Pajala and one with magnitude $M_L = 2.1$ was located 19 km NW of Ljungby. In February one earthquake with magnitude $M_L = 2.6$ was located 10 km east of Saltoluokta.

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 januari till mars 2008.

Det seismiska nätet består av 61 stationer. Under perioden januari till mars, 2008 var det 1 322 registrerade händelser varav 74 bedömdes som äkta jordskalv, 993 bedömdes vara förorsakade av explosioner eller sprängningar, 159 var inducerade skalv i närheten av gruvorna i Kiruna och Malmberget och 96 var osäkra händelser, men dessa var i huvudsak lokaliserade utanför det seismiska nätet och är sannolikt förorsakade av explosioner.

Fyra jordskalv hade magnitud över $M_L = 2,0$. I januari inträffade ett skalv i Finland, 22 km öster om Pajala med magnitud $M_L = 2,3$, samt ett skalv med magnitud $M_L = 2,1$ var lokaliserad 19 km nordväst om Ljungby. I februari inträffade ett skalv med magnitud $M_L = 2,6$ lokaliserad 10 km öster om Saltoluokta.

Contents

1	Introduction	7
2	Objective and scope	9
3	Recorded earthquakes during the first quarter of 2008	11
3.1	January	11
3.2	February	14
3.3	March	15

1 Introduction

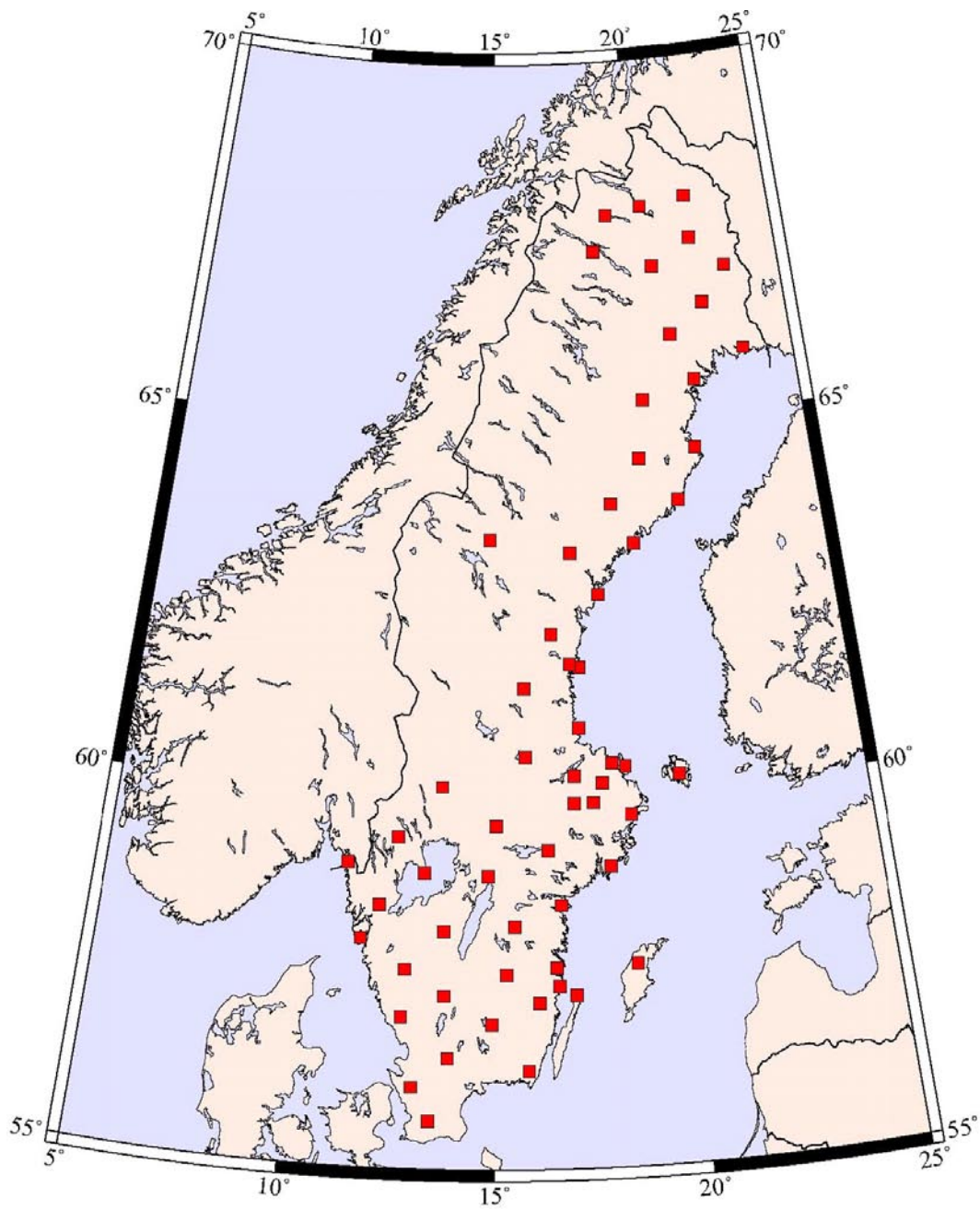
This document reports the seismic events recorded by the Swedish National Seismic Network (SNSN) for the first quarter of the year 2008. The work was carried out in accordance with activity plan AP PU 400-06-004. In Table 1-1 controlling document for performing this activity is listed. The activity plan is an SKB internal controlling document.

