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Swedish National Seismic Network (SNSN)

A short report on recorded earthquakes during the third quarter of the year 2006

Reynir Böðvarsson
Uppsala University, Department of Earth Sciences

October 2006

Svensk Kärnbränslehantering AB
Swedish Nuclear Fuel
and Waste Management Co
Box 5864
SE-102 40 Stockholm Sweden
Tel 08-459 84 00
+46 8 459 84 00
Fax 08-661 57 19
+46 8 661 57 19

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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 short report gives some information about the recorded seismicity during July through September 2006.

The Swedish National Seismic Network consists of 53 stations in operation and additional 7 are under construction. During July through September, 782 events were located whereof 58 are estimated as real earthquakes, 473 are estimated as explosions, 163 are induced earthquakes in the vicinity of the mines in Kiruna and Malmberget and 88 events are still considered as uncertain but these are mainly located outside the network.

The two largest earthquakes with magnitude $M_L = 2.3$ occurred in August 22 th, 25 km north of Vänersborg and another 10 km west of Keino or 84 km NW of Jokkmokk. Additional three earthquakes reached magnitude $M_L = 2.1$ during the quarter, one located 23 km SW of Skellefteå, one 21 km NE of Gävle and additional one 25 km NW of Robertsfors. One earthquake with magnitude $M_L = 2.0$ occurred 28 km east of Keino.

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 2006.

Det seismiska nätet består av 53 stationer som nu är i drift. Ytterligare 7 stationer är under uppbyggnad. Under perioden juli till september, 2006 var det 782 registrerade händelser varav 58 bedömdes som äkta jordskalv, 473 bedömdes vara förorsakade av explosioner eller sprängningar, 163 är inducerade skalv i närheten av gruvorna i Kiruna och Malmberget samt 88 var osäkra händelser, men dessa var i huvudsak lokaliserade utanför det seismiska nätet.

De två största jordskalven med en magnitud på 2,3 inträffade den 22 augusti, 25 km norr om Vänersborg och ett 10 km väster om Keino eller 84 km nordväst om Jokkmokk. Tre jordskalv med magnitud 2,1 inträffade 23 km sydväst om Skellefteå och ett 21 km nordost om Gävle samt ett 25 km mordväst om Robertsfors. Ett jordskalv med magnitud 2,0 inträffade 28 km öster om Keino.

Contents

1 Introduction

This document reports the seismic events recorded by the Swedish National Seismic Network (SNSN) for the third quarter of the year 2006. The work was carried out in accordance with activity plan AP TD F73-01-013. In Table 1-1 the controlling document for performing this activity is listed. The activity plan is an SKB internal controlling document.

At present 53 stations are in operation, Figure 1-1. Additional 7 stations are under construction in SW part of Sweden.

