The Research Council of Norway (NFR)

NORSAR

NORSAR Scientific Report No. 1-95/96

Semiannual Technical Summary

1 April - 30 September 1995

Kjeller, November 1995

19960327 024

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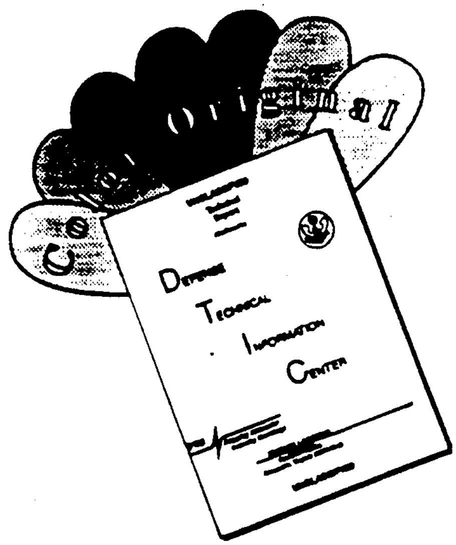

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Unclassified
SECURITY CLASSIFICATION OF THIS PAGE

REPORT DOCUMENTATION PAGE

1a. REPORT SECURITY CLASSIFICATION Unclassified	1b. RESTRICTIVE MARKINGS Not applicable
2a. SECURITY CLASSIFICATION AUTHORITY Not Applicable	3. DISTRIBUTION / AVAILABILITY OF REPORT Approved for public release; distribution unlimited
2b. DECLASSIFICATION / DOWNGRADING SCHEDULE	
4. PERFORMING ORGANIZATION REPORT NUMBER(S) Scientific Rep. 1-95/96	5. MONITORING ORGANIZATION REPORT NUMBER(S) Scientific Rep. 1-95/96
6a. NAME OF PERFORMING ORGANIZATION NFR/NORSAR 6b. OFFICE SYMBOL (If applicable)	7a. NAME OF MONITORING ORGANIZATION HQ/AFTAC/TTS
6c. ADDRESS (City, State, and ZIP Code) Post Box 51 N-2007 Kjeller, Norway	7b. ADDRESS (City, State, and ZIP Code) Patrick AFB, FL 32925-6001
8a. NAME OF FUNDING / SPONSORING ORGANIZATION Advanced Research Projects Agency 8b. OFFICE SYMBOL (If applicable) NMRO	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER Contract No. F08650-93-C-0002
8c. ADDRESS (City, State, and ZIP Code) 3701 N. Fairfax Dr. #717 Arlington, VA 22203-1714	10. SOURCE OF FUNDING NUMBERS PROGRAM ELEMENT NO. R&D PROJECT NO. NORSAR Phase 3 TASK NO. SOW Task 5.0 WORK UNIT ACCESSION NO. Sequence No. 004A2

11. TITLE (Include Security Classification)

Semiannual Technical Summary, 1 April - 30 September 1995

12. PERSONAL AUTHOR(S)

13a. TYPE OF REPORT	13b. TIME COVERED	14. DATE OF REPORT (Year, Month, Day)	15. PAGE COUNT
Scientific Summary	FROM 1 APR TO 30 Sep 95	1995 November	163

16. SUPPLEMENTARY NOTATION

17. COSATI CODES			18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)
FIELD	GROUP	SUB-GROUP	
8	11		NORSAR, Norwegian Seismic Array

19. ABSTRACT (Continue on reverse if necessary and identify by block number)

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(cont.)

20. DISTRIBUTION / AVAILABILITY OF ABSTRACT ☐ UNCLASSIFIED/UNLIMITED ☐ SAME AS RPT. ☐ DTIC USERS	21. ABSTRACT SECURITY CLASSIFICATION
22a. NAME OF RESPONSIBLE INDIVIDUAL Mr. Michael C. Baker	22b. TELEPHONE (Include Area Code) (407) 494-4219 22c. OFFICE SYMBOL AFTAC/TTS

DD FORM 1473, 84 MAR

83 APR edition may be used until exhausted.
All other editions are obsolete.

SECURITY CLASSIFICATION OF THIS PAGE

Abstract (cont.)

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This Semiannual Report also presents statistics from operation of the Intelligent Monitoring System (IMS). The IMS has been operated in a limited capacity, with continuous automatic detection and location and with analyst review of selected events of interest for GSETT-3. Data sources for the IMS have comprised all the regional arrays processed at NORSAR.

Since 1 October 1991, an effort has been undertaken to carry out a complete technical refurbishment of the NORSAR array. This project is funded jointly by AFTAC, ARPA and NFR. During the reporting period, work continued on gradually installing new digitizers, communications modules, broad-band seismometers of the KS-54000 "posthole" type as well as new short-period seismometers of type Teledyne Geotech S-20171. As of November 1995, the refurbishment effort was completed.

On-line detection processing and data recording at the NORSAR Data Processing Center (NDPC) of NORESS, ARCESS, FINESS and GERESS data have been conducted throughout the period. Data from two experimental small-aperture arrays at sites in Spitsbergen and Apatity, Kola Peninsula, as well as the Hagfors array in Sweden, have also been recorded and processed. Monthly processing statistics for the arrays as well as results of the IMS analysis for the reporting period are given.

Maintenance activities in the period comprise preventive/corrective maintenance in connection with all the NORSAR subarrays, NORESS and ARCESS. Other activities have involved testing of the NORSAR communications systems, preparations for the NORSAR refurbishment and work in connection with the experimental small-aperture arrays in Spitsbergen and Russia.

Summaries of seven scientific contributions are presented in Chapter 7 of this report.

Section 7.1 is a paper entitled "Analysis of data recorded at the Spitsbergen array". This paper presents results from analysis of data recorded at the Spitsbergen array (SPITS) from events in the Svalbard region during the period July through December 1994. Through this period 1258 seismic events in the Svalbard region were manually checked and located using data from the SPITS array. The broad band capability of the new extended short-period Guralp sensors installed August 1994 is demonstrated through records of the Chinese nuclear test on 7 October 1994 and is further illustrated by SPITS recordings from two events on the Knipovitch Ridge and SE Spitsbergen. These latter two events occurred before and after the sensors were changed, and the difference in data quality is evident. The new Guralp extended short-period sensors provide resolution also of the lower frequencies, where the larger earthquakes are particularly rich in energy. The smaller nearby

earthquakes do not have sufficient low frequent energy to exceed the background noise, and hence must be filtered before the signal can be recognized.

Section 7.2 presents a comparison of the NORSAR array monthly bulletin with the Reviewed Event Bulletin (REB) of the GSETT-3 IDC. The paper lists 207 seismic events detected and located by NORSAR, but not reported in the REB during January-August 1995. Most of these events are clustered in four areas: the Balkans, Hindu Kush, Japan and the Kuriles, and the Fiji-Tonga-Kermadec area. Taking into account the uncertainty in the magnitude estimates, it is concluded that this investigation has qualitatively confirmed the theoretical detection thresholds of the GSETT-3 network in the four regions considered. Also, it shows that introduction of the NORSAR teleseismic array in the GSETT-3 primary network in the near future holds promise that more events from these four regions will enter the REB. In this connection, it is noted that the on-going implementation of an improved NORSAR detector algorithm might add further events from areas where the NORSAR array is especially sensitive.

Section 7.3 is a paper entitled "Development of improved NORSAR time delay corrections". The paper briefly reviews the development of the large NORSAR array, which initially comprised a configuration of 22 subarrays distributed over a diameter of 100 km. After six years of experimental operation, the array was modified on 1 October 1976 to a reduced configuration which was more suitable for an automated, operational system, and the 7 best subarrays (in the NE part of the original array) were selected for this purpose. This configuration is still in operation today, with each subarray comprising 6 SP and one 3-component BB seismometer over an area 8 km in diameter. The total aperture of NORSAR is now 60 km. This array configuration enables excellent teleseismic detectability and location capability. A complete technical refurbishment of the NORSAR array is now being finalized.

In order to take full advantage of the NORSAR capabilities, it is desirable to update the beam deployment and revise the time delay anomalies taking into account the improved precision made possible from the increased sampling rate (40 Hz against previously 20 Hz) and the accumulated data base of reference events. This paper gives a progress report on the work carried out until now, and comprises an initial data base of 55 reference events. This data base will be further expanded in the future.

Section 7.4 is a paper entitled "Automatic onset time estimation based on autoregressive processing". This study has been undertaken in order to support the developments at the GSETT-3 IDC, and is based on the use of an autoregressive method for automatic onset time estimation, denoted AR-AIC. This method has for several years been operational in the processing of data from the Japanese national seismic network, and the software has been provided to us by scientists from the Japanese NDC.

In this paper we have adapted the Japanese method for application to GSETT-3 data, with emphasis on developing an automated procedure that includes new features such as multiple narrow-band filters, the concept of "usable bandwidth" and a quality measure of the estimated onset time. It is demonstrated that the AR-AIC method for onset time estimation can be adapted to work on a wide range of seismic signals. In particular, the quality measure makes it possible to distinguish between *reliable* and *unreliable* onsets. In this way we can avoid using erroneous data in the event location procedure and thus improve the location precision of the automatic processing system.

Section 7.5 is a paper entitled "Recommendation on Auxiliary Seismic Stations for the IMS Network". This contribution is a lightly edited version of a paper prepared by the GSETT-3 Working Group on Planning (WGP) in preparation for the 42nd GSE session in Geneva during 27 November - 1 December 1995. The main purpose of this GSE meeting was to make a specific recommendation for the auxiliary seismic network of the International Monitoring System (IMS), which will be installed to verify compliance with a Comprehensive Test Ban Treaty.

The paper provides the preliminary recommendation from the WGP and is intended as a basis for discussions during the 42nd GSE session. The network designs proposed herein will be reviewed and revised during the GSE session as additional information is received from GSE participants. Material on relevant experience from GSETT-3 will also be taken into account in the process of selecting a recommended IMS auxiliary network.

It is noted that further work and discussion are needed to establish the exact location capability of the networks and the operational status for the existing auxiliary stations proposed in this paper, and to check the progress of plans and proposals for the stations that are not yet operational. Further work is also needed to estimate the costs related to bringing stations and communications arrangements in line with the required IMS standards.

Section 7.6 contains a case study of magnitude estimation at the IDC. The paper contains a detailed analysis of a recent earthquake sequence in Greece during May-June 1995. This includes comparisons of IDC magnitudes in the Revised Event Bulletins to those of NORSAR and NEIC, with special view to network bias, recurrence statistics and detectability.

The paper demonstrates that the IDC m_b values are subject to the same "network bias" as the NEIC magnitudes for small events. This implies that the recurrence plots (magnitude/frequency) of IDC data have a too steep slope, which again might lead to a significant overestimation of the number of earthquakes expected to be processed at the IDC. The paper confirms the validity of the theoretical 90% detectability estimate of the GSETT-3 system presented in the IDC performance reports. This estimate is currently close to $m_b = 4.2$ for the area analyzed.

Section 7.7 contains an assessment of the estimated mean mislocation vectors for small-aperture arrays. The objective of this study has been to test the applicability of the estimated mean mislocation vectors for small-aperture arrays for use with different event-location procedures. The mean mislocation vectors were calculated in the slowness space and are now available for automatically estimated fk-results over a large range of azimuth and ray-parameter values. Additionally, mean standard deviations for the mislocation vectors could be defined as a function of the measured slowness values. All this information can now be used to increase the stability and quality of both phase association and event location based on automatically estimated fk-results.

Location results before and after the application of slowness and azimuth corrections are presented for about 25,000 events located during 1994 by ARCESS, FINESS, GERESS and NORESS. Furthermore, single-array solutions during 1995 are compared to REB-reported events both before and after applying the slowness corrections. The study concludes that the corrected slowness vectors provide a clear improvement and should therefore be used in the data processing at the IDC.

AFTAC Project Authorization	:	T/9141/B/PKP
ARPA Order No.	:	4138 AMD # 16
Program Code No.	:	0F10
Name of Contractor	:	Royal Norwegian Council for Scientific and Industrial Research (NTNF)
Effective Date of Contract	:	1 Oct 1992
Contract Expiration Date	:	30 Sep 1995
Project Manager	:	Frode Ringdal (63) 81 71 21
Title of Work	:	The Norwegian Seismic Array (NORSAR) Phase 3
Amount of Contract	:	$ 6,517,506
Contract Period Covered by Report	:	1 April - 30 September 95

This research was supported by the Advanced Research Projects Agency of the Department of Defense and was monitored by AFTAC, Patrick AFB, FL32925, under contract no. F08650-93-C-0002.

NORSAR Contribution No. 576

Table of Contents

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2 NORSAR Operation

2.1 Detection Processor (DP) operation

There have been 2 breaks in the otherwise continuous operation of the NORSAR online system within the 5-month interval April through August 1995. The uptime percentage for this period is 99.1 as compared to 99.6 for the previous six-month interval.

During September 1995, the NORSAR array was out of continuous operation due to the final refurbishment effort. Backup during this period was provided by the NORESS array, co-located with NORSAR subarray 06C. NORESS continued to be in full operation during the refurbishment work.

Fig. 2.1.1 and the accompanying Table 2.1.1 both show the daily DP downtime for the days between 1 April and 30 September 1995. The monthly recording times and percentages are given in Table 2.1.2.

The breaks can be grouped as follows:

a)	Hardware failure	0
b)	Stops related to program work or error	0
c)	Hardware maintenance stops	0
d)	Power jumps and breaks	2
e)	TOD error correction	0
f)	Communication lines	0

The total downtime for the period April-August was 35 hours and 23 minutes. The mean-time-between-failures (MTBF) was 51.0 days.

J. Torstveit

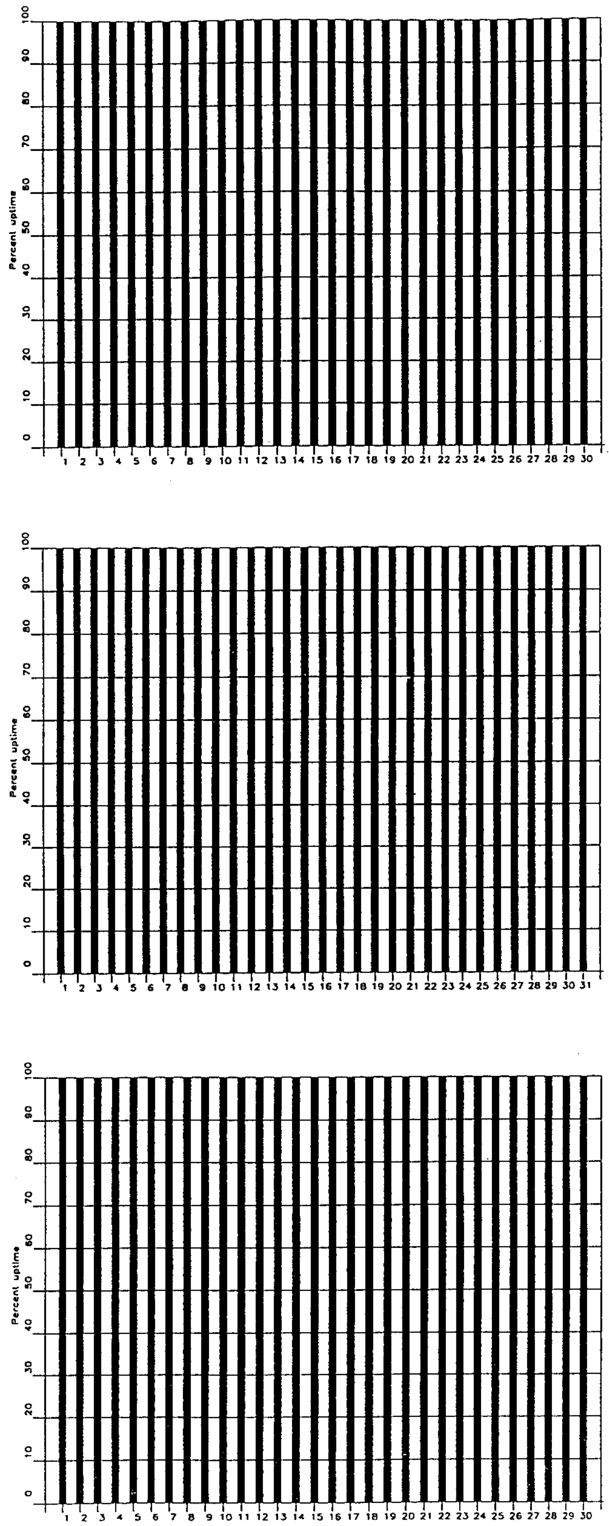
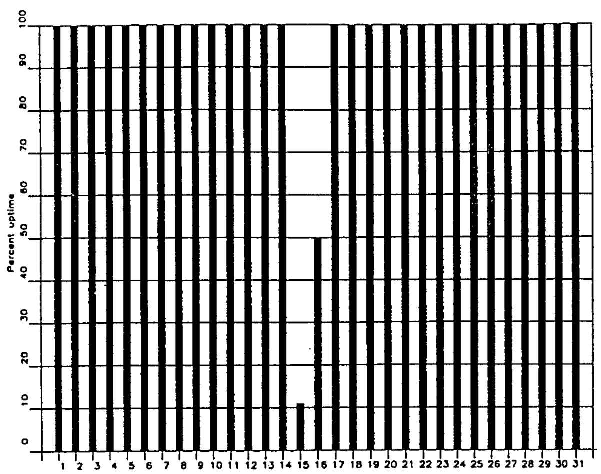


Fig. 2.1.1. Detection Processor uptime for April (top), May (middle) and June (bottom) 1995.



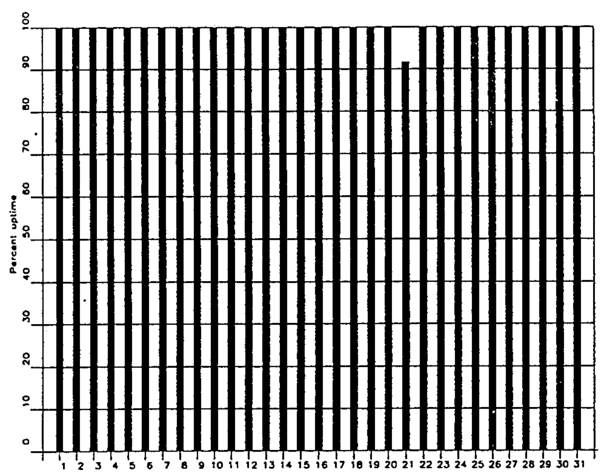


Fig. 2.1.1. Detection Processor uptime for July (top) and August (bottom) 1995.

Date	Time	Cause
15 Jul	0237 -	Power failure
16 Jul	- 1200	
21 Aug	1330 - 1500	Power Failure
01 Sep - 30 Sep		No recording due to NORSAR refurbishment

Table 2.1.1. The major downtimes in the period 1 April - 30 September 1995.

Month	DP Uptime Hours	DP Uptime %	No. of DP Breaks	No. of Days with Breaks	DP MTBF* (days)
Apr 95	720.00	100.00	0	0	30.0
May 95	744.00	100.00	0	0	31.0
Jun 95	720.00	100.00	0	0	30.0
Jul 95	710.62	95.51	1	2	15.5
Aug 95	742.00	99.73	1	1	15.5
Sep 95	0.00	00.00			

*Mean-time-between-failures = total uptime/no. of up intervals.

Table 2.1.2. Online system performance, 1 April - 30 September 1995.

2.2 Array Communications

As described in the previous Semiannual Report, the Modcomp/SLEM-based communication system experienced serious problems toward the end of 1993.

As an intermediate solution, it was decided on 1 January 1994 to implement a backup version of the NORSAR recording system, thus eliminating the Modcomp/SLEM-based recording. This change succeeded in improving both the timing reliability and the individual subarray uptimes.

In October 1994, the installation of a new data acquisition system began, in connection with the NORSAR Refurbishment. Details on this installation are given in Section 4.1 of this report.

During the reporting period, the communication lines to all subarrays except 06C were mostly in normal operation, but each of the subarrays was inoperative during parts of the reporting period in connection with testing and preparation for the NORSAR refurbishment. The reason for the extended downtime of subarray 06C was that this subarray was chosen as the main site for pre-installation testing of digitizers, CIMs and seismometers.

A simplified daily summary of the communications performance for the seven individual subarray lines is summarized, on a month-by-month basis, in Table 2.2.1.

F. Ringdal

Table 2.2.1 (Page 1 of 6)
NORSAR Communication Status Report
Month: April 1995

Day	Subarray						
	01A	01B	02B	02C	03C	04C	06C
01	X	X	X	X	X	X	A
02	X	X	X	X	X	X	A
03	X	X	X	X	X	X	A
04	X	X	X	X	X	X	A
05	X	X	X	X	X	X	A
06	X	X	X	X	X	X	A
07	X	X	X	X	X	X	A
08	X	X	X	X	X	A	A
09	X	X	X	X	X	X	A
10	X	X	X	X	X	X	A
11	X	X	X	X	X	X	A
12	X	X	X	X	X	X	A
13	X	X	X	X	X	X	A
14	X	X	X	X	X	X	A
15	X	X	X	X	X	X	A
16	X	X	X	X	X	X	A
17	X	X	X	X	X	X	A
18	X	X	X	X	X	X	A
19	X	X	X	X	X	X	A
20	X	X	X	X	X	X	A
21	X	X	X	X	X	X	A
22	X	X	X	X	X	X	A
23	X	X	X	X	X	X	A
24	X	X	X	X	X	X	A
25	X	X	X	X	X	X	A
26	X	X	X	X	X	X	A
27	X	X	X	X	X	X	X
28	X	X	X	X	X	X	X
29	X	X	X	X	X	X	X
30	X	X	X	X	X	X	X
31	--	--	--	--	--	--	--
Total hours normal operation	720	720	720	720	720	720	96
% normal operation	100	100	100	100	100	100	13

Legend:

X : Normal operations
A : All channels masked for more than 12 hours that day
B : All SP channels masked for more than 12 hours that day
C : All LP channels masked for more than 12 hours that day
I : Communication outage for more than 12 hours

Table 2.2.1 (Page 2 of 6)
NORSAR Communication Status Report
Month: May 1995

Day	Subarray						
	01A	01B	02B	02C	03C	04C	06C
01	X	X	X	X	X	X	X
02	X	X	X	X	X	X	X
03	X	X	X	X	X	X	X
04	X	X	X	X	X	X	X
05	X	X	X	X	X	X	X
06	X	X	X	X	X	X	X
07	X	X	X	X	X	X	X
08	X	X	X	X	X	A	X
09	X	X	X	X	X	X	X
10	X	X	X	X	X	X	X
11	X	X	X	X	X	X	X
12	X	X	X	X	X	X	X
13	A	X	X	X	X	X	X
14	A	X	X	X	X	X	X
15	X	X	X	X	X	X	X
16	X	X	A	X	X	X	X
17	X	X	A	X	X	X	X
18	X	X	X	X	X	X	X
19	X	X	X	X	X	X	X
20	X	X	X	X	X	X	X
21	X	X	X	X	X	X	X
22	X	X	X	X	X	X	X
23	X	X	X	X	X	X	X
24	X	X	X	X	X	X	X
25	X	X	X	X	X	X	X
26	X	X	X	X	X	X	X
27	X	X	X	X	X	X	X
28	X	X	X	X	X	X	X
29	X	X	X	X	X	X	X
30	X	X	X	X	X	X	X
31	X	X	A	X	X	X	X
Total hours normal operation	700	744	683	744	740	726	744
% normal operation	94	100	92	100	99	98	100

Legend:

X : Normal operations
A : All channels masked for more than 12 hours that day
B : All SP channels masked for more than 12 hours that day
C : All LP channels masked for more than 12 hours that day
I : Communication outage for more than 12 hours

Table 2.2.1 (Page 3 of 6)
NORSAR Communication Status Report
Month: June 1995

Day	Subarray						
	01A	01B	02B	02C	03C	04C	06C
01	X	X	X	X	X	X	X
02	X	A	X	X	X	X	X
03	A	A	X	X	X	X	X
04	A	A	X	X	X	X	X
05	A	A	X	X	X	X	X
06	A	X	X	X	X	X	X
07	X	X	X	X	X	X	X
08	X	X	X	X	X	A	X
09	X	X	X	X	X	X	X
10	X	X	X	X	X	X	X
11	X	X	X	X	X	A	X
12	X	X	X	X	X	A	X
13	A	X	X	X	X	A	X
14	A	X	X	X	X	X	X
15	X	X	X	X	X	X	X
16	X	X	A	X	X	X	X
17	X	X	A	X	X	X	X
18	X	X	X	X	X	X	A
19	X	X	X	X	X	X	A
20	X	X	X	X	X	X	A
21	X	X	X	X	X	X	A
22	X	X	X	X	X	X	A
23	X	X	X	X	X	X	A
24	X	X	X	X	X	X	X
25	X	X	X	X	X	X	X
26	X	X	X	X	X	X	X
27	X	X	X	X	X	X	X
28	X	X	A	X	X	X	X
29	X	X	X	X	X	X	A
30	X	X	X	X	X	X	X
31	X	X	A	X	X	X	X
Total hours normal operation	607	606	679	720	720	626	537
% normal operation	84	84	94	100	100	87	75

Legend:

X : Normal operations
A : All channels masked for more than 12 hours that day
B : All SP channels masked for more than 12 hours that day
C : All LP channels masked for more than 12 hours that day
I : Communication outage for more than 12 hours

Table 2.2.1 (Pae 4 of 6)
NORSAR Communication Status Report
Month: July 1995

	Subarray						
Day	01A	01B	02B	02C	03C	04C	06C
01	X	X	X	X	X	X	X
02	X	X	X	X	X	X	X
03	X	X	X	X	X	X	X
04	X	X	X	X	X	X	X
05	X	X	X	X	X	X	X
06	X	X	X	X	X	X	X
07	X	X	X	X	X	X	X
08	X	X	X	X	X	A	X
09	X	X	X	X	X	X	X
10	X	X	X	X	X	X	X
11	X	X	X	X	X	A	X
12	X	X	X	X	X	A	X
13	X	X	X	X	X	A	X
14	X	X	X	X	X	X	X
15	I	I	A	I	I	I	A
16	X	X	A	X	X	X	A
17	X	X	A	X	X	X	A
18	X	X	A	X	X	X	A
19	X	X	X	A	X	X	A
20	X	X	X	A	X	X	A
21	X	X	X	A	X	X	A
22	X	X	A	A	X	X	A
23	X	X	A	A	X	X	A
24	X	X	A	A	X	X	A
25	X	X	X	A	X	X	A
26	X	X	X	A	X	X	A
27	X	X	X	A	X	X	A
28	X	X	X	A	X	X	A
29	X	X	X	A	X	X	A
30	X	X	X	A	X	X	A
31	X	X	A	A	X	X	A
Total hours normal operation	711	711	542	406	711	711	348
% normal operation	96	96	73	55	96	96	47

Legend:

X : Normal operations
A : All channels masked for more than 12 hours that day
B : All SP channels masked for more than 12 hours that day
C : All LP channels masked for more than 12 hours that day
I : Communication outage for more than 12 hours

Table 2.2.1 (Page 5 of 6)
NORSAR Communication Status Report
Month: August 1995

Day	Subarray						
	01A	01B	02B	02C	03C	04C	06C
01	X	A	A	X	X	A	A
02	X	A	X	X	X	A	A
03	X	A	X	X	X	A	A
04	X	X	X	X	X	X	A
05	X	X	X	X	X	X	A
06	X	X	X	X	X	X	A
07	X	X	X	X	X	X	A
08	X	X	X	X	X	X	A
09	X	X	X	X	X	X	A
10	X	X	X	X	X	X	A
11	X	X	A	X	X	X	A
12	X	X	A	X	X	X	A
13	X	X	A	X	X	X	A
14	X	X	A	X	X	X	A
15	X	X	A	X	X	X	A
16	X	X	A	X	X	X	A
17	X	A	A	X	X	X	A
18	X	A	X	X	X	X	A
19	X	A	X	X	X	X	A
20	X	A	X	X	X	X	A
21	X	A	X	X	X	X	A
22	X	A	X	X	X	X	A
23	X	A	X	A	X	X	A
24	X	A	X	A	X	X	A
25	X	A	X	A	X	X	A
26	X	A	X	A	X	X	A
27	X	A	X	A	X	X	A
28	X	A	A	A	X	X	A
29	X	A	A	A	A	X	A
30	X	A	A	A	A	X	A
31	X	A	A	A	A	X	A
Total hours normal operation	742	330	440	508	680	685	0
% normal operation	99.7	44.4	59.1	68.3	91.4	92.1	0

Legend:

X : Normal operations
A : All channels masked for more than 12 hours that day
B : All SP channels masked for more than 12 hours that day
C : All LP channels masked for more than 12 hours that day
I : Communication outage for more than 12 hours

Table 2.2.1 (Page 6 of 6)
NORSAR Communication Status Report
Month: September 1995

Day	Subarray						
	01A	01B	02B	02C	03C	04C	06C
01	X	A	A	A	A	X	A
02	X	A	A	A	A	X	A
03	X	A	A	A	A	X	A
04	X	A	A	A	A	X	A
05	X	A	A	A	A	A	A
06	X	A	A	A	A	A	A
07	X	A	A	A	A	A	A
08	A	A	A	A	A	A	A
09	A	A	A	A	A	A	A
10	A	A	A	A	A	A	A
11	A	A	A	A	A	A	A
12	A	A	A	A	A	A	A
13	A	A	A	A	A	A	A
14	A	A	A	A	A	A	A
15	A	A	A	A	A	A	A
16	A	A	A	A	A	A	A
17	A	A	A	A	A	A	A
18	A	A	A	A	A	A	A
19	A	A	A	A	A	A	A
20	X	A	A	A	A	A	A
21	A	A	A	A	A	A	A
22	A	A	A	A	A	A	A
23	A	A	A	A	A	A	A
24	A	A	A	A	A	A	A
25	A	A	A	A	A	A	A
26	A	A	A	A	A	A	A
27	A	A	A	A	A	A	A
28	A	A	A	A	A	A	A
29	A	A	A	A	A	A	A
30	A	A	A	A	A	A	A
31	A	A	A	A	A	A	A
Total hours normal operation	174	0	0	0	0	104	0
% normal operation	24.2	0	0	0	0	14.4	0

Legend:

X : Normal operations
A : All channels masked for more than 12 hours that day
B : All SP channels masked for more than 12 hours that day
C : All LP channels masked for more than 12 hours that day
I : Communication outage for more than 12 hours

2.3 NORSAR Event Detection operation

In Table 2.3.1 some monthly statistics of the Detection and Event Processor operation are given. The table lists the total number of detections (DPX) triggered by the on-line detector, the total number of detections processed by the automatic event processor (EPX) and the total number of events accepted after analyst review (teleseismic phases, core phases and total).