At present 61 stations are in operation in the network, Figure 1-1.

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 i Sverige	AP PU 400-06-004	1.0



■ Stations in operation

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 sites.

3 Recorded earthquakes during the first quarter of 2008

Figure 3-1 shows the recorded events in Sweden during January through March. During the period 1,322 events were located whereof 74 are estimated as real earthquakes (which are shown in Figure 3-2). 993 are estimated as explosions and 96 are still considered as uncertain but are most probably explosions and are mainly located outside the network. Large amounts of induced seismicity around the mines in Kirunavaara, Malmberget and Aitik are observed and 159 events in the very vicinity of the mines have been excluded in the report.

Event lists for January through March 2008 are given in sections 3.1 through 3.3.

3.1 January

An event list for January is given in Table 3-1 with date, time (UTC), longitude, latitude, X (RT90 km), Y (RT90 km), depth and local magnitude (M_L). In January 25 events were located whereof one had magnitude $M_L = 2.3$ located in Finland 22 km east of Pajala and one with magnitude $M_L = 2.1$ located 19 km NW of Ljungby. Additional 5 earthquakes had magnitudes between $M_L = 1.0$ and $M_L = 1.5$. The depth range of the events varies between 1.1 and 29.3 km.

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

Date	Time (UTC)	Latitude	Longitude	X RT90 Km	Y RT90 Km	Depth Km	M_L Local magnitude
20080102	022528.0	56.971	13.789	6,317.9	1,377.2	4.6	2.1
20080104	175705.5	65.821	22.919	7,320.5	1,824.6	8.2	0.4
20080107	180359.0	61.924	17.673	6,869.1	1,597.9	24.3	-0.0
20080108	164753.8	68.549	19.240	7,610.3	1,640.0	13.2	1.2
20080111	143052.5	59.511	12.773	6,602.9	1,328.2	17.0	0.4
20080112	001152.7	59.941	13.216	6,649.6	1,355.1	19.3	0.7
20080112	014936.5	63.262	18.484	7,019.7	1,634.3	13.3	0.9
20080112	092342.7	63.017	16.207	6,989.6	1,520.2	10.2	0.7
20080112	103839.2	58.748	14.289	6,514.9	1,412.1	12.0	1.5
20080112	110103.6	58.751	14.292	6,515.2	1,412.2	10.5	0.9
20080112	113615.7	58.748	14.295	6,514.9	1,412.4	15.3	0.4
20080112	173018.9	65.219	23.770	7,258.5	1,871.7	13.2	0.9
20080113	002338.3	62.751	18.816	6,963.5	1,653.6	22.2	-0.2
20080114	065124.8	65.188	22.654	7,248.9	1,820.2	7.5	0.9
20080114	094140.7	62.132	16.725	6,891.2	1,547.8	4.7	-1.0
20080114	112830.0	66.800	22.600	7,427.5	1,798.2	29.3	1.0
20080119	195202.4	67.266	23.822	7,485.5	1,844.9	8.7	2.3
20080120	204418.8	66.471	22.494	7,390.5	1,797.5	16.6	-0.0
20080121	024517.1	63.032	18.816	6,994.7	1,652.2	5.7	0.6
20080121	224330.4	61.711	17.312	6,844.9	1,579.5	22.7	0.0
20080126	030807.9	66.828	22.043	7,428.1	1,773.5	2.7	0.1
20080126	141322.8	61.858	17.420	6,861.4	1,584.8	23.7	0.0
20080127	174406.6	65.680	23.321	7,307.0	1,844.7	1.1	1.5
20080127	221152.3	57.343	14.998	6,357.8	1,451.2	14.6	-0.1
20080130	065903.2	65.033	22.343	7,230.2	1,807.4	3.8	1.1

