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# **Semiannual Technical Summary**

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## 7 Summary of Technical Reports / Papers Published

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

#### *Introduction*

This contribution is essentially an update of the two status reports Mykkeltveit & Baadshaug (1996a) and Mykkeltveit & Baadshaug (1996b) which cover the periods January 1995 - June 1996 and April 1996 - September 1996, respectively.

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

From the second half of 1993 until 1 October 1996, Norway provided continuous data from three GSETT-3 primary array stations: ARCESS, NORESS and Spitsbergen. The location and configurations of these three stations are shown in Fig. 7.1.1. ARCESS and NORESS are 25-element arrays with identical geometries and an aperture of 3 km, whereas the Spitsbergen array has 9 elements within a 1-km aperture. All three stations have a broadband three-component seismometer at the array center.

Data from these three stations were transmitted continuously and in real time to NOR\_NDC. The NORESS data transmission uses a dedicated 64 Kbits/s land line, whereas data from the other two arrays are transmitted via satellite links of capacity 64 Kbits/s and 19.2 Kbits/s for the ARCESS and Spitsbergen arrays, respectively.

The NORESS array has been used in GSETT-3 as a temporary substitute for the NORSAR teleseismic array (also shown in Fig. 7.1.1; station code NOA), awaiting a complete technical refurbishment of the latter. This effort has now been completed, and starting 30 August 1996, data from the NORSAR array have been transmitted continuously to the IDC. The NORESS array will, however, be retained as a GSETT-3 primary station at least until such time that the NORSAR array data are fully used in the IDC operational processing cycle. We are cooperating with the IDC on the task of preparing for the processing of NORSAR data at the IDC (see section 7.3 of this report). Some Testbed processing of NORSAR data has been performed. The purpose of the IDC Testbed is to facilitate integration testing and therefore minimize disruption to the operational system. The Testbed is basically a scaled down version of the operational system.

On 1 October 1996 numerous changes were made worldwide to the GSETT-3 network. The purpose of these coordinated changes was to bring the GSETT-3 network in line with the seismic component of the International Monitoring System (IMS) to the extent possible. As the Spitsbergen array is an auxiliary station in IMS, this station changed its status from primary to auxiliary in GSETT-3 on that date. This involved terminating the continuous forwarding of SPITS data to the IDC and making data from this station available to the IDC on a request basis via the AutoDRM protocol (Kradolfer, 1993; Kradolfer, 1996).

### *Uptimes and data availability*

Figs. 7.1.2 - 7.1.4 show the monthly uptimes for the two Norwegian GSETT-3 primary stations ARCESS, NORESS and for the testbed primary station NOA, respectively, for the period October 1996 - March 1997, 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. 7.1.2-7.1.4 also give the data availability for these three stations as reported by the IDC in the IDC Station Status reports. The main reason for the discrepancies between the NOR\_NDC and IDC 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 IDC 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).

Between November 1995 and the network changes on 1 October 1996, only 207 requests from external users were processed.

After SPITS changed station status from primary to auxiliary, the request load increased sharply, and for the month of October 1996, the NOR\_NDC AutoDRM responded to 12338 requests for SPITS waveforms from two different accounts at the IDC: 9555 response messages were sent to the "pipeline" account and 2783 to "testbed".

The monthly number of requests for SPITS data is shown in Fig. 7.1.5.

### *NDC automatic processing and data analysis*

These tasks have proceeded in accordance with the descriptions given in Mykkeltveit and Baadshaug (1996a). For the period October 1996 - March 1997, NOR\_NDC derived information on 1209 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 IDC. These events are plotted in Fig. 7.1.6.

