

NORSAR Scientific Report No. 2-97/98

Semiannual Technical Summary

1 October 1997 – 31 Mars 1998

Kjeller, May 1998

APPROVED FOR PUBLIC RELEASE, DISTRIBUTION UNLIMITED

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

Introduction

This contribution is a report for the period October 1997 - March 1998 on activities associated with Norway's participation in the GSETT-3 experiment, which is now being coordinated by PrepCom's Working Group B. This report represents an update of contributions that can be found in the previous four editions of NORSAR's Semiannual Technical Summary.

Norwegian GSETT-3 stations and communications arrangements

During the reporting interval 1 October 1997 - 31 March 1998, Norway has provided data to the GSETT-3 experiment from the four 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 and NORES are 25-element regional arrays with identical geometries and an aperture of 3 km, whereas the Sptisbergen array (station code SPITS) has 9 elements within a 1-km aperture. ARCES, NORES, and SPITS all have a broadband three-component seismometer at the array center.

Data from these four stations are transmitted continuously and in real time to NOR_NDC. The NOA and NORES 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 NORES array has been used in GSETT-3 as a temporary substitute for the NOA teleseismic array, awaiting the completion of a technical refurbishment of the latter. This effort has been completed, and data from the NOA array have been transmitted since 30 August 1996 to the PIDC for Testbed processing. The purpose of the PIDC Testbed is to facilitate integration testing and therefore minimize disruption to the operational system. Results of NOA Testbed processing are given in Fyen and Paulsen (1997). Following approval by the PIDC Configuration Control Board in December 1997, processing of the NOA data was moved to the PIDC operational pipeline, and the NOA data are now fully used in the PIDC bulletin production. This changeover from NORES to NOA in the PIDC operational processing was effective on 7 January 1998.

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 - 7.7.4 show the monthly uptimes for the Norwegian GSETT-3 primary stations ARCESS (period 1 October 1997 - 31 March 1998), NORESS (1 October 1997 - 6 January 1998), and NOA (7 January - 31 March 1998), respectively, 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 each of these three stations. The downtimes inferred from these figures thus represent the cumulative effect of field equipment outages, station site to NOR_NDC communication outages and NOR_NDC data acquisition outages.

Figs. 7.7.2-7.7.4 also give the data availability for these three 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. As can be seen from these figures, these differences in the reporting practice in particular affect the results for the NORESS and NOA arrays.

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 October 1997- March 1998 is shown in Fig. 7.7.5.

NDC automatic processing and data analysis

These tasks have proceeded in accordance with the descriptions given in Mykkeltveit and Baadshaug (1996). For the period October 1997 - March 1998, NOR_NDC derived information on 991 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. 7.7.6.

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. 7.7.7 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 inclusion 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.

U. Baadshaug
S. Mykkeltveit
J. Fyen

References

- Fyen, J. & B. Paulsen (1997): NORSAR large array processing at the IDC Testbed. *Semiann. Tech. Summ.*, 1 April - 30 September 1997, NORSAR Sci. Rep. No. 1-97/98, Kjeller, Norway
- Kradolfer, U. (1993): Automating the exchange of earthquake information. *EOS, Trans., AGU*, 74, 442.
- 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.

