

NORSAR Scientific Report No. 1-98/99

# **Semiannual Technical Summary**

**1 April – 30 September 1998**

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## 7.7 Status Report: Norway's participation in GSETT-3

### *Introduction*

This contribution is a report for the period April - September 1998 on activities associated with Norway's participation in the GSETT-3 experiment, which is now being coordinated by Prep-Com's Working Group B. This report represents an update of contributions that can be found in the previous five editions of NORSAR's Semiannual Technical Summary.

### *Norwegian GSETT-3 stations and communications arrangements*

During the reporting interval 1 April - 30 September 1998, Norway has provided data to the GSETT-3 experiment from the three seismic stations shown in Fig. 7.7.1. The NORSAR array (station code NOA) is a 60 km aperture teleseismic array, comprised of 7 subarrays, each containing six vertical short period sensors and a three-component broadband instrument. ARCES is a 25-element regional array with an aperture of 3 km, whereas the Sptisbergen array (station code SPITS) has 9 elements within a 1-km aperture. ARCES and SPITS both have a broadband three-component seismometer at the array center.

Data from these three stations are transmitted continuously and in real time to NOR\_NDC. The NOA data are transmitted using dedicated land lines, whereas data from the other two arrays are transmitted via satellite links of capacity 64 Kbits/s and 19.2 Kbits/s for the ARCES and SPITS arrays, respectively. From the NOR\_NDC, relevant data (see below) are forwarded to the prototype IDC (PIDC) in Arlington, Virginia, USA, via a dedicated fiber optical 256 Kbits/s link between the two centers.

The NOA and ARCES arrays are primary stations in the GSETT-3 network, which implies that data from these stations are transmitted continuously to the PIDC with a delay not exceeding 5 minutes. The SPITS array is an auxiliary station in GSETT-3, and the SPITS data are available to the PIDC on a request basis via use of the AutoDRM protocol (Kradolfer, 1993; Kradolfer, 1996). The Norwegian stations are thus participating in GSETT-3 with the same status (primary/auxiliary seismic stations) they have in the International Monitoring System (IMS) defined in the protocol to the Comprehensive Nuclear Test-Ban Treaty.

### *Uptimes and data availability*

Figs. 7.7.2 - 7.7.3 show the monthly uptimes for the Norwegian GSETT-3 primary stations ARCESS and NOA, respectively, for the period 1 April - 30 September 1998, given as the hatched (taller) bars in these figures. These barplots reflect the percentage of the waveform data that are available in the NOR\_NDC tape archives for these two arrays. The downtimes inferred from these figures thus represent the cumulative effect of field equipment outages, station site to NOR\_NDC communication outage, and NOR\_NDC data acquisition outages.

Figs. 7.7.2-7.7.3 also give the data availability for these two stations as reported by the PIDC in the PIDC Station Status reports. The main reason for the discrepancies between the NOR\_NDC and PIDC data availabilities as observed from these figures is the difference in the ways the two data centers report data availability for arrays: Whereas NOR\_NDC reports an array station to be up and available if at least one channel produces useful data, the PIDC uses

weights where the reported availability (capability) is based on the number of actually operating channels.

### *Experience with the AutoDRM protocol*

NOR\_NDC's AutoDRM has been operational since November 1995 (Mykkeltveit & Baadshaug, 1996).

The PIDC started actively and routinely using NOR\_NDC's AutoDRM service after SPITS changed its station status from primary to auxiliary on 1 October 1996. For the month of October 1996, the NOR\_NDC AutoDRM responded to 12338 requests for SPITS waveforms from two different accounts at the PIDC: 9555 response messages were sent to the "pipeline" account and 2783 to "testbed". Following this initial burst of activity, the number of "pipeline" requests stabilized at a level between 5000 and 7000 per month. Requests from the "testbed" account show large variations.

The monthly number of requests for SPITS data for the period April - September 1998 is shown in Fig. 7.7.4.

### *NDC automatic processing and data analysis*

These tasks have proceeded in accordance with the descriptions given in Mykkeltveit and Baadshaug (1996). For the period April - September 1998, NOR\_NDC derived information on 491 supplementary events in northern Europe and submitted this information to the Finnish NDC as the NOR\_NDC contribution to the joint Nordic Supplementary (Gamma) Bulletin, which in turn is forwarded to the PIDC. These events are plotted in Fig. 7.7.5.