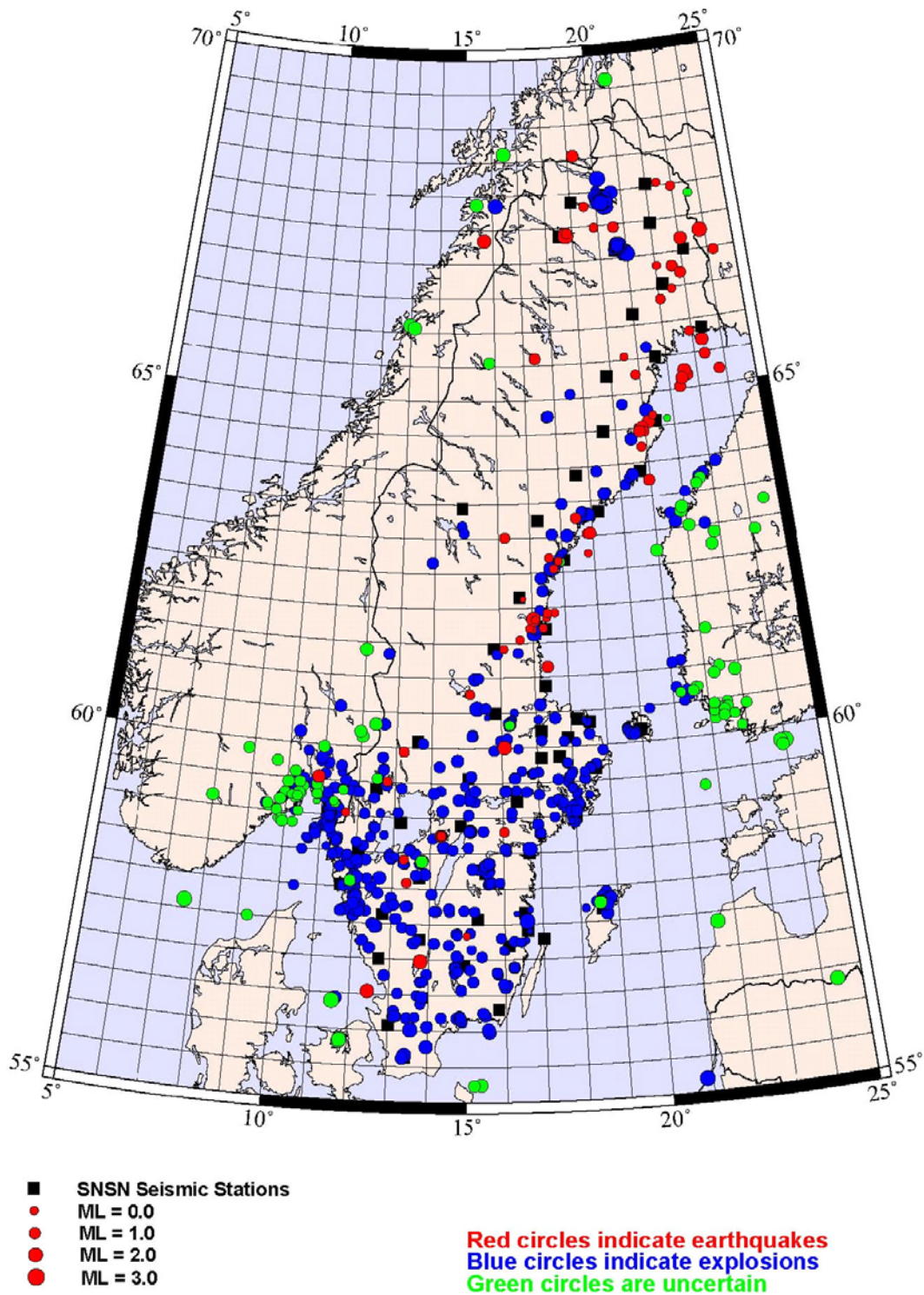


Figure 3-1. Recorded events including explosions in the SNSN network during the period January through March 2008.

