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Swedish National Seismic Network (SNSN)

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

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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.

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 some information about the recorded seismicity during July through September 2007.

The Swedish National Seismic Network consists of 59 stations in operation and additional 2 under construction. During July through September, 680 events were located whereof 48 are estimated as real earthquakes, 552 are estimated as explosions, 32 are induced earthquakes in the vicinity of the mines in Kiruna and Malmberget and 48 events are still considered as uncertain but these are mainly outside the network.

The largest earthquake $M_L = 2.0$ occurred on September 16th, 28 km north of Bollnäs. One earthquake with magnitude $M_L = 1.8$ occurred on August 2nd, 10 km east of Saltoluokta and one with magnitude $M_L = 1.7$ occurred on August 8th, 13 km south of Sundsvall.

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 juli till september 2007.

Det seismiska nätet består av 59 stationer i drift. Ytterligare 2 stationer är under uppbyggnad. Under perioden juli till september, 2007 var det 680 registrerade händelser varav 48 bedömdes som äkta jordskalv, 552 bedömdes vara förorsakade av explosioner eller sprängningar, 32 är inducerade skalv i närheten av gruvorna i Kiruna och Malmberget samt 48 är osäkra händelser, men dessa är i huvudsak lokaliserade utanför det seismiska nätet.

Det största jordskalvet med en magnitud på $M_L = 2,0$ inträffade den 16 september, 28 km norr om Bollnäs. Ett jordskalv med magnitud $M_L = 1,8$ inträffade den 2 augusti, 10 km öster om Saltoluokta och ett med magnitud $M_L = 1,7$ inträffade den 8 augusti, 13 km söder om Sundsvall.

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1 Introduction

This document reports the seismic events recorded by the Swedish National Seismic Network (SNSN) for the third 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 southwestern 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 i Sverige	AP PU 400-06-004	1.0