### *Data forwarding for GSETT-3 stations in other countries*

NOR\_NDC continues to forward data to the PIDC from GSETT-3 primary stations in several countries. These currently include FINESS (Finland), GERESS (Germany) and Sonseca (Spain). In addition, communications for the GSETT-3 auxiliary station at Nilore, Pakistan, are provided through a VSAT satellite link between NOR\_NDC and Pakistan's NDC in Nilore. The PIDC obtains data from the Hagfors array (HFS) in Sweden through requests to the AutoDRM server at NOR\_NDC (in the same way requests for Spitsbergen array data are handled, see above). Fig. 7.7.6 shows the monthly number of requests for HFS data from the two PIDC accounts "pipeline" and "testbed".

### *Future plans*

NOR\_NDC will continue the efforts towards improvements and hardening of all critical data acquisition and data forwarding hardware and software components, so as to meet future requirements related to operation of IMS stations to the maximum extent possible.

The PrepCom has tasked its Working Group B with overseeing, coordinating, and evaluating the GSETT-3 experiment until the end of 1998. The PrepCom has also encouraged states that operate IMS-designated stations to continue to do so on a voluntary basis and in the framework of the GSETT-experiment until such time that the stations have been certified for formal inclu-

sion in IMS. In line with this, and provided that adequate funding is obtained, we envisage continuing the provision of data from Norwegian IMS-designated stations without interruption to the PIDC, and later on, following certification, to the IDC in Vienna, via the new global communications infrastructure currently being elaborated by the PrepCom.

The certification process for NOA was initiated by an overview station inspection visit by a PTS (Provisional Technical Secretariat of the PrepCom) team in mid-June 1998. We are currently (1 October 1998) awaiting the PTS report on their findings during this visit.

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### References

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- Kradolfer, U. (1996): AutoDRM — The first five years, *Seism. Res. Lett.*, 67, 4, 30-33.
- Mykkeltveit, S. & U. Baadshaug (1996): Norway's NDC: Experience from the first eighteen months of the full-scale phase of GSETT-3. *Semiann. Tech. Summ.*, 1 October 1995 - 31 March 1996, NORSAR Sci. Rep. No. 2-95/96, Kjeller, Norway.

