



Progress Report No 11

for the project

Norwegian National Seismic Network

For the period July 1 to December 31, 1997

Sponsored by

Oljeindustriens Landsforening

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and

NORSAR
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1. Introduction

This 11th progress report, under the project Norwegian National Seismic Network (NNSN), covers the last half of 1997. The purpose of this report is to describe the current technical operation of the stations, the data recorded, the costs and budget of the project for the reported period. Presentations and studies made throughout 1997, with use of NNSN data are listed in section 7. A separate report is given on the seismicity of Norway and surrounding areas in which the data recorded is presented (Appendix 1). The report on the Svalbard array is given in Appendix 2.

2. Operation

The operational stability for each station is seen in Table 1. The average downtime for all 13 stations is 3.9 % which is comparable to the previous six-month period when the downtime was 3.5 %.

Table 1 Downtime in % for the time period July to December, 1997 for each station in the NNSN.

Station	Downtime in %
Karmøy (KMY)	11.7
Odda (ODD1)	0
Blåsjø (BLS)	3,8
Høyanger (HYA)	0
Sulen (SUE)	0
Molde (MOL)	0
Florø (FOO)	7.1
Namsos (NSS)	0
Mo i Rana (MOR8)	0
Lofoten (LOF)	2.2
Tromsø (TRO)	0
Kautokeino (KTK)	0
Bjørnøya (BJO1)	25.5

3. Field stations and technical service

The technical changes are listed for each station below. If these changes are not related to a visit of the UiB technical staff, it is noted.

Bjørnøya (BJO1)

11.08.97: Installation of:
SEISLOG - seislog version 7.0

Florø (FOO)

15.10.97: Installation of:

- New SEISLOG system (PC version 7.0)
- New Garmin GPS clock
- Cisco box for ISDN

The data are now transferred via ISDN line using Internet

26.11.97: System down since 14th November. The main board in PC was damaged and the PC was taken to Bergen.

28.11.97: System running after a new PC was installed.

Høyanger (HYA)

15.07.97: From 1st July not able to login to the SEISLOG system due to power failure on the Cisco box. The SEISLOG system was running, no data were lost during this period.

30.07.97: From 21th July not able to login to the SEISLOG system due to failure on the Cisco box. A new Cisco box was installed. The SEISLOG system was running, no data were lost during this period.

Karmøy (KMY)

09.10.97: The old system (VME) was stopped.

05.11.97: The previous weeks there had been stability problem with the SEISLOG system. A new SEISLOG system (PC version 7.0) was installed.

12.11.97: From 5th November it was not possible to login to the SEISLOG system due to failure of the Cisco box. A new Cisco box was installed. The SEISLOG system was running, no data were lost during this period.

18.12.97: There has been stability problem with the SEISLOG system. A new SEISLOG system (PC version 7.0) was installed.

Lofoten (LOF)

06.11.97: Local people installed:

- New SEISLOG system (PC version 7.0)
- Cisco box

The data are now transferred via ISDN line using Internet.

Mo i Rana (MOR8)

No visit or technical changes

Molde (MOL)

29.07.97: System down between 26th and 29th July due to lightning. The system was restarted by the local people.

23.10.97: Installation of:

- New SEISLOG system (PC version 7.0)
- New Garmin GPS clock
- Cisco box

The data are now transferred via ISDN line using Internet.

Namsos (NSS)

No visit or technical changes

Tromsø (TRO)

23.07.97: Due to unstable timing a new Garmin GPS clock was installed.

08.08.97: A new SEISLOG system (PC version 7.0) was installed to replace the old one.

03.12.97: Replaced the malfunctioning GPS with a new one.

Sulen (SUE)

No visit or technical changes

Odda (ODD1)

29.09.97: Installation of:

- New SEISLOG system (PC version 7.0)
- Cisco box

The data are now transferred via ISDN line using Internet.

07.10.97: After the installation of the SEISLOG system problems on the serial line occurred. Replaced SEISLOG system (PC) and digitizer.

18.12.97: There has been stability problem with the SEISLOG system. A new SEISLOG system (PC version 7.0) was installed.

Internet connection to remaining field stations: For the stations Kautokeino, Mo i Rana and Blåsjø, it is currently not possible to get ISDN connections so these stations have remained with modems. Currently it is investigated whether Internet using modem is practical or as an alternative to install special equipment so ISDN can be used.

NORSAR is operating a small network near Mo i Rana and there is a possibility to move the current Mo i Rana station within and integrated with this network. That would solve the ISDN problem for Mo i Rana

4. Data

An overview of the seismic activity in Norway and surrounding areas for the last half of 1997 is given in a separate report (Appendix 1). The data recorded by the seismic stations were collected and monthly bulletins were prepared and distributed. Since there was no event in Norway of magnitude larger than 5.0 during the last half of 1997, no special report has been written. The performance of, and data recorded by the Svalbard array, are described in Appendix 2.