	Total DPX	Total EPX	Accepted events		Sum	Daily
			P-phases	Core Phases		
Apr 95	10950	897	355	59	414	13.8
May 95	7737	1138	596	85	681	22.0
Jun 95	4231	644	230	51	281	9.4
Jul 95	8128	987	273	76	349	11.3
Aug 95	9620	998	234	68	302	9.7
Sep 95	0	0	0	0	0	
			1688	339	2027	13.2

Table 2.3.1. Detection and Event Processor statistics, 1 April - 30 September 1995.

NORSAR Detections

The number of detections (phases) reported by the NORSAR detector during day 091, 1995, through day 273, 1995, was 47,110, giving an average of 293 detections per processed day (161 days processed). Table 2.3.2 shows daily and hourly distribution of detections for NORSAR.

B. Paulsen

NB2 .DPX Hourly distribution of detections

Day	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Sum	Date
91	14	36	36	48	31	19	21	23	20	15	16	13	23	20	19	20	13	14	23	20	20	24	17	17	522	Apr 01 Saturday
92	10	21	23	28	20	13	13	25	9	13	14	6	10	11	8	10	7	8	13	14	16	20	10	21	343	Apr 02 Sunday
93	24	26	17	22	18	8	10	16	9	18	13	13	18	16	13	9	21	13	12	9	24	7	24	13	373	Apr 03 Monday
94	29	18	20	28	18	15	13	14	4	13	15	29	16	14	13	20	17	31	10	20	13	18	15	19	422	Apr 04 Tuesday
95	21	16	18	13	19	7	3	14	12	19	12	12	11	58	10	18	12	12	8	7	15	16	8	8	349	Apr 05 Wednesday
96	11	14	15	14	4	15	3	1	11	3	3	8	4	12	20	5	8	9	7	13	12	10	9	14	225	Apr 06 Thursday
97	22	23	23	20	20	9	9	4	9	9	16	28	7	7	13	13	11	12	21	17	19	16	32	26	386	Apr 07 Friday
98	14	30	31	27	30	16	19	15	12	16	16	13	15	19	19	12	18	28	17	26	18	17	23	18	469	Apr 08 Saturday
99	23	33	22	34	27	27	18	21	19	9	19	13	19	10	11	13	11	10	13	8	6	8	8	13	395	Apr 09 Sunday
100	11	13	6	16	10	7	6	4	3	3	13	20	7	22	5	6	6	2	7	17	12	11	10	13	230	Apr 10 Monday
101	15	14	11	10	5	8	4	5	4	20	7	20	40	20	13	13	14	16	17	20	29	27	16	18	366	Apr 11 Tuesday
102	18	21	20	17	21	16	20	11	4	17	9	32	21	16	16	22	22	11	27	20	17	19	23	27	447	Apr 12 Wednesday
103	27	18	32	29	28	28	23	20	17	21	22	31	18	21	19	36	12	33	21	12	26	16	20	21	551	Apr 13 Thursday
104	22	19	30	13	19	23	13	19	22	21	19	35	30	27	29	24	17	14	17	20	23	10	13	20	499	Apr 14 Friday
105	7	14	13	9	12	13	11	16	12	13	20	18	18	23	17	24	25	20	19	16	18	19	19	21	397	Apr 15 Saturday
106	16	17	14	13	14	13	23	18	18	14	15	10	7	24	14	15	12	19	21	12	19	17	8	15	368	Apr 16 Sunday
107	9	18	6	16	10	11	8	20	11	10	9	16	14	26	9	16	4	22	21	12	15	14	13	21	331	Apr 17 Monday
108	17	19	30	12	25	16	14	11	7	11	9	14	10	3	3	12	3	10	10	17	16	12	13	24	318	Apr 18 Tuesday
109	23	11	17	10	20	6	8	6	7	18	3	6	7	12	16	7	8	13	8	14	8	12	20	18	278	Apr 19 Wednesday
110	5	18	18	12	10	7	8	4	17	18	4	20	5	12	17	9	6	7	9	9	11	13	18	8	265	Apr 20 Thursday
111	36	43	40	18	10	26	9	9	15	13	8	16	8	13	10	12	8	12	14	14	28	6	7	12	387	Apr 21 Friday
112	19	10	15	19	27	17	16	14	11	12	9	18	10	13	22	19	14	17	14	14	6	26	19	10	371	Apr 22 Saturday
113	13	15	16	29	19	39	35	14	26	17	16	13	14	9	22	10	17	7	15	13	17	13	15	17	421	Apr 23 Sunday
114	22	22	24	15	14	5	12	3	4	5	11	4	0	14	8	15	11	17	14	10	10	16	16	17	289	Apr 24 Monday
115	15	15	23	20	17	10	16	5	20	17	20	9	23	27	22	12	24	19	11	18	18	7	27	18	413	Apr 25 Tuesday
116	24	28	24	15	15	6	4	12	8	12	17	12	11	20	15	16	19	15	13	22	19	11	15	16	369	Apr 26 Wednesday
117	19	24	22	20	14	10	12	13	8	13	7	11	13	14	10	10	14	12	11	8	10	7	16	14	312	Apr 27 Thursday
118	20	17	9	13	6	5	6	10	3	9	13	3	18	5	6	14	16	33	15	7	23	16	4	12	283	Apr 28 Friday
119	14	15	15	5	17	15	10	6	7	13	21	7	13	14	19	10	8	17	15	8	16	18	15	19	317	Apr 29 Saturday
120	17	24	20	15	24	15	15	13	6	6	7	14	10	1	9	6	13	3	1	3	3	21	5	10	261	Apr 30 Sunday
121	20	9	15	18	20	14	13	15	19	18	14	13	17	20	16	19	27	16	30	24	21	25	25	48	476	May 01 Monday
122	33	32	17	23	14	17	25	12	19	6	6	17	7	4	10	11	8	10	13	16	14	12	12	27	365	May 02 Tuesday
123	22	19	25	10	6	7	1	4	9	7	17	14	6	16	25	42	108	52	76	35	0	11	7	5	524	May 03 Wednesday
124	14	7	15	13	8	2	1	8	0	8	4	14	8	11	4	10	14	2	7	6	8	7	4	2	177	May 04 Thursday
125	11	5	3	6	27	7	7	0	4	11	4	5	6	13	6	6	2	22	10	4	5	8	10	17	199	May 05 Friday
126	12	13	20	11	5	8	7	10	5	0	4	13	6	4	8	7	21	6	4	3	5	6	8	5	191	May 06 Saturday
127	6	6	2	6	5	6	3	10	3	3	5	6	12	1	4	0	2	2	6	2	5	1	8	8	112	May 07 Sunday
128	4	4	6	21	6	10	1	3	3	2	3	1	3	8	11	7	3	12	30	11	12	14	10	13	198	May 08 Monday
129	3	22	19	14	20	5	2	3	4	11	12	13	13	2	17	7	7	2	12	5	12	6	11	6	228	May 09 Tuesday
130	10	14	7	6	7	3	1	5	2	9	7	2	8	4	2	7	7	5	9	3	9	13	16	27	183	May 10 Wednesday
131	4	13	11	10	5	5	4	8	1	4	1	16	7	2	20	19	5	13	6	4	10	5	12	10	195	May 11 Thursday
132	6	13	10	14	8	9	0	0	3	19	4	15	10	2	9	6	4	3	9	9	9	11	7	24	204	May 12 Friday
133	12	9	10	13	17	13	20	20	16	65	38	37	10	25	20	22	11	18	40	24	11	31	22	31	535	May 13 Saturday
134	21	26	23	18	27	18	35	15	11	13	17	26	13	11	16	7	12	18	12	6	7	14	20	14	400	May 14 Sunday
135	30	18	17	17	17	13	9	6	31	21	8	16	7	24	35	17	9	15	14	17	31	15	29	22	438	May 15 Monday
136	28	29	22	37	29	12	11	15	18	6	10	12	17	13	15	8	10	10	16	10	26	38	22	20	434	May 16 Tuesday
137	17	15	21	25	26	16	18	20	11	13	17	38	23	11	14	24	11	21	7	16	17	8	7	22	418	May 17 Wednesday
138	21	9	6	13	7	2	5	5	8	7	2	5	8	5	10	18	3	8	18	6	10	7	2	7	192	May 18 Thursday
139	7	17	2	14	4	2	6	15	5	1	1	11	8	8	7	10	10	16	10	10	9	14	10	14	211	May 19 Friday
140	9	19	20	18	19	14	15	10	7	4	15	7	9	10	10	8	15	14	10	19	35	25	30	14	356	May 20 Saturday
141	16	16	11	16	17	9	9	11	8	8	5	8	8	10	3	4	6	12	5	11	7	14	7	4	225	May 21 Sunday
142	12	5	5	6	25	2	0	4	1	8	10	18	14	7	13	8	9	8	0	8	13	16	10	13	215	May 22 Monday
143	6	8	6	12	9	7	7	19	18	4	7	7	5	2	0	8	7	2	1	0	13	18	9	5	180	May 23 Tuesday
144	1	9	2	3	5	8	13	15	22	5	43	29	11	20	15	14	11	4	0	1	11	12	4	1	259	May 24 Wednesday
145	6	15	1	3	9	10	0	1	8	20	12	1	6	6	5	1	3	0	8	2	2	7	4	4	134	May 25 Thursday
146	1	0	7	35	1	6	5	1	0	15	5	14	0	3	6	6	12	1	0	0	6	4	0	10	138	May 26 Friday

Table 2.3.2 (Page 1 of 4)

NB2 .DPX Hourly distribution of detections

Day	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Sum	Date
147	1	9	0	4	1	2	2	10	8	8	1	0	1	25	21	7	3	0	14	7	12	21	10	1	168	May 27 Saturday
148	0	1	9	4	5	3	12	2	10	1	8	2	1	3	6	1	5	1	2	3	9	11	2	0	101	May 28 Sunday
149	2	8	2	1	0	7	10	9	1	2	6	3	1	1	6	0	1	4	6	0	3	0	0	0	73	May 29 Monday
150	0	1	12	4	17	3	8	0	2	0	0	11	15	10	14	1	7	8	0	0	2	2	1	0	118	May 30 Tuesday
151	12	2	0	1	2	1	5	2	9	1	8	3	12	28	8	7	1	0	0	0	8	0	4	1	115	May 31 Wednesday
152	1	1	0	0	0	0	0	1	0	0	6	1	8	0	5	6	4	3	1	1	0	0	0	4	42	Jun 01 Thursday
153	0	3	1	3	2	1	1	6	7	2	4	1	1	2	0	3	5	0	3	5	3	0	0	3	56	Jun 02 Friday
154	0	0	0	0	1	1	1	0	1	9	4	2	7	1	4	3	1	0	1	0	0	6	9	1	52	Jun 03 Saturday
155	0	4	7	0	2	0	0	1	1	3	0	2	0	0	1	4	2	0	1	0	2	2	1	1	34	Jun 04 Sunday
156	0	1	0	1	1	5	0	6	3	0	0	1	0	0	0	0	4	1	2	3	6	0	1	4	39	Jun 05 Monday
157	8	2	3	9	13	4	0	0	0	9	0	0	3	16	0	7	3	6	5	7	0	4	0	6	105	Jun 06 Tuesday
158	1	9	1	1	5	1	0	3	4	10	1	6	6	8	2	5	2	0	0	0	6	1	2	15	89	Jun 07 Wednesday
159	2	0	2	1	1	1	7	6	2	3	5	13	18	10	11	7	5	4	5	3	4	6	5	11	132	Jun 08 Thursday
160	11	4	2	0	6	2	7	1	24	8	2	11	10	3	6	6	0	5	2	0	2	2	10	3	127	Jun 09 Friday
161	2	0	7	8	4	4	1	5	1	6	3	0	3	3	2	3	2	3	1	6	0	2	2	1	69	Jun 10 Saturday
162	2	2	0	0	7	0	3	1	0	10	5	0	1	1	2	2	3	9	8	6	7	1	15	5	90	Jun 11 Sunday
163	2	5	4	7	3	2	4	4	1	4	5	8	12	9	8	0	7	17	7	3	18	8	14	15	167	Jun 12 Monday
164	10	6	8	3	0	5	5	5	5	4	9	5	0	11	11	4	17	1	4	8	8	9	7	3	148	Jun 13 Tuesday
165	5	8	6	3	4	11	3	3	5	12	8	10	9	7	4	3	13	2	7	7	3	4	6	3	146	Jun 14 Wednesday
166	18	19	7	4	8	6	3	9	2	3	12	16	1	4	6	9	10	0	4	9	3	3	5	16	177	Jun 15 Thursday
167	4	3	5	2	1	0	3	8	10	11	7	4	4	7	13	12	4	4	4	2	2	4	1	2	117	Jun 16 Friday
168	6	4	11	0	6	1	16	3	0	3	8	6	6	1	11	5	5	12	2	2	5	9	2	2	126	Jun 17 Saturday
169	2	10	3	3	10	2	2	7	6	8	2	4	12	12	11	11	19	11	16	3	6	14	13	21	208	Jun 18 Sunday
170	9	13	10	12	12	6	4	6	4	5	2	7	2	5	7	12	2	6	6	4	9	3	8	4	158	Jun 19 Monday
171	5	21	6	5	2	9	11	26	11	9	11	12	6	9	2	7	14	16	1	3	1	14	6	6	213	Jun 20 Tuesday
172	2	9	5	5	1	4	5	0	1	7	5	6	8	19	9	8	9	3	11	10	12	15	10	22	186	Jun 21 Wednesday
173	10	21	13	14	10	3	6	3	7	2	4	7	10	3	7	16	7	5	19	6	12	3	10	4	202	Jun 22 Thursday
174	13	7	6	8	6	1	4	2	4	5	7	18	1	3	6	13	11	7	15	5	8	10	4	9	173	Jun 23 Friday
175	7	8	15	13	6	11	7	19	10	7	6	9	4	9	8	4	8	17	8	4	7	8	8	8	211	Jun 24 Saturday
176	2	10	11	6	8	28	8	11	10	10	4	3	6	4	4	3	1	9	9	11	8	3	11	11	191	Jun 25 Sunday
177	13	9	6	5	8	3	3	8	2	0	12	7	2	5	8	2	2	8	5	4	5	8	7	16	148	Jun 26 Monday
178	7	7	4	5	7	2	4	3	0	0	12	18	8	3	13	8	5	22	9	6	2	9	4	1	159	Jun 27 Tuesday
179	8	8	9	18	7	15	1	5	16	0	9	31	19	14	21	0	2	5	4	3	17	14	8	13	247	Jun 28 Wednesday
180	6	8	11	9	8	6	4	8	2	3	2	8	35	5	12	15	9	2	8	10	5	4	12	13	205	Jun 29 Thursday
181	3	7	10	5	3	3	4	10	1	17	3	22	14	7	7	2	18	8	9	16	14	12	19	17	231	Jun 30 Friday
182	19	13	13	17	16	7	4	8	12	12	7	10	8	10	12	12	13	10	5	9	22	19	19	17	294	Jul 01 Saturday
183	17	17	14	11	12	14	24	13	9	15	19	11	10	12	11	12	11	13	16	5	6	12	10	5	299	Jul 02 Sunday
184	26	28	8	7	9	2	1	2	0	0	12	2	13	11	9	6	4	3	7	6	22	13	28	21	240	Jul 03 Monday
185	12	14	23	23	15	2	2	5	4	3	8	3	18	8	12	8	9	20	19	12	20	14	23	19	296	Jul 04 Tuesday
186	27	24	21	25	17	17	6	5	4	8	5	6	21	20	9	10	17	17	15	16	23	8	11	16	348	Jul 05 Wednesday
187	13	14	16	13	19	3	4	6	8	6	9	15	9	9	10	2	12	14	7	7	13	11	12	9	241	Jul 06 Thursday
188	14	18	12	21	14	2	6	7	9	10	5	11	12	19	19	13	17	8	11	11	15	15	8	13	290	Jul 07 Friday
189	15	18	18	18	17	17	28	8	6	12	10	19	8	13	17	13	11	20	10	22	11	11	18	12	352	Jul 08 Saturday
190	22	8	15	12	12	10	11	9	6	12	4	9	9	7	5	4	6	12	15	7	11	10	9	11	236	Jul 09 Sunday
191	16	12	20	12	9	0	0	1	2	1	4	9	3	14	5	3	7	12	7	12	2	7	15	6	179	Jul 10 Monday
192	8	7	11	5	3	4	2	0	5	6	4	25	5	17	4	5	5	10	2	9	3	12	14	16	182	Jul 11 Tuesday
193	9	21	9	9	8	1	3	1	4	11	5	13	6	7	6	5	25	9	11	8	6	4	10	10	201	Jul 12 Wednesday
194	11	9	9	8	2	2	1	9	4	0	3	8	18	7	9	10	4	16	10	15	3	8	14	19	199	Jul 13 Thursday
195	9	15	16	18	7	8	1	4	4	12	12	34	10	9	5	6	9	15	8	15	10	11	21	48	307	Jul 14 Friday
196	40	18	28	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	88	Jul 15 Saturday
197	0	0	0	0	0	0	0	0	0	0	0	0	7	0	5	2	2	2	1	14	0	1	0	4	38	Jul 16 Sunday
198	7	3	2	3	0	6	1	0	4	1	16	7	10	8	7	3	5	3	3	5	14	7	5	8	128	Jul 17 Monday
199	9	7	9	10	6	11	2	8	4	3	2	13	9	20	32	22	23	10	21	13	15	10	16	19	294	Jul 18 Tuesday
200	17	12	12	7	5	4	5	3	5	4	14	39	38	17	5	7	15	1	13	6	12	9	4	12	266	Jul 19 Wednesday
201	15	13	12	6	15	8	3	4	6	7	2	15	20	3	4	13	5	2	7	3	8	7	6	6	190	Jul 20 Thursday
202	6	10	3	4	3	8	1	8	1	1	13	9	2	12	12	7	3	10	15	11	11	17	19	9	195	Jul 21 Friday

Table 2.3.2. (Page 2 of 4)

NB2 .DPX Hourly distribution of detections

Day	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Sum	Date
203	9	11	17	9	13	7	15	26	8	7	12	25	19	40	22	26	32	20	19	25	13	19	12	8	414	Jul 22 Saturday
204	22	23	12	11	16	14	16	12	9	10	13	22	15	7	14	12	12	18	23	17	15	15	12	6	346	Jul 23 Sunday
205	21	17	13	8	9	7	5	4	7	12	11	10	4	9	16	10	18	11	11	25	15	12	13	10	278	Jul 24 Monday
206	10	6	11	13	5	6	7	7	8	9	5	12	8	13	7	23	5	3	3	5	16	17	15	8	222	Jul 25 Tuesday
207	11	10	10	6	8	4	1	1	1	11	9	3	5	3	10	8	13	7	16	14	11	11	17	25	215	Jul 26 Wednesday
208	14	20	16	15	8	5	14	6	4	1	6	1	17	10	11	21	7	5	5	8	9	7	19	6	235	Jul 27 Thursday
209	6	12	7	4	7	6	2	10	5	8	16	12	9	3	15	11	6	7	2	8	15	15	12	18	216	Jul 28 Friday
210	13	11	6	2	2	2	5	3	14	3	4	4	8	5	6	3	14	2	12	6	13	5	9	4	156	Jul 29 Saturday
211	10	10	9	4	7	46	10	12	9	33	19	18	39	34	26	14	17	8	9	7	5	18	34	81	479	Jul 30 Sunday
212	35	9	14	13	9	13	7	4	13	11	14	88	211	35	17	34	35	18	19	9	13	50	22	24	717	Jul 31 Monday
213	16	16	21	27	15	5	13	7	14	9	9	7	15	30	5	14	5	1	1	9	9	11	18	8	285	Aug 01 Tuesday
214	1	11	5	7	15	16	7	10	5	15	31	27	23	4	8	14	15	8	7	20	5	13	10	9	286	Aug 02 Wednesday
215	7	9	15	8	13	1	3	6	4	5	3	11	9	13	6	15	6	12	12	15	16	16	15	13	233	Aug 03 Thursday
216	14	14	14	13	5	8	9	7	2	1	10	8	12	17	13	6	7	4	12	1	6	8	9	9	209	Aug 04 Friday
217	30	15	18	2	0	0	0	0	0	0	9	14	13	17	16	15	18	19	15	17	18	20	19	18	293	Aug 05 Saturday
218	15	18	17	16	21	22	15	15	18	12	14	10	15	15	21	14	8	11	16	28	19	24	17	21	402	Aug 06 Sunday
219	25	6	18	23	13	8	5	9	3	9	8	6	3	2	11	6	9	13	23	11	15	18	11	18	273	Aug 07 Monday
220	18	19	19	6	10	4	5	13	3	1	3	6	37	5	6	6	15	9	14	19	10	6	9	19	262	Aug 08 Tuesday
221	17	8	13	21	14	7	3	6	17	3	7	5	9	3	5	10	6	7	4	8	9	9	10	4	205	Aug 09 Wednesday
222	17	8	14	11	4	1	3	3	4	9	7	26	32	1	8	16	4	4	9	6	6	12	3	8	216	Aug 10 Thursday
223	7	13	11	7	9	1	1	4	9	10	19	19	8	2	7	3	3	2	9	3	9	9	21	8	194	Aug 11 Friday
224	7	13	9	4	11	14	10	11	11	5	4	5	3	15	9	4	15	14	7	10	14	15	26	6	242	Aug 12 Saturday
225	7	14	15	10	11	15	10	9	8	8	20	6	14	8	19	13	18	16	10	11	18	18	24	12	314	Aug 13 Sunday
226	13	28	13	10	32	9	2	6	9	1	0	11	4	3	5	6	17	39	40	8	5	9	12	11	293	Aug 14 Monday
227	9	10	15	15	7	6	5	0	11	5	14	5	27	20	4	5	12	5	7	9	12	26	14	29	272	Aug 15 Tuesday
228	27	25	18	9	11	12	16	3	4	14	36	31	14	0	13	22	35	11	10	16	16	18	18	61	440	Aug 16 Wednesday
229	43	23	23	15	17	10	2	4	8	9	23	23	19	14	3	15	11	11	11	8	16	13	15	19	355	Aug 17 Thursday
230	16	11	32	17	15	12	4	5	12	11	10	14	10	23	12	3	9	9	11	12	14	7	11	18	298	Aug 18 Friday
231	9	11	11	16	22	3	7	6	4	6	2	6	4	1	2	1	5	14	16	11	25	30	22	18	252	Aug 19 Saturday
232	14	27	11	22	11	13	9	12	8	20	4	6	7	6	6	17	10	6	14	19	19	8	8	6	283	Aug 20 Sunday
233	6	11	15	6	8	0	0	4	4	8	7	1	7	0	0	2	20	8	10	5	13	16	19	21	191	Aug 21 Monday
234	17	30	14	12	6	17	1	3	3	7	4	9	28	11	17	17	7	10	4	7	5	9	15	5	258	Aug 22 Tuesday
235	7	8	7	7	11	8	15	22	21	12	16	8	10	5	5	6	14	4	4	4	13	10	13	16	246	Aug 23 Wednesday
236	10	12	21	10	16	8	11	1	20	4	10	14	15	3	25	7	7	11	6	2	9	14	24	14	274	Aug 24 Thursday
237	18	17	11	15	19	8	14	12	10	11	3	21	8	5	7	7	19	13	21	12	30	11	13	16	321	Aug 25 Friday
238	20	22	22	20	17	20	14	21	19	15	25	23	19	30	21	18	17	15	18	14	23	18	17	18	466	Aug 26 Saturday
239	24	15	33	18	23	18	15	16	20	16	13	4	17	10	12	18	14	22	27	27	19	22	24	16	443	Aug 27 Sunday
240	20	21	26	12	8	8	2	10	3	4	16	16	5	13	13	23	5	10	10	10	17	17	17	21	307	Aug 28 Monday
241	17	22	26	18	12	7	10	7	8	15	9	31	18	25	21	5	17	16	15	31	31	37	37	33	468	Aug 29 Tuesday
242	45	43	36	26	19	8	9	9	25	12	19	12	23	27	8	12	12	14	16	17	16	41	35	35	519	Aug 30 Wednesday
243	32	38	32	45	15	8	11	20	24	12	16	11	16	20	29	23	10	18	17	17	21	30	34	34	533	Aug 31 Thursday
244	33	28	34	32	18	11	13	8	14	13	17	25	23	9	10	14	7	11	8	15	16	23	32	25	439	Sep 01 Friday
245	36	31	52	44	50	20	27	14	17	14	8	9	17	8	12	9	26	15	25	37	30	36	31	34	602	Sep 02 Saturday
246	35	38	34	37	44	39	39	32	34	38	29	35	25	47	24	33	19	29	31	50	70	51	45	58	916	Sep 03 Sunday
247	48	38	53	54	30	17	12	8	12	15	10	22	27	16	17	15	22	21	25	33	35	27	38	26	621	Sep 04 Monday
248	36	24	49	32	21	7	8	26	39	30	30	37	47	27	40	46	49	43	48	46	63	57	56	71	932	Sep 05 Tuesday
249	75	53	54	68	39	46	36	36	34	30	32	48	36	28	31	43	40	49	40	28	47	51	54	69	1067	Sep 06 Wednesday
250	64	58	68	67	45	41	73	29	40	38	48	32	43	39	40	36	25	47	28	36	59	48	51	47	1102	Sep 07 Thursday
251	63	71	86	72	55	28	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	387	Sep 08 Friday
252	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Sep 09 Saturday
253	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Sep 10 Sunday
254	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Sep 11 Monday
255	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Sep 12 Tuesday
256	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Sep 13 Wednesday
257	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Sep 14 Thursday
258	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Sep 15 Friday