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

NOR\_NDC continues to forward data to the IDC 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. Data from the Hagfors array (HFS) in Sweden were provided continuously through

NOR\_NDC until 1 October 1996, on which date this station changed its status in GSETT-3 from primary to auxiliary, in accordance with the status of HFS in IMS. From 1 October 1996, the IDC obtains HFS data through requests to the AutoDRM server at NOR\_NDC (in the same way requests for Spitsbergen array data are now handled, see above). Fig. 7.1.7 shows the monthly number of requests for HFS data from the two IDC 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 requirements related to operation of IMS stations to the maximum extent possible. For example, the PrepCom (Preparatory Commission for the Comprehensive Nuclear Test-Ban Organization) has now adopted a data availability of 98% or more as a requirement for primary and auxiliary IMS seismic stations. Figs. 7.1.2-4 show that this requirement is met for the three primary stations ARCES, NORES and NOA, as far as availability at NOR\_NDC is concerned.

The PrepCom has now tasked its Working Group B with overseeing the GSETT-3 experiment until the end of 1997, and to submit proposals to the PrepCom on the basis for the continuation of GSETT-3 in 1998. Whatever this basis will be, we envisage continuing the provision of data from Norwegian IMS stations without interruption to the prototype IDC in Arlington, Virginia, USA and later on to the IDC in Vienna, following the installation of the new global communications infrastructure now envisaged by the PrepCom.

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**S. Mykkeltveit**

### *References*

- 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 (1996a): 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.
- Mykkeltveit, S. & U. Baadshaug (1996b): Status Report: Norway's participation in GSETT-3. *Semiann. Tech. Summ., 1 April 1996 - 30 September 1996*, NORSAR Sci. Rep. No. 1-96/97, Kjeller, Norway.