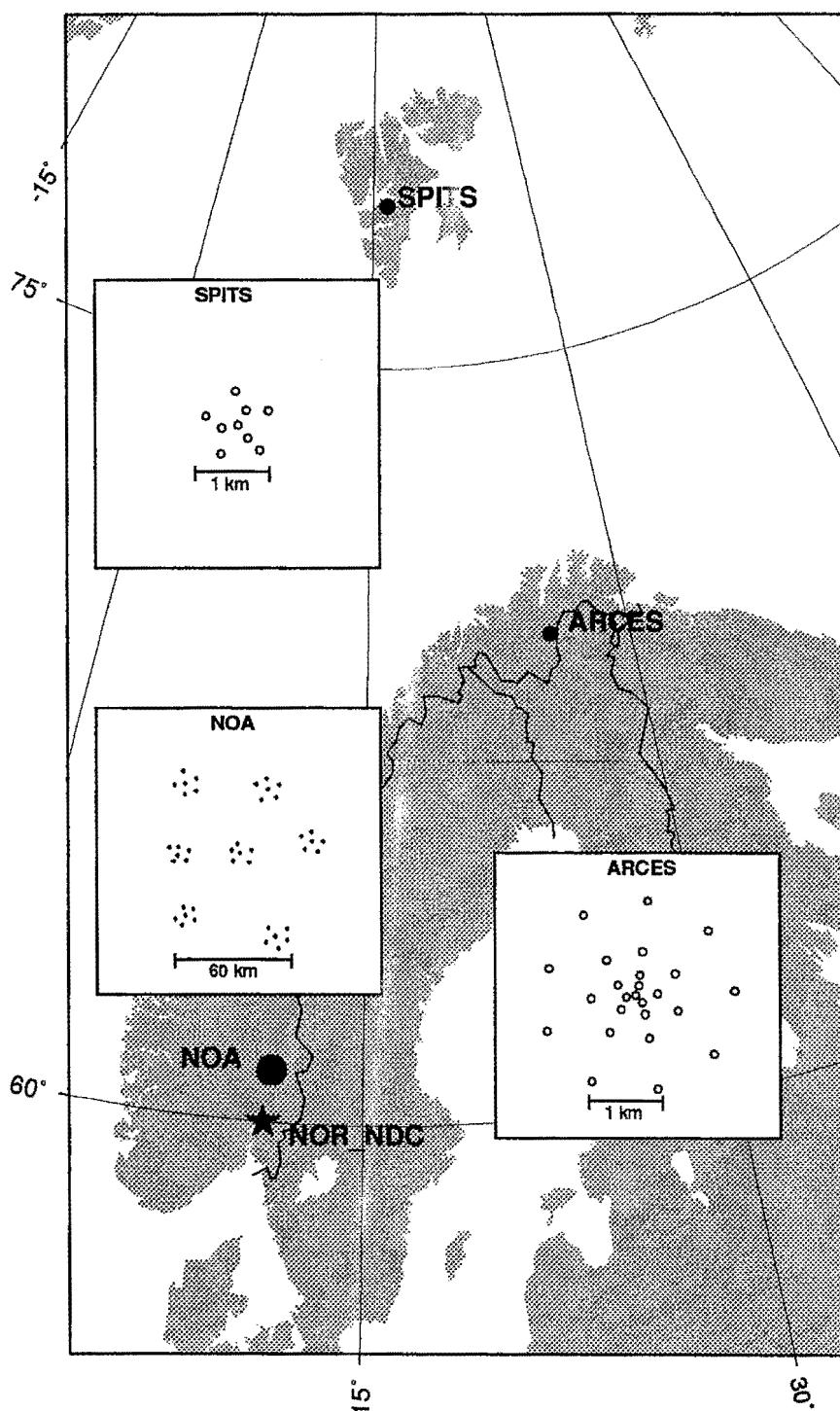


Fig. 7.7.1. The figure shows the locations and configurations of the three Norwegian seismic array stations that have provided data to the GSETT-3 experiment during the period 1 April - 30 September 1998. The data from these stations are transmitted continuously and in real time to the Norwegian NDC (NOR\_NDC). The stations NOA and ARCES have participated in GSETT-3 as primary stations, whereas SPITS has contributed as an auxiliary station.

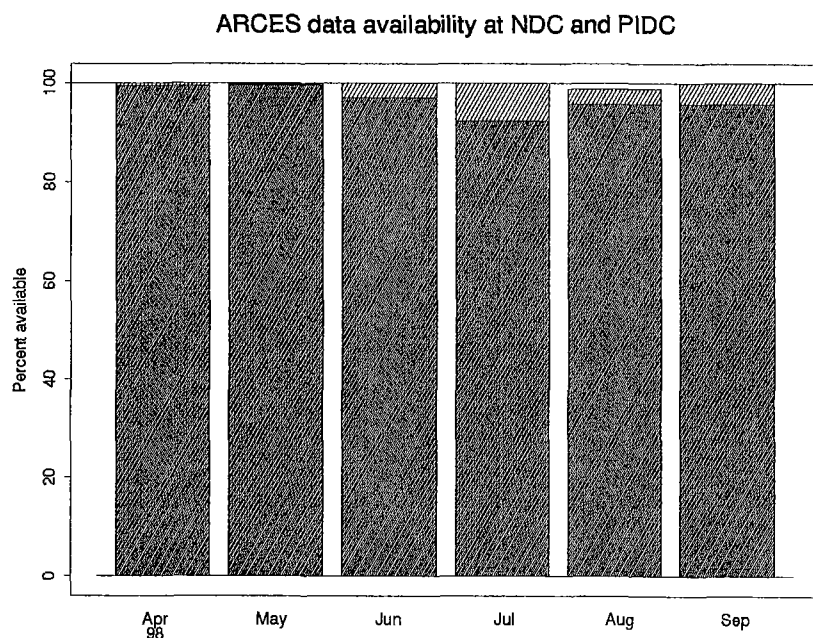


Fig. 7.7.2. The figure shows the monthly availability of ARCESS array data for the period April - September 1998 at NOR\_NDC and the PIDC. See the text for explanation of differences in definition of the term "data availability" between the two centers. The higher values (hatched bars) represent the NOR\_NDC data availability.