Data from Ekofisk.

At the previous meeting, the question was raised whether data was available from Ekofisk for larger earthquakes also recorded on land. Philips has been contacted and could inform that no large earthquakes had been recorded on the local seismic network since it only had been in operation for shorter periods of time. The largest earthquake recorded was magnitude 1.4. The network is not in operation now, however there are plans for a new network to be installed so

useful data could be recorded in the future. All data is freely available. The result have been documented in 2 reports of which the final reports, see reference list below.

Data available on Internet

The complete data base available at the University of Bergen has now been made accessible on Internet. The data includes all earthquake parameter data (readings, hypocenters and magnitudes) since 1980, the historical catalog from before 1980 and all digital waveform data from 1982 (when digital recording started at Jan Mayen). The data is available on the ftp server with address <ftp://ifjf.uib.no> under directory seismo. All software used is also available at the same site. The easiest way to access the data is from the Institute home page since using a Web browser makes it possible to look at the parameter files before downloading the data. The address is: <http://www.ifjf.uib.no/>

6. Technical equipment at stations.

Below follows a list of the technical equipment at each station as of 31st December 1997.

Instruments/Stations	KMY	BLS	ODD	HYA	SUE	FOO	MOL	NSS	MOR	LOF	TRO	KTK	BJO
3-comp. Seismometer	x	x	x	x	x	x	x	x	x	x	x	x	
Guralp CMG-40T Broad band seismometer													x
Accelerometer, FBA-23					x								
Accelerometer, FBA-13							x			x			
GPS Clock, Garmin	x			x	x	x	x		x		x		x
GPS Clock, Lowrance	x	x	x					x		x		x	x
Power supply, clock	x	x	x	x	x	x	x	x	x	x	x	x	x
GPS clock battery		x		x	x	x	x	x	x	x		x	
PC system, SEISLOG	x		x	x	x	x	x		x	x	x		x
Os9 system (VME)		x						x				x	
DAT tape station													x
Nanometrics, RD3	x	x		x		x		x	x		x	x	
Nanometrics, RD6					x		x			x			
Power supply Nanom.	x	x		x	x	x	x	x	x	x	x	x	
Earth Data ED24			x										x
Power supply, ED24			x										x
Cisco box, ISDN	x		x	x	x	x	x			x			
Multimeter				x			x	x	x	x			x
Phone	x	x	x	x	x	x	x	x	x	x		x	
Lightning protection	x	x	x	x	x	x	x	x	x	x	x	x	x
Auto power switch, PC	x	x		x	x	x	x	x	x	x	x	x	
Modem Octo/Microcom		x						x	x			x	x
Printer													x

7. Use of NNSN data during 1997.

Under this section publications, talks, posters etc in which NNSN data is used will be listed. Please note that this is probably not a complete listing.

Publications (peer review)

Bungum, H. & C. Lindholm (1997): Seismo- and neotectonics in Finnmark, Kola and the southern Barents Sea, Part 2: Seismological analysis and seismotectonics. *Tectonophysics*, **270**, 15-28.

Fejerskov, M. & C. Lindholm (1997): Crustal stress in and around Norway; An evaluation of stress-generating mechanisms. *J. Geol. Soc. London* (in press).

Husebye, E.S. and Ruud, B.O., 1997. Seismic wave propagation in the crust - event location in a semiautomatic manner. In: Proceedings of the 19th Annual Seismic Research Symposium on Monitoring a Comprehensive Test Ban Treaty, Orlando, FL, 23-25 Sept. 1997, 242-251.

Lindholm, C., H. Bungum, E. Hicks & M. Villagran (1997): Crustal stress and tectonics in Norwegian regions determined from earthquake focal mechanisms. *J. Geol. Soc. London* (in press).

Mendi, C.D., Ruud, B.O. and Husebye, E.S., 1997. The North Sea Lg-blockage puzzle, *Geophys. J. Int.*, **130**, 669-680.

Extended abstracts/proceedings

Atakan, K., Anundsen, K. and Helle, S.K. 1997. Seismotectonics at Yrkje, Southwestern Norway: Correlation with local fault zones and geodetic measurements. *Geonytt* **24**, Nr.1, 22-23.

Scientific work

Atakan, K., 1997. A recent submarine mass-movement in Grunnevik (Duesund), Masfjorden, western Norway. *Technical report no. 7*. Institute of Solid Earth Physics, University of Bergen, Norway.

Atakan, K. and Langeland, C. 1997. Seismicity and heat-flow, Paleoheatflow project. Progress Report 97-01. Institute of Solid Earth Physics, University of Bergen.

Oral and poster presentations

Atakan, K., Anundsen, K. and Helle, S.K. 1997. Seismotectonics at Yrkje, Southwestern Norway: Correlation with local fault zones and geodetic measurements.