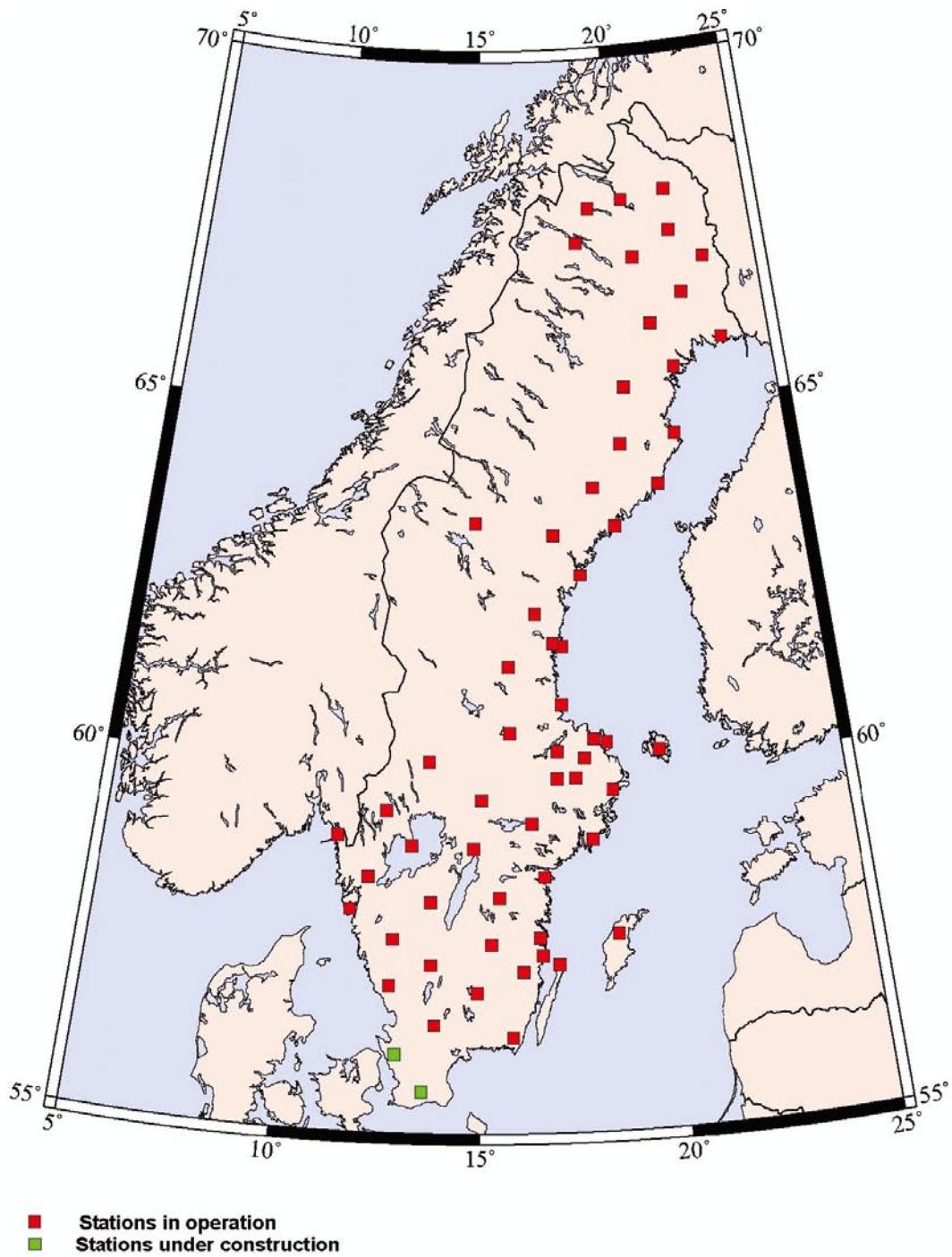


Figure 1-1. The present Swedish National Seismic Network (SNSN).

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 third quarter of 2007

Figure 3-1 shows the recorded events in Sweden during July through September. During the period 680 events were located whereof 48 are estimated as real earthquakes (which are shown in Figure 3-2). 552 are estimated as explosions, 32 are induced earthquakes in the vicinity of the mines in Kiruna and Malmberget and 48 are still considered as uncertain but are most probably explosions and are mainly located outside the network. The events classified as induced earthquakes in the vicinity of the mines have been excluded from the lists.

Event lists for July through September 2007 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 16 events were located whereof two with magnitude $M_L = 1.1$, one located 9.5 km W of Sundsvall and one 15 km SE of Boliden. Additionally one earthquake had magnitude $M_L = 1.0$. The depth range of the events varies between 0.9 and 31.1 km.