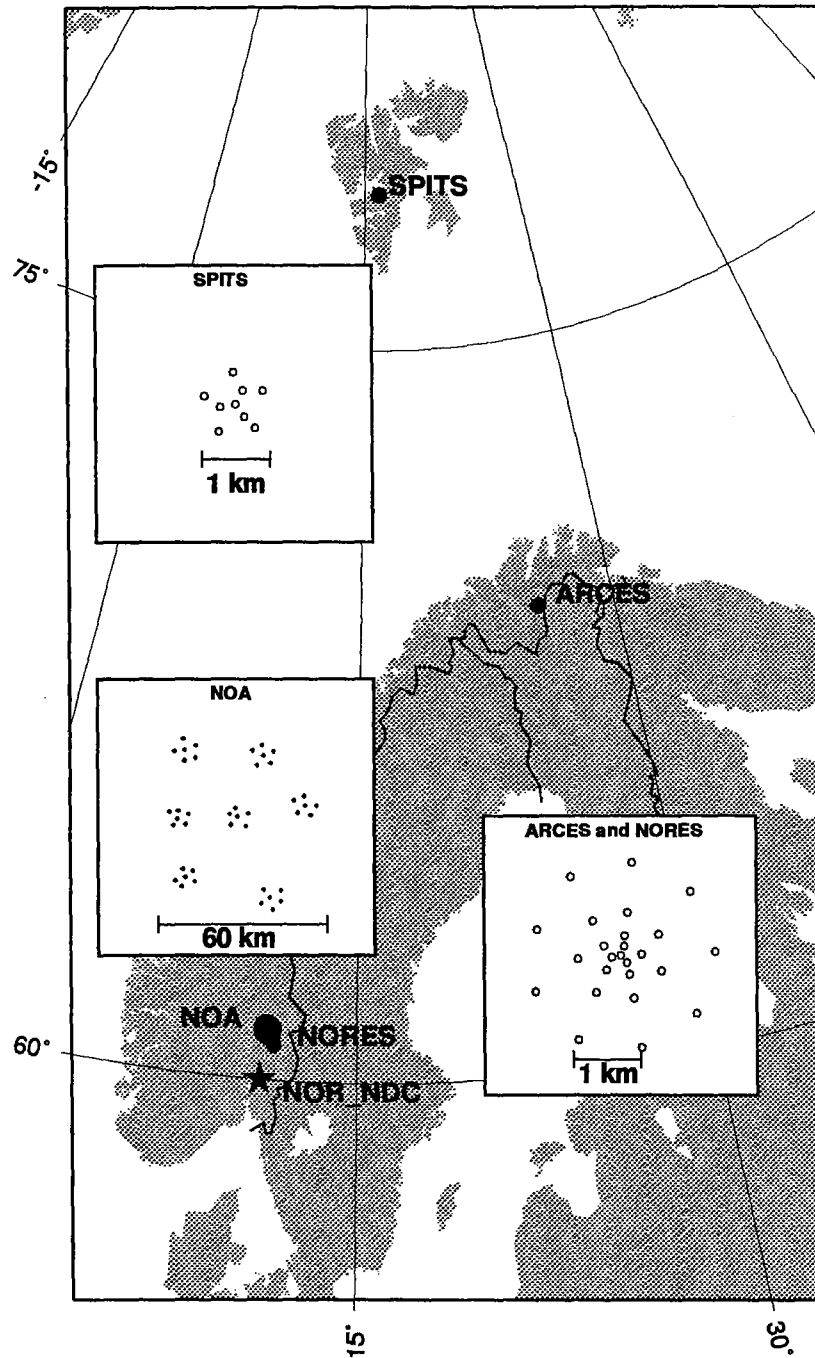


Fig. 7.7.1. The figure shows the locations and configurations of the four Norwegian seismic array stations that have provided data to the GSETT-3 experiment during the period 1 October 1997 - 31 March 1998. The data from these stations are transmitted continuously and in real time to the Norwegian NDC (NOR_NDC). The stations NOA, NORES and ARCES have participated in GSETT-3 as primary stations, whereas SPITS has contributed as an auxiliary station. On 7 January 1998, NOA replaced NORES in the PIDC processing pipeline.