Table 2.3.2. (Page 3 of 4)

NB2 .DPX Hourly distribution of detections

Day	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Sum	Date
259	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Sep 16 Saturday
260	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Sep 17 Sunday
261	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Sep 18 Monday
262	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Sep 19 Tuesday
263	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Sep 20 Wednesday
264	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Sep 21 Thursday
265	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Sep 22 Friday
266	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Sep 23 Saturday
267	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Sep 24 Sunday
268	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Sep 25 Monday
269	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Sep 26 Tuesday
270	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Sep 27 Wednesday
271	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Sep 28 Thursday
272	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Sep 29 Friday
273	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Sep 30 Saturday

NB2	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23		
Sum	2440	2499	2495	2290	2042	1534	1401	1403	1426	1554	1654	2151	2156	1910	1849	1796	1871	1836	1911	1803	2147	2198	2269	2475	47110	Total sum
161	15	16	15	14	13	10	9	9	9	10	10	13	13	12	11	11	12	11	12	11	13	14	14	15	293	Total average
108	16	16	15	14	12	8	7	7	8	8	10	14	14	11	11	11	12	11	11	10	13	13	14	16	283	Average workdays
53	13	15	15	14	15	13	12	12	10	12	11	12	11	12	12	11	11	12	13	13	14	15	14	15	307	Average weekends

Table 2.3.2. Daily and hourly distribution of NORSAR detections. For each day is shown number of detections within each hour of the day and number of detections for that day. The end statistics give total number of detections distributed for each hour and the total sum of detections during the period. The averages show number of processed days, hourly distribution and average per processed day. (Page 4 of 4)

3 Operation of Regional Arrays

3.1 Recording of NORESS data at NDPC, Kjeller

Table 3.1.1 lists the main outage times and reasons.

The average recording time was 97.79% as compared to 99.17% during the previous reporting period.

Date	Time			Cause
04Apr	2031	-		Software failure
05 Apr		-	-0548	
20 Apr	0728	-	0747	Power failure
03 May	0931	-	1010	Software failure
05 Jun	0149	-	0821	Hardware failure
13 Jun	0332	-	0558	Software failure
08 Jul	0002	-	0836	Software failure
15 Jul	0327	-		Power failure at NDPC due to thunderstorm
16 Jul		-	1210	
19 Jul	1821	-		Hardware failure Hub
20 Jul		-	1311	
26 Jul	0117	-	0635	Software failure
05 Aug	0855	-	2053	Software failure
07 Aug	1336	-		Hardware failure Hub
08 Aug		-	0715	
19 Aug	0824	-	0941	Software failure
21 Aug	0617	-	0630	Software failure
21 Aug	1329	-	1430	Power failure
16 Sep	1347	-	1439	Software failure
24 Sep	0100	-	0200	Software failure
27 Sep	0720	-	0744	Software failure
28 Sep	0441	-	0533	Transmission line failure

Table 3.1.1. Interruptions in recording of NORESS data at NDPC, 1April - 30 September 1995.

Monthly uptimes for the NORESS on-line data recording task, taking into account all factors (field installations, transmissions line, data center operation) affecting this task were as follows:

April 95	:	98.66
May	:	99.91
June	:	98.75
July	:	91.21
August	:	98.67
September	:	99.55

Fig. 3.1.1 shows the uptime for the data recording task, or equivalently, the availability of NORESS data in our tape archive, on a day-by-day basis, for the reporting period.

J. Torstveit

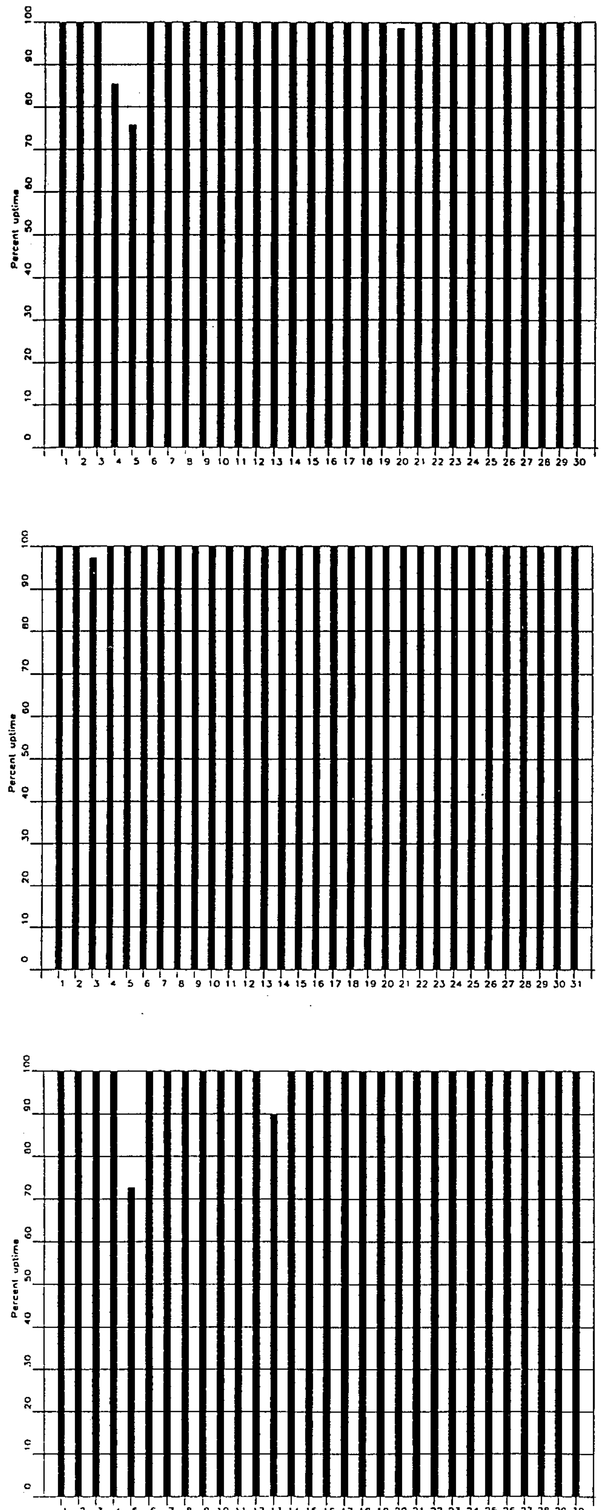


Fig. 3.1.1. NORESS data recording uptime for April (top), May (middle) and June (bottom) 1995.

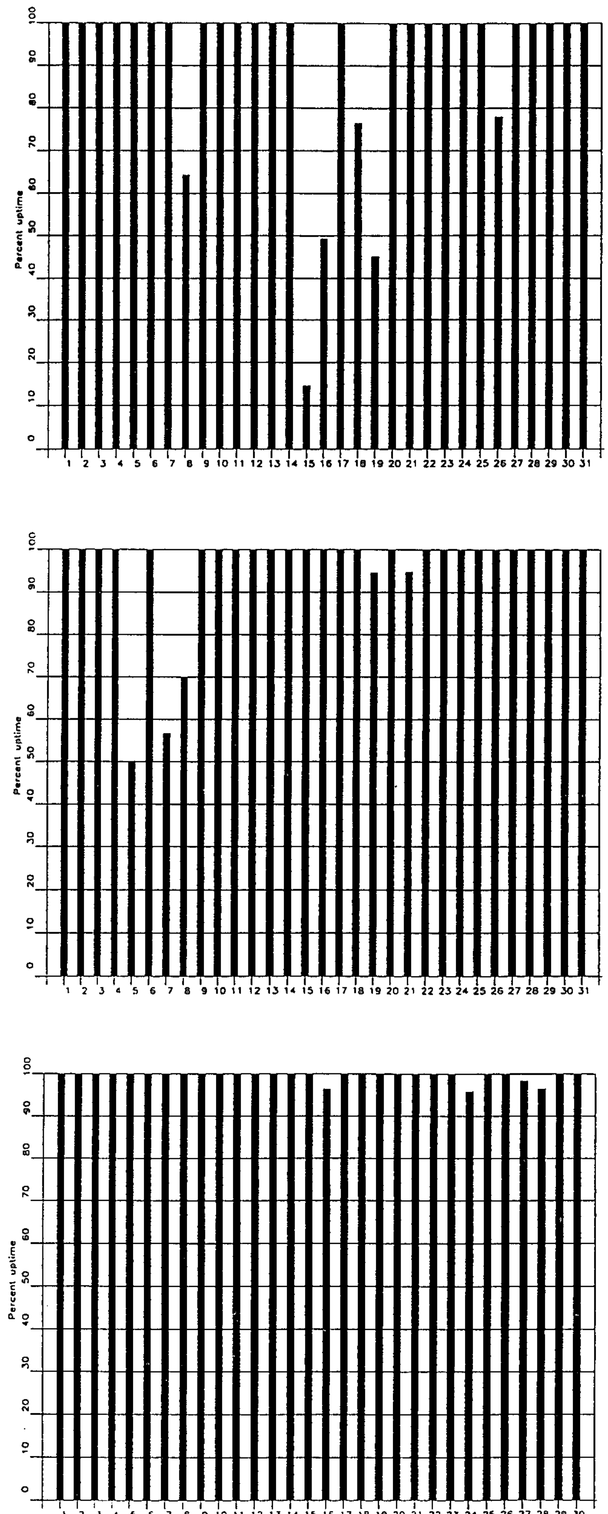


Fig. 3.1.1. (cont.) NORESS data recording uptime for July (top), August (middle) and September (bottom) 1995.

3.2 Recording of ARCESS data at NDPC, Kjeller

Table 3.2.1 lists the main outage times and reasons.
The average recording time was 92.56% as compared to 99.37% for the previous reporting period.

Date	Time			Cause
03 Jun	2158	-		Satellite link failure
04 Jun		-	0039	
13 Jun	0805	-	2237	Power break and hardware problem
13 Jun	2302	-		Hardware problems after power break
14 Jun		-	1542	
15 Jun	0000	-		Hardware problems after power break
16 Jun		-	0823	
01 Jul	0838	-	1022	Timing problems
14 Jul	0642	-	0754	Software failure
15 Jul	0327	-		Power failure at NDPC due to thunderstorm
16 Jul		-	1240	
18 Jul	0708	-	1653	Power failure Hub due to thunderstorm
27 Jul	2109	-	2328	Satellite link failure
28 Jul	0032	-		Power failure Hub
29 Jul		-	1048	
02 Aug	1821	-	1834	Hardware failure Hub
02 Aug	2318	-	2329	Hardware failure Hub
03 Aug	0054	-	1604	Hardware failure Hub
14 Aug	0913	-	0943	Power failure Hub
21 Aug	1329	-	1440	Power failure DPC
25 Aug	0701	-	0928	Power failure Hub
07 Sep	0416	-		Hardware failure satellite link
13 Sep		-	1031	
26 Sep	1020	-	1244	Power failure Hub

Table 3.2.1. The main interruptions in recording of ARCESS data at NDPC, 1 April - 30 September 1995.

Monthly uptimes for the ARCESS on-line data recording task, taking into account all factors (field installations, transmissions line, data center operation) affecting this task were as follows:

April 95	:	99.98%
May	:	99.98%
June	:	90.71%
July	:	88.83%
August	:	97.09%
September	:	78.75%

Fig. 3.2.1. shows the uptime for the data recording task, or equivalently, the availability of ARCESS data in our tape archive, on a day-by-day basis, for the reporting period.

J. Torstveit

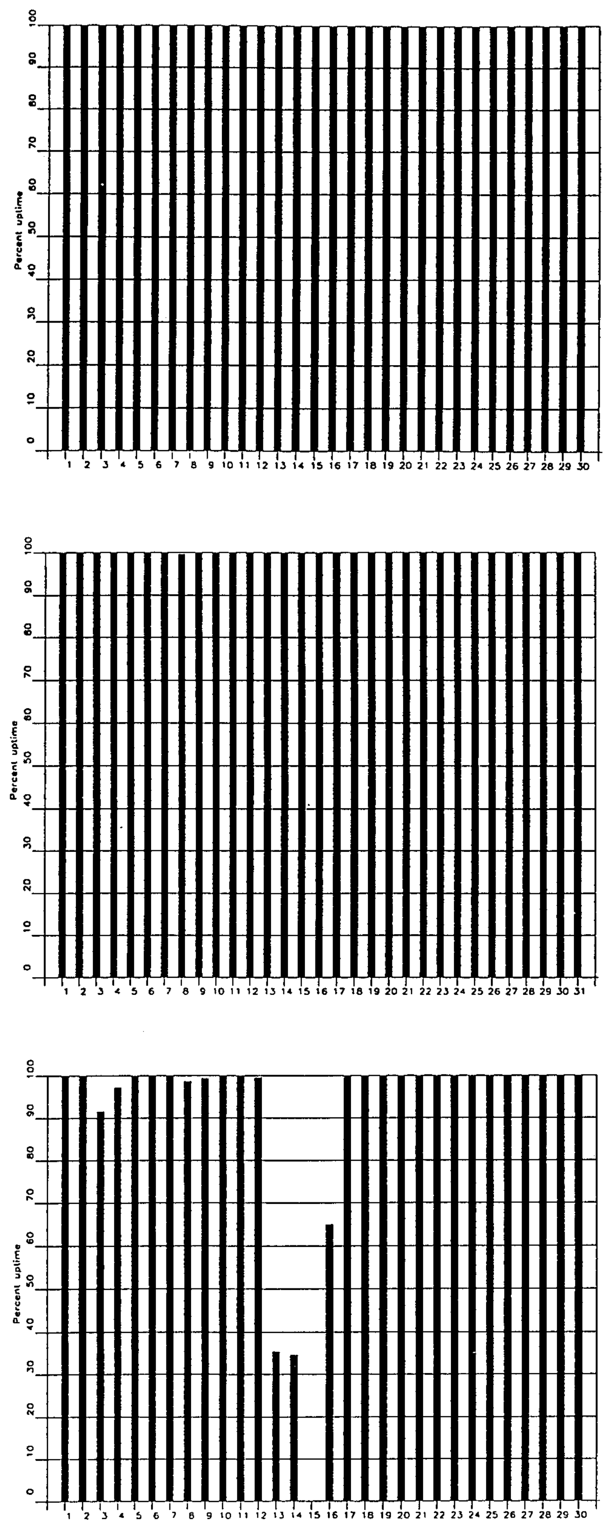
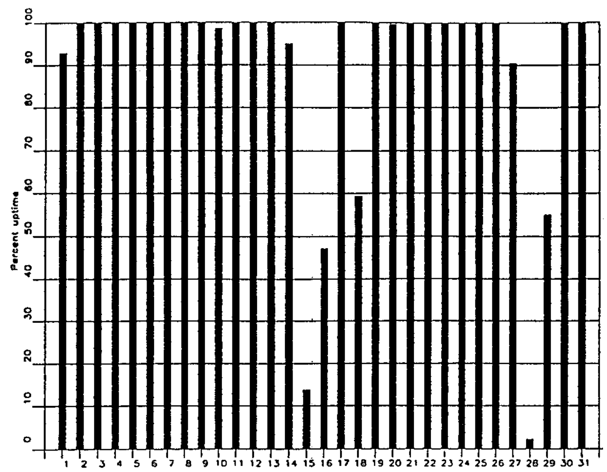
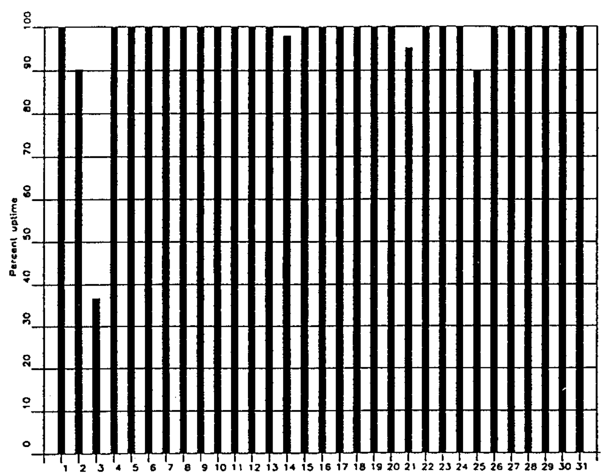


Fig. 3.2.1. ARCESS data recording uptime for April (top), May (middle) and June (bottom) 1995.





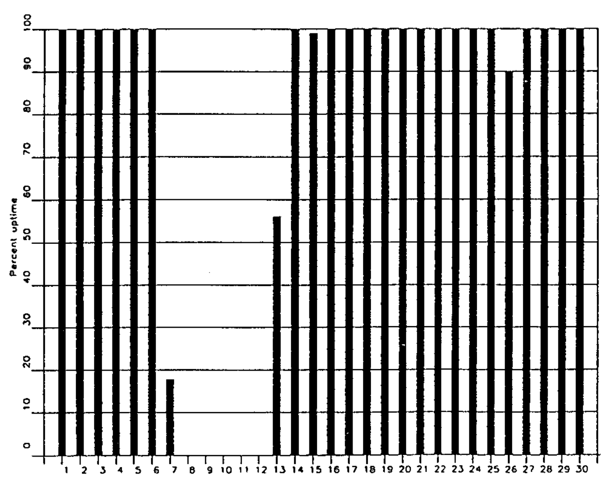


Fig. 3.2.1. ARCESS data recording uptime for July (top), August (middle) and September (bottom) 1995.

3.3 Recording of FINESS data at NDPC, Kjeller

The average recording time was 98.55% as compared to 97.8% for the previous reporting period.

Date	Time	Cause
18 Apr	0542 - 0757	Software failure Helsinki
10 Jun	1119 -	Hardware failure Helsinki
11 Jun	- 1220	
14 Jun	1351 - 1427	Transmission line failure
15 Jul	0324 -	Power failure at NDPC due to thunderstorm
16 Jul	- 0342	
31 Aug	0658 - 1039	Hardware failure Helsinki
11 Sep	0531 - 1144	Hardware being moved in Helsinki
11 Sep	1200 - 1233	Hardware being moved in Helsinki

Table 3.3.1. The main interruptions in recording of FINESS data at NDPC, 1 April - 30 September 1995.

Monthly uptimes for the FINESS on-line data recording task, taking into account all factors (field installations, transmission lines, data center operation) affecting this task were as follows:

April 95	:	99.68%
May	:	100.00%
June	:	96.43%
July	:	96.70%
August	:	99.46%
September	:	99.05%

Fig. 3.3.1 shows the uptime for the data recording task, or equivalently, the availability of FINESS data in our tape archive, on a day-by-day basis, for the reporting period.

J. Torstveit

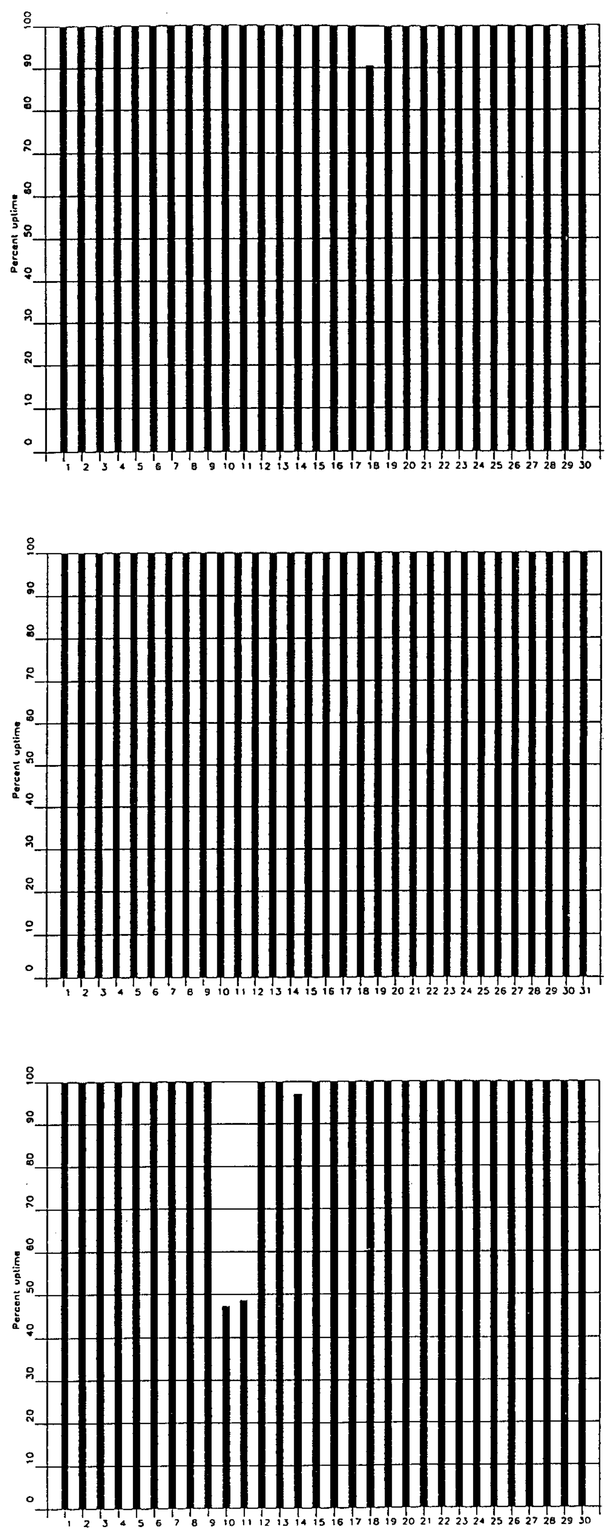


Fig. 3.3.1. FINESS data recording uptime for April (top), May (middle) and June (bottom) 1995.

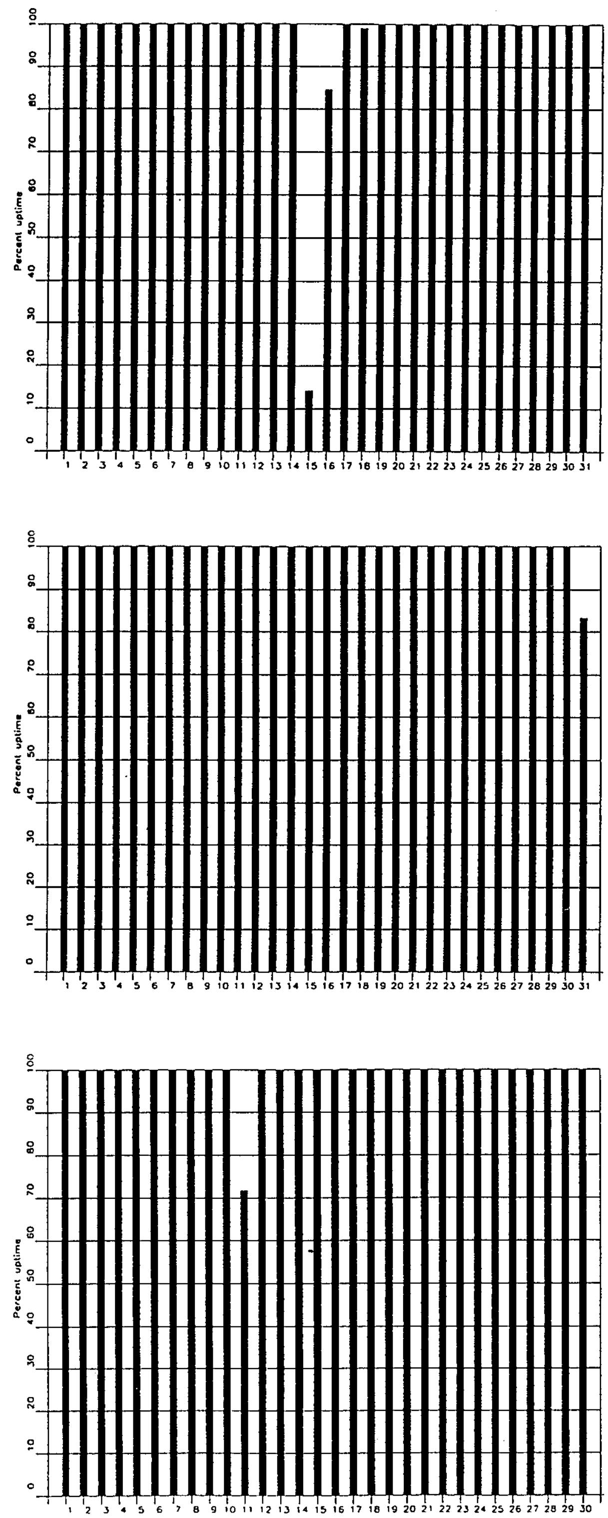


Fig. 3.3.1. FINESS data recording uptime for July (top), August (middle) and September (bottom) 1995.