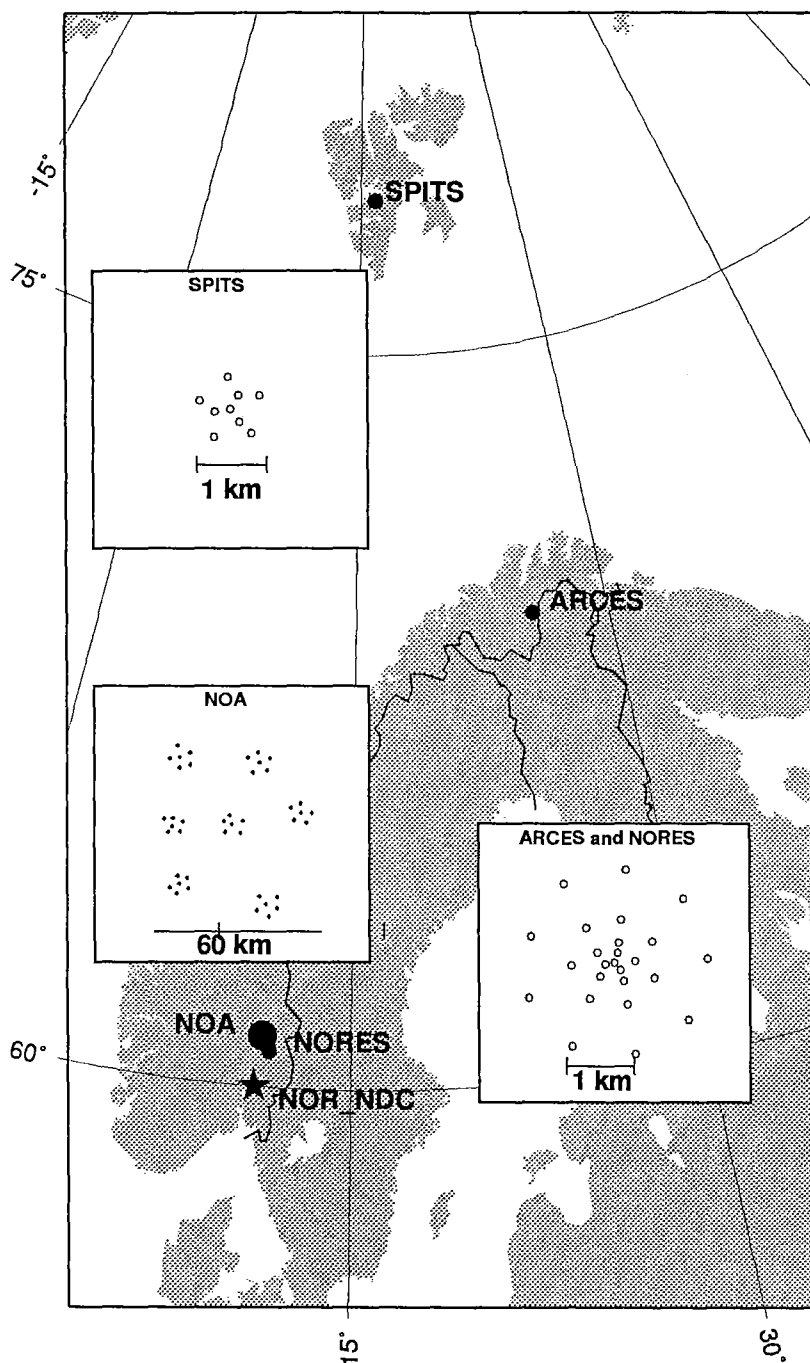


Fig. 7.1.1. The figure shows the locations and configurations of the two Norwegian GSETT-3 primary array stations with station codes NORES and ARCES. The data from these stations are transmitted continuously and in real time to the Norwegian NDC (NOR\_NDC) and then on to the GSETT-3 IDC. The figure also shows the location of the testbed primary station NOA, which is soon to be fully used in GSETT-3 as a primary station. The auxiliary station SPITS is also shown in the figure.

ARCES data availability at NDC and IDC

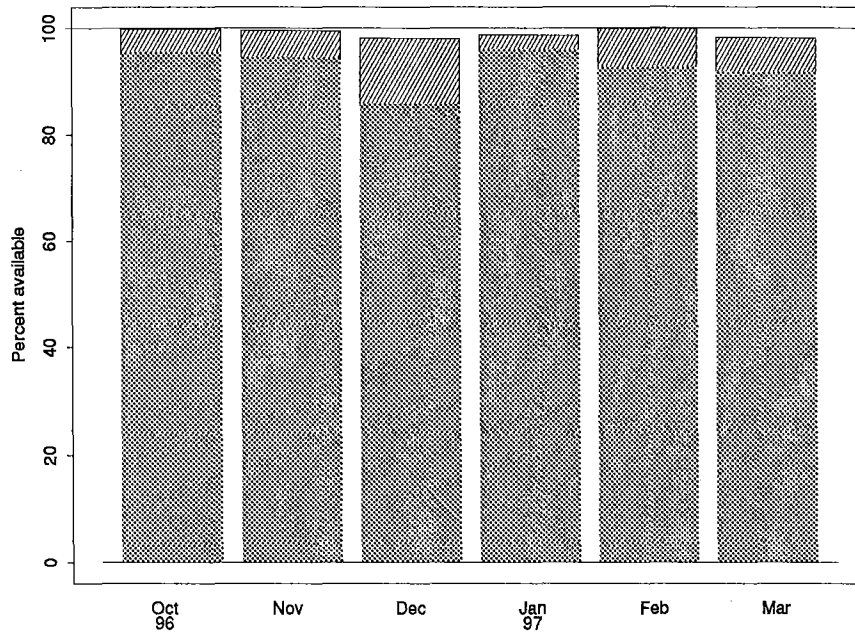


Fig. 7.1.2. The figure shows the monthly availability of ARCESS array data for the period October 1996 - March 1997 at NOR\_NDC and the IDC. See the text for explanation of differences in definition of the term "data availability" between the two centers. The higher values (hatched bars) represent the NOR\_NDC data availability.