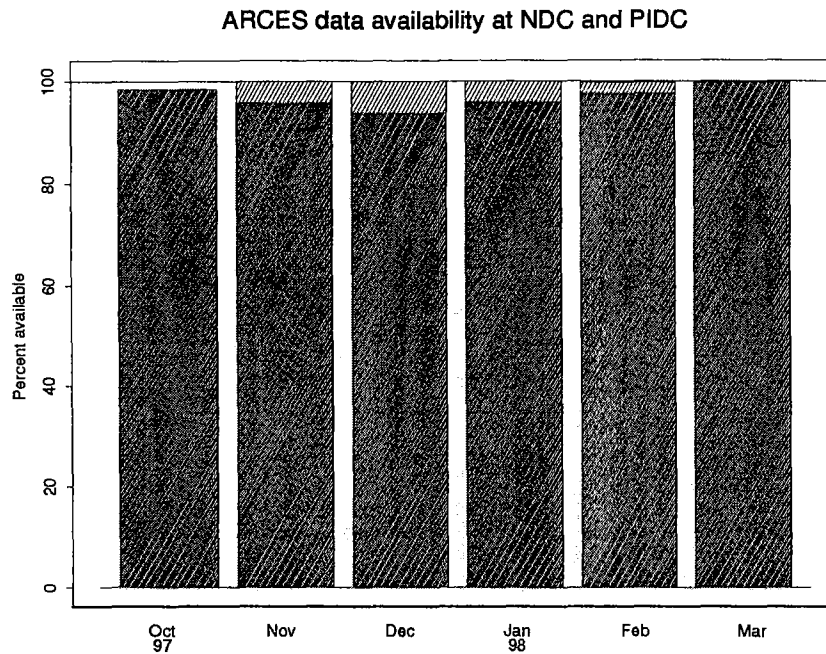


Fig. 7.7.2. The figure shows the monthly availability of ARCESS array data for the period October 1997 - March 1998 at NOR_NDC and the PIDC. See the text for explanation of differences in definition of the term "data availability" between the two centers. The higher values (hatched bars) represent the NOR_NDC data availability.

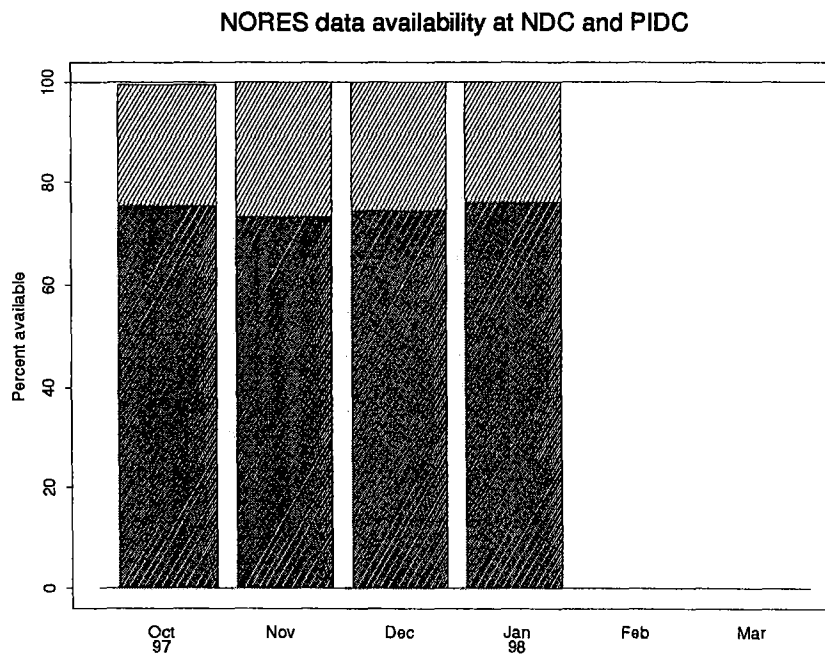


Fig. 7.7.3. The figure shows the monthly availability of NORESS array data for the period 1 October 1997 - 6 January 1998 (when NOA replaced NORES in the PIDC processing pipeline) at NOR_NDC and the PIDC. See the text for explanation of differences in the definition of the term "data availability" between the two centers. The higher values (hatched bars) represent the NOR_NDC data availability.

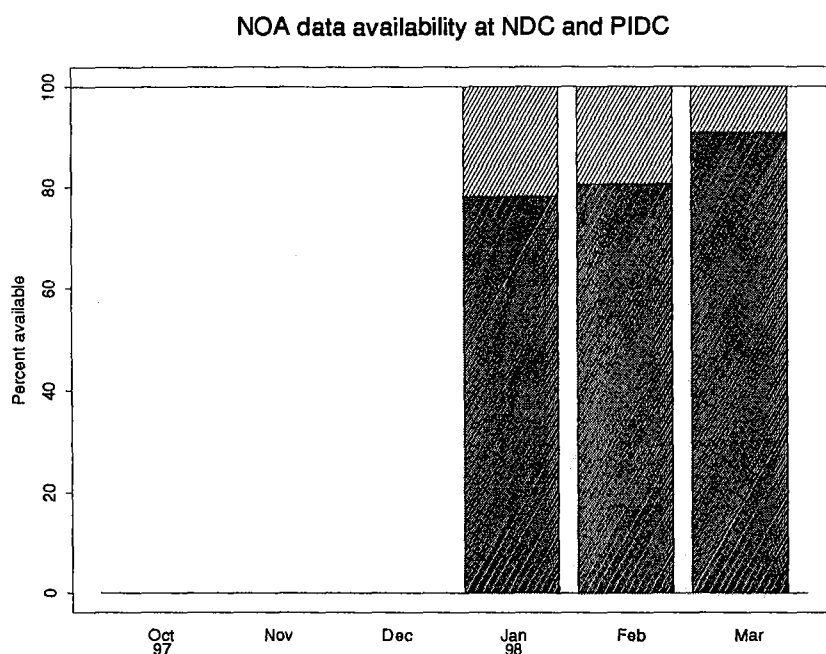


Fig. 7.7.4. The figure shows the monthly availability of NORSAR array data for the period 7 January - 31 March 1998 at NOR_NDC and the PIDC. See the text for explanation of differences in definition of the term "data availability" between the two centers. The higher values (hatched bars) represent the NOR_NDC data availability.