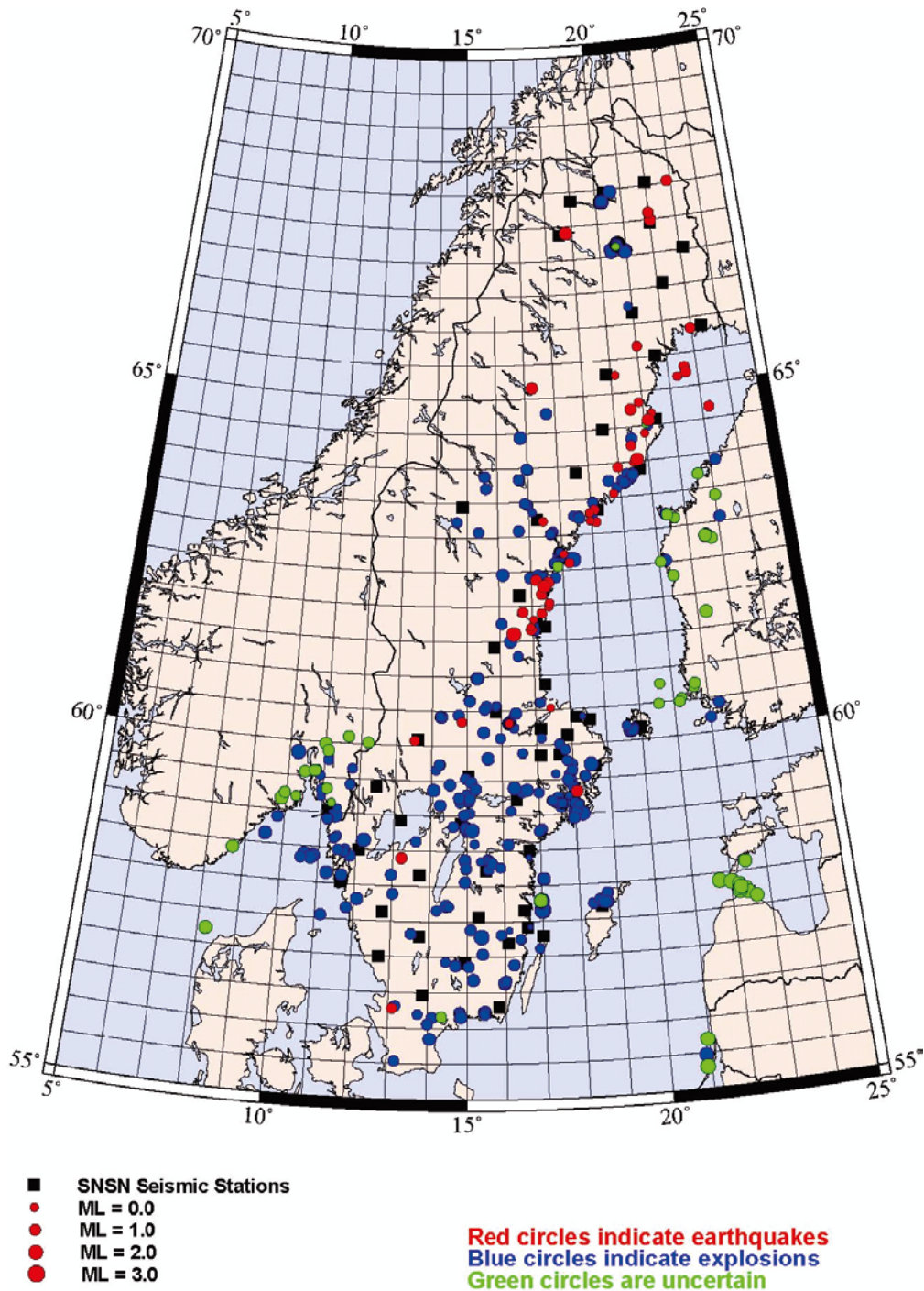


Figure 3-1. Recorded events including explosions in the SNSN network during the period July through September 2007.