NORES data availability at NDC and IDC

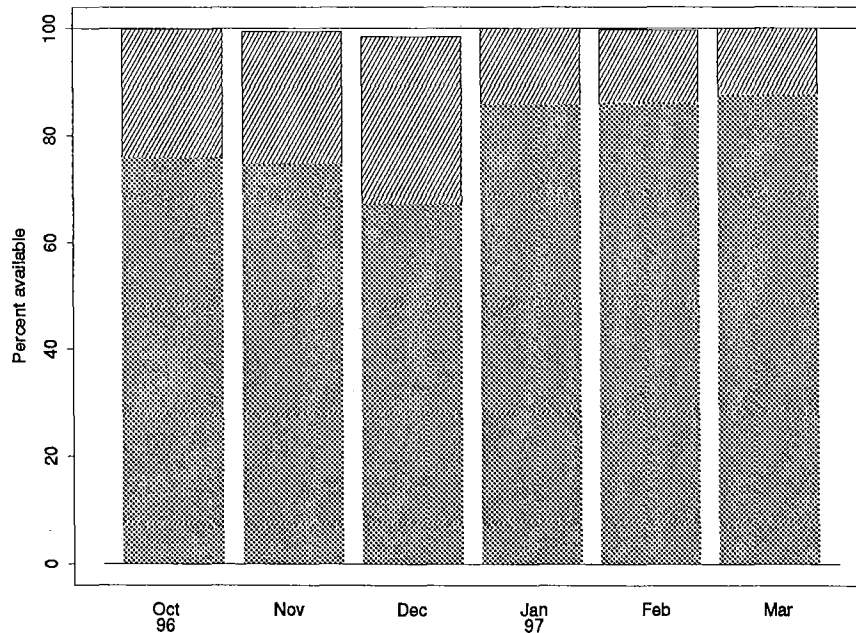


Fig. 7.1.3. The figure shows the monthly availability of NORESS array data for the period October 1996 - March 1997 at NOR\_NDC and the IDC. See the text for explanation of differences in the definition of the term "data availability" between the two centers. The higher values (hatched bars) represent the NOR\_NDC data availability.

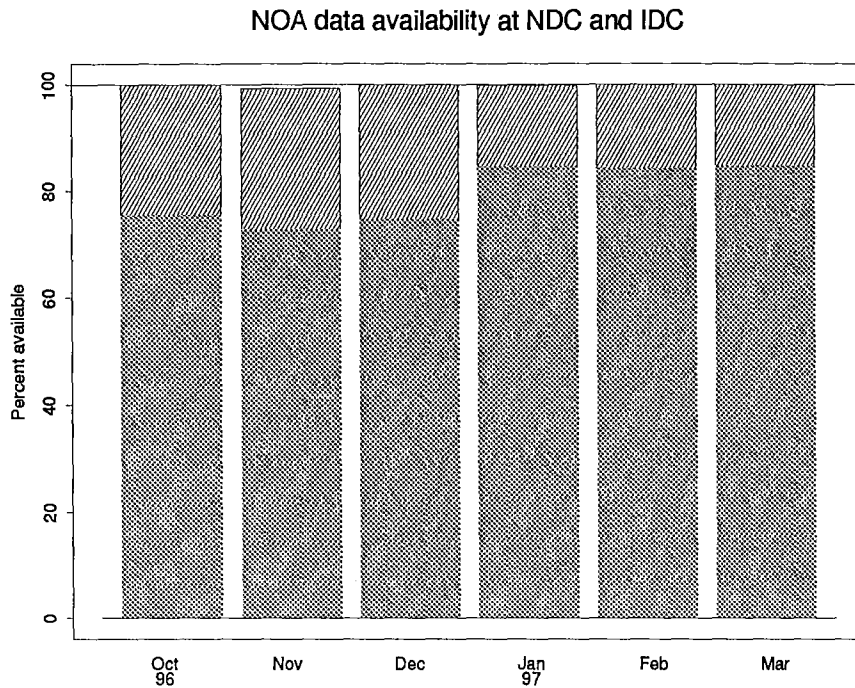


Fig. 7.1.4. The figure shows the monthly availability of NORSAR array data for the period October 1996 - March 1997 at NOR\_NDC and the IDC. See the text for explanation of differences in definition of the term "data availability" between the two centers. The higher values (hatched bars) represent the NOR\_NDC data availability.