AutoDRM SPITS requests received by NOR_NDC from pipeline and testbed

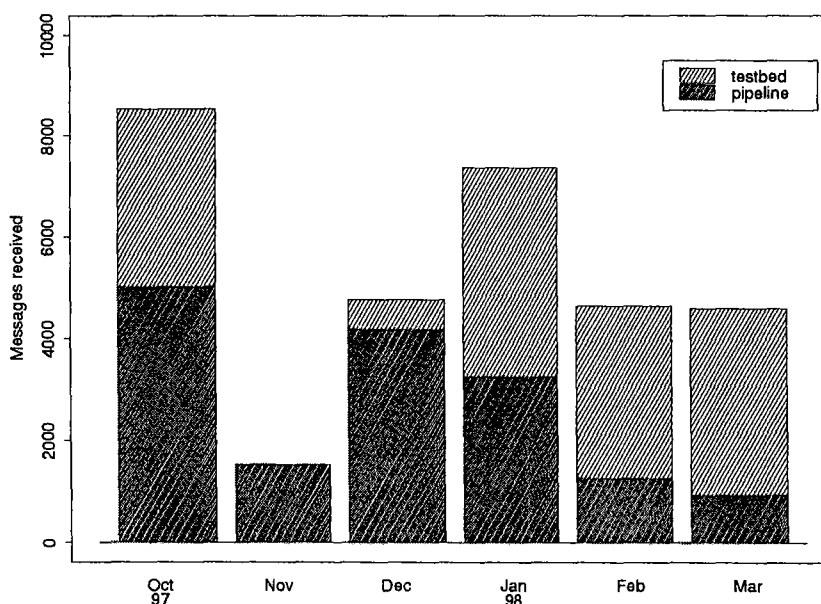


Fig. 7.7.5. The figure shows the monthly number of requests received by NOR_NDC from the PIDC for SPITS waveform segments. The numbers for the period 7 November - 25 November 1997 were lost when a logfile-disk filled up.