3.4 Recording of Spitsbergen data at NDPC, Kjeller

The average recording time was 65.81% as compared to 96.80% for the previous reporting period.

The main reasons for downtime follow:

Date	Time			Cause
01 Apr	0000	-		Power failure Spitsbergen 31/3
07 Apr		-	1205	
08 Apr	0000	-	0841	Software failure
10 Apr	0900	-		Hardware failure Spitsbergen
20 Apr		-	0718	
26 Apr	1037	-	1136	Hardware failure
04 May	1928	-	2017	Communication line failure
05 May	1001	-	1143	Communication line failure
09 May	0856	-	0922	Maintenance Spitsbergen
15 May	0112	-	0130	Communication line failure
15 May	0443	-	0506	Communication line failure
26 May	0705	-	0754	Communication line failure
26 May	0923	-	0943	Communication line failure
26 May	1115	-	1151	Communication line failure
20 Jun	2053	-		Hardware failure Spitsbergen
03 Aug		-	1950	
18 Aug	0643	-	0729	Hardware maintenance NDPC
21 Aug	1329	-	1438	Power breack NDPC
25 Aug	0946	-	1118	Maintenance communication line
04 Sep	0734	-	0825	Software failure
05 Sep	2105	-		Software failure
06 Sep		-	0621	
10 Sep	0037	-	0812	Communication line failure
13 Sep	0919	-	0942	Maintenance communication line

Table 3.4.1. The main interruptions in recording of Spitsbergen data at NDPC, 1 April - 30 September 1995.

Monthly uptimes for the Spitsbergen online data recording task, taking into account all factors (field installations, transmission line, data center operation) affecting this task were as follows:

April 95	:	43.62%
May	:	98.14%
June	:	65.78%
July	:	0.00%
August	:	90.27%
September	:	97.07%

Fig. 3.4.1 shows the uptime for the data recording task, or equivalently, the availability of Spitsbergen data in our tape archive, on a day-by-day basis for the reporting period.

J. Torstveit

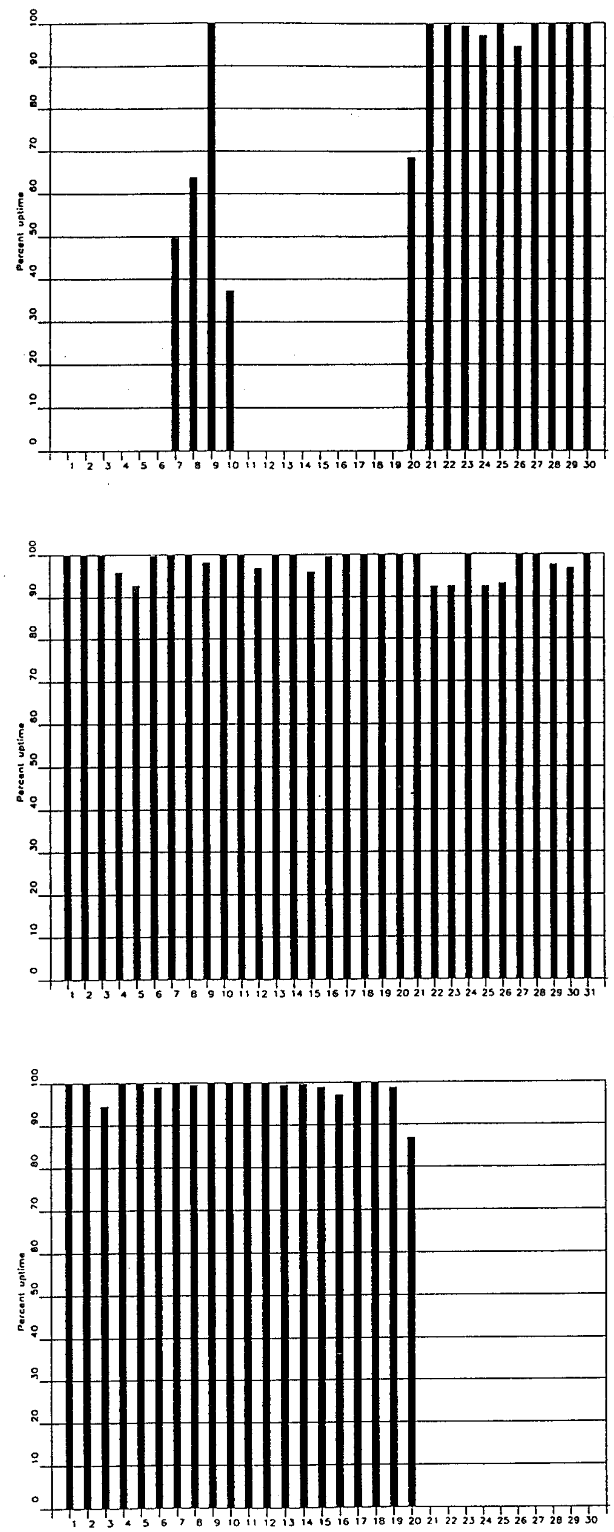


Fig. 3.4.1. Spitsbergen data recording uptime for April (top), May (middle) and June (bottom) 1995.

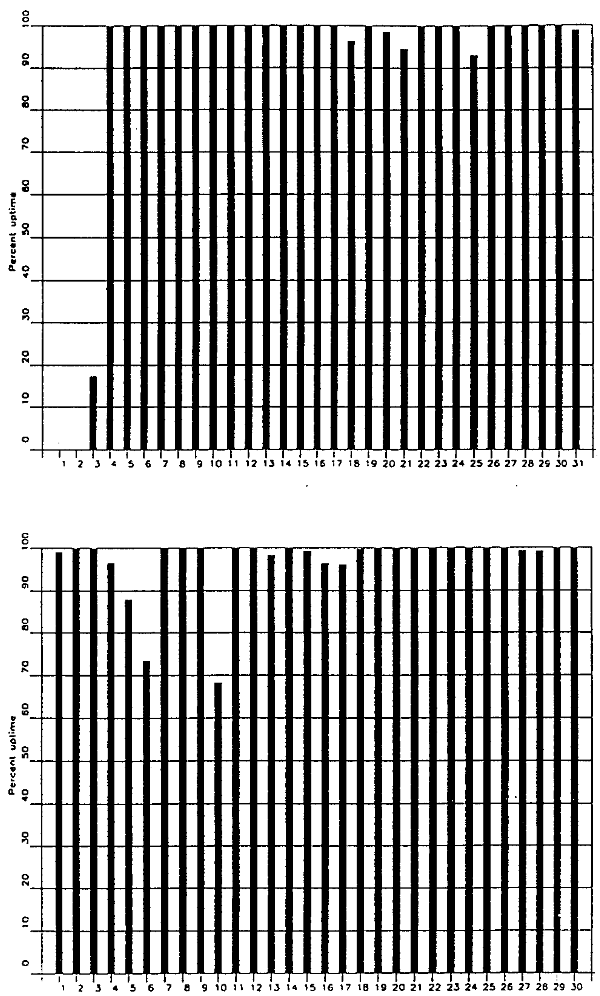


Fig. 3.4.1. Spitsbergen data recording uptime for August (top) and September (bottom) 1995.

3.5 Event detection operation

This section reports results from one-array automatic processing using signal processing recipes and "ronapp" recipes for the ep program (NORSAR Sci. Rep. No 2-88/89).

Three systems are in parallel operation to associate detected phases and locate events:

1. The ep program with "ronapp" recipes is operated independently on each array to obtain simple one-array automatic solutions.
2. The Generalized Beamforming method (GBF) (see F. Ringdal and T. Kværna (1989), A mulitchannel processing approach to real time network detection, phase association and threshold monitoring, BSSA Vol 79, no 6, 1927-1940) processes the four arrays jointly and presents locations of regional events.
3. The IMS system is operated on the same set of arrivals as ep and GBF and reports also teleseismic events in addition to regional ones.

IMS results are reported in section 3.6.

In addition to these three event association processes, we are running test versions of the so-called Threshold Monitoring (TM) process. This is a process that monitors the seismic amplitude level continuously in time to estimate the upper magnitude limit of an event that might go undetected by the network. Simple displays of so-called threshold curves reveal instants of particular interest; i.e., instants when events above a certain magnitude threshold may have occurred in the target region. Results from the three processes described above are used to help resolve what actually happened during these instances.

NORESS detections

The number of detections (phases) reported from day 091, 1995, through day 273, 1995, was 36,371, giving an average of 199 detections per processed day (183 days processed).

Table 3.5.1 shows daily and hourly distribution of detections for NORESS.

Events automatically located by NORESS

During days 091, 1995, through 273, 1995, 2013 local and regional events were located by NORESS, based on automatic association of P- and S-type arrivals. This gives an average of 11.0 events per processed day (183 days processed). 67% of these events are within 300 km, and 88% of these events are within 1000 km.

ARCESS detections

The number of detections (phases) reported during day 091, 1995, through day 273, 1995, was 86,374, giving an average of 485 detections per processed day (183 days processed).

Table 3.5.2 shows daily and hourly distribution of detections for ARCESS.

Table 3.5.2 shows daily and hourly distribution of detections for ARCESS.

Events automatically located by ARCESS

During days 091, 1995, through 273, 1995, 6187 local and regional events were located by ARCESS, based on automatic association of P- and S-type arrivals. This gives an average 34.8 events per processed day (183 days processed). 57% of these events are within 300 km, and 87% of these events are within 1000 km.

FINESS detections

The number of detections (phases) reported during day 091, 1995, through day 273, 1995, was 41,241, giving an average of 225 detections per processed day (183 days processed).

Table 3.5.3 shows daily and hourly distribution of detections for FINESS.

Events automatically located by FINESS

During days 091, 1995, through 273, 1995, 2456 local and regional events were located by FINESS, based on automatic association of P- and S-type arrivals. This gives an average of 13.4 events per processed day (183 days processed). 80% of these events are within 300 km, and 91% of these events are within 1000 km.

GERESS detections

The number of detections (phases) reported from day 091, 1995, through day 273, 1995, was 38,748, giving an average of 212 detections per processed day (183 days processed).

Table 3.5.4 shows daily and hourly distribution of detections for GERESS.

Events automatically located by GERESS

During days 091, 1995, through 273, 1995, 3917 local and regional events were located by GERESS, based on automatic association of P- and S-type arrivals. This gives an average of 21.4 events per processed day (183 days processed). 77% of these events are within 300 km, and 89% of these events are within 1000 km.

Apatity array detections

The number of detections (phases) reported from day 091, 1995, through day 273, 1995, was 114,866, giving an average of 649 detections per processed day (177 days processed).

As described in earlier reports, the data from the Apatity array are transferred by one-way (simplex) radio links to Apatity city. The transmission suffers from radio disturbances that occasionally result in a large number of small data gaps and spikes in the data. In order for the communication protocol to correct such errors by requesting retransmission of data, a two-way radio link would be needed (duplex radio). However, it should be noted that noise from cultural activities and from the nearby lakes cause most of the unwanted detections. These unwanted detections are "filtered" in the signal processing, as they give seismic velocities that are outside accepted limits for regional and teleseismic phase velocities.

Table 3.5.5 shows daily and hourly distribution of detections for the Apatity array.

Events automatically located by the Apatity array

During days 091, 1995, through 273, 1995, 1309 local and regional events were located by the Apatity array, based on automatic association of P- and S-type arrivals. This gives an average of 7.4 events per processed day (177 days processed). 41% of these events are within 300 km, and 72% of these events are within 1000 km.

Spitsbergen array detections

The number of detections (phases) reported from day 091, 1995, through day 273, 1995, was 126,090, giving an average of 1009 detections per processed day (125 days processed).

Table 3.5.6 shows daily and hourly distribution of detections for the Spitsbergen array.

Events automatically located by the Spitsbergen array

During days 091, 1995, through 273, 1995, 12,388 local and regional events were located by the Spitsbergen array, based on automatic association of P- and S-type arrivals. This gives an average of 99.1 events per processed day (125 days processed). 49% of these events are within 300 km, and 74% of these events are within 1000 km.

Hagfors array detections

The number of detections (phases) reported from day 091, 1995, through day 273, 1995, was 48,529, giving an average of 265 detections per processed day (183 days processed).

Table 3.5.7 shows daily and hourly distribution of detections for the Hagfors array

Events automatically located by the Hagfors array

During days 091, 1995, through 273, 1995, 1963 local and regional events were located by the Hagfors array, based on automatic association of P- and S-type arrivals. This gives an average of 10.7 events per processed day (183 days processed). 38% of these events are within 300 km, and 77% of these events are within 1000 km

U. Baadshaug

NRS .FKX Hourly distribution of detections

Day	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Sum	Date
91	6	4	1	2	6	9	5	5	5	8	6	5	7	10	4	1	5	0	6	2	4	2	4	5	112	Apr 01 Saturday
92	1	3	8	7	3	3	0	11	24	38	13	3	1	2	2	9	8	3	6	1	1	3	8	12	170	Apr 02 Sunday
93	17	28	26	33	24	9	3	8	4	6	7	13	9	6	16	0	9	9	4	2	6	13	5	9	266	Apr 03 Monday
94	32	29	52	50	29	18	11	10	6	5	10	17	19	11	11	8	10	14	7	18	3	0	0	0	370	Apr 04 Tuesday
95	0	0	0	0	0	1	4	9	9	10	12	14	21	30	8	12	12	2	4	11	12	4	1	4	180	Apr 05 Wednesday
96	4	6	3	5	1	7	13	2	9	5	3	13	9	14	12	2	30	10	4	19	1	2	4	4	182	Apr 06 Thursday
97	2	12	3	4	10	6	1	5	5	8	21	16	3	7	4	6	2	8	10	14	11	10	11	7	186	Apr 07 Friday
98	6	7	3	14	14	20	8	11	6	7	9	6	4	5	6	9	4	10	9	7	2	4	9	11	191	Apr 08 Saturday
99	47	53	20	20	31	20	3	3	13	16	6	16	11	9	2	1	4	2	11	5	14	12	17	7	343	Apr 09 Sunday
100	20	28	15	16	30	22	13	16	12	9	17	9	7	10	11	11	7	14	5	77	52	4	0	5	410	Apr 10 Monday
101	2	3	3	3	8	6	7	4	4	3	7	8	21	16	17	12	16	4	21	7	6	7	4	4	193	Apr 11 Tuesday
102	5	1	1	9	4	3	9	6	6	10	8	27	25	8	13	9	2	5	5	2	2	1	5	4	170	Apr 12 Wednesday
103	4	1	10	7	8	11	21	12	1	22	13	12	13	4	3	18	5	6	6	8	7	1	7	4	204	Apr 13 Thursday
104	7	6	3	1	3	3	3	4	15	113	116	16	4	10	8	6	5	27	10	7	5	1	3	3	379	Apr 14 Friday
105	1	3	5	1	3	19	2	7	6	4	6	9	4	8	3	4	1	12	2	16	6	5	7	5	139	Apr 15 Saturday
106	3	1	13	5	0	6	5	9	11	5	4	4	0	5	6	3	4	8	6	4	5	1	1	6	115	Apr 16 Sunday
107	4	9	5	4	5	6	1	7	10	11	4	10	3	19	3	6	2	5	4	3	9	6	5	71	212	Apr 17 Monday
108	11	1	15	4	9	6	7	0	1	6	5	9	13	3	3	6	4	6	5	16	3	15	4	4	156	Apr 18 Tuesday
109	0	2	3	2	9	1	1	5	1	9	5	3	15	10	10	7	8	0	7	7	2	2	6	2	117	Apr 19 Wednesday
110	3	0	2	1	5	3	3	3	6	7	4	15	5	7	13	8	14	5	9	121	5	12	4	3	258	Apr 20 Thursday
111	27	12	12	3	3	9	2	1	6	7	12	6	8	7	6	0	2	13	8	12	8	2	5	1	172	Apr 21 Friday
112	16	6	8	6	1	9	4	1	4	1	2	6	2	15	3	2	6	3	27	7	6	7	6	4	152	Apr 22 Saturday
113	3	5	4	10	5	12	10	6	5	5	13	1	2	0	3	4	14	4	3	4	11	4	0	4	132	Apr 23 Sunday
114	6	16	2	4	4	2	7	1	1	3	6	4	2	10	9	20	7	7	5	7	0	7	2	8	140	Apr 24 Monday
115	1	4	1	6	1	3	7	1	8	12	16	4	16	31	9	2	10	5	1	10	5	8	1	3	165	Apr 25 Tuesday
116	0	5	14	5	1	3	2	5	2	10	11	13	20	12	2	5	11	6	2	5	6	1	5	1	147	Apr 26 Wednesday
117	2	6	13	5	0	2	4	6	7	18	7	8	12	6	4	1	10	6	3	6	4	7	3	2	142	Apr 27 Thursday
118	2	4	12	0	2	2	8	4	2	2	14	3	15	1	5	4	9	18	6	11	4	4	0	0	132	Apr 28 Friday
119	3	2	2	1	2	9	7	2	4	8	5	5	3	7	8	9	4	3	5	1	1	2	1	4	98	Apr 29 Saturday
120	4	6	0	5	14	2	8	9	2	0	4	4	3	2	6	7	13	4	2	16	2	31	8	2	154	Apr 30 Sunday
121	6	5	5	3	5	6	6	2	10	4	6	5	6	7	7	13	3	8	9	4	1	5	6	14	146	May 01 Monday
122	3	16	7	2	6	7	15	9	9	3	13	14	8	8	2	2	5	4	3	12	6	9	3	5	171	May 02 Tuesday
123	4	4	10	7	0	4	2	1	5	2	12	10	5	12	2	6	9	4	4	12	1	13	3	1	133	May 03 Wednesday
124	8	11	12	3	3	3	0	4	2	11	6	10	10	19	4	6	35	2	5	5	5	14	3	2	183	May 04 Thursday
125	2	3	2	5	14	6	1	2	1	9	12	10	7	7	1	2	5	11	6	7	1	1	3	8	126	May 05 Friday
126	4	4	8	7	5	9	8	8	2	4	1	4	1	0	5	6	4	1	3	4	1	3	2	3	97	May 06 Saturday
127	1	0	1	0	1	2	2	4	2	4	5	3	5	2	1	1	2	0	5	2	1	1	4	2	51	May 07 Sunday
128	0	6	1	12	0	4	0	0	7	6	3	4	9	4	10	8	4	12	11	5	5	2	2	17	132	May 08 Monday
129	5	8	6	1	2	0	0	3	0	7	12	10	16	2	5	1	4	0	5	4	4	10	2	1	108	May 09 Tuesday
130	0	4	2	0	2	0	1	0	2	5	1	3	6	8	9	7	2	2	3	5	2	10	5	9	88	May 10 Wednesday
131	1	2	9	1	2	1	1	7	1	4	5	9	10	6	17	11	3	16	4	4	3	12	11	4	144	May 11 Thursday
132	7	12	3	9	8	4	4	0	2	12	13	16	13	2	4	7	4	2	6	10	0	5	4	5	152	May 12 Friday
133	5	10	7	1	3	8	11	6	16	60	36	30	19	19	17	19	10	15	27	20	9	19	18	22	407	May 13 Saturday
134	20	14	19	18	14	16	22	8	10	6	7	8	7	5	7	4	3	6	5	6	1	3	5	3	217	May 14 Sunday
135	11	13	5	5	9	7	6	6	18	10	8	11	5	28	9	6	4	2	1	11	24	80	6	2	287	May 15 Monday
136	2	12	5	9	11	7	0	1	20	2	6	8	8	10	8	5	10	1	8	11	24	25	12	6	211	May 16 Tuesday
137	13	2	12	8	14	12	10	6	7	6	9	18	27	4	14	13	7	16	3	5	3	2	3	5	219	May 17 Wednesday
138	7	9	7	4	3	0	3	2	9	7	7	7	7	7	23	14	6	5	12	10	1	14	2	3	169	May 18 Thursday
139	1	17	5	2	24	380	25	7	2	0	6	8	8	9	8	7	13	12	18	7	1	4	4	3	571	May 19 Friday
140	0	6	3	3	7	4	2	2	5	4	4	5	2	10	2	3	3	7	5	7	25	8	10	4	131	May 20 Saturday
141	0	6	7	6	4	3	1	6	4	2	3	4	3	5	7	3	3	12	11	21	22	27	25	32	217	May 21 Sunday
142	31	31	27	25	21	6	8	2	0	22	13	24	17	9	15	5	13	7	3	5	14	8	5	4	315	May 22 Monday
143	4	16	5	9	9	5	6	9	11	1	12	9	22	5	9	16	13	9	13	15	17	19	17	23	274	May 23 Tuesday
144	18	25	23	24	13	10	9	16	15	10	24	25	11	14	8	13	16	6	1	11	8	16	3	2	321	May 24 Wednesday
145	8	7	3	12	10	15	15	3	7	22	3	13	20	8	4	3	4	5	6	3	4	6	1	7	189	May 25 Thursday
146	4	4	6	15	0	5	4	2	3	11	1	12	4	6	7	8	12	12	9	51	5	6	0	13	200	May 26 Friday

Table 3.5.1 (Page 1 of 4)

NRS .FKX Hourly distribution of detections

Day	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Sum	Date
147	6	4	0	2	1	10	3	2	2	3	0	2	3	18	10	4	3	3	15	9	5	19	12	6	142	May 27 Saturday
148	8	8	16	4	8	7	8	9	12	7	4	5	9	10	13	8	7	6	10	6	20	14	12	7	218	May 28 Sunday
149	11	10	7	9	4	7	4	6	8	9	8	8	8	6	2	5	9	4	6	6	4	1	1	0	143	May 29 Monday
150	2	11	10	2	12	1	11	4	7	7	6	11	13	20	4	2	10	9	1	4	2	6	1	2	158	May 30 Tuesday
151	5	5	10	0	4	0	4	7	14	11	9	7	22	16	4	10	7	2	4	6	6	2	4	1	160	May 31 Wednesday
152	2	6	4	0	0	1	6	7	7	8	11	4	13	13	6	10	5	8	5	2	1	4	4	8	135	Jun 01 Thursday
153	3	11	9	10	8	8	7	17	11	16	7	10	6	2	1	5	4	0	2	5	2	1	1	1	147	Jun 02 Friday
154	3	0	0	0	1	3	0	1	2	7	4	2	7	2	2	3	2	4	1	0	3	3	6	1	57	Jun 03 Saturday
155	1	2	5	0	4	0	1	2	2	1	0	3	1	6	8	6	0	1	0	3	8	14	19	15	102	Jun 04 Sunday
156	19	18	0	0	0	0	0	0	1	1	3	2	1	2	1	8	15	10	14	15	21	1	3	12	147	Jun 05 Monday
157	16	13	15	25	19	12	5	4	5	6	6	7	15	16	3	12	1	2	7	9	7	4	0	6	215	Jun 06 Tuesday
158	3	6	2	3	9	2	4	5	9	18	6	7	10	18	17	5	2	0	1	3	9	0	1	11	151	Jun 07 Wednesday
159	2	4	6	4	3	1	0	3	4	9	17	23	18	6	7	3	1	9	2	6	8	7	8	14	165	Jun 08 Thursday
160	18	0	1	1	2	6	15	5	12	19	15	15	17	10	8	9	7	5	3	9	4	0	10	11	202	Jun 09 Friday
161	14	13	24	25	18	21	8	15	6	7	4	10	3	4	5	5	6	3	1	6	0	3	4	3	208	Jun 10 Saturday
162	1	2	2	1	3	1	2	2	3	8	2	2	4	3	2	0	1	6	3	3	6	3	12	2	74	Jun 11 Sunday
163	1	2	2	4	2	5	6	7	6	10	6	7	16	6	7	0	12	14	2	11	18	41	80	44	309	Jun 12 Monday
164	32	2	5	6	0	0	3	9	6	7	9	15	6	26	11	5	23	5	4	6	7	5	4	0	196	Jun 13 Tuesday
165	1	1	2	3	4	6	7	5	6	14	7	21	13	9	5	7	19	2	7	4	1	2	2	4	152	Jun 14 Wednesday
166	12	8	4	2	2	6	10	14	5	9	10	15	15	6	2	7	11	1	3	4	2	0	0	4	152	Jun 15 Thursday
167	1	0	3	0	3	1	3	11	6	6	8	1	7	7	16	14	5	4	2	0	1	2	1	1	103	Jun 16 Friday
168	4	7	1	0	4	2	3	3	3	5	14	4	1	2	12	1	2	4	1	2	2	3	0	0	80	Jun 17 Saturday
169	2	4	1	3	2	2	2	6	0	2	4	5	17	11	0	10	7	2	7	0	1	5	3	5	101	Jun 18 Sunday
170	3	11	3	6	5	1	9	5	9	12	2	8	13	7	10	7	9	3	5	2	9	0	4	4	147	Jun 19 Monday
171	4	11	1	6	4	3	4	4	9	1	7	5	8	4	2	5	9	8	2	2	10	15	2	5	131	Jun 20 Tuesday
172	3	2	0	4	6	8	6	5	6	10	2	11	21	25	3	5	12	4	5	3	6	5	9	4	165	Jun 21 Wednesday
173	1	6	0	9	2	4	7	11	15	3	10	19	20	14	14	11	5	2	11	9	4	2	3	1	183	Jun 22 Thursday
174	1	3	5	5	2	4	13	27	21	14	32	32	17	11	9	10	8	13	8	16	15	12	15	18	311	Jun 23 Friday
175	14	13	13	11	16	14	20	14	32	38	47	49	22	26	32	24	34	32	30	32	24	20	25	22	604	Jun 24 Saturday
176	11	22	11	8	5	18	12	13	7	6	20	11	7	8	13	10	13	5	2	6	2	3	11	6	230	Jun 25 Sunday
177	11	18	10	9	6	13	23	45	24	9	30	29	11	16	11	8	4	11	5	4	20	10	8	12	347	Jun 26 Monday
178	11	7	9	7	4	4	4	4	8	12	9	11	17	21	31	4	10	15	8	3	5	9	7	4	224	Jun 27 Tuesday
179	6	1	11	5	2	25	13	10	12	5	8	23	16	6	11	5	8	9	8	7	13	9	3	4	220	Jun 28 Wednesday
180	4	11	2	3	3	5	5	7	2	0	6	7	27	7	17	6	5	5	5	9	2	14	1	11	164	Jun 29 Thursday
181	6	5	2	0	6	3	1	4	3	9	2	11	21	7	5	3	10	4	23	73	8	5	7	1	219	Jun 30 Friday
182	3	4	2	2	7	4	7	5	1	5	11	3	7	5	7	7	2	10	6	2	6	1	9	2	118	Jul 01 Saturday
183	1	8	4	7	7	2	4	7	5	3	4	2	6	2	2	4	8	2	3	4	3	6	1	4	99	Jul 02 Sunday
184	9	26	10	0	3	2	4	2	3	8	8	12	14	19	8	1	6	6	5	1	23	9	18	6	203	Jul 03 Monday
185	6	11	20	12	6	12	14	14	28	28	31	75	40	68	86	63	21	4	7	13	7	6	9	8	589	Jul 04 Tuesday
186	3	11	4	10	3	36	41	63	70	37	35	20	26	42	11	11	16	11	7	16	16	11	2	6	508	Jul 05 Wednesday
187	4	3	13	2	9	9	8	2	26	31	20	18	45	41	10	12	14	6	3	10	1	16	3	4	310	Jul 06 Thursday
188	2	16	5	12	4	28	28	52	39	43	53	31	18	14	13	14	9	2	5	13	3	7	2	5	418	Jul 07 Friday
189	0	0	0	0	0	0	0	0	5	9	8	10	1	0	5	4	4	10	3	5	5	6	6	4	85	Jul 08 Saturday
190	4	1	11	1	3	1	6	7	2	0	4	2	5	4	3	2	6	8	8	5	6	5	2	4	100	Jul 09 Sunday
191	5	0	3	8	1	3	1	3	3	3	8	11	11	7	7	1	5	21	14	14	3	4	6	5	147	Jul 10 Monday
192	6	1	6	4	2	5	2	1	7	5	6	15	7	17	9	8	15	6	8	21	3	7	8	8	177	Jul 11 Tuesday
193	10	21	4	5	3	6	3	2	8	11	8	15	4	6	4	2	17	5	13	3	4	4	7	9	174	Jul 12 Wednesday
194	10	18	6	11	3	7	5	8	9	13	4	3	16	7	8	5	7	8	17	11	2	8	3	3	192	Jul 13 Thursday
195	2	17	5	6	4	3	4	9	4	14	8	21	12	13	4	12	8	13	21	6	15	6	6	16	229	Jul 14 Friday
196	5	6	10	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	26	Jul 15 Saturday
197	0	0	0	0	0	0	0	0	0	0	0	0	0	26	51	45	49	43	38	37	43	42	52	57	483	Jul 16 Sunday
198	57	48	50	48	51	28	21	23	19	19	16	24	18	17	23	12	18	16	22	14	10	0	1	7	562	Jul 17 Monday
199	8	2	5	6	1	13	4	10	6	2	2	12	7	10	60	12	14	12	8	0	0	0	0	0	194	Jul 18 Tuesday
200	0	0	0	0	0	0	0	0	0	0	0	0	0	9	7	3	9	7	5	14	6	5	1	3	69	Jul 19 Wednesday
201	5	7	3	4	6	16	3	4	5	4	6	9	6	0	3	9	14	5	18	3	10	2	3	2	147	Jul 20 Thursday
202	2	1	2	1	2	4	2	4	1	6	13	6	3	15	6	9	12	11	5	27	3	3	6	6	150	Jul 21 Friday