### AutoDRM SPITS requests received by NOR\_NDC from pipeline and testbed

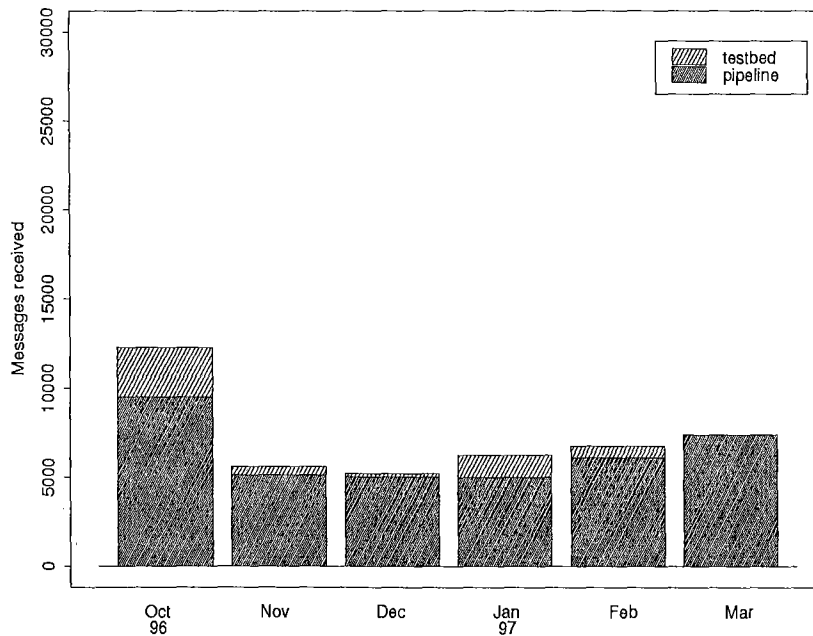


Fig. 7.1.5. The figure shows the monthly number of requests received by NOR\_NDC from the IDC for SPITS waveform segments.