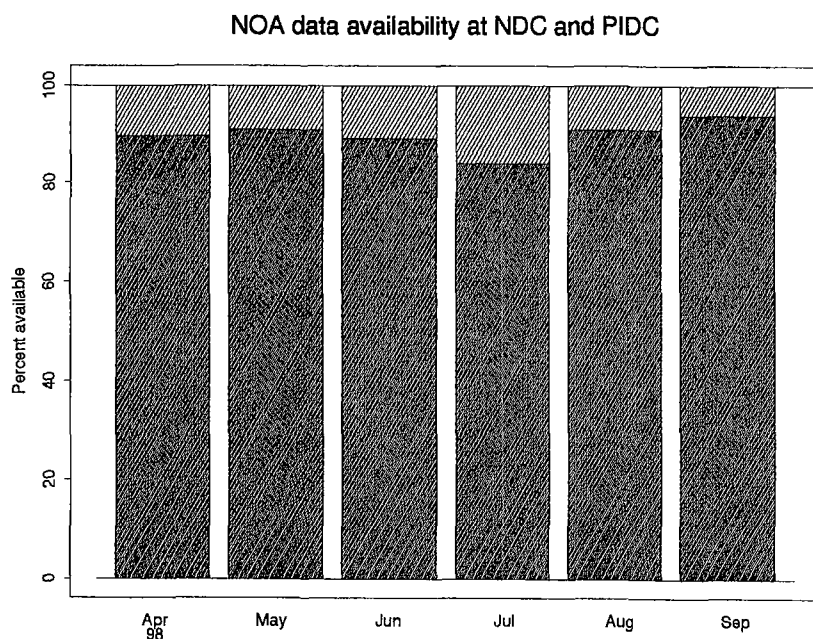


Fig. 7.7.3. The figure shows the monthly availability of NORSAR array data for the period April - September 1998 at NOR\_NDC and the PIDC. See the text for explanation of differences in definition of the term "data availability" between the two centers. The higher values (hatched bars) represent the NOR\_NDC data availability.

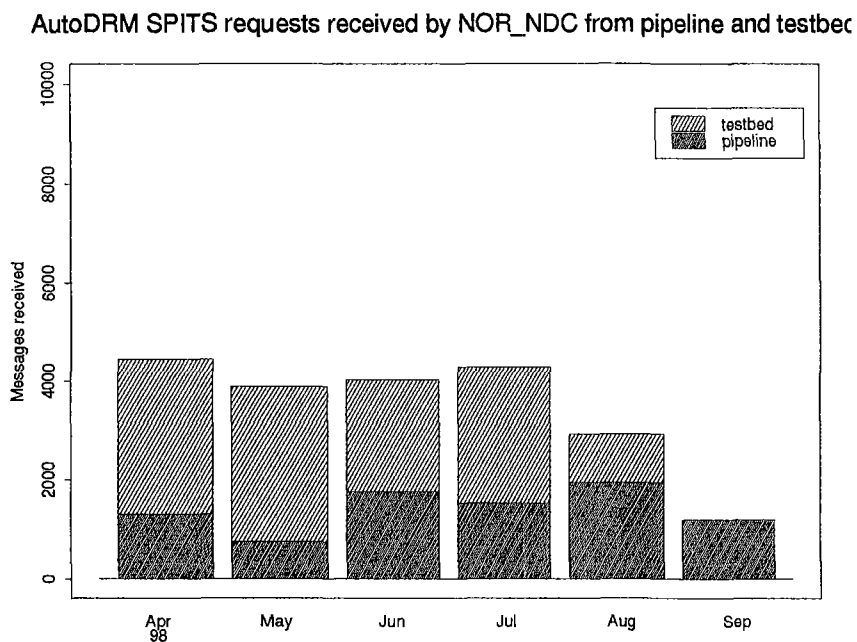


Fig. 7.7.4. The figure shows the monthly number of requests received by NOR\_NDC from the PIDC for SPITS waveform segments during April - September 1998.