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	

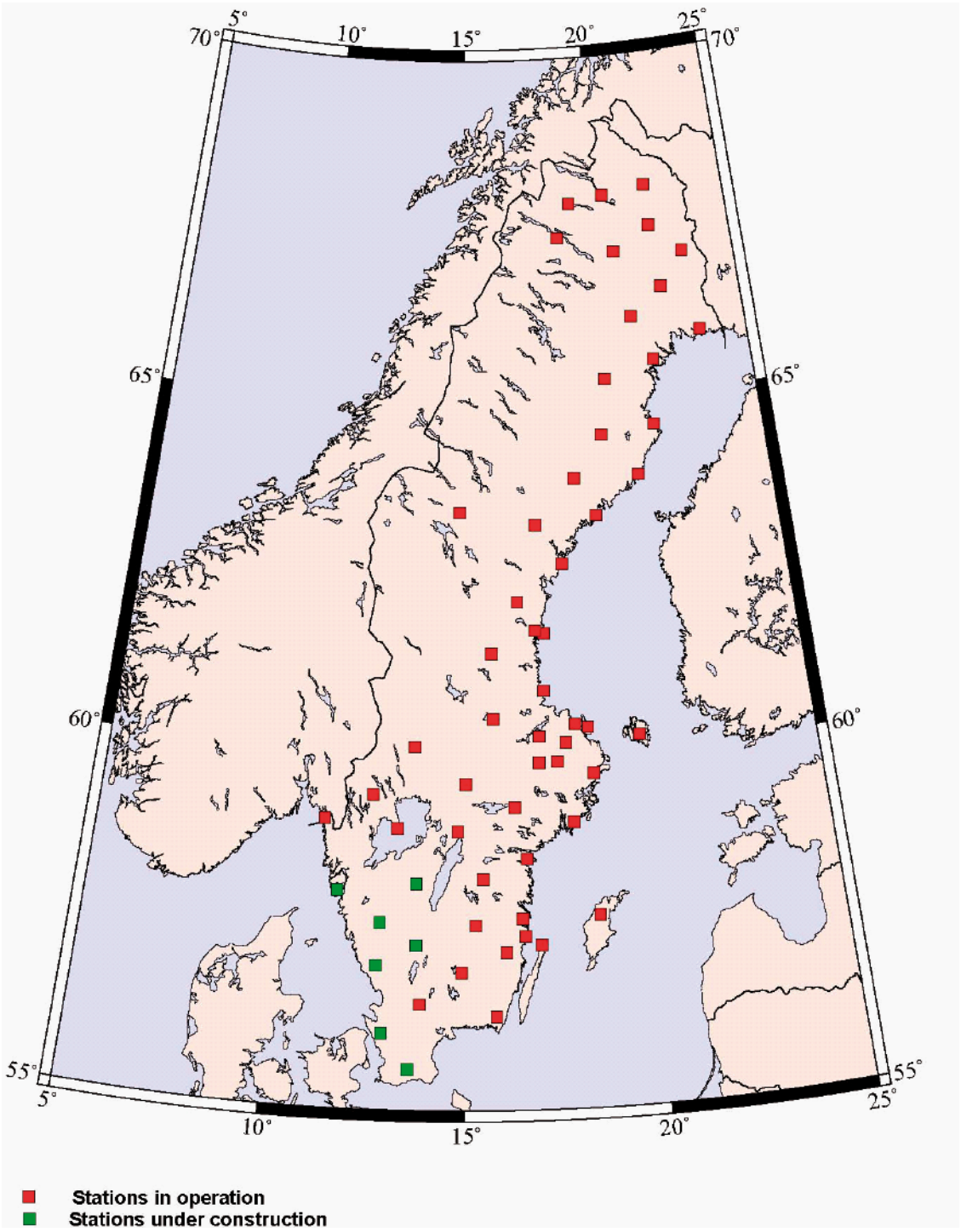

Figure 1-1. *The present Swedish National Seismic Network (SNSN).*

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 are 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 third quarter of 2006

Figure 3-1 shows the recorded events in Sweden during July through September. During the period 782 events were located whereof 58 are estimated as real earthquakes (which are shown in Figure 3-2). 473 are estimated as explosions, 163 are induced earthquakes in the vicinity of the mines in Kiruna and Malmberget and 88 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 lists.

Event lists for July through September 2006 are given in sections 3.1 through 3.3.

3.1 July

An event list for July is given in Table 3-1 with date, time longitude, latitude, X (RT90 km), Y (RT90 km), depth and local magnitude (M_L). In July 15 events were located whereof two with magnitude 2.1, one located 23 km SW of Skellefteå and one 21 km NE of Gävle. Additional 4 earthquakes had magnitude equal to or larger than 1.0. The depth range of the events varies between 0.1 and 19.8 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
20060702	160823.5	67.835	20.229	7,533.3	1,686.0	3.0	–0.0
20060706	044049.7	64.452	20.791	7,158.9	1,739.6	11.7	2.1
20060710	142713.9	63.829	16.724	7,080.3	1,545.1	6.5	0.8
20060710	154121.4	61.678	16.486	6,840.5	1,535.9	7.6	0.9
20060711	044533.5	66.820	22.580	7,429.7	1,797.1	1.1	1.1
20060712	200738.2	66.762	22.833	7,424.4	1,808.9	19.8	0.2
20060713	171705.4	58.821	15.144	6,522.2	1,461.6	18.1	1.5
20060716	112957.3	60.852	17.454	6,749.5	1,589.4	0.9	2.1
20060718	231914.3	61.668	16.332	6,839.4	1,527.7	2.2	0.7
20060720	123410.1	63.010	17.576	6,990.0	1,589.5	0.1	1.7
20060723	050408.9	62.442	17.279	6,926.3	1,575.9	0.1	0.2
20060723	084801.9	66.749	22.883	7,423.3	1,811.2	0.1	0.6
20060728	195411.3	67.453	22.182	7,498.1	1,772.4	18.0	1.2
20060729	023421.4	61.042	16.788	6,769.9	1,552.9	19.4	0.5
20060730	093523.4	60.269	15.821	6,683.3	1,500.7	17.6	0.6