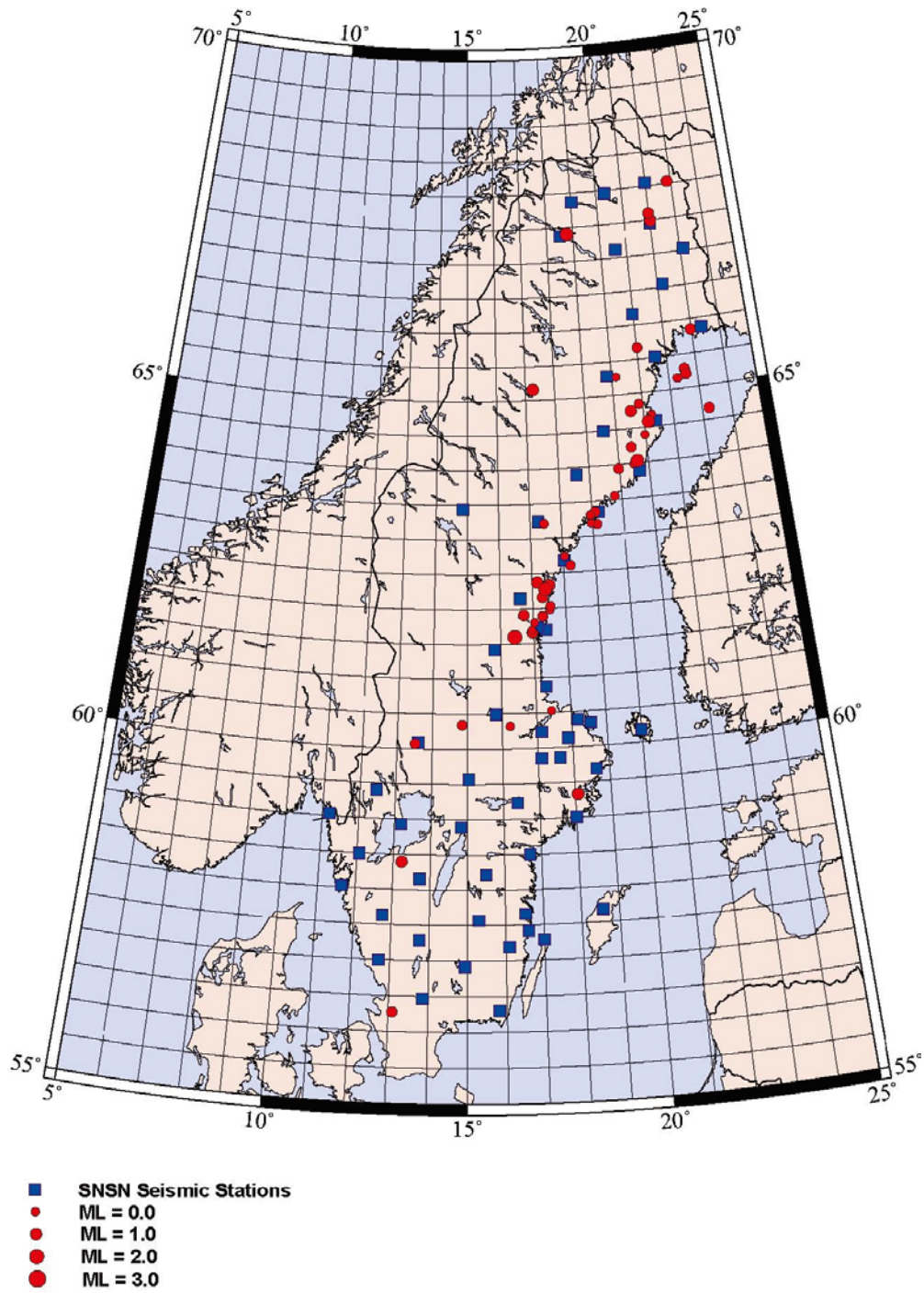


Figure 3-2. Earthquake activity in Sweden during July through September 2007.

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
20070702	030409.6	68.032	22.852	7,565.4	1,793.6	2.6	0.9
20070703	023108.8	67.486	22.015	7,501.0	1,764.9	8.6	1.0
20070704	165529.2	63.939	19.973	7,098.9	1,704.1	13.0	0.6
20070708	084939.8	63.343	19.101	7,030.1	1,664.8	3.3	0.5
20070708	165830.3	61.888	17.285	6,864.6	1,577.6	18.5	0.5
20070709	071705.9	62.376	17.152	6,918.8	1,569.5	17.6	1.1
20070713	095945.2	61.798	17.031	6,854.3	1,564.5	0.9	-0.1
20070713	161254.0	63.167	19.139	7,010.6	1,667.7	7.3	0.4
20070716	034147.7	63.305	18.946	7,025.5	1,657.3	4.9	0.0
20070716	075806.6	61.66	16.959	6,838.8	1,561.0	7.4	0.9
20070719	002232.9	64.755	20.571	7,191.8	1,726.5	20.0	1.1
20070721	043703.5	64.673	21.268	7,185.3	1,760.4	1.1	-0.1
20070721	225235.4	65.267	20.156	7,247.3	1,702.9	20.3	-0.1
20070724	094441.3	62.161	17.313	6,895.1	1,578.4	1.1	0.9
20070725	004900.5	67.597	21.981	7,513.3	1,762.3	31.1	0.9
20070725	203203.2	63.555	19.769	7,055.6	1,696.8	1.0	0.0