Reviewed Supplementary events

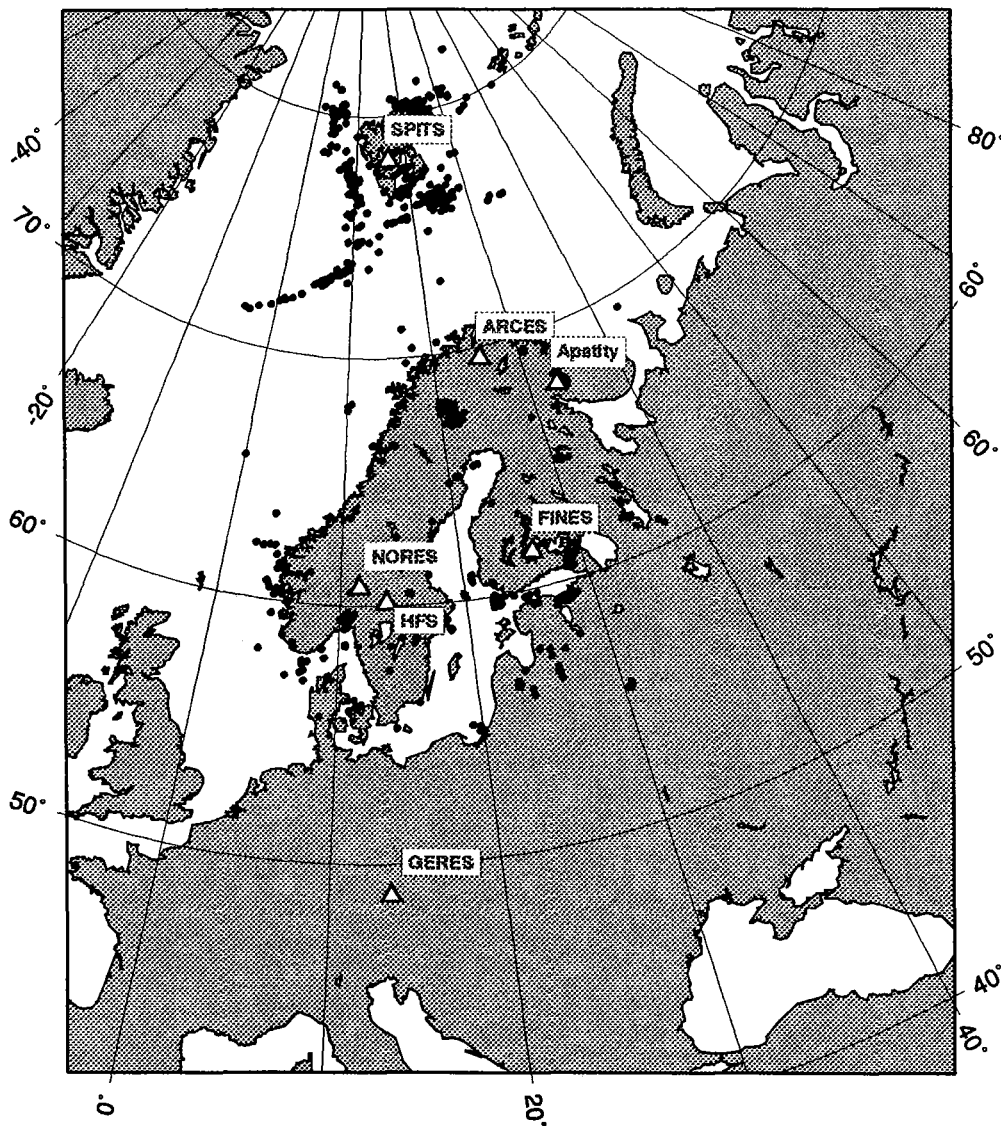


Fig. 7.7.6. The map shows the 991 events in and around Norway contributed by NOR_NDC during October 1997 - March 1998 as Supplementary (Gamma) data to the PIDC, as part of the Nordic Supplementary data compiled by the Finnish NDC. The map also shows the seismic stations used in the data analysis to define these events.

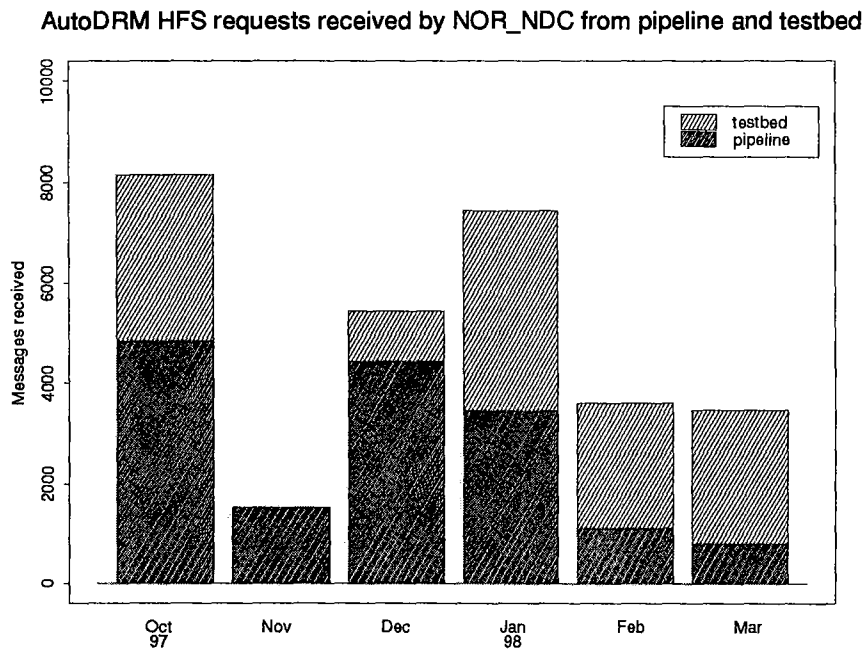


Fig. 7.7.7. The figure shows the monthly number of requests received by NOR_NDC from the PIDC for HFS waveform segments. The numbers for the period 7 November - 25 November 1997 were lost when a logfile-disk filled up.