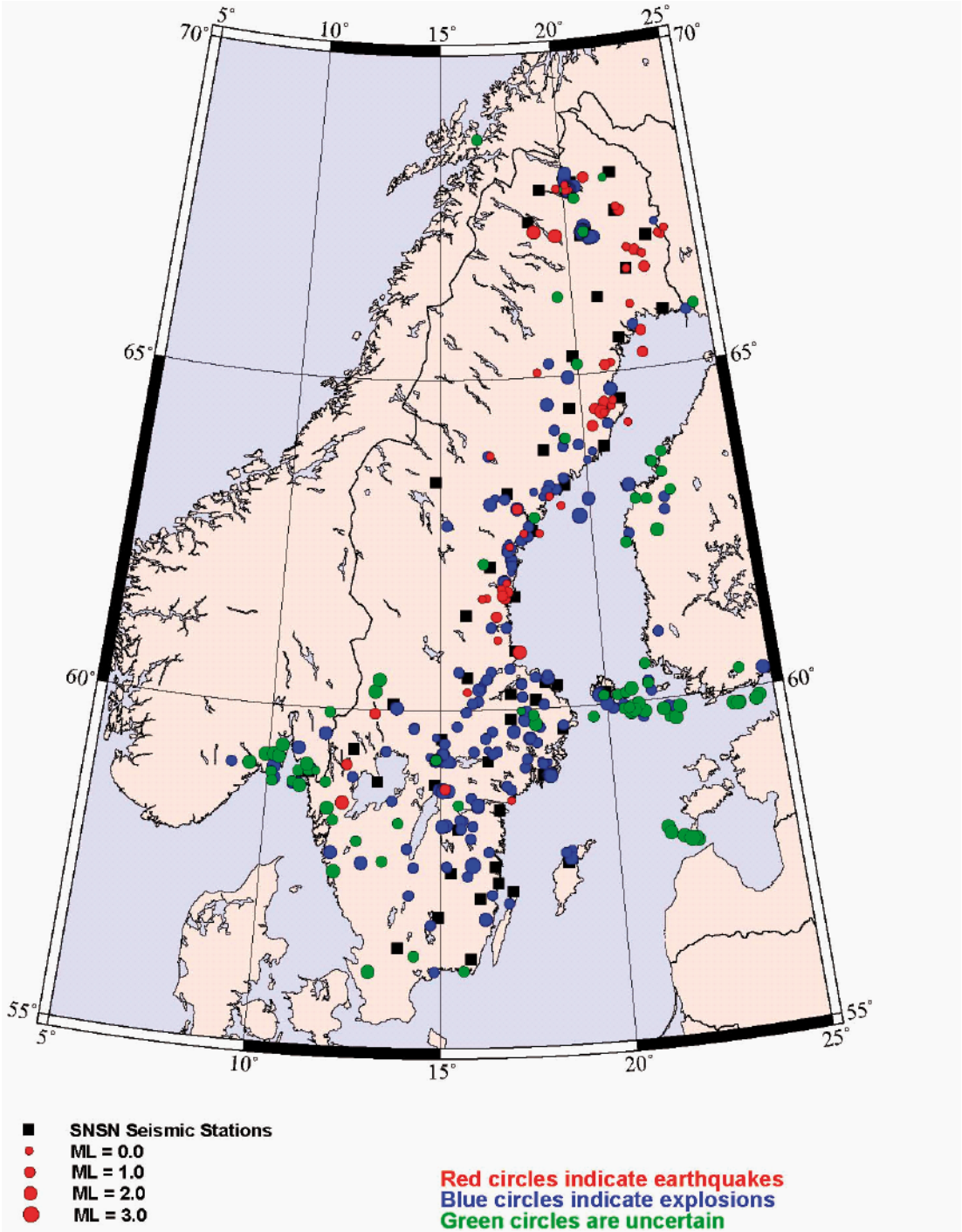

Figure 3-1. *Recorded events including explosions in the SNSN network during the period July through September 2006.*