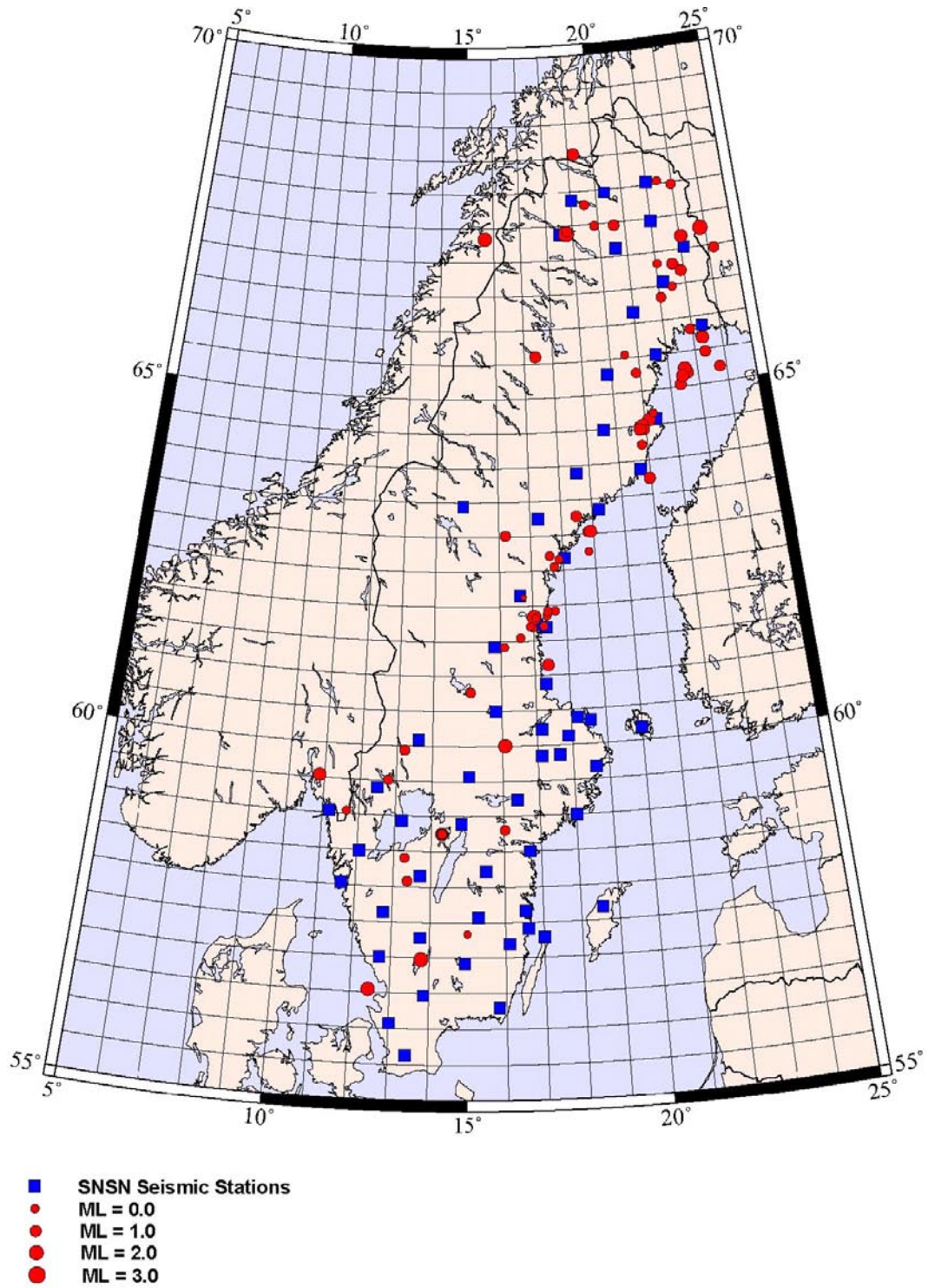


Figure 3-2. Earthquake activity in Sweden during January through March 2008.

3.2 February

An event list for February 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 February 25 events were located whereof one with magnitude $M_L = 2.6$, located 10 km east of Saltoluokta. One earthquake with magnitude $M_L = 2.1$ was located 15 km north of Hudiksvall. Additional 9 events had magnitudes equal or above $M_L = 1.0$. The depth range of the events varies between 0.1 and 25.1 km.

