Progress Report No 17

for the project

Norwegian National Seismic Network

For the period July 1st to December 31st, 2000

Sponsored by

Oljeindustriens Landsforening

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and

NORSAR
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1. Introduction

This 17th progress report, under the project Norwegian National Seismic Network (NNSN), covers the second half of 2000. The purpose is to describe the current technical operation of the stations, the data recorded, the costs and the budget for the project for the reporting period. In addition the following is presented in Appendix 1-6

Appendix 1; Seismicity of Norway and surrounding areas.
Appendix 2; The NORSAR regional arrays
Appendix 3; The M_L 4.5 Stord/Bømlo, earthquake of August 12, 2000.
Appendix 4; An introduction to the earthquake internet pages.
Appendix 5; Monthly variation in earthquake activity.
Appendix 6; The Kursk submarine accident.

2. Operation

The operational stability for each station is shown in Table 1. The average downtime for all 13 stations is 6.6 % compared to 5.2% for the last reporting period. This is within acceptable limits, with respect to the goal of average downtime below 2 %. Repeated communication problems occurred at the stations ODD and TRO.

Table 1. Downtime in % for the time period July to December, 2000 for each station of the NNSN.

Station	Downtime in %
Karmøy (KMY)	0
Odda (ODD1)	22
Blåsjø (BLS)	0
Høyanger (HYA)	0.5
Sulen (SUE)	3
Molde (MOL)	0
Florø (FOO)	24
Namsos (NSS)	0
Mo i Rana (MOR8)	11
Lofoten (LOF)	0
Tromsø (TRO)	26
Kautokeino (KTK)	0
Bjørnøya (BJO1)	0

3. Field stations and technical service

The technical changes for each seismic station, are listed below. It is noted if these changes are not related to a visit of the UiB technical staff. When a station stops working, tests are made to locate the problem. Sometimes the reason cannot be found and the cause of the problem will be marked as unknown.

Bjørnøya (BJO1)

01.10.00 Installation of a PC, Seislog version8.3 and a new GPS with 1 puls/sec.

Florø (FOO)

No visits or technical changes.
Between 09.09 and 24.10 the station has been running but no events are triggered. Unknown reason for the problem.

Høyanger (HYA)

No visits or technical changes.
05-06.07.00 Station was down for one day. Unknown reason for the problem.

Karmøy (KMY)

No visits or technical changes.

Lofoten (LOF)

No visits or technical changes.

Mo i Rana (MOR8)

10.09.00. A new ISDN connection was installed by TELENOR
19.09.00. Installation of a PC, Seislog version 8.3 and a Cisco-box. The station was updated with a GURALP broadband seismometer.
10.10.00. PC started with use of the remote control. The station was down for 9 days.
23.10.00. PC started with use of the remote control. The station was down for 4 days.
30.10.00. PC started with use of the remote control. The station was down for 2 days.
02.11.00. PC started with use of the remote control. The station was down for 1 days.
22.11.00. PC started with use of the remote control. The station was down for 2 days.
03.12.00. PC started with use of the remote control. The station was down for 3 days.
05-13.12.00. Several restarts were necessary. The reason for this problem is unknown.

Molde (MOL)

01.11.00. The station was upgraded with a GURALP broadband seismometer.
17.04.00. PC installed by the local operator.

Namsos (NSS)

No visits or technical changes.

Tromsø (TRO)

05.09.00. The PC was restarted by the local operator. The station was down for 5 days.
19.07.00. A new GPS, giving minute marks to the helicorder, was installed.
10.08.00. The PC was restarted by the local operator. The station was down for 4 days.
16.08.00. The PC was restarted by the local operator. The station was down for 14 days.
18.09.00. The PC was restarted by the local operator. The station was down for 6 days.
08.10.00. The PC was restarted by the local operator. The station was down for 8 days.
14.11.00. The PC was restarted by the local operator. The station was down for 5 days.
20.11.00. The PC was restarted by the local operator. The station was down for 2 days.
04.12.00. The PC was restarted by the local operator. The station was down for 4 days.

Sulen (SUE)

29.11.00. A new ISDN box was installed by TELENOR since the previous was damaged by lightning (25.11.00). The station was restarted by the local operator (30.11.00). Total downtime: 5 days.

Odda (ODD1)

10.07.00. A PC was installed by the local operator.
10-28.08.00. Bug in the Seislog system caused the station to run only 5 hours a day.
27.09.00. A PC with latest Seislog version and a digitiser was installed by the local operator. The previous PC and digitiser was damaged by lightning. Downtime 18 days.
05.10.00. PC was restarted using the remote control. The station was down for 4 days.
09-22.10.00. Several restarts were necessary.
22.10.00. A PC was installed.
29.10.00. The PC was restarted using the remote control. Downtime 1 day.
22.11.00. The PC was restarted using the remote control. Downtime 1 day.

Blåsjø (BLS)

No visits or technical changes.