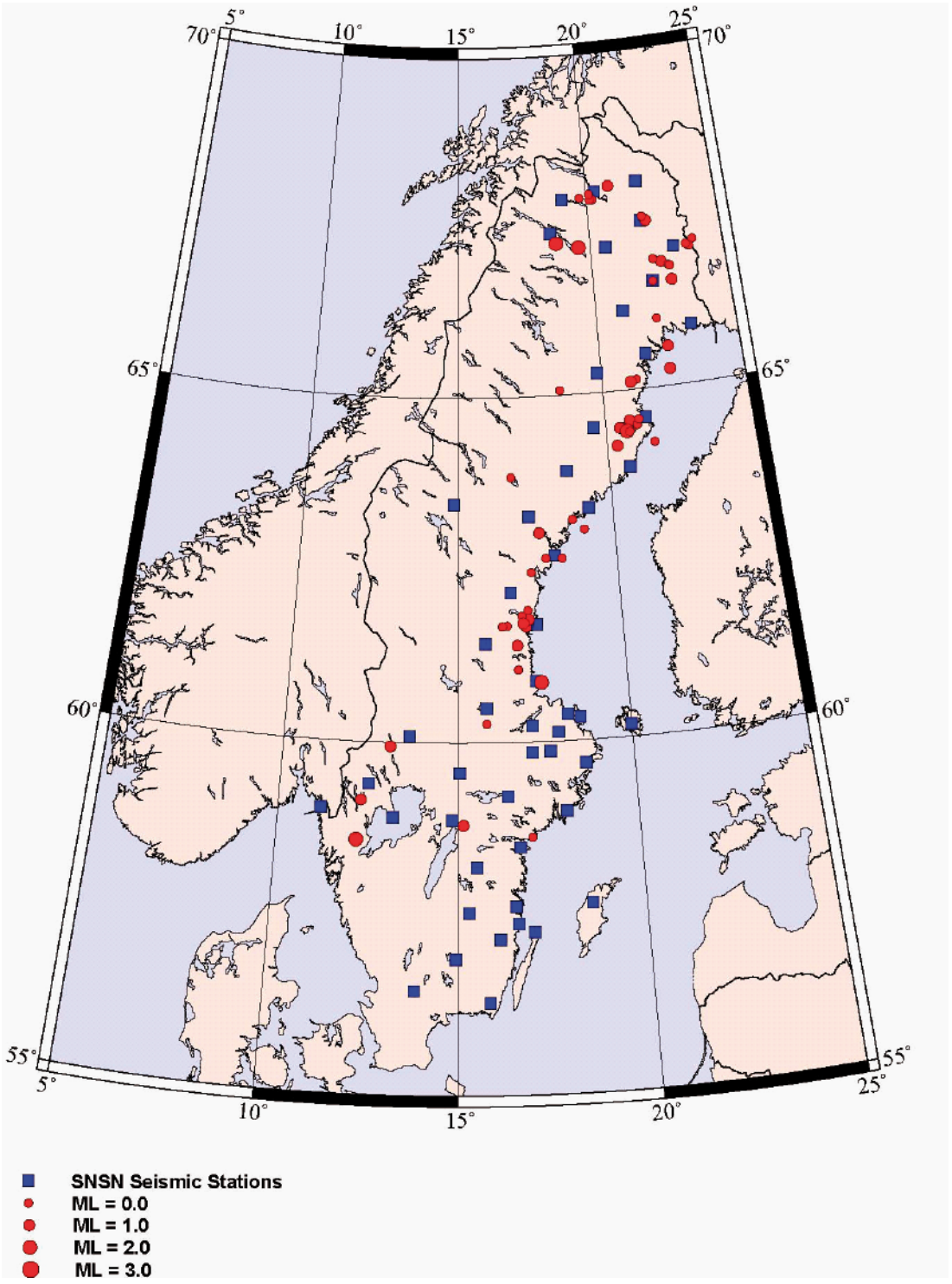

Figure 3-2. *Earthquake activity in Sweden during July through September 2006.*

3.2 August

An event list for August is given in Table 3-2 with date, time (UTC), latitude, longitude, X (RT90 km), Y (RT90 km), depth and local magnitude (ML . In August 17 events were located whereof one with magnitude 2.3, 25 km N of Vänersborg and one with magnitude 1.8, 41.3 km NW of Övertorneå. Additional 5 earthquakes had a magnitude larger or equal to 1.0. The depth range of the events varies between 0.0 and 29.5 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	ML Local Magnitude
20060803	055343.4	67.835	20.125	7,533.0	1,681.7	5.4	–0.0
20060804	071407.8	64.552	20.817	7,170.1	1,740.0	3.5	1.1
20060805	232857.6	58.642	17.042	6,502.7	1,571.6	2.0	0.5
20060810	002329.8	62.638	17.761	6,948.8	1,600.2	15.1	0.8
20060812	221256.6	64.381	20.701	7,150.7	1,735.9	11.6	1.4
20060813	062227.3	63.181	18.674	7,011.1	1,644.2	22.8	0.6
20060815	012619.0	67.092	23.858	7,466.4	1,848.9	0.1	0.7
20060817	160121.0	66.000	22.159	7,336.6	1,787.9	14.2	0.7
20060819	210655.4	66.541	22.898	7,400.2	1,814.5	29.5	1.8
20060820	122108.0	59.167	12.287	6,565.9	1,298.7	0.0	1.4
20060820	124854.6	61.666	17.059	6,839.6	1,566.3	0.0	1.0
20060820	204510.8	61.896	17.130	6,865.4	1,569.5	0.0	0.6
20060822	024943.2	65.141	21.196	7,237.1	1,752.6	23.7	–0.2
20060822	122508.5	58.596	12.200	6,502.7	1,290.3	0.1	2.3
20060824	033039.0	64.451	20.545	7,157.9	1,727.8	24.9	1.2
20060825	212829.4	65.071	18.510	7,221.2	1,627.1	2.2	0.7
20060831	032546.6	67.517	22.067	7,504.7	1,766.8	6.9	0.9

3.3 September