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

Date	Time (UTC)	Latitude	Longitude	X RT90 Km	Y RT90 Km	Depth Km	M_L Local magnitude
20080201	070806.6	60.006	16.081	6,654.1	1,515.2	17.2	1.9
20080201	123648.8	61.144	17.394	6,781.9	1,585.4	6.9	1.3
20080202	054823.0	67.384	18.751	7,479.4	1,626.3	0.1	2.6
20080202	202828.3	64.226	20.815	7,133.8	1,742.8	1.4	0.4
20080203	003626.2	62.551	17.710	6,939.0	1,597.8	5.2	0.2
20080203	170044.5	61.694	16.989	6,842.7	1,562.5	7.4	-0.1
20080204	111744.9	67.185	23.066	7,472.5	1,813.5	1.2	1.6
20080206	232439.5	64.437	20.927	7,157.7	1,746.3	0.1	-0.1
20080207	105847.2	67.343	15.665	7,471.8	1,493.8	1.5	1.9
20080208	102049.6	61.843	17.028	6,859.4	1,564.3	10.4	2.1
20080209	112355.0	67.470	19.842	7,491.5	1,672.4	7.1	0.2
20080209	205614.7	65.273	20.854	7,250.4	1,735.4	1.1	0.4
20080210	190930.7	67.413	18.798	7,482.7	1,628.1	3.4	0.7
20080212	041150.0	61.921	17.449	6,868.5	1,586.2	25.1	0.2
20080216	144918.7	59.539	10.859	6,612.4	1,220.2	0.1	1.5
20080216	183925.2	62.658	17.863	6,951.2	1,605.3	4.5	0.1
20080217	053256.2	62.710	17.576	6,956.6	1,590.4	1.1	0.3
20080220	182633.9	65.258	22.554	7,256.2	1,814.6	3.5	1.7
20080220	195819.7	64.576	21.135	7,174.0	1,755.0	18.3	1.5
20080222	021646.5	66.956	24.221	7,453.5	1,866.7	3.6	0.7
20080223	100219.8	64.669	21.296	7,185.0	1,761.8	11.0	-0.2
20080224	202739.3	56.542	12.461	6,273.3	1,294.2	9.2	1.9
20080225	093158.1	66.334	22.038	7,373.2	1,778.8	16.9	0.5
20080226	035637.0	63.051	18.865	6,997.0	1,654.6	5.5	0.2
20080226	081714.5	63.036	18.913	6,995.5	1,657.1	1.7	1.4

3.3 March

An event list for March 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 March 24 events were located all below magnitude $M_L = 2.0$. The three largest earthquakes had magnitude $M_L = 1.4$ located 52 km south of Luleå, $M_L = 1.3$ located 24 km SW of Skellefteå and $M_L = 1.2$ located 15 km SW of Skellefteå. Additional 3 earthquakes had magnitudes equal to or above $M_L = 1.0$. The depth range was between 0.7 and 31.8 km.

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

Date	Time (UTC)	Latitude	Longitude	X RT90 Km	Y RT90 Km	Depth Km	M_L Local magnitude
20080302	172556.7	64.507	20.771	7,165.0	1,738.2	26.2	0.1
20080303	001734.2	65.547	20.522	7,279.8	1,717.6	19.1	-0.1
20080303	013159.9	61.708	16.898	6,844.2	1,557.6	10.2	-0.1
20080303	050726.9	65.463	23.341	7,283.1	1,848.5	1.1	0.9
20080303	095421.7	67.969	22.959	7,558.9	1,798.9	1.2	0.4
20080303	113651.8	60.767	15.096	6,739.0	1,461.2	13.9	0.5
20080308	094249.7	64.434	20.763	7,156.8	1,738.4	17.8	-0.3
20080309	174319.6	64.509	20.903	7,165.7	1,744.5	9.6	1.2
20080310	031915.8	64.441	20.954	7,158.4	1,747.6	18.8	0.5
20080318	041503.5	61.547	16.599	6,825.9	1,542.1	17.3	0.1
20080318	042011.7	67.456	20.586	7,492.3	1,704.3	31.8	0.9
20080319	132515.1	58.804	16.029	6,520.1	1,512.8	18.2	0.5
20080321	004540.9	67.785	19.525	7,525.8	1,656.8	0.7	0.4
20080321	055806.6	68.045	22.424	7,564.9	1,775.7	17.8	0.1
20080323	020048.6	59.044	11.663	6,554.3	1,262.2	8.7	0.0
20080323	064710.0	63.740	20.956	7,080.3	1,754.0	7.9	1.1
20080323	225655.3	58.410	13.292	6,479.0	1,352.9	20.9	0.4
20080324	053739.4	65.151	22.449	7,243.8	1,811.0	11.9	1.4
20080326	105536.2	66.692	22.880	7,416.9	1,811.8	29.5	1.0
20080326	230837.6	61.410	16.106	6,810.5	1,515.9	14.7	0.0
20080328	155634.2	61.830	17.084	6,857.9	1,567.2	28.8	-0.1
20080330	191049.6	65.602	17.382	7,278.6	1,572.5	2.5	1.0
20080331	013305.7	64.451	20.794	7,158.8	1,739.8	5.1	1.3
20080331	140329.3	58.081	13.378	6,442.3	1,356.7	19.6	0.5