# Reviewed Gamma events

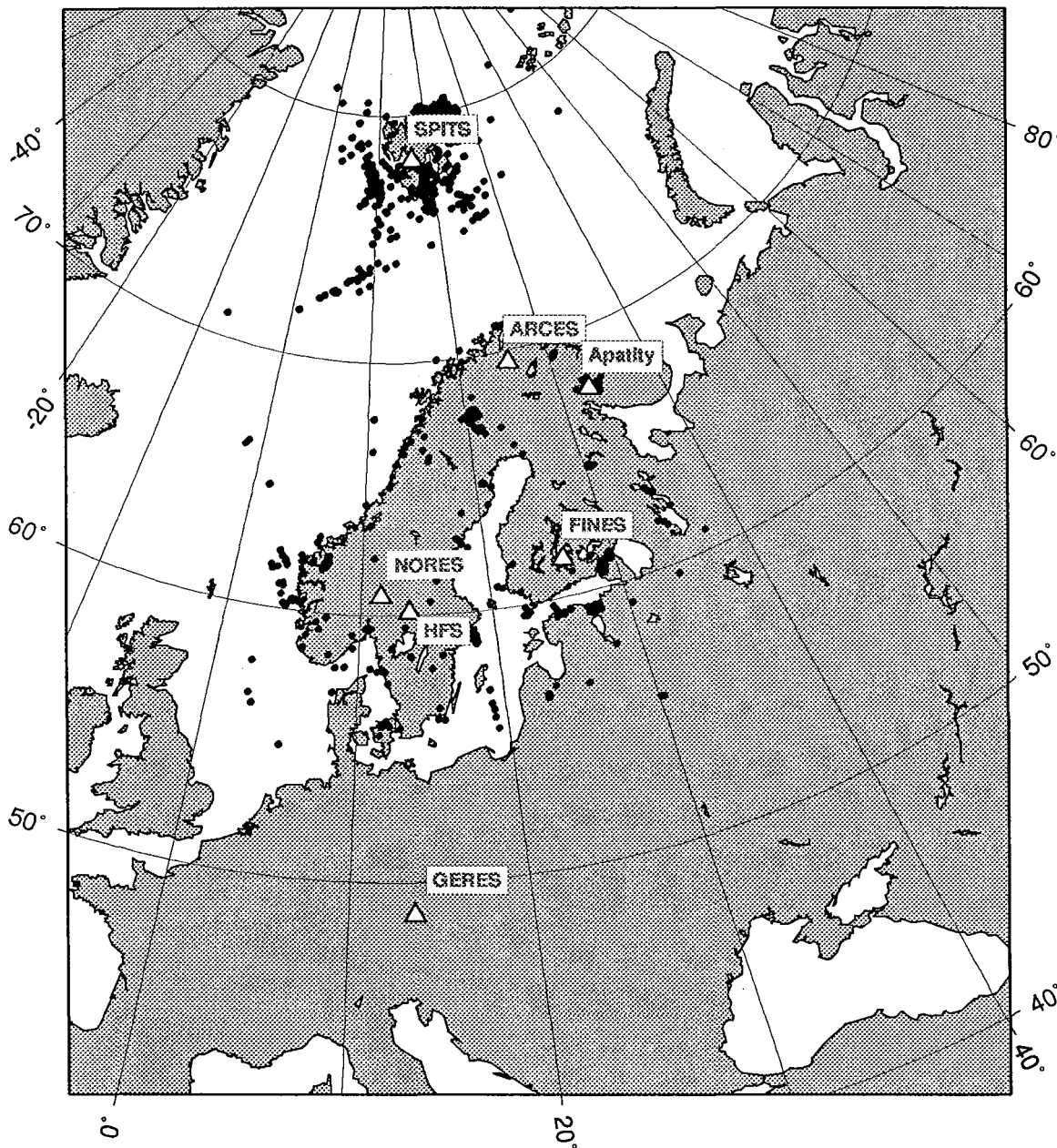


Fig. 7.1.6. The map shows the 1209 events in and around Norway contributed by NOR\_NDC during October 1996 - March 1997 as Supplementary (Gamma) data to the IDC, as part of the Nordic Supplementary data compiled by the Finnish NDC. The map also shows the seismic stations used in the data analysis to define these events.



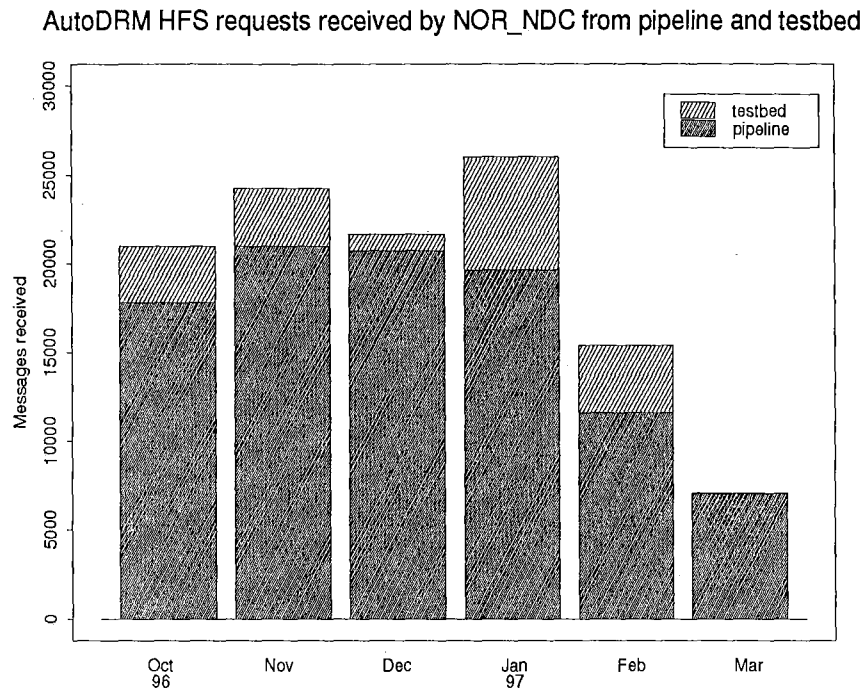


Fig. 7.1.7. The figure shows the monthly number of requests received by NOR\_NDC from the IDC for HFS waveform segments.