An event list for September 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 September 26 events were located whereof one with magnitude 2.3 10 km west of Keino or 84 km NW of Jokkmokk. Another event in the same area with magnitude 2.0 was located 28 km east of Keino. One event with magnitude 2.1 was located 25 km NW of Robertsfors. Additional 10 earthquakes had magnitudes equal or above 1.0. The depth range varies between 0.1 and 30.1 km.

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	ML Local Magnitude
20060903	034243.1	66.547	22.192	7,397.6	1,783.2	28.2	0.6
20060904	212318.2	61.764	17.150	6,850.6	1,570.8	15.3	1.9
20060905	014213.3	68.016	20.893	7,555.6	1,712.3	5.0	1.6
20060905	102819.6	67.867	19.735	7,535.4	1,665.0	4.6	0.3
20060906	014603.3	64.481	21.061	7,163.1	1,752.3	24.0	0.9
20060907	191827.9	64.203	20.337	7,129.6	1,719.8	5.9	1.3
20060907	205618.3	59.942	13.059	6,650.1	1,346.4	0.7	1.9
20060908	155102.2	66.998	23.698	7,455.2	1,843.4	0.1	0.9
20060910	010722.8	64.457	20.466	7,158.2	1,724.0	7.5	1.3
20060912	002620.7	64.404	20.699	7,153.2	1,735.6	11.5	2.1
20060914	050038.7	67.919	20.103	7,542.3	1,680.1	0.1	0.5
20060915	045620.2	67.028	23.590	7,457.9	1,838.3	3.7	0.4
20060916	011259.1	63.032	19.039	6,995.4	1,663.4	14.4	0.4
20060916	201711.6	61.812	16.938	6,855.8	1,559.5	0.3	0.8
20060917	012432.1	65.245	22.410	7,254.0	1,808.1	0.1	1.1
20060917	013013.8	61.392	16.770	6,808.8	1,551.4	30.1	1.0
20060917	210159.9	65.581	22.438	7,291.5	1,805.4	0.1	1.1
20060919	000238.2	64.563	21.137	7,172.6	1,755.2	0.1	0.4
20060919	013417.4	62.630	18.271	6,948.8	1,626.3	10.8	0.9
20060920	131132.3	66.874	22.297	7,434.4	1,784.0	0.1	0.9
20060921	201404.8	64.390	20.793	7,152.0	1,740.3	19.5	0.7
20060924	051637.4	67.226	18.713	7,461.7	1,625.5	3.2	2.3
20060925	002338.9	61.709	16.977	6,844.3	1,561.8	0.1	1.3
20060928	004946.8	67.146	19.549	7,454.8	1,662.1	0.1	2.0
20060929	003321.1	65.113	20.985	7,233.2	1,742.9	18.5	1.1
20060929	180916.9	64.210	21.591	7,135.3	1,780.5	1.7	0.9