Kautokeino (KTK)

10.07.00. A new ISDN connector was installed by TELENOR
18.07.00. Installation of a PC, Seislog version 8.27 and a Cisco box.

System stops and technical problems:

In some cases systems stop without any obvious reason. This is normally discovered during the daily collection of data from each station. The procedure is then to restart the data acquisition remotely through a Tele-Commander. This is a unit installed on most field stations that enable us to turn off and on the power on different units in the field via a terminal located at the institute. A restart of the systems will in most cases solve the problem, at least until the next maintenance visit.
In some cases however, the problem is of a more severe character, and parts of the field unit may have to be replaced. The following Problems have occurred:

- Lightning: This of course, may destroy parts or the complete station. Our experience is that the most vulnerable parts are the serial ports of the computer and the communication devices. If the serial ports are destroyed, the station is not able to receive the timing signal from the GPS clock that is connected to a serial port. The actual data from the digitiser is also connected to a serial port and cannot be read if the serial port is destroyed.
- Digitiser: If the digitiser for some reason stops sending data, the acquisition programs will of course also stop.
- Timing: If the GPS clock stops sending data, the timing of the data will drift with the accuracy of the computers internal clock.
- Computer: We have also seen that different computers may give different problems. Some newer versions of PCs give more problems with the serial ports than older versions. Identical versions of the acquisition software may give different problems on a new and an older PC. One digitiser may work perfectly on an old computer, and it may be unstable on a new one. The problem exists since new PCs are bought regularly to maintain the stations.
- Software: Some of the stops we experience will also be the result of errors in the data acquisition software, which may only be seen with a specific configuration of the acquisition system. The software is continuously upgraded and modified to improve the stability.

Other technical matters

All stations, except Bjørnøya, are now on internet.
Bjørnøya has worked very well during the reporting period (and still is) with only minor time periods with noise problems.

4. Data

An overview of the seismic activity in Norway and surrounding areas for the last half of 2000 is given in Appendix 1. The data recorded by the seismic stations were collected and monthly bulletins were prepared and distributed. There was no event in Norway of magnitude larger than 5.0 during the last half of 2000.
The report on the Svalbard array, SPITS, is given in Appendix 2.

In August 2000 there were three felt earthquakes and several aftershocks located in the outer Hardanger fjord. A report on these earthquakes is prepared and is presented in Appendix 3.

A short introduction to the internet pages given by NORSAR and IFJ, UiB are given in Appendix 4.

6. Use of NNSN data during 2000

Publications and reports

Atakan, K. The role of Caledinoan structures in present day seismicity of Norway and the adjacent areas. Geonytt No.1, 2000, 33

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Bungum H., C. Lindholm, A. Dahle, G. Woo, F. Nadim, J.K. Holme, O.T.

Gudmestad, T.S. Hagberg and K. Karthigeyan (2000): New seismic zoning maps for Norway, the north Sea and UK. Seism. Res. Lett., 71, pp. 687-697.

Dehls J. and O. Olesen (eds.) (2000): Neotectonics in Norway. Annual Technical report 1999. NGU Report 2000.001.

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Hicks E., H. Bungum and C. Lindholm (2000): Seismic activity, inferred crustal stresses and seismotectonics in the Rana region, Northern Norway. Quaternary Science Reviews, 19, pp. 1423-1436

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Hicks E. and L. Ottemøller (in press): The ML 4.5 Stord/Bømlo, southwestern Norway, earthquake of August 12, 2000. Norsk Geol. Tidsskrift.

Institute of Solid Earth Physics, UiB and Norsar 2000. A preliminary report on the 12 August 2000, Stord earthquake. Norwegian National Seismological Network, Technical Report No.9. Institute of Solid Earth Physics, University of Bergen, Norway, 5p.

Lindholm C. and H. Bungum (2000): Probabilistic Seismic Hazard; A review of the seismological frame of reference with examples from Norway. Soil Dyn. and Earthq. Eng. 20, pp. 27-38.

Oral and poster presentations

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Bungum, H., M. Roth and R.A.W. Haddon: Full waveform modelling of the August 17, 1999, Kola Peninsula earthquake. 31st Nordic Seminar on Detection Seismology, Korsør, Denmark, 27-29 September 2000.

Lindholm C., J. Schweitzer, F. Krüger, F. Scherbaum, G. Richter, J. Höhne, E. Hicks and H. Bungum: MASI-project 1999, a seismic survey to study neotectonic phenomena in the Finnmark area. Poster presentation. XXVII General Assembly of the European Seimological Commission (ESC), Lisbon, Sept. 10 -15, 2000.

Lindholm C., S. Molina and H. Bungum (2000): Probabilistic Seismic Hazard Analysis: Zoning Free versus zoning methodology. Nordic Detection seminar, Korsør 27-29 September, 2000.
Lindholm C., J. Schweitzer, F. Krüger, F. Scherbaum, G. Richter, J.

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