Table 3.5.1 (Page 2 of 4)

NRS .FKX Hourly distribution of detections

Day	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Sum	Date
203	3	1	14	4	1	7	3	11	3	6	3	7	0	7	3	1	3	4	3	9	6	2	1	3	105	Jul 22 Saturday
204	1	8	1	0	2	5	5	5	10	4	8	9	0	3	3	6	2	7	11	2	1	2	2	3	100	Jul 23 Sunday
205	6	3	4	1	2	4	6	4	4	6	8	9	3	9	15	5	20	7	12	10	4	1	4	4	151	Jul 24 Monday
206	18	1	4	5	2	7	5	4	3	6	4	10	12	10	7	15	8	3	15	3	6	4	8	1	161	Jul 25 Tuesday
207	5	0	0	0	0	0	2	1	0	13	11	11	17	1	5	4	12	6	13	4	8	5	2	11	131	Jul 26 Wednesday
208	21	3	1	1	1	9	8	5	1	3	7	4	9	12	9	9	6	5	9	2	4	3	5	5	142	Jul 27 Thursday
209	13	2	1	3	2	2	2	12	11	17	15	7	6	6	10	12	0	5	5	11	23	2	3	5	175	Jul 28 Friday
210	11	5	1	4	1	9	1	1	8	5	8	4	6	1	3	2	8	7	10	1	3	6	8	3	116	Jul 29 Saturday
211	7	2	4	4	0	31	12	11	6	12	14	6	11	3	11	9	5	9	2	1	2	6	1	3	172	Jul 30 Sunday
212	3	3	1	4	3	4	4	8	27	14	10	7	10	6	7	10	3	3	3	12	2	5	3	6	158	Jul 31 Monday
213	1	15	5	1	0	2	1	5	22	40	52	24	61	49	6	11	4	3	0	8	2	10	8	8	338	Aug 01 Tuesday
214	2	5	1	3	6	16	42	16	59	64	65	32	63	62	11	7	8	6	3	19	1	5	4	2	502	Aug 02 Wednesday
215	5	16	7	6	2	66	55	43	56	56	50	24	59	57	10	4	5	11	1	2	14	5	0	3	557	Aug 03 Thursday
216	0	12	3	3	3	37	15	4	6	5	7	13	5	11	27	2	7	9	17	6	0	3	2	0	197	Aug 04 Friday
217	1	5	1	5	3	11	2	2	1	0	0	0	0	0	0	0	0	0	0	0	1	3	8	6	49	Aug 05 Saturday
218	8	8	3	3	6	7	0	5	6	3	3	3	3	3	3	6	6	2	1	5	2	4	1	6	97	Aug 06 Sunday
219	4	6	1	3	4	14	1	9	9	5	21	9	26	21	0	0	0	0	0	0	0	0	0	0	133	Aug 07 Monday
220	0	0	0	0	0	0	0	15	21	25	34	9	45	32	7	9	5	2	7	8	0	7	3	2	231	Aug 08 Tuesday
221	4	2	18	3	5	38	42	21	49	21	21	9	16	13	9	12	3	6	3	8	4	9	2	4	322	Aug 09 Wednesday
222	9	1	8	3	1	2	4	9	10	12	11	19	42	11	7	6	2	7	6	12	4	11	3	2	202	Aug 10 Thursday
223	1	2	10	6	8	3	7	2	17	12	17	15	7	9	5	0	5	1	6	19	1	5	6	2	166	Aug 11 Friday
224	1	3	6	0	3	12	1	7	12	3	7	4	9	10	7	8	3	10	3	11	7	1	11	7	146	Aug 12 Saturday
225	3	4	7	7	5	7	9	6	5	3	16	10	3	3	6	7	3	6	6	1	5	4	7	6	139	Aug 13 Sunday
226	7	14	7	3	11	6	0	2	2	0	2	7	11	6	10	7	3	7	4	1	4	8	5	6	133	Aug 14 Monday
227	2	20	7	7	2	5	3	2	7	5	13	10	20	10	8	3	6	2	1	8	9	11	1	2	164	Aug 15 Tuesday
228	5	4	9	3	7	9	8	4	4	8	28	25	17	9	11	14	18	7	5	14	2	15	7	18	251	Aug 16 Wednesday
229	15	14	7	5	9	11	4	5	9	8	12	18	16	9	13	21	7	10	9	5	5	13	6	16	247	Aug 17 Thursday
230	9	10	18	10	9	5	3	6	6	3	6	16	12	28	10	2	4	1	7	14	11	5	1	10	206	Aug 18 Friday
231	6	6	5	6	8	13	3	6	3	0	3	3	2	3	4	6	1	13	6	3	8	10	9	6	133	Aug 19 Saturday
232	0	7	3	11	4	3	4	3	2	11	12	0	5	4	5	3	1	1	6	12	2	3	2	2	106	Aug 20 Sunday
233	0	6	28	2	7	2	1	11	2	8	13	1	11	2	3	7	16	5	4	3	15	1	2	2	152	Aug 21 Monday
234	8	16	12	2	9	14	3	3	5	7	6	6	24	17	16	12	10	10	3	8	6	7	7	5	216	Aug 22 Tuesday
235	3	3	3	0	11	9	6	21	20	4	8	7	16	8	6	6	10	5	5	9	4	9	2	7	182	Aug 23 Wednesday
236	2	19	10	2	7	9	8	4	5	1	5	10	16	10	9	9	8	7	4	4	3	4	1	2	159	Aug 24 Thursday
237	2	10	4	2	7	2	1	3	4	6	5	12	8	6	7	14	4	5	8	4	5	3	11	0	133	Aug 25 Friday
238	10	5	9	3	4	7	3	5	3	2	2	4	8	3	5	7	4	13	1	6	4	6	6	6	126	Aug 26 Saturday
239	8	7	8	8	11	7	7	2	8	10	7	6	1	2	1	8	3	7	9	7	1	1	3	3	135	Aug 27 Sunday
240	7	14	2	6	6	3	1	4	2	4	9	10	7	7	5	12	6	4	4	9	4	2	15	3	146	Aug 28 Monday
241	8	4	13	2	4	3	7	0	6	7	10	8	9	13	18	13	4	7	3	11	2	8	8	5	173	Aug 29 Tuesday
242	2	2	4	7	7	11	6	4	8	11	10	6	13	17	7	9	7	11	2	12	8	12	4	7	187	Aug 30 Wednesday
243	5	1	2	8	4	6	1	3	11	5	7	9	10	19	7	12	1	14	5	5	5	4	3	7	154	Aug 31 Thursday
244	7	13	4	9	1	12	2	4	4	3	7	6	9	11	8	0	10	5	4	14	5	6	4	11	159	Sep 01 Friday
245	13	5	8	14	2	7	3	9	7	5	9	1	5	3	2	3	7	6	3	13	17	12	11	29	194	Sep 02 Saturday
246	5	18	8	8	10	27	10	3	5	4	1	8	4	3	3	0	4	1	11	1	2	8	6	4	154	Sep 03 Sunday
247	7	19	6	3	10	4	6	0	3	1	6	12	9	3	10	9	9	2	3	9	3	1	1	1	137	Sep 04 Monday
248	10	15	6	2	4	6	2	1	7	11	12	13	18	14	17	1	8	7	3	19	7	18	2	4	207	Sep 05 Tuesday
249	4	5	6	3	5	5	9	9	7	4	7	10	8	12	2	2	4	5	7	9	15	13	8	29	188	Sep 06 Wednesday
250	30	27	13	11	4	9	7	10	13	6	10	16	18	16	14	4	14	9	5	12	3	4	5	5	265	Sep 07 Thursday
251	8	20	12	8	14	5	3	1	14	10	17	3	13	10	7	9	10	3	8	24	8	8	3	4	222	Sep 08 Friday
252	5	13	7	2	3	17	4	1	8	11	2	5	12	17	4	9	2	8	6	3	3	3	10	4	159	Sep 09 Saturday
253	9	11	12	8	6	15	13	9	11	11	11	7	8	6	9	6	3	8	4	4	5	6	6	7	195	Sep 10 Sunday
254	11	11	6	6	10	4	1	2	8	3	7	9	15	7	7	1	10	6	4	5	3	7	16	15	174	Sep 11 Monday
255	8	9	27	13	6	14	6	6	2	4	7	6	7	15	8	2	15	2	3	4	4	13	8	4	193	Sep 12 Tuesday
256	7	5	5	1	7	7	1	0	18	11	13	23	17	16	15	9	9	7	13	3	8	11	1	3	210	Sep 13 Wednesday
257	13	16	10	7	10	11	8	3	7	19	16	29	17	12	12	7	9	9	5	10	4	5	4	3	246	Sep 14 Thursday
258	6	17	4	0	6	6	8	14	11	10	17	13	19	17	7	6	15	1	5	19	0	10	2	1	214	Sep 15 Friday

Table 3.5.1 (Page 3 of 4)

NRS .FKX Hourly distribution of detections

Day	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Sum	Date
259	5	13	1	46	84	37	11	17	3	3	26	16	13	25	5	5	8	11	8	9	4	18	10	3	381	Sep 16 Saturday
260	9	6	15	11	10	10	14	10	8	13	8	7	9	16	8	8	19	16	4	6	6	8	8	12	241	Sep 17 Sunday
261	11	16	15	13	7	10	11	6	9	18	7	7	13	23	2	7	4	13	8	7	5	5	9	4	230	Sep 18 Monday
262	8	11	20	7	8	7	4	5	15	12	8	12	21	18	8	7	3	5	3	7	17	16	5	9	236	Sep 19 Tuesday
263	8	7	7	12	12	139	102	6	11	5	9	23	11	10	11	5	15	11	3	10	3	4	12	8	444	Sep 20 Wednesday
264	9	16	4	9	5	7	8	9	10	8	6	13	25	11	7	7	6	10	4	10	4	6	9	7	210	Sep 21 Thursday
265	7	13	11	13	11	13	12	8	9	10	9	22	12	4	10	11	5	12	6	11	7	1	2	4	223	Sep 22 Friday
266	0	5	12	6	2	14	19	16	14	5	4	12	14	2	14	18	17	2	9	3	5	3	8	4	208	Sep 23 Saturday
267	6	8	6	4	9	6	6	4	2	7	1	6	3	6	3	5	0	5	14	4	10	9	5	8	137	Sep 24 Sunday
268	7	13	2	16	5	6	5	2	5	3	2	12	13	9	9	3	8	7	1	8	7	4	3	4	154	Sep 25 Monday
269	2	5	3	6	6	8	7	4	3	3	5	5	9	12	15	9	3	8	4	8	6	2	5	4	142	Sep 26 Tuesday
270	1	3	11	11	4	7	5	2	3	3	3	14	17	13	15	10	10	10	5	0	6	1	5	7	166	Sep 27 Wednesday
271	27	3	9	15	3	6	15	5	8	6	4	10	13	14	23	11	15	2	1	4	5	2	2	3	206	Sep 28 Thursday
272	2	6	23	6	5	5	6	5	6	4	10	9	12	7	13	9	6	6	10	1	9	3	13	14	190	Sep 29 Friday
273	3	1	2	3	5	5	46	34	5	9	12	9	23	14	13	9	40	26	2	10	8	11	8	7	305	Sep 30 Saturday
NRS	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23		
Sum	1262	1557	1345	1174	1175	1986	1377	1297	1580	1809	1980	1991	2210	2052	1643	1356	1494	1288	1206	1723	1203	1335	1099	1229	36371	Total sum
183	7	9	7	6	6	11	8	7	9	10	11	11	12	11	9	7	8	7	7	9	7	7	6	7	199	Total average
123	7	9	8	7	6	12	8	7	10	10	12	13	15	13	10	8	9	7	6	11	7	7	5	6	212	Average workdays
60	6	7	6	6	7	9	7	6	6	10	9	7	6	7	7	7	7	8	7	7	7	7	8	9	172	Average weekends

Table 3.5.1. (Page 4 of 4) Daily and hourly distribution of NORESS detections. For each day is shown number of detections within each hour of the day, and number of detections for that day. The end statistics give total number of detections distributed for each hour and the total sum of detections during the period. The averages show number of processed days, hourly distribution and average per processed day.

ARC .FKX Hourly distribution of detections

Day	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Sum	Date
91	12	16	14	19	32	19	16	25	16	15	17	22	22	14	9	14	5	3	13	11	15	19	16	23	387	Apr 01 Saturday
92	11	11	10	18	17	10	2	7	3	11	17	11	8	9	7	7	12	17	21	22	12	8	5	14	270	Apr 02 Sunday
93	7	11	15	23	13	15	15	15	21	7	20	27	21	18	14	18	10	21	13	16	18	7	19	25	389	Apr 03 Monday
94	14	6	13	21	19	12	14	20	25	21	15	16	11	19	18	9	17	25	18	34	52	65	84	79	627	Apr 04 Tuesday
95	78	84	94	112	104	81	54	41	16	14	22	32	43	30	7	26	21	12	11	10	14	20	37	23	986	Apr 05 Wednesday
96	28	18	27	17	13	15	17	28	31	21	25	21	28	23	23	21	18	17	13	25	20	18	15	21	503	Apr 06 Thursday
97	30	46	45	58	32	20	24	21	31	24	14	40	17	15	12	16	12	21	8	17	10	12	49	47	621	Apr 07 Friday
98	64	89	104	98	115	81	71	41	41	31	48	48	51	43	28	21	30	13	21	5	4	6	27	24	1104	Apr 08 Saturday
99	34	36	50	64	65	53	40	17	21	34	33	44	41	24	28	16	33	20	14	13	14	11	19	30	754	Apr 09 Sunday
100	21	30	25	33	26	36	17	11	17	11	19	33	30	28	28	13	23	18	9	9	10	9	8	25	489	Apr 10 Monday
101	14	7	8	5	11	16	22	11	17	27	33	19	19	26	22	33	11	5	15	12	19	16	7	17	392	Apr 11 Tuesday
102	5	3	3	3	13	21	13	26	37	7	13	31	32	19	15	19	20	14	19	13	17	14	17	12	386	Apr 12 Wednesday
103	13	16	41	60	33	13	15	19	13	12	20	20	23	29	14	26	12	23	16	11	6	1	23	27	486	Apr 13 Thursday
104	26	14	30	37	39	24	14	14	16	10	20	11	25	12	11	14	19	8	14	8	12	16	30	39	463	Apr 14 Friday
105	50	54	61	48	24	14	20	5	30	20	16	13	10	17	12	13	19	16	15	16	3	26	58	63	623	Apr 15 Saturday
106	64	77	89	92	61	31	20	19	9	23	5	22	15	28	10	14	14	15	17	11	14	29	6	26	711	Apr 16 Sunday
107	9	15	9	22	6	7	15	16	18	22	12	25	16	26	8	11	26	19	9	13	5	15	31	29	384	Apr 17 Monday
108	12	7	13	18	17	29	12	21	18	25	14	18	24	11	13	15	25	9	5	17	14	22	19	20	398	Apr 18 Tuesday
109	15	17	11	15	31	14	14	10	25	36	25	20	23	16	16	27	20	24	20	22	19	10	19	23	472	Apr 19 Wednesday
110	12	10	6	5	5	8	25	17	17	10	8	17	16	28	14	20	30	13	19	15	17	15	21	22	370	Apr 20 Thursday
111	54	58	51	40	32	38	37	35	28	21	30	37	28	34	26	20	16	32	34	15	25	7	23	26	747	Apr 21 Friday
112	16	9	15	12	18	11	21	20	19	20	13	21	19	8	16	20	12	11	30	18	13	17	16	12	387	Apr 22 Saturday
113	7	3	11	22	24	40	33	20	29	19	19	5	16	23	16	7	13	24	13	14	24	16	13	19	430	Apr 23 Sunday
114	16	16	17	8	9	9	15	14	20	21	12	18	26	7	9	18	11	26	17	9	11	19	12	32	372	Apr 24 Monday
115	12	2	10	8	8	15	18	27	19	18	19	24	27	19	23	32	25	18	8	21	23	6	18	31	431	Apr 25 Tuesday
116	11	19	24	7	9	12	30	4	25	23	19	18	23	16	17	28	13	21	21	13	9	14	25	29	430	Apr 26 Wednesday
117	31	43	47	45	40	26	14	22	28	26	18	28	34	18	15	29	23	28	32	18	16	31	41	56	709	Apr 27 Thursday
118	83	93	103	90	98	71	57	48	26	28	31	41	27	22	40	30	22	34	13	17	16	14	21	36	1061	Apr 28 Friday
119	45	83	87	94	83	64	46	26	26	27	16	26	28	13	38	20	15	15	15	12	14	15	22	15	845	Apr 29 Saturday
120	22	46	47	53	71	58	48	31	17	9	12	27	31	22	22	22	19	12	11	7	16	30	20	13	666	Apr 30 Sunday
121	14	18	40	32	33	35	22	6	20	17	15	25	20	14	18	24	20	10	21	11	20	10	26	22	493	May 01 Monday
122	11	12	15	27	22	15	27	24	22	12	19	19	19	26	15	21	20	12	14	14	27	11	23	19	446	May 02 Tuesday
123	10	5	20	15	8	13	16	13	7	16	18	39	23	17	21	34	23	20	15	14	8	14	28	18	415	May 03 Wednesday
124	20	18	10	6	9	11	11	13	16	26	30	27	11	11	21	36	20	17	35	12	8	21	30	18	437	May 04 Thursday
125	6	7	10	11	37	32	12	20	24	27	30	33	34	27	21	20	23	24	18	21	13	14	28	31	523	May 05 Friday
126	27	7	22	22	10	2	17	12	17	12	11	27	6	12	11	19	6	6	14	20	22	14	14	23	353	May 06 Saturday
127	6	13	30	5	9	25	10	12	13	18	10	9	14	19	14	12	7	13	26	12	20	21	21	22	361	May 07 Sunday
128	13	4	9	21	12	23	10	13	11	18	17	11	21	16	24	16	23	17	33	14	21	17	21	25	410	May 08 Monday
129	7	17	11	6	13	17	22	12	15	12	27	16	13	8	19	19	23	18	15	14	22	27	15	28	396	May 09 Tuesday
130	39	20	31	49	16	11	12	22	9	16	23	11	27	18	20	23	17	19	24	13	14	15	39	62	550	May 10 Wednesday
131	48	73	86	88	58	35	16	14	10	8	15	25	12	18	21	20	3	14	13	15	10	7	28	20	657	May 11 Thursday
132	20	16	35	50	58	24	10	21	30	26	39	27	22	18	35	28	25	10	25	19	22	19	14	35	628	May 12 Friday
133	13	5	21	17	16	12	24	16	17	42	28	31	13	11	11	19	11	8	19	12	13	22	17	30	428	May 13 Saturday
134	11	12	20	14	31	9	11	19	14	19	13	19	24	7	18	18	11	9	9	21	4	11	32	22	378	May 14 Sunday
135	19	11	18	5	13	9	16	7	23	16	15	26	30	24	9	19	1	9	23	16	31	12	18	12	382	May 15 Monday
136	13	23	8	13	28	13	16	20	23	24	19	20	23	32	15	30	15	27	15	11	35	41	45	33	542	May 16 Tuesday
137	22	20	36	6	24	20	18	14	9	30	21	22	23	19	16	18	21	13	16	18	10	21	13	16	446	May 17 Wednesday
138	23	9	6	7	18	16	16	18	6	18	22	31	18	14	23	10	10	16	12	9	11	8	22	16	359	May 18 Thursday
139	4	11	10	11	13	9	23	13	20	23	31	27	20	22	16	22	18	14	28	16	16	15	34	25	441	May 19 Friday
140	16	14	27	22	15	8	8	20	24	30	17	28	34	39	19	19	17	25	31	11	20	16	22	24	506	May 20 Saturday
141	21	13	9	28	9	19	17	19	17	17	12	15	32	22	30	9	16	26	16	18	14	24	21	18	442	May 21 Sunday
142	5	3	14	21	22	8	14	20	24	26	37	42	36	22	23	20	30	29	19	11	18	12	11	21	488	May 22 Monday
143	8	9	16	16	6	8	17	31	31	28	29	19	38	30	15	40	26	23	35	10	12	18	16	21	502	May 23 Tuesday
144	8	19	13	10	15	11	31	36	32	31	32	32	42	33	28	29	15	18	18	19	21	14	15	16	538	May 24 Wednesday
145	4	26	18	7	12	19	19	28	19	32	23	6	30	24	21	21	13	21	17	17	7	9	13	12	418	May 25 Thursday
146	3	8	16	15	6	23	33	21	37	29	31	49	51	29	21	27	12	22	18	17	13	9	15	19	524	May 26 Friday

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ARC .FKX Hourly distribution of detections