Norsk Geologisk Forening XV Landsmøte (NGF-97), University of Bergen, Bergen, Norway, Jan.9-11, 1997.

Atakan, K. 1997. Jordskjelvsrisiko i Norge: Ren statistikk eller virkelighet?
Norsk Statistisk Forening, Bergen, Norway, 15 May 1997.

Atakan, K. and Dahle, A. 1997. Recent felt earthquakes in Norway.
28th Nordic Seminar on 'Detection Seismology', Helsinki, Finland, 16-18 June 1997.

Bungum, H.: Ground motions from large European earthquakes: Data base and prediction models.
29th General Assembly of IASPEI, Thessaloniki, Greece, 18-28 August 1997.

Baadshaug, U. & S. Mykkeltveit: NOR_NDC; Norwegian Data Center.
28th Nordic Seminar on Detection Seismology, Helsinki, Finland, 16-17 June 1996.

Dehls, J., O. Olesen, H. Bungum & C. Lindholm: NEONOR: Neotectonics in Norway. ES-SSA 97
Abstract. Seismological Society of America, Eastern Section, Ottawa, 6-9 October.

Fedorenko, Y., Husebye, E.S. and Ruud, B.O. Epicenter locations tied to ANN multidimensional envelope waveform recognition.
29th General Assembly of the IASPEI, Thessaloniki, Greece, 18-28 Aug. 1997.

Havskov, J., Computer communication and seismic networks.
29th General Assembly of the IASPEI, Thessaloniki, Greece, 18-28 August 1997.

Havskov, J., Sismologia en Noruega. Instituto Nacional de Sismologia, Santiago de Cuba, Cuba, April.

Hicks, E.: Stress inversion of earthquake focal mechanism solutions in Norway.
28th Nordic Seminar on Detection Seismology, Helsinki, Finland, 16-17 June 1997.

Husebye, E.S. and Ruud, B.O. Fast, Robust and Reliable Epicenter Determinations - Envelope Processing of Local Network Data.
29th General Assembly of the IASPEI, Thessaloniki, Greece, 18-28 Aug. 1997.

Husebye, E.S. and Ruud, B.O. Seismic wave propagation in the crust - event location in a semiautomatic manner.
19th Annual Seismic Research Symposium on Monitoring a Comprehensive Test Ban Treaty, Orlando, FL, 23-25 Sept. 1997.

Kremenetskaya, E., V.E. Asming & F. Ringdal: Study of travel-time models for the Barents region.
28th Nordic Seminar on Detection Seismology, Helsinki, Finland, 16-17 June 1997.

Kværna, T. & F. Ringdal: Event magnitude, capability maps and magnitude thresholds.
28th Nordic Seminar on Detection Seismology, Helsinki, Finland, 16-17 June 1997.

Kværna, T. & F. Ringdal: Event magnitudes, capability maps and magnitude thresholds. Proc. 19th Annual Seismic Research Symposium on Monitoring a Comprehensive Test Ban Treaty, 23-25 September.

Lindholm, C., H. Bungum, A. Dahle, K. Atakan, R. Wahlström, S. Gregersen, P. Manyiemi, M. Uski & G. Grünthal: Seismic zonation of Scandinavia (a GSHAP subproject). 29th General Assembly of IASPEI, Thessaloniki, Greece, 18-28 August 1997.

Mendi, C.D., Ruud, B.O. and Husebye, E.S. The North Sea Lg-blockage puzzle. 29th General Assembly of the IASPEI, Thessaloniki, Greece, 18-28 Aug. 1997.

Ottmøller, L. 1997. Determination of velocity models for Norway by inverting travel times of local earthquakes and explosions. 29th General Assembly of the IASPEI, Thessaloniki, Greece, 18-28 Aug. 1997.

Ringdal, F., C. Lindholm, H. Bungum & A. Dahle: Earthquake hazard zonation in NW Europe. 28th Nordic Seminar on Detection Seismology, Helsinki, Finland, 16-17 June 1997.

Wolf, E., C. Lindholm, H. Bungum, K. Atakan, S. Gregersen, K. Arhe & J. Malaska: Seismogeographical regionalization of Scandinavia. 29th General Assembly of IASPEI, Thessaloniki, Greece, 18-28 August 1997.

8. References

Ekofisk:

James Rutledge, 1993: Results of the Ekofisk Microseismic Monitoring Project. Los Alamos National Laboratory, GeoEngineering Group, EES-4, Mail Stop D443, Los Alamos, NM 87545 USA.

James Rutledge and Barbara Schuessler, 1995. Microseismic Monitoring in Ekofisk 2/4 B22D, Final report. Los Alamos National Laboratory, GeoEngineering Group, EES-4, Mail Stop D443, Los Alamos, NM 87545 USA.