## Reviewed Supplementary events

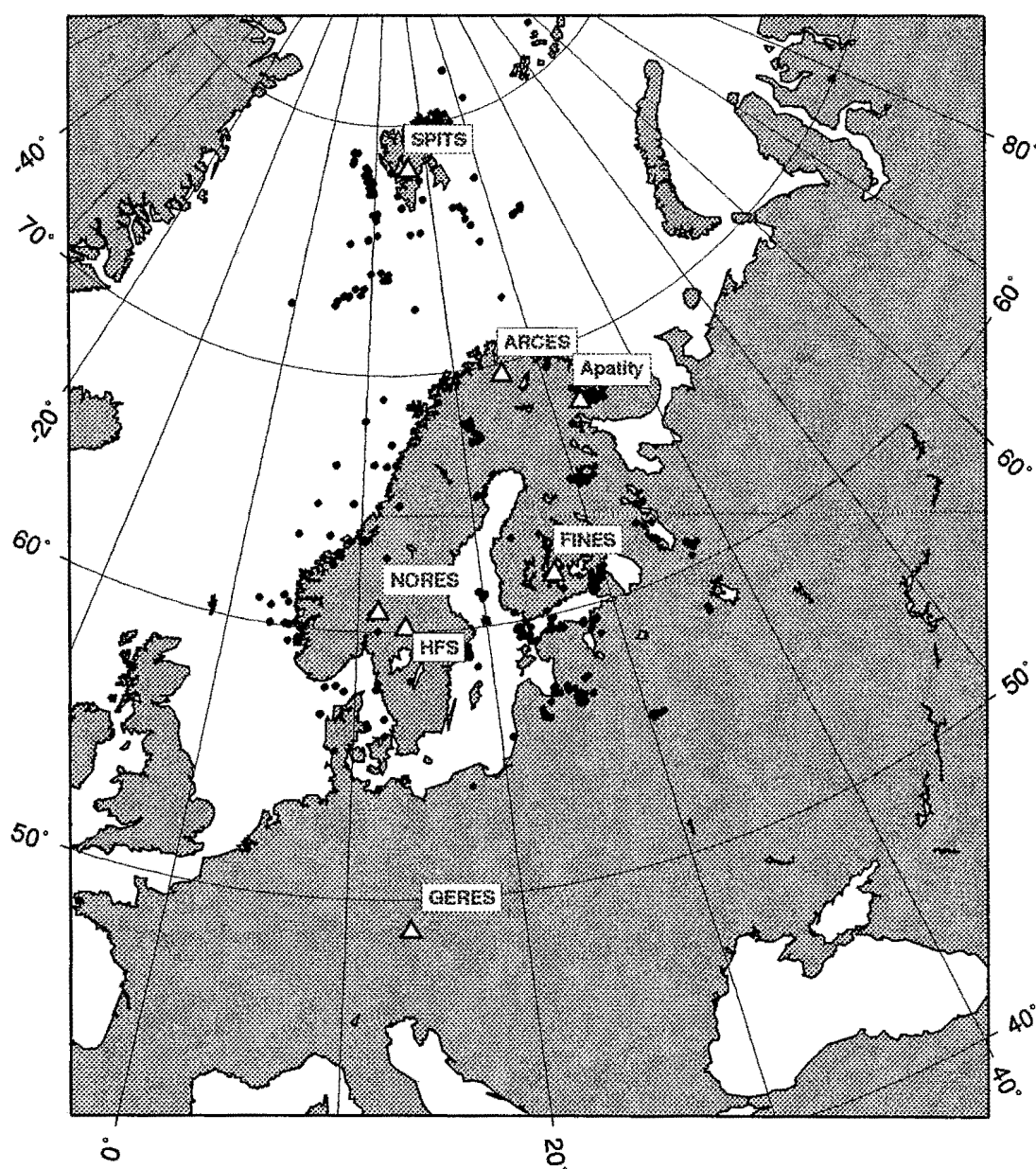


Fig. 7.7.5. The map shows the 491 events in and around Norway contributed by NOR\_NDC during April - September 1998 as Supplementary (Gamma) data to the PIDC, as part of the Nordic Supplementary data compiled by the Finnish NDC. The map also shows the seismic stations used in the data analysis to define these events.



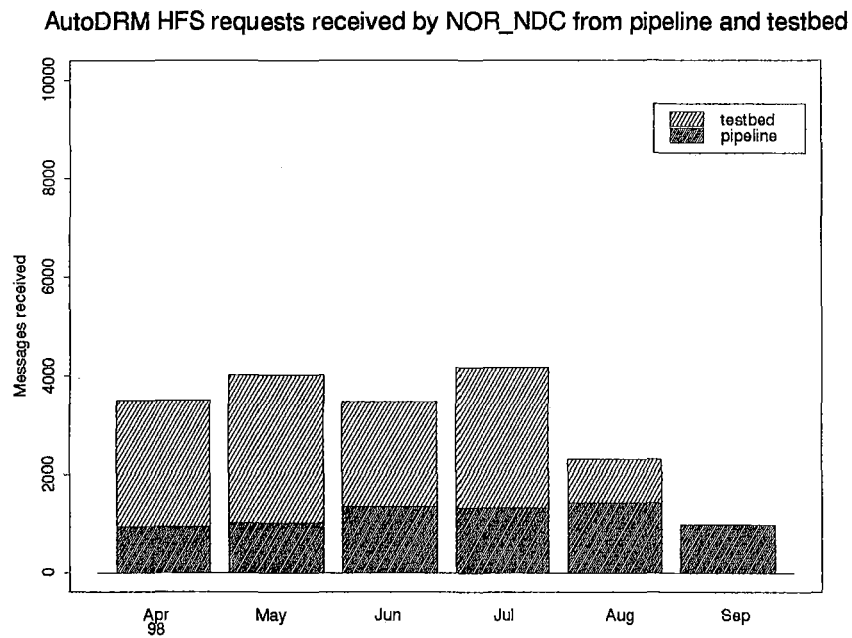


Fig. 7.7.6. The figure shows the monthly number of requests received by NOR\_NDC from the PIDC for HFS waveform segments during April - September 1998.