Day	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Sum	Date
147	12	12	11	12	8	4	7	11	7	27	21	22	22	29	33	15	10	13	18	12	18	28	14	22	388	May 27 Saturday
148	8	8	21	10	8	5	15	6	9	15	15	12	9	24	20	13	10	10	16	18	15	9	14	20	310	May 28 Sunday
149	15	12	12	7	6	15	27	24	36	17	16	22	35	19	8	19	15	7	10	10	12	14	18	13	389	May 29 Monday
150	3	10	11	8	11	18	27	30	20	18	10	17	20	29	23	14	17	10	16	12	7	3	15	18	367	May 30 Tuesday
151	20	8	7	8	11	5	11	22	43	17	37	36	32	35	17	22	25	9	19	15	8	11	28	19	465	May 31 Wednesday
152	10	5	6	4	9	1	5	33	35	24	20	18	11	18	16	19	15	10	21	17	11	8	15	23	354	Jun 01 Thursday
153	9	11	6	10	2	6	19	19	16	28	24	32	26	9	8	22	20	13	14	18	10	3	17	18	360	Jun 02 Friday
154	7	4	6	18	10	11	23	20	16	26	17	8	19	18	18	14	9	7	15	4	17	16	0	0	303	Jun 03 Saturday
155	6	11	18	1	12	5	7	9	11	9	14	28	14	11	10	16	5	10	16	13	11	10	3	13	263	Jun 04 Sunday
156	8	6	4	2	8	10	22	38	16	12	13	10	14	22	15	28	16	43	26	19	10	3	11	25	381	Jun 05 Monday
157	13	9	11	20	18	44	18	46	27	28	22	13	38	29	8	12	10	15	14	19	9	12	16	14	465	Jun 06 Tuesday
158	7	19	11	7	15	5	17	35	44	17	39	44	36	39	20	29	26	23	12	18	23	26	31	16	559	Jun 07 Wednesday
159	11	5	11	5	12	17	24	23	19	16	24	23	36	41	18	20	16	12	10	13	9	14	10	13	402	Jun 08 Thursday
160	14	9	3	12	14	7	8	28	32	19	39	36	28	14	16	16	15	7	20	12	2	10	10	18	389	Jun 09 Friday
161	3	6	10	9	17	20	11	10	16	24	28	9	17	7	6	12	7	5	24	19	10	9	22	18	319	Jun 10 Saturday
162	7	2	4	11	13	6	8	13	15	14	10	17	19	18	6	12	10	9	27	22	17	14	17	15	306	Jun 11 Sunday
163	5	4	5	13	8	7	8	10	15	13	12	23	13	7	11	18	19	16	16	10	11	14	12	27	297	Jun 12 Monday
164	11	6	19	10	10	17	15	24	4	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	117	Jun 13 Tuesday
165	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	22	10	25	8	18	13	12	11	123	Jun 14 Wednesday
166	24	10	8	9	14	14	24	34	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	155	Jun 15 Thursday
167	0	0	0	0	0	0	0	0	13	28	42	34	37	30	29	21	18	39	28	22	10	15	20	16	402	Jun 16 Friday
168	10	6	20	10	8	5	13	26	31	10	26	44	17	17	19	8	10	17	10	16	8	15	11	10	367	Jun 17 Saturday
169	5	6	6	1	6	2	5	19	24	25	25	24	20	15	7	10	12	14	19	5	20	15	7	19	311	Jun 18 Sunday
170	10	13	10	11	10	13	17	30	28	44	26	27	13	46	22	31	15	11	12	9	11	6	17	12	444	Jun 19 Monday
171	12	8	3	7	11	17	15	31	33	44	33	56	24	41	30	34	15	14	24	24	13	24	29	13	555	Jun 20 Tuesday
172	6	20	8	6	11	12	45	33	41	33	25	25	23	26	15	19	21	12	7	17	17	19	19	15	475	Jun 21 Wednesday
173	17	17	14	10	20	10	36	23	28	21	17	27	22	13	56	19	7	19	11	23	10	8	14	17	459	Jun 22 Thursday
174	8	10	2	1	16	16	49	40	43	44	50	44	35	28	48	25	26	31	30	5	10	15	16	20	612	Jun 23 Friday
175	19	16	18	24	9	17	15	32	27	28	18	9	11	6	13	24	17	12	7	33	38	15	11	16	435	Jun 24 Saturday
176	22	50	16	12	15	25	12	11	12	13	23	35	22	14	16	16	9	12	40	61	29	99	26	20	610	Jun 25 Sunday
177	20	9	2	9	13	9	13	9	5	7	15	10	5	3	9	19	10	4	12	19	21	22	8	11	264	Jun 26 Monday
178	14	3	8	4	13	12	24	5	9	9	11	15	13	21	9	9	9	18	13	8	11	19	14	12	283	Jun 27 Tuesday
179	18	6	13	15	6	8	12	15	27	18	23	42	32	24	22	14	22	13	18	22	23	21	6	19	439	Jun 28 Wednesday
180	9	15	7	5	14	19	18	19	15	23	14	22	47	20	5	16	14	13	20	5	12	4	6	22	364	Jun 29 Thursday
181	3	7	5	6	5	9	11	24	17	26	16	36	17	10	11	13	18	10	17	14	7	15	6	26	329	Jun 30 Friday
182	13	6	13	17	25	7	22	10	18	0	25	21	30	15	18	12	8	8	22	16	18	17	14	18	373	Jul 01 Saturday
183	7	10	12	5	10	2	18	10	19	24	22	30	35	21	27	11	10	22	17	12	11	8	33	24	400	Jul 02 Sunday
184	15	16	13	11	24	10	21	23	39	30	40	31	26	23	14	22	25	24	14	16	29	14	19	25	524	Jul 03 Monday
185	8	11	19	40	16	11	8	13	42	28	31	35	15	23	9	39	51	83	94	34	41	29	27	25	732	Jul 04 Tuesday
186	10	5	11	21	15	5	9	27	61	53	24	29	22	15	31	22	19	15	15	11	6	9	11	19	465	Jul 05 Wednesday
187	7	12	20	6	15	12	19	28	28	37	74	65	53	64	43	19	40	43	32	70	39	18	6	24	774	Jul 06 Thursday
188	12	17	8	29	25	9	20	39	30	51	54	42	43	25	26	20	35	23	31	18	16	18	16	16	623	Jul 07 Friday
189	5	13	16	11	7	12	18	29	18	13	32	30	17	11	14	24	19	18	11	8	18	18	6	10	378	Jul 08 Saturday
190	14	11	20	8	21	5	10	19	18	11	21	28	11	10	16	12	8	12	11	12	4	8	14	18	322	Jul 09 Sunday
191	9	2	10	14	9	9	4	8	15	20	19	19	13	9	3	19	8	13	18	10	6	18	11	11	277	Jul 10 Monday
192	8	11	24	7	9	4	8	26	35	43	15	30	15	22	17	11	20	12	11	16	8	17	13	28	410	Jul 11 Tuesday
193	8	9	6	19	6	12	27	14	18	25	15	16	11	13	6	20	14	10	12	5	16	12	22	19	335	Jul 12 Wednesday
194	16	14	15	7	12	14	13	11	11	10	11	13	18	11	11	22	19	34	14	16	13	9	23	40	377	Jul 13 Thursday
195	13	19	31	13	19	13	6	0	27	24	27	45	39	42	35	36	25	20	9	25	14	18	15	11	526	Jul 14 Friday
196	10	21	13	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	49	Jul 15 Saturday
197	0	0	0	0	0	0	0	0	0	0	0	0	10	19	27	22	28	11	10	12	5	9	5	21	179	Jul 16 Sunday
198	16	9	4	17	24	14	14	18	26	19	40	45	30	24	20	21	32	22	18	32	16	19	3	23	506	Jul 17 Monday
199	3	1	12	16	16	9	8	3	0	0	0	0	0	0	0	0	2	16	22	19	26	14	18	36	221	Jul 18 Tuesday
200	12	8	21	7	6	11	16	36	30	41	40	41	24	35	18	14	18	16	18	11	9	6	26	27	491	Jul 19 Wednesday
201	9	5	10	8	26	9	36	31	22	42	29	63	33	51	30	19	16	17	16	20	12	22	16	20	562	Jul 20 Thursday
202	9	5	14	12	13	15	48	35	21	29	51	62	53	57	17	15	23	18	39	17	7	3	26	18	607	Jul 21 Friday

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ARC .FKX Hourly distribution of detections

Day	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Sum	Date
203	17	4	20	10	7	14	5	23	13	13	25	20	10	16	12	10	11	11	25	14	19	5	10	10	324	Jul 22 Saturday
204	4	13	6	8	16	6	7	15	13	27	34	36	11	22	19	10	5	12	16	8	10	11	14	17	340	Jul 23 Sunday
205	8	15	16	12	6	14	24	34	22	26	22	27	39	18	24	7	11	10	27	19	10	15	25	19	450	Jul 24 Monday
206	10	19	18	17	18	5	19	20	17	19	21	20	12	24	17	17	18	20	23	21	27	26	48	41	497	Jul 25 Tuesday
207	34	37	31	24	10	9	9	19	21	24	15	17	7	21	15	27	14	19	14	7	23	18	15	23	453	Jul 26 Wednesday
208	11	8	7	6	7	22	24	10	25	32	34	33	36	27	13	13	19	34	20	21	19	5	0	9	435	Jul 27 Thursday
209	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	Jul 28 Friday
210	0	0	0	0	0	0	0	0	0	0	3	21	21	17	14	20	21	15	19	19	7	28	13	9	227	Jul 29 Saturday
211	23	9	15	12	5	42	21	26	14	42	26	28	28	18	19	13	22	18	20	29	15	14	10	10	479	Jul 30 Sunday
212	9	12	12	16	22	10	10	12	26	34	38	30	17	11	17	26	16	16	25	27	5	32	27	39	489	Jul 31 Monday
213	20	14	13	15	18	16	28	23	18	31	35	44	27	11	20	25	39	33	38	32	29	22	23	21	595	Aug 01 Tuesday
214	14	7	28	14	16	32	25	45	59	28	37	43	44	32	37	27	19	2	17	26	9	2	0	11	574	Aug 02 Wednesday
215	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	12	23	36	10	16	16	17	20	164	Aug 03 Thursday
216	17	16	6	7	12	18	56	46	27	32	47	41	28	22	16	11	12	17	19	9	7	13	12	12	503	Aug 04 Friday
217	17	7	15	17	13	9	7	16	7	18	27	34	29	22	21	13	18	12	6	16	15	16	21	18	394	Aug 05 Saturday
218	23	10	8	7	19	4	10	15	9	24	16	22	31	22	26	20	19	21	20	20	24	6	12	26	414	Aug 06 Sunday
219	7	10	21	6	1	14	21	26	44	54	40	22	16	22	20	7	12	24	22	25	15	22	10	12	473	Aug 07 Monday
220	10	20	9	10	9	16	54	32	13	19	43	50	35	16	16	16	25	19	19	16	14	15	21	15	512	Aug 08 Tuesday
221	21	2	14	16	14	6	9	14	21	18	25	43	18	22	14	16	19	27	14	22	28	16	24	13	436	Aug 09 Wednesday
222	17	5	8	7	21	15	23	37	33	12	22	20	15	21	12	9	13	16	10	16	13	12	23	20	400	Aug 10 Thursday
223	7	3	6	3	12	14	48	45	21	28	25	24	20	37	13	18	16	19	25	13	14	12	16	22	461	Aug 11 Friday
224	7	7	3	16	24	18	16	12	25	39	22	14	32	18	21	16	13	20	17	26	19	15	26	25	451	Aug 12 Saturday
225	6	11	14	15	19	24	15	28	15	31	26	38	23	25	9	19	11	22	20	4	24	12	26	24	461	Aug 13 Sunday
226	15	8	8	2	26	15	14	17	18	11	32	24	18	20	11	16	8	15	30	12	18	13	18	19	388	Aug 14 Monday
227	16	7	10	22	11	23	22	30	26	20	29	34	23	25	21	25	30	25	27	12	9	16	22	30	515	Aug 15 Tuesday
228	5	14	16	10	11	8	34	25	20	61	72	67	30	26	34	42	21	13	19	15	19	11	22	50	645	Aug 16 Wednesday
229	32	13	14	7	12	19	14	20	43	35	52	36	20	30	18	35	17	10	21	10	14	10	17	34	533	Aug 17 Thursday
230	18	7	26	12	20	28	34	21	19	28	16	27	17	18	18	10	13	15	10	12	15	16	17	24	441	Aug 18 Friday
231	7	15	3	9	13	10	17	16	20	8	14	10	14	16	21	14	26	21	17	7	11	8	13	21	331	Aug 19 Saturday
232	5	21	11	23	3	14	16	14	15	16	12	5	8	4	8	14	10	11	10	19	8	13	12	10	282	Aug 20 Sunday
233	6	10	18	4	5	2	11	13	17	16	28	25	17	9	7	3	9	5	18	15	6	3	4	13	264	Aug 21 Monday
234	8	11	3	7	10	23	28	27	25	37	42	31	34	34	34	56	27	37	32	33	20	21	24	13	617	Aug 22 Tuesday
235	10	16	10	2	12	21	32	35	24	37	37	14	30	12	15	29	11	12	5	9	13	9	19	26	440	Aug 23 Wednesday
236	3	17	13	7	15	14	24	28	32	7	19	32	29	25	29	15	32	31	18	29	20	17	19	31	506	Aug 24 Thursday
237	13	12	8	6	17	30	17	0	0	13	28	42	28	21	25	21	22	31	9	25	23	17	42	37	487	Aug 25 Friday
238	27	38	36	31	29	29	28	15	20	13	15	13	11	11	15	17	6	12	11	2	8	9	9	9	414	Aug 26 Saturday
239	19	11	20	15	15	14	9	3	11	16	18	19	14	20	5	6	21	15	20	25	7	9	21	13	346	Aug 27 Sunday
240	7	4	7	10	18	5	35	50	51	27	29	29	36	18	30	35	43	15	14	35	9	10	19	20	556	Aug 28 Monday
241	18	3	16	51	70	19	75	95	32	26	12	89	92	105	85	85	88	104	76	70	76	50	44	41	1422	Aug 29 Tuesday
242	20	21	10	33	13	28	61	39	34	30	47	47	26	22	19	44	38	31	14	15	9	21	13	20	655	Aug 30 Wednesday
243	9	6	10	11	19	20	32	34	25	28	30	26	26	35	23	32	30	37	24	24	47	6	17	28	579	Aug 31 Thursday
244	5	21	19	3	11	24	47	32	69	35	41	47	26	37	18	20	24	26	17	22	13	17	24	13	611	Sep 01 Friday
245	19	81	81	85	88	84	79	86	35	19	14	30	21	9	30	87	83	65	63	60	49	27	21	22	1238	Sep 02 Saturday
246	6	10	3	5	44	87	85	74	59	29	18	7	32	54	47	43	55	41	29	41	31	53	49	27	929	Sep 03 Sunday
247	9	17	13	7	21	17	39	48	34	40	54	45	58	48	37	56	38	56	39	28	28	23	11	18	784	Sep 04 Monday
248	12	19	15	21	24	38	46	55	46	37	25	36	19	30	30	51	44	37	15	23	24	27	22	12	708	Sep 05 Tuesday
249	16	6	28	12	6	32	45	43	50	43	33	49	32	29	28	27	33	23	34	20	14	4	23	27	657	Sep 06 Wednesday
250	17	13	7	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	55	Sep 07 Thursday
251	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Sep 08 Friday
252	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Sep 09 Saturday
253	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Sep 10 Sunday
254	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Sep 11 Monday
255	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Sep 12 Tuesday
256	0	0	0	0	0	0	0	0	0	0	31	57	60	68	70	53	25	69	52	31	34	38	37	21	646	Sep 13 Wednesday
257	8	19	13	12	19	22	23	27	51	32	74	71	74	46	64	44	28	15	22	21	10	11	59	37	802	Sep 14 Thursday
258	50	72	64	80	50	30	56	47	79	66	77	79	93	86	78	48	21	16	17	21	11	22	21	15	1199	Sep 15 Friday

Table 3.5.2 (Page 3 of 4)

ARC .FKX Hourly distribution of detections

Day	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Sum	Date
259	10	14	15	22	19	13	12	17	28	17	21	24	18	21	18	21	17	17	18	13	12	22	21	21	431	Sep 16 Saturday
260	6	14	11	14	18	10	4	14	12	24	8	14	25	17	20	14	17	16	17	12	25	15	15	26	368	Sep 17 Sunday
261	6	6	11	13	22	28	41	48	41	27	43	35	28	46	17	31	51	27	21	13	24	11	16	18	624	Sep 18 Monday
262	11	20	22	8	6	20	18	28	29	12	24	24	22	15	18	20	18	12	10	23	16	14	23	20	433	Sep 19 Tuesday
263	15	17	10	22	16	13	27	34	19	28	28	25	27	42	20	33	18	23	21	30	36	21	50	48	623	Sep 20 Wednesday
264	40	46	47	45	39	40	41	47	50	24	52	47	24	47	29	37	23	21	25	24	25	5	20	16	814	Sep 21 Thursday
265	9	23	14	15	12	23	29	16	20	24	45	37	33	30	24	21	25	18	20	18	20	10	24	18	528	Sep 22 Friday
266	11	7	19	15	20	7	8	16	23	8	8	28	21	40	18	25	25	11	13	17	19	8	19	7	393	Sep 23 Saturday
267	11	6	10	5	3	3	8	20	26	23	18	8	11	13	13	8	23	12	20	19	11	6	6	20	303	Sep 24 Sunday
268	19	6	12	9	14	19	17	15	17	18	23	15	26	20	21	5	29	18	21	18	18	16	8	12	396	Sep 25 Monday
269	25	18	12	9	5	16	27	20	30	37	7	0	15	23	21	29	45	29	23	17	25	13	12	11	469	Sep 26 Tuesday
270	21	19	32	8	30	20	34	42	48	41	28	46	40	33	30	21	47	26	24	11	35	40	38	28	742	Sep 27 Wednesday
271	40	38	23	27	42	30	34	56	30	23	13	24	35	39	46	33	38	48	75	49	39	29	26	36	873	Sep 28 Thursday
272	37	25	31	23	25	37	32	48	22	35	41	32	48	26	22	31	27	25	22	27	26	25	21	33	721	Sep 29 Friday
273	27	20	16	19	22	18	28	20	10	26	31	26	36	34	33	41	29	32	38	35	47	39	45	51	723	Sep 30 Saturday

ARC	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23		
Sum		2889		3244		3136		4067		4021		4850		4081		3760		3419		3122		2840		3869		
	2752		3283		3392		3835		4091		4347		4403		3536		3490		3524		2959		3464		86374	Total sum
178	15	16	18	18	19	18	22	23	23	23	24	27	25	23	20	21	20	19	20	18	17	16	19	22	485	Total average
120	15	15	16	16	17	17	23	25	26	24	27	30	27	25	21	23	21	21	20	18	17	16	20	23	502	Average workdays
58	16	19	23	22	22	19	19	19	18	19	18	21	20	19	17	18	17	16	18	17	15	17	18	20	446	Average weekends

Table 3.5.2.(Page 4 of 4) Daily and hourly distribution of ARCESS detections. For each day is shown number of detections within each hour of the day, and number of detections for that day. The end statistics give total number of detections distributed for each hour and the total sum of detections during the period. The averages show number of processed days, hourly distribution and average per processed day.

FIN .FKX Hourly distribution of detections

Day	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Sum	Date
91	17	21	23	27	23	20	21	24	21	23	24	32	20	17	24	28	20	18	21	20	18	21	21	25	529	Apr 01 Saturday
92	23	25	24	21	24	23	23	20	21	23	16	25	24	24	20	23	25	23	27	28	21	26	24	25	558	Apr 02 Sunday
93	29	14	35	31	21	18	27	17	17	17	17	24	24	31	23	13	15	13	17	20	26	18	16	29	512	Apr 03 Monday
94	28	25	36	27	20	18	16	16	27	24	21	27	24	10	10	15	10	23	13	18	15	21	14	13	471	Apr 04 Tuesday
95	15	20	18	14	13	18	16	18	22	12	13	25	24	29	12	16	16	14	18	13	22	17	22	17	424	Apr 05 Wednesday
96	27	16	32	29	25	14	10	7	7	11	12	19	12	8	10	13	11	9	6	14	9	10	17	16	344	Apr 06 Thursday
97	16	22	14	8	4	4	8	8	8	13	17	19	14	8	11	14	13	20	12	17	20	19	30	25	344	Apr 07 Friday
98	18	29	24	31	29	29	30	18	19	19	11	13	22	20	19	19	17	21	24	16	16	15	18	22	499	Apr 08 Saturday
99	18	24	16	24	21	20	21	19	13	19	14	17	16	10	22	18	21	18	17	14	15	12	13	16	418	Apr 09 Sunday
100	15	17	10	11	11	8	9	7	5	9	8	20	11	30	19	24	7	14	16	13	6	13	20	16	319	Apr 10 Monday
101	15	13	9	18	6	7	4	13	10	8	5	26	22	13	12	13	7	7	5	12	14	16	19	13	287	Apr 11 Tuesday
102	12	14	16	8	8	6	9	6	13	9	16	25	10	15	12	12	8	11	8	13	15	16	17	13	292	Apr 12 Wednesday
103	19	12	20	12	10	12	11	8	18	16	20	23	10	13	13	16	13	16	14	13	13	14	19	20	355	Apr 13 Thursday
104	17	16	11	16	18	15	17	19	25	26	14	19	17	20	19	18	17	18	28	15	25	19	17	18	444	Apr 14 Friday
105	21	26	14	13	10	16	9	14	11	8	8	13	13	13	9	8	9	9	13	15	11	13	9	15	300	Apr 15 Saturday
106	14	12	27	17	15	14	8	9	5	18	8	11	7	7	7	6	5	11	12	13	13	15	9	10	273	Apr 16 Sunday
107	15	14	17	13	5	8	7	13	8	13	12	10	11	18	7	13	10	17	15	15	18	15	15	18	307	Apr 17 Monday
108	22	13	15	6	13	6	0	0	8	14	16	14	8	9	14	12	1	6	8	11	7	3	16	10	232	Apr 18 Tuesday
109	3	9	13	23	26	13	14	23	15	18	24	25	19	18	8	6	7	11	5	9	7	3	15	13	327	Apr 19 Wednesday
110	13	9	11	12	22	25	18	28	18	24	10	33	13	21	17	10	9	11	9	12	14	9	15	15	378	Apr 20 Thursday
111	34	36	35	13	18	21	18	13	12	12	13	28	13	21	5	9	12	12	4	10	20	6	10	8	383	Apr 21 Friday
112	13	10	13	7	5	6	9	1	9	5	9	13	4	11	8	5	7	5	7	5	8	6	7	5	178	Apr 22 Saturday
113	8	4	7	10	9	30	29	10	9	10	10	7	7	9	9	5	3	13	14	13	14	13	7	17	267	Apr 23 Sunday
114	12	13	11	16	23	24	14	11	7	7	17	21	20	13	14	12	10	12	13	8	4	6	13	16	317	Apr 24 Monday
115	7	17	13	9	19	11	11	8	19	23	16	14	22	28	10	13	7	12	8	9	7	10	3	11	307	Apr 25 Tuesday
116	7	12	15	11	9	3	5	11	13	11	17	17	19	16	18	12	8	10	10	10	8	6	6	8	262	Apr 26 Wednesday
117	7	14	10	12	3	2	5	8	24	20	15	12	21	21	5	26	17	9	8	18	12	17	6	4	296	Apr 27 Thursday
118	6	23	19	5	4	3	16	7	12	12	26	21	21	18	20	20	16	17	12	9	9	16	6	3	321	Apr 28 Friday
119	10	6	6	16	9	13	9	4	6	10	15	9	8	4	14	8	7	4	4	6	5	3	2	3	181	Apr 29 Saturday
120	6	11	9	3	11	2	7	5	7	5	2	2	5	9	9	3	7	3	3	6	2	8	5	3	133	Apr 30 Sunday
121	6	5	8	1	1	7	4	8	6	6	7	5	7	7	1	10	4	9	19	8	13	15	13	5	175	May 01 Monday
122	8	15	11	3	4	3	15	9	16	10	11	12	21	16	6	2	4	6	6	5	2	6	11	6	208	May 02 Tuesday
123	16	8	16	5	7	11	9	6	17	11	20	24	17	18	15	10	9	11	9	7	7	10	3	6	272	May 03 Wednesday
124	9	8	10	14	18	18	12	11	13	20	26	26	20	14	2	11	15	9	16	11	7	10	8	3	311	May 04 Thursday
125	12	8	10	7	18	10	5	6	11	25	16	24	7	8	9	3	3	16	8	16	3	2	5	18	250	May 05 Friday
126	7	8	15	14	3	6	8	9	6	4	4	8	10	8	5	1	5	7	7	9	4	17	0	3	168	May 06 Saturday
127	0	4	1	3	12	5	7	13	9	12	8	12	9	6	7	10	10	19	18	18	23	9	22	17	254	May 07 Sunday
128	14	14	5	15	5	7	5	5	10	14	8	13	2	4	14	10	11	9	17	15	11	18	21	13	260	May 08 Monday
129	13	18	7	9	7	7	5	2	9	4	20	12	13	12	7	4	8	13	7	7	12	9	7	14	226	May 09 Tuesday
130	11	18	17	6	9	1	5	10	10	14	9	14	15	13	8	5	3	5	8	16	10	8	12	18	245	May 10 Wednesday
131	11	11	10	8	5	9	8	4	11	18	16	27	7	12	8	10	7	9	12	5	5	10	13	2	238	May 11 Thursday
132	12	6	7	9	8	3	4	9	8	15	14	16	14	9	3	6	10	4	12	10	10	8	10	10	217	May 12 Friday
133	4	16	7	6	6	6	7	6	14	20	15	11	5	2	9	7	15	8	8	6	8	14	15	25	240	May 13 Saturday
134	26	32	33	29	37	43	34	31	36	35	34	40	34	28	25	27	15	11	12	4	10	10	9	3	598	May 14 Sunday
135	13	10	8	5	14	3	9	4	18	30	22	16	8	13	12	13	7	10	5	10	13	7	9	8	267	May 15 Monday
136	4	14	9	12	13	5	5	9	11	14	17	22	20	12	7	11	7	17	14	7	21	19	11	13	294	May 16 Tuesday
137	9	13	14	10	11	4	6	2	7	9	11	21	12	10	10	9	11	8	5	18	7	7	6	11	231	May 17 Wednesday
138	20	13	4	10	5	6	6	3	11	10	11	21	7	5	9	11	7	6	6	7	6	5	13	5	207	May 18 Thursday
139	3	14	19	4	2	6	5	26	29	19	14	21	11	18	6	10	25	12	39	16	16	24	27	9	375	May 19 Friday
140	22	17	17	20	6	5	2	9	8	6	8	10	15	5	10	9	7	6	1	2	11	5	14	1	216	May 20 Saturday
141	4	4	4	5	3	1	5	4	2	5	3	3	6	8	7	5	6	9	12	13	20	9	4	7	149	May 21 Sunday
142	12	15	9	5	20	4	2	4	10	12	13	20	19	12	14	8	8	5	2	13	12	8	8	11	246	May 22 Monday
143	8	14	5	6	8	3	2	4	14	8	8	11	2	25	17	17	4	6	7	11	11	12	12	13	228	May 23 Tuesday
144	19	18	18	4	3	5	5	11	29	18	25	27	21	19	9	9	7	25	3	5	9	15	4	7	315	May 24 Wednesday
145	7	16	2	8	4	10	41	21	31	24	16	5	13	8	11	7	11	15	16	9	7	9	5	5	301	May 25 Thursday
146	11	9	4	16	1	6	6	7	2	22	15	15	8	6	5	12	11	11	5	6	8	7	3	6	202	May 26 Friday

Table 3.5.3 (Page 1 of 4)