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 (M_L). In August 19 earthquakes were located whereof one located 13 km S of Sundsvall with magnitude $M_L = 1.7$. One earthquake with magnitude $M_L = 1.8$ was located 10 km E of Saltoluokta. An earthquake occurred in Gamla stan i Stockholm on August 18th with magnitude 1.3. Additionally 2 earthquakes had magnitude larger or equal to 1.0. The depth range of the events varies between 1.0 and 29.5 km.

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 13 earthquakes were located whereof one with magnitude $M_L = 2.0$, 28 km north of Bollnäs. Additionally 3 earthquakes had magnitudes M_L equal or above 1.0. The depth range was between 0.1 and 25.3 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
20070802	045247.0	62.332	17.517	6,914.4	1,588.5	2.6	1.2
20070802	064646.0	65.668	21.012	7,294.9	1,739.1	19.6	0.6
20070802	111709.4	67.404	18.768	7,481.6	1,626.9	3.0	1.8
20070802	191706.4	63.186	18.947	7,012.3	1,658.0	12.7	-0.2
20070804	214747.2	63.986	20.494	7,106.0	1,729.2	1.0	-0.3
20070805	103910.7	56.274	13.102	6,241.8	1,332.4	15.1	0.8
20070807	104707.0	64.233	20.472	7,133.4	1,726.1	1.1	0.5
20070808	090428.0	62.275	17.400	6,907.9	1,582.6	14.3	1.7
20070808	221437.8	65.845	22.970	7,323.4	1,826.6	2.5	0.8
20070810	025135.3	63.214	17.441	7,012.6	1,582.1	29.5	0.3
20070815	122400.3	62.599	18.214	6,945.2	1,623.5	1.1	0.4
20070818	230740.6	59.326	18.067	6,580.5	1,628.5	2.4	1.3
20070819	005246.2	64.845	20.872	7,202.9	1,740.0	25.8	0.3
20070823	021552.6	61.696	16.950	6,842.8	1,560.4	1.4	-0.3
20070823	055507.0	65.289	22.572	7,259.7	1,815.1	4.4	0.7
20070823	221342.7	60.526	17.431	6,713.1	1,589.1	18.0	-0.1
20070826	211122.9	64.576	21.135	7,174.0	1,755.0	1.2	1.4
20070829	070654.2	64.393	20.974	7,153.1	1,748.9	19.0	-0.1
20070830	225318.7	62.732	18.044	6,959.8	1,614.3	19.7	-0.1

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
20070901	220820.4	60.344	14.848	6,692.0	1,447.0	6.6	0.6
20070904	024902.5	64.668	23.229	7,194.3	1,853.7	10.1	0.7
20070904	025957.1	61.912	16.713	6,866.8	1,547.5	17.9	0.7
20070905	125507.6	65.206	22.595	7,250.6	1,817.2	10.3	0.9
20070907	140851.0	64.031	20.641	7,111.5	1,736.0	0.5	1.6
20070910	045108.9	58.396	13.233	6,477.6	1,349.4	14.1	1.0
20070910	100301.5	60.072	13.512	6,663.6	1,372.2	6.3	0.5
20070910	232411.3	65.156	17.251	7,228.8	1,567.6	1.1	1.3
20070916	022915.2	61.599	16.425	6,831.7	1,532.7	0.6	2.0
20070925	004535.2	61.98	17.506	6,875.1	1,589.0	25.3	0.0
20070927	011906.1	62.031	17.533	6,880.9	1,590.3	17.0	0.2
20070927	012736.9	65.156	22.292	7,243.6	1,803.6	0.1	0.3
20070929	020738.4	60.32	16.229	6,689.1	1,523.2	3.0	0.1