FIN .FKX Hourly distribution of detections

Day	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Sum	Date
147	2	5	4	13	5	3	5	4	6	9	9	3	2	16	14	5	4	0	5	7	11	26	9	3	170	May 27 Saturday
148	3	12	14	8	7	7	12	2	2	3	6	5	8	5	6	3	9	8	13	7	17	19	14	9	199	May 28 Sunday
149	5	12	14	6	5	11	9	9	4	5	8	11	5	17	6	8	12	5	8	6	12	5	10	7	200	May 29 Monday
150	9	15	15	7	9	7	11	8	7	10	19	19	18	9	12	6	6	15	8	7	14	13	9	5	258	May 30 Tuesday
151	17	13	14	10	3	5	12	19	14	19	17	25	13	16	11	5	13	5	5	10	8	8	9	13	284	May 31 Wednesday
152	11	12	10	5	3	1	7	6	17	17	19	16	5	4	9	9	2	9	8	12	14	8	10	11	225	Jun 01 Thursday
153	18	17	9	4	2	3	5	15	10	17	11	18	9	8	13	7	13	18	8	12	5	5	10	5	242	Jun 02 Friday
154	2	10	16	6	3	8	7	7	9	15	6	6	6	6	6	5	7	2	6	2	6	4	9	2	156	Jun 03 Saturday
155	8	2	10	8	4	5	5	6	8	9	3	5	5	8	3	1	4	8	11	9	10	12	8	5	157	Jun 04 Sunday
156	12	14	4	4	6	9	6	8	9	7	4	6	4	7	6	8	13	4	2	10	9	12	16	11	191	Jun 05 Monday
157	12	16	13	6	9	5	4	6	4	7	3	18	9	17	4	9	9	11	8	11	9	4	8	10	212	Jun 06 Tuesday
158	8	9	8	5	4	4	7	5	13	13	16	23	9	5	4	4	4	6	10	8	16	15	14	17	227	Jun 07 Wednesday
159	7	16	13	7	3	5	9	5	7	11	13	14	15	13	13	2	16	7	8	5	10	9	8	22	238	Jun 08 Thursday
160	16	12	11	3	6	14	16	8	10	12	15	18	12	2	10	7	8	13	6	6	4	4	1	12	226	Jun 09 Friday
161	4	10	12	4	7	10	10	9	2	6	7	1	0	0	0	0	0	0	0	0	0	0	0	0	82	Jun 10 Saturday
162	0	0	0	0	0	0	0	0	0	0	0	0	7	5	2	10	4	8	13	8	16	8	14	5	100	Jun 11 Sunday
163	9	5	6	6	5	4	3	2	7	7	4	22	6	18	10	2	8	21	10	1	13	14	12	10	205	Jun 12 Monday
164	11	9	6	2	9	4	3	13	15	17	11	15	11	9	7	7	25	5	6	9	15	8	13	10	240	Jun 13 Tuesday
165	9	9	9	2	13	8	4	4	21	11	14	25	11	6	17	15	10	17	4	9	7	2	10	8	245	Jun 14 Wednesday
166	24	12	8	9	6	6	5	17	4	13	9	8	9	4	12	13	5	4	5	10	5	10	10	13	221	Jun 15 Thursday
167	16	11	12	6	6	7	3	11	13	9	4	8	2	18	10	15	21	14	9	7	8	13	7	8	238	Jun 16 Friday
168	8	4	17	7	2	6	5	13	8	5	3	4	4	7	4	4	6	2	4	7	14	18	17	13	182	Jun 17 Saturday
169	5	12	5	1	6	10	4	8	15	13	16	8	9	10	4	14	6	16	13	9	6	10	8	10	218	Jun 18 Sunday
170	18	12	11	9	3	3	5	9	6	13	10	15	11	8	10	10	12	5	14	10	10	10	7	5	226	Jun 19 Monday
171	7	16	10	7	7	7	7	6	14	8	19	19	11	10	8	14	12	11	10	8	13	13	5	10	252	Jun 20 Tuesday
172	22	20	14	6	6	5	8	4	13	18	18	19	12	14	16	11	9	9	5	5	12	9	13	12	280	Jun 21 Wednesday
173	11	14	13	10	5	4	6	12	21	15	20	20	4	4	6	8	2	6	9	13	8	3	2	10	226	Jun 22 Thursday
174	2	2	0	3	9	3	4	4	11	6	7	15	9	1	4	7	7	4	10	1	3	4	8	3	127	Jun 23 Friday
175	3	2	4	3	0	5	7	13	6	7	3	3	1	3	4	3	4	5	4	1	2	3	0	2	88	Jun 24 Saturday
176	2	6	2	0	4	14	7	5	11	3	0	6	2	2	2	2	4	11	9	19	4	15	14	7	151	Jun 25 Sunday
177	5	13	6	6	7	7	5	11	11	11	15	13	7	8	8	7	6	7	9	6	12	9	10	11	210	Jun 26 Monday
178	11	6	13	8	4	3	4	12	8	6	27	19	5	15	4	10	8	15	11	6	7	9	14	2	227	Jun 27 Tuesday
179	10	6	12	11	3	11	6	6	6	14	13	24	17	14	11	4	2	4	6	5	9	5	7	8	214	Jun 28 Wednesday
180	9	20	5	1	7	3	5	8	13	7	2	18	13	9	5	14	4	8	3	3	9	5	11	12	194	Jun 29 Thursday
181	0	12	8	2	5	3	10	14	7	12	10	19	8	6	5	4	4	8	11	8	9	6	7	0	178	Jun 30 Friday
182	4	13	8	6	9	14	14	13	4	7	10	2	5	5	6	3	7	8	4	1	2	2	9	2	158	Jul 01 Saturday
183	8	4	1	1	5	3	3	2	8	6	7	6	4	2	3	1	5	3	12	11	7	4	10	6	122	Jul 02 Sunday
184	10	9	15	4	3	5	3	8	8	11	10	16	20	6	2	8	6	8	6	6	15	9	19	7	214	Jul 03 Monday
185	13	10	4	10	3	0	2	2	6	11	10	8	8	7	12	8	4	8	7	3	5	6	11	4	162	Jul 04 Tuesday
186	6	6	9	7	2	7	0	3	16	8	12	13	19	6	6	5	12	6	8	5	5	7	6	7	181	Jul 05 Wednesday
187	6	6	3	4	4	1	4	4	12	6	12	18	22	11	6	0	5	9	12	11	11	12	4	14	197	Jul 06 Thursday
188	4	5	1	9	8	7	10	5	9	17	13	7	7	6	9	6	3	5	12	5	7	7	7	4	173	Jul 07 Friday
189	5	6	3	7	4	5	16	9	5	10	7	13	5	1	2	5	12	6	2	7	4	3	1	3	141	Jul 08 Saturday
190	7	4	9	2	7	1	5	8	2	3	3	4	5	4	2	5	2	8	9	17	15	9	8	14	153	Jul 09 Sunday
191	5	5	11	6	6	2	6	3	13	9	17	14	9	14	10	12	6	15	9	14	9	8	7	12	222	Jul 10 Monday
192	9	11	7	10	7	7	4	6	7	24	9	18	21	14	8	13	6	9	6	7	16	5	7	11	242	Jul 11 Tuesday
193	4	13	7	3	4	4	15	12	12	14	19	15	13	12	8	15	14	7	13	8	11	13	21	14	271	Jul 12 Wednesday
194	18	14	11	8	11	11	2	4	6	11	9	20	13	5	10	8	10	12	7	9	17	7	10	14	247	Jul 13 Thursday
195	12	9	9	10	4	3	8	3	4	11	10	14	7	2	6	6	7	9	10	6	7	11	9	7	184	Jul 14 Friday
196	7	11	6	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	26	Jul 15 Saturday
197	0	0	0	0	4	10	6	8	8	5	7	6	11	2	4	3	7	5	10	13	17	12	14	11	163	Jul 16 Sunday
198	17	14	7	3	2	4	4	4	9	5	11	18	15	6	6	7	8	8	5	10	14	8	11	15	211	Jul 17 Monday
199	13	4	19	9	3	4	4	4	9	8	9	16	13	11	11	12	2	10	3	2	6	10	4	17	203	Jul 18 Tuesday
200	10	18	1	3	3	2	3	7	7	11	17	12	16	16	3	10	10	1	11	3	10	5	20	9	208	Jul 19 Wednesday
201	3	11	4	7	6	13	3	10	7	11	11	17	9	10	23	15	11	9	12	6	13	9	6	7	233	Jul 20 Thursday
202	13	6	6	20	16	8	7	14	11	7	9	21	16	12	2	5	4	5	0	3	6	7	13	5	216	Jul 21 Friday

Table 3.5.3 (Page 2 of 4)

FIN .FKX Hourly distribution of detections

Day	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Sum	Date
203	8	0	7	5	6	3	2	11	3	4	1	4	3	5	0	2	7	4	1	6	1	2	2	13	100	Jul 22 Saturday
204	30	4	8	2	2	5	13	10	4	5	7	6	2	2	1	1	6	12	12	15	10	10	15	2	184	Jul 23 Sunday
205	9	7	12	4	4	9	3	7	7	7	17	13	9	15	8	0	10	5	11	12	12	10	11	10	212	Jul 24 Monday
206	12	6	6	7	12	6	11	9	5	16	21	17	9	14	3	14	4	10	9	2	6	8	8	6	221	Jul 25 Tuesday
207	7	8	7	5	13	8	3	5	13	21	16	20	24	25	25	13	18	19	5	6	9	8	6	15	299	Jul 26 Wednesday
208	11	18	15	4	26	19	17	14	18	11	15	7	15	9	12	33	14	14	12	12	9	8	18	12	343	Jul 27 Thursday
209	7	11	5	13	6	3	11	22	16	11	20	15	6	10	10	9	4	3	10	5	8	3	5	4	217	Jul 28 Friday
210	5	5	6	3	3	0	4	6	8	6	2	4	2	5	7	4	4	3	13	1	8	0	11	0	110	Jul 29 Saturday
211	3	2	2	3	2	21	8	5	10	5	9	11	10	7	5	16	11	6	11	9	8	10	13	5	192	Jul 30 Sunday
212	8	12	4	10	6	5	4	5	16	10	8	11	10	9	10	11	10	13	15	5	12	8	13	10	225	Jul 31 Monday
213	13	14	7	4	5	2	4	6	3	10	9	8	12	10	6	10	8	17	10	8	4	13	16	9	208	Aug 01 Tuesday
214	9	15	2	10	10	5	7	15	17	16	26	7	16	9	11	8	8	6	9	15	11	10	14	11	267	Aug 02 Wednesday
215	10	12	13	11	4	0	2	6	9	12	7	16	9	6	9	7	3	4	13	8	11	8	8	8	196	Aug 03 Thursday
216	9	8	11	7	3	2	9	6	12	13	15	18	15	13	9	6	3	5	6	7	5	11	5	6	204	Aug 04 Friday
217	8	5	0	1	10	0	9	10	4	4	3	8	11	2	6	3	9	4	5	4	9	3	6	4	128	Aug 05 Saturday
218	5	10	2	0	5	2	2	4	2	5	8	7	8	3	15	3	5	4	11	15	9	6	11	14	156	Aug 06 Sunday
219	12	4	7	7	6	15	19	7	9	18	17	14	6	21	15	21	15	7	5	7	12	11	15	10	280	Aug 07 Monday
220	14	19	8	6	4	6	4	13	6	11	14	7	10	19	26	9	12	11	6	9	11	3	10	5	243	Aug 08 Tuesday
221	11	11	11	4	7	3	2	3	14	33	21	13	15	23	7	9	1	4	3	8	4	8	10	15	240	Aug 09 Wednesday
222	9	11	12	7	1	1	8	11	11	11	9	29	22	6	7	7	7	7	8	6	15	12	11	10	238	Aug 10 Thursday
223	7	6	8	10	7	3	3	2	5	16	7	10	9	10	12	7	6	8	10	4	8	2	8	1	169	Aug 11 Friday
224	6	6	6	3	3	3	2	6	5	0	1	2	5	11	15	8	4	5	10	5	4	3	14	3	130	Aug 12 Saturday
225	1	5	5	3	6	18	7	4	4	6	7	2	11	8	1	4	0	10	18	9	16	11	20	6	182	Aug 13 Sunday
226	3	8	6	4	9	4	0	6	18	7	9	29	30	10	17	13	11	7	13	5	6	5	7	4	231	Aug 14 Monday
227	3	14	5	2	6	9	9	7	8	12	21	14	8	9	7	5	3	12	10	6	9	4	11	4	198	Aug 15 Tuesday
228	3	11	7	3	3	6	7	8	10	22	34	30	20	17	18	20	23	13	16	3	9	7	7	18	315	Aug 16 Wednesday
229	14	16	9	2	5	19	9	10	10	11	13	11	12	9	2	12	8	11	12	7	14	5	8	7	236	Aug 17 Thursday
230	7	5	25	3	5	4	4	12	12	12	17	14	2	6	3	4	5	3	6	4	4	3	8	13	181	Aug 18 Friday
231	5	10	4	7	12	5	8	5	3	6	3	3	3	6	3	1	3	2	10	0	9	9	9	1	127	Aug 19 Saturday
232	3	8	3	5	5	6	4	3	4	5	3	5	6	3	0	3	5	2	13	8	4	7	12	5	122	Aug 20 Sunday
233	0	7	10	5	5	2	2	5	8	17	6	5	13	5	5	10	13	3	11	1	6	9	9	5	162	Aug 21 Monday
234	4	3	4	3	5	5	4	5	10	10	14	8	9	6	9	8	5	8	3	6	4	7	16	4	160	Aug 22 Tuesday
235	4	2	7	6	3	8	10	34	18	19	13	18	11	11	5	12	8	5	3	2	10	1	4	6	220	Aug 23 Wednesday
236	7	6	19	6	3	4	8	7	17	2	10	23	14	5	12	12	9	3	2	9	4	9	4	4	199	Aug 24 Thursday
237	9	4	3	5	2	1	3	3	5	11	8	18	10	4	6	6	7	9	4	2	4	3	6	2	135	Aug 25 Friday
238	4	7	7	6	4	5	3	6	3	2	6	7	5	8	3	6	6	3	1	4	4	0	6	2	108	Aug 26 Saturday
239	6	2	5	5	2	4	2	2	4	8	3	4	4	5	3	2	4	8	6	5	9	5	5	3	106	Aug 27 Sunday
240	4	3	6	5	2	1	2	6	7	6	13	13	7	6	8	10	9	5	0	4	3	3	11	3	137	Aug 28 Monday
241	5	5	5	1	2	3	1	4	11	13	8	17	14	7	4	11	7	8	6	10	0	4	8	6	160	Aug 29 Tuesday
242	4	7	5	5	8	4	9	5	17	18	12	14	12	5	5	7	7	12	2	5	4	13	6	7	193	Aug 30 Wednesday
243	5	3	3	4	2	4	5	0	0	0	0	12	16	7	8	8	7	11	5	5	10	7	13	8	143	Aug 31 Thursday
244	6	9	7	3	7	6	6	6	14	16	17	15	9	6	3	8	6	3	8	9	8	10	8	3	193	Sep 01 Friday
245	4	2	5	8	0	6	4	5	1	5	4	5	3	4	4	5	9	1	2	1	6	1	0	3	88	Sep 02 Saturday
246	3	6	1	2	3	1	2	3	4	3	4	2	2	2	6	2	3	7	11	2	4	6	8	7	94	Sep 03 Sunday
247	4	6	8	5	8	6	5	4	9	6	12	20	17	5	10	9	9	5	7	7	11	3	9	9	194	Sep 04 Monday
248	10	6	15	6	3	5	8	10	5	12	15	13	17	13	12	8	10	11	7	12	10	9	11	3	231	Sep 05 Tuesday
249	9	8	8	0	5	7	4	5	6	10	21	8	3	7	9	4	5	4	8	6	6	7	9	7	166	Sep 06 Wednesday
250	6	9	7	4	3	8	9	8	12	14	27	7	15	17	13	4	13	13	7	10	4	12	15	9	246	Sep 07 Thursday
251	9	11	12	7	16	5	9	9	10	8	15	20	9	4	6	12	11	14	14	12	11	10	7	9	250	Sep 08 Friday
252	13	8	8	8	9	9	8	15	11	7	20	9	16	18	14	11	15	13	23	14	11	10	14	17	301	Sep 09 Saturday
253	10	9	9	11	10	10	10	5	9	4	8	4	7	9	3	7	7	13	12	9	8	11	14	6	205	Sep 10 Sunday
254	13	15	6	2	6	6	0	0	0	0	0	3	7	7	4	13	7	6	4	7	6	9	12	5	138	Sep 11 Monday
255	2	2	5	3	4	2	2	7	7	4	8	12	13	11	6	4	9	4	7	2	9	6	5	1	135	Sep 12 Tuesday
256	9	7	7	4	2	3	6	2	11	17	8	14	15	7	4	8	4	7	7	1	5	10	6	4	168	Sep 13 Wednesday
257	7	9	3	1	7	3	3	7	5	11	18	12	14	5	15	7	9	5	3	4	7	10	4	4	173	Sep 14 Thursday
258	2	10	2	6	3	1	6	7	10	7	9	13	7	2	4	3	4	2	5	3	4	9	9	8	136	Sep 15 Friday

Table 3.5.3 (Page 3 of 4)

FIN .FKX Hourly distribution of detections

Day	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Sum	Date
259	6	12	8	6	9	8	4	7	3	3	6	5	3	1	4	6	2	4	4	11	2	8	3	0	125	Sep 16 Saturday
260	3	4	6	8	6	5	4	6	7	4	5	7	4	5	2	1	7	11	2	9	12	6	14	5	143	Sep 17 Sunday
261	8	9	7	8	3	0	2	12	7	9	15	10	8	9	5	3	3	11	5	2	13	7	3	7	166	Sep 18 Monday
262	8	10	11	4	3	5	2	6	12	9	9	22	10	9	4	6	6	14	13	4	10	7	13	8	205	Sep 19 Tuesday
263	10	7	3	6	4	4	5	3	9	21	15	22	24	12	7	4	7	9	4	4	6	9	9	3	207	Sep 20 Wednesday
264	9	1	6	4	3	6	0	8	10	19	13	14	16	2	4	4	6	4	7	5	10	8	10	5	174	Sep 21 Thursday
265	6	4	8	8	4	8	2	14	11	9	8	16	31	4	4	14	13	7	5	4	1	8	5	4	198	Sep 22 Friday
266	6	3	4	7	5	10	1	3	2	3	1	2	5	2	1	3	5	6	0	4	3	6	9	3	94	Sep 23 Saturday
267	1	6	1	3	2	4	3	1	1	9	9	7	1	5	1	3	2	2	7	6	10	2	9	2	97	Sep 24 Sunday
268	6	8	3	7	1	4	2	1	2	6	8	9	20	10	5	5	2	4	3	8	4	4	4	8	134	Sep 25 Monday
269	3	2	6	2	5	5	2	8	2	6	16	9	10	13	2	7	3	5	5	2	6	4	7	5	135	Sep 26 Tuesday
270	6	3	7	4	1	4	3	4	3	10	7	11	17	7	5	3	4	7	3	5	4	7	4	14	143	Sep 27 Wednesday
271	5	5	5	3	4	9	8	5	11	15	7	5	18	5	9	4	4	0	4	3	9	4	2	7	151	Sep 28 Thursday
272	1	2	4	2	5	8	7	4	4	8	12	13	14	2	7	2	4	1	1	1	0	1	3	12	118	Sep 29 Friday
273	1	3	1	3	2	6	1	3	8	5	11	3	3	9	7	8	3	4	7	1	3	2	1	8	103	Sep 30 Saturday
FIN	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23		
Sum	1743	1902	1760	1392	1354	1339	1362	1532	1847	2089	2175	2559	2099	1844	1579	1601	1506	1617	1625	1503	1719	1622	1843	1629	41241	Total sum
183	10	10	10	8	7	7	7	8	10	11	12	14	11	10	9	9	8	9	9	8	9	9	10	9	225	Total average
123	10	11	10	7	7	6	7	8	11	13	14	17	13	11	9	9	8	9	8	8	9	9	10	9	233	Average workdays
60	8	9	9	8	8	9	9	8	8	9	8	8	8	8	7	7	8	8	10	9	10	9	10	8	202	Average weekends

Table 3.5.3. (Page 4 of 4) Daily and hourly distribution of FINESS detections. For each day is shown number of detections within each hour of the day, and number of detections for that day. The end statistics give total number of detections distributed for each hour and the total sum of detections during the period. The averages show number of processed days, hourly distribution and average per processed day.

GER .FKX Hourly distribution of detections

Day	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Sum	Date
91	3	1	2	2	4	4	7	3	8	4	5	6	6	3	1	2	5	0	11	6	12	10	12	5	122	Apr 01 Saturday
92	6	6	8	4	1	2	6	0	1	0	9	3	1	1	1	1	0	0	8	0	2	3	2	4	69	Apr 02 Sunday
93	4	1	4	5	2	1	2	7	12	8	10	12	11	14	11	9	9	1	5	2	7	1	6	4	148	Apr 03 Monday
94	3	3	8	5	2	3	3	15	7	25	19	30	8	10	7	9	0	15	3	2	1	5	3	6	192	Apr 04 Tuesday
95	4	0	5	0	5	4	11	11	13	19	25	20	11	8	7	10	6	3	0	6	2	0	6	2	178	Apr 05 Wednesday
96	0	2	1	1	2	7	7	12	21	25	22	18	18	22	8	5	2	3	1	2	3	7	4	4	197	Apr 06 Thursday
97	1	3	2	2	2	5	2	13	11	12	15	36	1	3	4	1	3	2	3	3	7	2	9	12	154	Apr 07 Friday
98	9	8	3	3	6	2	4	2	1	3	14	6	2	2	3	1	5	6	4	2	2	2	6	8	104	Apr 08 Saturday
99	3	3	3	2	6	1	1	2	1	5	12	0	1	1	1	3	5	1	1	2	9	4	8	6	81	Apr 09 Sunday
100	4	5	3	10	3	4	11	6	8	21	24	21	10	11	11	1	5	4	3	9	1	4	2	1	182	Apr 10 Monday
101	3	4	4	1	2	2	7	12	8	18	28	28	38	6	14	13	2	4	5	6	3	8	6	1	223	Apr 11 Tuesday
102	2	2	6	3	5	4	6	14	16	19	35	12	15	11	9	9	2	2	3	1	5	3	0	4	188	Apr 12 Wednesday
103	3	1	8	10	5	5	5	8	5	25	28	30	6	14	3	9	2	2	8	7	4	3	7	5	203	Apr 13 Thursday
104	3	1	2	1	1	0	7	9	11	16	11	10	6	5	8	0	3	5	8	1	6	1	8	13	136	Apr 14 Friday
105	6	1	5	1	3	7	2	1	5	4	14	8	9	4	1	5	1	2	1	4	1	6	1	4	96	Apr 15 Saturday
106	1	11	3	6	6	0	6	5	2	6	8	1	2	5	5	8	2	3	4	2	2	3	4	0	95	Apr 16 Sunday
107	3	5	3	8	5	3	0	5	2	0	6	0	2	1	2	7	5	6	12	0	1	5	5	9	95	Apr 17 Monday
108	6	7	5	3	12	3	15	12	13	13	14	14	11	7	8	12	2	1	2	4	3	4	5	8	184	Apr 18 Tuesday
109	3	4	8	1	8	1	2	11	7	13	29	15	12	13	7	2	6	7	4	2	3	2	7	4	171	Apr 19 Wednesday
110	4	1	4	2	1	1	9	12	19	27	20	16	8	17	8	6	1	3	1	2	5	5	6	10	188	Apr 20 Thursday
111	19	10	7	7	7	6	7	14	25	20	16	22	0	4	1	11	2	8	7	1	7	5	2	1	209	Apr 21 Friday
112	9	5	4	5	2	1	0	3	9	8	17	8	1	5	6	3	0	5	4	7	0	4	8	1	115	Apr 22 Saturday
113	4	3	2	9	3	15	10	6	4	12	9	0	4	0	2	0	3	2	3	3	5	4	8	5	116	Apr 23 Sunday
114	9	6	5	3	11	2	9	7	3	14	17	17	14	5	8	11	5	3	1	1	3	0	0	3	157	Apr 24 Monday
115	13	2	2	1	5	3	9	6	23	16	34	11	10	9	5	3	8	6	4	6	1	5	2	3	187	Apr 25 Tuesday
116	6	1	3	12	0	2	8	7	18	22	14	34	6	13	21	7	2	3	9	1	4	17	3	2	215	Apr 26 Wednesday
117	2	0	6	2	1	1	9	5	7	21	31	31	18	12	15	1	7	7	1	2	4	0	1	5	189	Apr 27 Thursday
118	4	3	2	10	5	9	9	12	19	19	21	15	10	3	2	5	9	14	12	4	4	5	1	1	198	Apr 28 Friday
119	3	3	7	3	4	4	5	0	7	13	12	8	3	7	13	5	4	3	8	6	2	3	2	2	127	Apr 29 Saturday
120	3	7	4	4	5	4	1	1	0	4	11	6	16	3	6	3	7	1	4	3	2	1	1	6	103	Apr 30 Sunday
121	4	1	4	0	4	1	1	6	4	15	38	15	4	6	2	3	1	5	1	3	3	3	7	6	137	May 01 Monday
122	1	5	4	4	7	7	21	10	17	26	19	22	11	11	5	3	2	17	8	2	5	3	5	10	225	May 02 Tuesday
123	4	5	3	3	4	5	15	10	16	24	32	16	9	9	14	8	3	3	3	4	3	11	6	2	212	May 03 Wednesday
124	8	6	6	3	3	11	8	10	25	13	22	32	21	23	20	13	11	2	4	5	2	4	5	4	261	May 04 Thursday
125	9	3	4	3	13	10	16	13	23	29	11	35	13	13	2	9	9	7	2	12	6	5	5	10	262	May 05 Friday
126	5	3	16	11	3	7	3	3	6	3	5	13	1	8	8	3	5	1	1	20	5	3	0	0	133	May 06 Saturday
127	0	1	0	0	3	4	5	2	1	9	8	3	3	4	10	7	1	0	5	0	1	6	7	3	83	May 07 Sunday
128	7	7	4	17	1	8	12	14	11	8	13	32	32	36	21	11	0	6	8	4	0	38	0	0	290	May 08 Monday
129	0	0	0	0	0	0	0	13	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	18	May 09 Tuesday
130	0	0	0	0	0	0	0	14	21	19	15	32	8	15	12	7	2	1	4	2	3	3	11	7	176	May 10 Wednesday
131	4	3	6	9	5	5	10	6	18	23	20	32	18	25	23	11	7	4	1	5	10	2	7	6	260	May 11 Thursday
132	2	7	8	3	1	4	5	15	4	16	20	12	5	5	3	9	7	5	7	5	6	4	8	1	162	May 12 Friday
133	6	8	7	16	7	4	5	7	13	15	12	25	4	5	8	7	6	11	7	7	7	4	4	11	206	May 13 Saturday
134	2	4	7	5	8	6	10	2	3	3	11	8	8	6	4	2	0	7	7	0	1	5	8	3	120	May 14 Sunday
135	5	6	1	3	13	8	8	16	14	16	15	20	13	18	14	18	3	6	6	4	12	3	7	3	232	May 15 Monday
136	3	6	0	8	13	7	9	23	25	18	21	15	18	19	18	12	0	7	0	0	0	0	0	0	222	May 16 Tuesday
137	0	0	0	0	0	0	6	21	29	31	41	28	27	12	24	20	7	13	12	21	19	11	8	5	335	May 17 Wednesday
138	10	9	7	7	3	2	16	10	31	29	44	24	26	35	18	25	10	11	6	8	15	0	9	2	357	May 18 Thursday
139	9	6	3	5	12	5	17	16	17	25	16	16	14	23	8	6	9	11	18	7	5	3	6	2	259	May 19 Friday
140	2	7	5	12	2	2	8	3	8	12	19	17	5	4	0	4	4	6	4	5	8	7	5	0	149	May 20 Saturday
141	1	3	2	2	6	3	8	7	5	5	9	17	10	10	6	4	4	8	5	7	5	3	8	2	140	May 21 Sunday
142	5	0	4	10	20	13	8	20	16	25	36	42	21	13	22	18	8	5	3	6	9	5	8	7	324	May 22 Monday
143	2	1	14	15	5	15	6	8	22	32	39	16	26	21	10	11	20	7	5	10	5	4	25	2	321	May 23 Tuesday
144	3	6	9	4	19	17	21	23	32	34	28	31	22	18	25	25	5	6	4	3	17	9	4	3	368	May 24 Wednesday
145	1	4	0	9	7	4	6	3	27	17	16	29	7	7	6	15	3	10	3	0	1	6	9	9	199	May 25 Thursday
146	9	8	18	9	3	5	10	6	20	13	19	17	13	7	6	4	9	7	11	11	2	3	6	9	225	May 26 Friday

Table 3.5.4 (Page 1 of 4)

GER .FKX Hourly distribution of detections

Day	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Sum	Date
147	6	3	5	4	5	8	18	13	7	10	15	11	4	27	15	12	1	3	12	5	8	14	3	0	209	May 27 Saturday
148	3	3	5	6	2	0	10	5	8	13	24	7	3	2	8	2	2	5	3	6	12	8	4	12	153	May 28 Sunday
149	11	7	8	12	23	15	14	20	25	31	36	22	13	20	15	9	5	7	21	7	10	7	4	8	350	May 29 Monday
150	6	64	5	39	24	14	13	17	29	37	20	16	27	15	14	14	1	10	3	1	3	7	3	8	390	May 30 Tuesday
151	6	7	4	8	6	12	18	21	35	23	31	15	20	24	13	21	14	26	37	32	0	0	0	0	373	May 31 Wednesday
152	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	31	18	2	3	14	13	3	92	Jun 01 Thursday
153	2	3	0	24	14	28	10	7	17	20	38	19	8	13	16	17	27	13	20	6	2	2	3	4	313	Jun 02 Friday
154	9	0	3	11	9	8	8	8	7	13	16	16	11	6	9	5	8	10	3	2	3	4	3	2	174	Jun 03 Saturday
155	4	3	6	4	2	0	2	2	3	9	14	3	9	12	5	3	2	5	1	2	1	3	1	0	96	Jun 04 Sunday
156	3	3	1	1	1	6	2	7	12	5	25	7	3	2	4	13	5	2	1	3	12	3	8	7	136	Jun 05 Monday
157	11	10	6	2	10	7	10	17	13	39	27	37	13	24	1	10	5	5	1	2	4	5	3	8	270	Jun 06 Tuesday
158	0	10	3	5	1	3	6	9	20	18	22	28	15	13	10	13	4	2	2	3	8	6	3	11	215	Jun 07 Wednesday
159	4	3	2	0	3	7	9	19	14	29	20	30	7	14	15	26	5	9	2	5	8	11	17	8	267	Jun 08 Thursday
160	7	2	5	13	8	2	5	6	14	16	27	18	8	12	12	11	9	17	5	5	8	3	5	15	233	Jun 09 Friday
161	3	3	10	11	8	5	7	4	7	9	7	7	7	5	3	5	3	5	8	8	3	6	2	0	136	Jun 10 Saturday
162	5	2	1	1	1	2	8	0	4	3	14	6	9	0	5	8	6	1	13	4	9	7	15	8	132	Jun 11 Sunday
163	10	9	7	10	2	2	4	15	15	18	16	24	15	9	17	13	12	10	10	7	16	15	18	28	302	Jun 12 Monday
164	19	20	16	9	4	4	6	18	12	26	22	30	10	11	18	7	9	5	9	7	1	3	2	3	271	Jun 13 Tuesday
165	4	3	3	1	6	17	9	14	15	29	25	33	18	14	10	6	6	5	6	2	8	4	1	0	239	Jun 14 Wednesday
166	16	4	3	4	9	2	7	10	7	17	32	26	5	5	11	4	4	2	2	9	3	7	4	4	197	Jun 15 Thursday
167	8	9	5	2	2	4	8	8	22	31	32	13	12	8	12	2	1	2	0	4	4	4	1	3	197	Jun 16 Friday
168	2	3	9	8	6	3	8	1	9	5	14	21	12	8	10	3	7	2	4	1	3	6	2	0	147	Jun 17 Saturday
169	2	5	2	1	6	1	3	7	9	10	5	11	8	11	2	2	13	5	6	2	9	5	8	3	136	Jun 18 Sunday
170	3	6	5	28	3	6	12	13	24	26	24	15	20	20	14	15	0	1	2	3	3	2	5	3	253	Jun 19 Monday
171	5	10	3	3	8	14	16	20	24	30	31	22	22	19	14	10	10	8	10	2	2	2	8	2	295	Jun 20 Tuesday
172	2	7	8	16	5	4	16	26	5	28	36	32	14	8	54	34	16	14	4	5	6	2	2	7	351	Jun 21 Wednesday
173	6	10	6	7	7	6	5	16	21	31	40	25	33	15	15	4	18	6	4	5	13	3	4	2	302	Jun 22 Thursday
174	1	7	5	12	1	0	6	9	11	15	28	18	17	11	11	18	8	0	3	0	3	3	2	2	191	Jun 23 Friday
175	6	8	6	4	1	12	10	25	6	8	6	17	9	7	7	10	4	6	5	2	2	5	0	0	166	Jun 24 Saturday
176	0	2	5	7	3	3	12	5	4	6	3	2	8	5	0	3	2	11	9	3	3	1	0	1	98	Jun 25 Sunday
177	6	5	1	28	4	4	12	10	18	17	29	19	12	15	9	11	19	6	0	4	9	9	2	5	254	Jun 26 Monday
178	3	6	6	14	17	4	6	13	17	16	30	22	21	17	5	13	12	17	3	5	1	4	2	2	256	Jun 27 Tuesday
179	6	6	7	8	5	5	8	7	19	13	31	31	18	13	17	13	10	6	9	2	10	5	7	9	265	Jun 28 Wednesday
180	6	10	5	7	5	6	8	15	16	41	39	15	25	10	17	6	15	6	11	4	1	3	5	5	281	Jun 29 Thursday
181	8	6	11	3	5	7	9	21	17	34	23	11	14	11	6	16	13	1	2	3	6	11	7	5	250	Jun 30 Friday
182	3	1	4	1	7	7	3	5	10	13	6	15	3	6	4	1	0	6	3	2	0	7	9	0	116	Jul 01 Saturday
183	2	4	3	3	1	1	1	7	2	3	17	6	1	3	2	7	0	1	4	3	1	13	4	4	93	Jul 02 Sunday
184	13	12	7	1	0	6	4	14	11	21	27	19	14	9	22	37	33	12	9	13	9	6	15	1	315	Jul 03 Monday
185	1	9	6	6	1	2	9	12	12	27	26	18	12	13	13	15	21	3	8	3	5	3	13	5	243	Jul 04 Tuesday
186	5	4	5	7	1	2	2	4	12	17	30	22	11	8	20	11	10	3	10	5	3	6	1	5	204	Jul 05 Wednesday
187	3	2	3	3	1	6	3	9	22	13	20	17	17	5	21	19	11	4	3	4	8	11	8	14	227	Jul 06 Thursday
188	11	12	5	5	6	2	9	19	23	25	33	30	8	9	6	9	18	8	10	12	18	16	8	7	309	Jul 07 Friday
189	6	8	6	2	9	6	11	12	0	9	10	9	3	3	1	5	6	7	2	5	17	10	10	1	158	Jul 08 Saturday
190	5	2	8	2	0	2	2	8	4	7	21	9	8	4	9	9	5	3	4	2	10	1	7	3	135	Jul 09 Sunday
191	4	5	7	8	6	3	14	15	7	20	13	18	11	15	8	6	4	7	10	6	5	5	12	2	211	Jul 10 Monday
192	8	5	4	1	2	5	3	15	17	13	14	27	11	55	89	22	37	8	0	2	2	3	5	7	355	Jul 11 Tuesday
193	11	4	3	3	6	5	10	16	19	25	24	16	5	12	3	8	21	21	6	6	5	8	8	4	249	Jul 12 Wednesday
194	10	8	4	21	3	2	5	12	19	30	21	72	17	8	16	16	5	4	8	7	3	4	6	15	316	Jul 13 Thursday
195	4	11	7	1	0	4	5	16	26	28	34	22	5	4	4	9	15	16	8	11	3	6	3	7	249	Jul 14 Friday
196	2	3	5	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	17	Jul 15 Saturday
197	0	0	0	0	0	0	0	0	0	0	0	0	24	5	10	4	9	3	3	5	5	2	4	14	88	Jul 16 Sunday
198	17	4	9	44	12	3	10	17	19	23	27	19	13	15	7	2	16	3	2	8	3	11	4	9	297	Jul 17 Monday
199	2	4	4	8	3	9	4	19	25	32	18	29	16	9	13	13	9	5	3	2	4	5	11	7	254	Jul 18 Tuesday
200	16	7	6	5	19	3	9	28	14	25	10	16	21	12	15	12	3	4	8	9	8	7	5	6	268	Jul 19 Wednesday
201	8	8	9	10	15	9	10	12	22	35	28	28	21	17	9	17	10	3	5	27	7	11	9	16	346	Jul 20 Thursday
202	8	5	6	1	2	4	9	12	15	23	29	10	6	12	9	6	1	5	4	3	10	8	7	8	203	Jul 21 Friday

Table 3.5.4 (Page 2 of 4)

GER .FKX Hourly distribution of detections

Day	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Sum	Date
203	5	2	4	4	0	7	4	9	10	7	8	19	0	8	11	4	3	1	3	1	16	7	4	0	137	Jul 22 Saturday
204	1	4	4	1	1	2	8	9	0	6	8	6	2	4	3	6	5	2	5	8	4	12	12	6	119	Jul 23 Sunday
205	19	4	6	3	0	1	8	43	13	15	24	34	17	19	8	15	12	18	7	12	5	14	9	8	314	Jul 24 Monday
206	5	9	11	49	10	2	18	14	18	11	33	34	23	14	11	14	7	3	18	6	4	6	10	5	335	Jul 25 Tuesday
207	13	9	4	5	10	1	5	8	13	32	23	20	18	9	16	7	1	9	8	2	6	12	5	7	243	Jul 26 Wednesday
208	12	10	3	6	7	1	14	10	19	16	29	25	14	27	25	11	10	2	3	6	10	13	23	4	300	Jul 27 Thursday
209	6	9	7	1	4	27	16	35	21	38	19	21	9	4	17	4	9	3	3	4	3	4	10	2	276	Jul 28 Friday
210	17	3	5	5	0	5	2	9	15	3	8	18	7	3	5	7	12	5	14	5	3	0	6	1	158	Jul 29 Saturday
211	4	0	5	5	5	11	4	5	8	16	12	11	10	8	7	7	5	4	2	3	7	14	8	5	166	Jul 30 Sunday
212	8	6	6	5	7	4	16	12	17	27	18	16	13	10	13	5	9	16	8	3	3	8	4	5	239	Jul 31 Monday
213	5	12	12	8	5	3	6	15	16	18	10	24	13	21	37	6	2	2	4	5	0	3	10	5	242	Aug 01 Tuesday
214	7	7	9	14	1	5	13	13	21	24	32	17	18	15	17	6	3	3	6	10	10	4	10	7	272	Aug 02 Wednesday
215	3	8	11	2	2	12	2	17	14	13	31	20	12	11	11	8	7	12	6	3	10	5	2	7	229	Aug 03 Thursday
216	6	10	8	0	12	7	13	21	19	34	29	63	45	79	14	16	8	15	21	3	6	0	3	6	438	Aug 04 Friday
217	2	7	6	2	3	5	1	3	11	0	4	10	7	1	4	5	22	4	3	2	6	1	4	4	117	Aug 05 Saturday
218	3	3	6	3	4	2	0	2	17	11	5	6	3	10	5	11	3	5	4	5	2	15	6	7	138	Aug 06 Sunday
219	9	20	14	12	1	2	8	8	16	16	19	5	18	21	18	12	9	1	14	8	5	7	7	3	253	Aug 07 Monday
220	6	16	12	6	4	0	6	9	7	16	22	24	22	15	17	8	7	2	7	6	6	0	8	2	228	Aug 08 Tuesday
221	0	5	11	4	1	4	4	19	38	23	15	19	26	6	9	16	6	9	0	0	2	0	6	4	227	Aug 09 Wednesday
222	17	7	5	8	2	5	12	12	12	26	17	21	20	22	14	9	8	8	9	0	4	3	1	2	244	Aug 10 Thursday
223	2	3	4	4	74	12	4	13	14	22	45	14	26	12	9	4	0	5	4	5	3	6	1	4	290	Aug 11 Friday
224	8	3	1	8	6	5	8	10	10	10	11	26	2	10	13	1	1	2	6	1	3	0	5	1	151	Aug 12 Saturday
225	0	5	1	0	9	10	4	4	2	9	9	3	7	1	7	5	2	7	4	0	7	4	8	6	114	Aug 13 Sunday
226	4	7	9	5	6	3	10	10	11	12	31	21	11	7	8	7	7	5	6	4	2	4	6	2	198	Aug 14 Monday
227	0	6	3	6	2	4	4	2	17	28	15	23	11	9	13	3	2	0	1	0	6	6	12	6	179	Aug 15 Tuesday
228	4	12	2	8	1	4	5	7	12	19	55	42	14	14	20	24	7	7	4	4	4	0	0	0	269	Aug 16 Wednesday
229	0	0	0	0	0	3	2	9	15	28	17	25	14	17	49	16	12	5	10	1	3	5	8	14	253	Aug 17 Thursday
230	7	5	11	9	4	11	12	11	12	36	21	14	10	3	4	1	3	5	8	3	7	4	1	4	206	Aug 18 Friday
231	5	5	6	3	5	10	12	3	9	27	17	13	5	3	0	2	6	0	9	0	4	11	9	1	165	Aug 19 Saturday
232	1	5	4	11	12	4	5	6	10	6	1	6	4	4	3	6	3	4	5	8	7	4	10	7	136	Aug 20 Sunday
233	5	7	6	0	11	10	10	14	15	22	23	24	12	2	2	11	10	4	24	5	1	6	5	4	233	Aug 21 Monday
234	5	5	6	3	4	8	10	12	12	34	18	24	15	18	12	11	11	1	4	1	1	1	11	5	232	Aug 22 Tuesday
235	5	5	7	7	13	5	12	22	21	25	34	16	19	27	21	8	7	1	5	3	4	3	5	77	352	Aug 23 Wednesday
236	17	2	11	3	4	10	16	19	18	42	28	30	10	15	12	7	7	11	5	3	4	6	1	7	288	Aug 24 Thursday
237	3	4	6	3	15	6	4	22	21	25	15	14	9	3	11	15	7	7	4	8	3	4	5	0	214	Aug 25 Friday
238	4	7	1	2	2	5	0	10	7	17	4	11	3	1	4	4	6	7	1	2	9	3	4	1	115	Aug 26 Saturday
239	5	0	2	3	6	10	2	0	5	17	10	5	0	3	2	4	1	8	7	15	4	48	20	7	184	Aug 27 Sunday
240	18	4	8	19	8	5	5	6	8	31	31	15	21	15	7	11	13	7	3	4	6	3	5	2	255	Aug 28 Monday
241	6	3	14	12	4	2	5	14	18	19	17	21	15	10	10	6	4	1	4	6	1	2	4	6	204	Aug 29 Tuesday
242	3	2	7	5	0	2	5	18	12	21	15	16	20	18	7	0	6	2	1	6	4	11	2	9	192	Aug 30 Wednesday
243	0	7	8	3	0	0	5	7	16	23	27	35	15	14	18	8	6	14	2	9	5	1	4	5	232	Aug 31 Thursday
244	1	2	2	6	1	7	7	6	11	14	9	20	13	6	8	11	0	3	11	7	3	1	1	3	153	Sep 01 Friday
245	1	1	4	2	7	3	1	8	3	3	5	7	11	10	2	6	0	3	3	6	1	8	1	2	98	Sep 02 Saturday
246	3	3	4	2	0	1	3	6	10	7	3	2	10	2	1	4	1	1	1	6	3	1	6	1	81	Sep 03 Sunday
247	11	10	6	2	13	0	5	17	10	14	19	25	5	6	18	7	10	10	2	9	4	6	1	3	213	Sep 04 Monday
248	3	7	4	8	2	4	7	14	20	19	27	22	21	14	11	12	12	9	1	11	6	4	2	2	242	Sep 05 Tuesday
249	5	18	17	11	2	7	4	10	21	19	27	32	18	13	6	10	3	3	5	6	6	4	11	8	266	Sep 06 Wednesday
250	5	6	10	10	3	3	6	3	12	19	31	27	24	11	6	4	13	16	7	8	4	2	12	7	249	Sep 07 Thursday
251	14	21	12	16	2	3	5	10	15	15	17	25	11	13	7	3	9	7	8	6	3	1	7	7	237	Sep 08 Friday
252	5	5	2	4	3	7	2	3	2	10	11	5	9	12	7	7	12	5	4	9	4	8	2	3	141	Sep 09 Saturday
253	3	1	4	7	8	2	6	8	6	10	13	4	12	5	19	14	5	9	5	4	1	6	3	7	162	Sep 10 Sunday
254	2	12	6	1	13	6	5	12	25	22	21	21	20	12	14	8	7	9	4	5	1	4	5	6	241	Sep 11 Monday
255	3	15	43	2	6	1	3	10	15	34	20	23	14	19	17	7	2	14	6	1	6	5	10	5	281	Sep 12 Tuesday
256	4	12	7	2	2	3	10	10	9	20	22	37	8	20	14	11	10	2	5	3	2	1	1	0	215	Sep 13 Wednesday
257	3	16	6	5	8	4	5	10	16	22	18	24	11	6	11	9	8	9	6	3	3	9	4	5	221	Sep 14 Thursday
258	1	2	1	1	2	3	3	10	23	21	25	23	10	11	4	2	11	8	2	3	2	6	3	2	179	Sep 15 Friday

Table 3.5.4 (Page 3 of 4)

GER .FKX Hourly distribution of detections

Day	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Sum	Date
259	10	6	5	8	26	4	1	8	2	7	5	3	10	12	2	9	4	3	2	7	0	0	2	2	138	Sep 16 Saturday
260	4	1	2	1	7	3	2	10	3	4	11	9	7	63	125	7	15	10	0	7	3	6	6	9	315	Sep 17 Sunday
261	8	5	11	8	12	1	3	6	21	4	15	26	11	13	15	10	12	14	9	2	10	2	0	4	222	Sep 18 Monday
262	5	17	13	6	8	8	13	12	16	33	22	38	28	33	23	14	12	10	7	9	3	4	3	12	349	Sep 19 Tuesday
263	3	8	14	11	3	7	16	21	20	21	39	24	22	17	21	14	7	6	3	4	7	6	11	13	318	Sep 20 Wednesday
264	9	5	5	10	6	6	3	13	19	16	24	36	20	16	14	7	2	4	6	1	10	5	0	3	240	Sep 21 Thursday
265	11	7	8	7	4	17	17	50	22	22	12	30	12	14	13	2	6	2	5	7	10	1	0	4	283	Sep 22 Friday
266	0	8	5	6	4	7	8	2	6	10	6	6	7	10	0	3	4	6	1	1	2	7	8	7	124	Sep 23 Saturday
267	3	1	2	3	1	1	1	0	2	11	4	14	11	13	3	3	6	5	3	2	4	5	1	7	106	Sep 24 Sunday
268	7	5	6	14	3	13	3	3	9	15	16	30	28	21	10	17	3	6	0	4	4	6	7	6	236	Sep 25 Monday
269	2	7	6	5	8	5	9	5	23	15	21	22	19	36	15	19	10	8	17	2	6	3	4	7	274	Sep 26 Tuesday
270	6	5	11	10	2	2	8	12	17	26	25	33	23	19	21	16	9	5	7	5	3	2	6	4	277	Sep 27 Wednesday
271	1	6	8	8	5	10	11	7	19	11	13	21	23	17	17	13	18	9	2	7	2	2	2	9	241	Sep 28 Thursday
272	5	2	8	4	6	4	15	7	18	22	24	38	27	22	5	7	3	4	1	4	7	3	5	3	244	Sep 29 Friday
273	1	4	1	3	6	4	1	1	3	3	11	9	10	13	2	5	4	1	1	0	12	0	4	1	100	Sep 30 Saturday
GER	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23		
Sum	976	1071	1058	1184	1041	949	1332	1956	2442	3242	3607	3479	2282	2204	2096	1605	1262	1115	1039	883	925	991	1031	978	38748	Total sum
183	5	6	6	6	6	5	7	11	13	18	20	19	12	12	11	9	7	6	6	5	5	5	6	5	212	Total average
123	6	7	7	7	6	6	8	13	17	22	24	23	15	14	13	10	8	7	6	5	5	5	6	6	247	Average workdays
60	4	4	4	4	4	4	5	5	6	9	11	10	6	7	7	5	4	4	5	4	5	6	6	4	135	Average weekends

Table 3.5.4. (Page 4 of 4) Daily and hourly distribution of GERESS detections. For each day is shown number of detections within each hour of the day, and number of detections for that day. The end statistics give total number of detections distributed for each hour and the total sum of detections during the period. The averages show number of processed days, hourly distribution and average per processed day.

APA .FKX Hourly distribution of detections

Day	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Sum	Date
91	2	5	5	12	23	6	9	17	12	14	24	15	9	4	8	5	12	1	4	4	5	7	5	5	213	Apr 01 Saturday
92	1	1	4	14	11	6	8	11	3	12	8	5	11	10	4	7	9	5	2	0	7	0	1	4	144	Apr 02 Sunday
93	6	8	4	5	7	15	16	23	8	25	13	19	24	18	5	5	10	1	5	8	6	4	1	11	247	Apr 03 Monday
94	5	4	14	9	12	21	24	22	25	12	18	22	12	13	17	12	7	17	4	2	0	2	5	9	288	Apr 04 Tuesday
95	22	37	27	24	13	36	19	17	11	22	13	25	18	36	18	25	5	13	6	8	3	8	0	5	411	Apr 05 Wednesday
96	9	20	10	11	26	29	18	9	15	18	16	20	21	19	8	9	10	4	5	1	11	7	5	6	307	Apr 06 Thursday
97	10	7	10	4	6	22	18	27	31	20	41	61	36	16	5	22	5	8	3	3	16	2	22	9	404	Apr 07 Friday
98	13	11	13	12	7	6	19	6	17	16	30	11	7	8	4	2	12	12	4	6	5	5	5	9	240	Apr 08 Saturday
99	2	3	3	16	6	18	8	0	5	7	10	8	12	15	5	3	13	3	2	4	7	5	9	4	168	Apr 09 Sunday
100	14	7	12	13	14	19	17	17	16	10	9	14	6	22	14	7	6	14	24	13	8	9	7	5	297	Apr 10 Monday
101	3	5	20	15	15	38	17	23	26	17	13	16	25	17	16	29	9	10	0	3	17	6	8	0	348	Apr 11 Tuesday
102	3	9	15	21	17	34	43	37	40	17	19	36	29	31	38	30	26	22	15	38	6	22	19	24	591	Apr 12 Wednesday
103	23	33	31	44	48	38	31	24	30	23	25	25	37	39	36	22	11	30	32	17	17	9	5	4	634	Apr 13 Thursday
104	15	13	34	46	38	70	66	60	44	44	42	32	37	39	45	25	22	16	21	16	19	10	15	15	784	Apr 14 Friday
105	20	13	17	14	20	35	33	35	67	22	20	32	33	33	45	33	44	46	24	12	5	42	21	12	678	Apr 15 Saturday
106	7	21	21	27	24	30	59	31	34	26	21	35	39	43	94	21	12	31	33	18	2	14	17	32	692	Apr 16 Sunday
107	29	40	26	44	36	52	69	63	65	57	56	56	61	53	41	28	19	23	10	24	7	14	18	13	904	Apr 17 Monday
108	23	19	29	56	65	64	74	52	55	79	53	42	48	47	34	37	31	32	14	14	17	5	10	8	908	Apr 18 Tuesday
109	12	22	33	60	57	69	85	88	67	71	69	90	86	62	37	39	43	25	13	30	17	12	15	12	1114	Apr 19 Wednesday
110	8	12	50	62	70	60	83	68	51	59	57	62	45	66	53	58	16	34	15	4	8	8	18	7	974	Apr 20 Thursday
111	37	37	59	39	51	91	80	59	54	67	73	57	39	57	38	31	46	45	34	32	23	12	11	27	1099	Apr 21 Friday
112	21	5	41	19	34	49	42	36	39	27	26	54	37	32	28	5	25	17	35	38	19	12	12	15	668	Apr 22 Saturday
113	24	26	21	17	39	24	24	23	16	16	7	22	23	14	33	16	34	26	29	10	44	52	52	31	623	Apr 23 Sunday
114	42	49	53	65	66	80	76	58	86	73	79	79	86	70	58	49	51	42	42	61	44	31	20	50	1410	Apr 24 Monday
115	36	22	50	33	44	106	75	44	42	78	48	76	35	51	44	61	49	40	47	49	55	29	51	11	1176	Apr 25 Tuesday
116	34	36	36	76	49	92	72	73	90	69	92	52	46	32	48	43	45	46	60	71	45	53	39	55	1354	Apr 26 Wednesday
117	36	34	53	32	46	42	48	43	52	122	48	62	72	64	58	37	32	49	48	41	60	89	68	48	1284	Apr 27 Thursday
118	24	31	35	46	31	31	46	38	27	34	20	33	47	42	54	47	52	75	47	60	32	44	38	31	965	Apr 28 Friday
119	57	25	18	26	18	13	43	11	20	27	12	36	28	27	28	24	29	32	40	31	40	26	36	18	665	Apr 29 Saturday
120	31	40	24	15	20	20	25	10	12	18	27	30	13	19	44	28	15	27	25	23	33	28	48	49	624	Apr 30 Sunday
121	39	24	24	16	7	11	7	15	33	3	10	17	19	22	9	8	26	12	7	4	15	30	53	39	450	May 01 Monday
122	39	38	31	21	12	20	43	10	40	60	76	40	30	42	49	32	48	29	22	10	6	24	19	29	770	May 02 Tuesday
123	37	24	56	16	38	43	39	78	38	66	60	111	103	88	33	43	66	0	0	0	0	0	0	0	939	May 03 Wednesday
124	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	9	22	7	25	69	May 04 Thursday
125	5	16	40	48	66	91	92	67	82	91	66	50	72	50	38	42	33	29	30	49	44	22	15	17	1155	May 05 Friday
126	42	59	48	51	48	29	63	97	52	96	112	98	68	40	40	31	30	35	28	24	34	16	24	16	1181	May 06 Saturday
127	10	33	26	19	40	37	20	10	31	18	17	29	44	52	43	23	22	29	45	23	13	15	14	17	630	May 07 Sunday
128	9	22	6	14	27	34	30	35	43	15	35	36	60	39	27	17	56	42	45	16	24	43	22	33	730	May 08 Monday
129	44	22	36	21	24	19	31	12	35	55	68	29	70	55	48	26	72	53	4	16	0	12	7	8	767	May 09 Tuesday
130	8	15	18	25	31	65	50	50	53	74	40	38	46	21	46	21	32	30	11	10	18	27	22	40	791	May 10 Wednesday
131	40	26	33	25	46	92	63	58	62	40	52	59	45	35	71	33	21	21	32	14	20	9	13	9	919	May 11 Thursday
132	2	10	29	35	48	32	49	48	40	46	40	51	48	41	37	27	33	11	8	25	14	9	7	20	710	May 12 Friday
133	3	5	16	10	18	20	30	24	37	34	21	29	15	26	15	8	21	5	27	20	17	17	18	5	441	May 13 Saturday
134	18	9	13	6	20	27	30	20	16	21	8	30	22	11	19	5	14	7	13	16	20	16	40	37	438	May 14 Sunday
135	37	33	27	44	41	71	84	65	74	50	42	84	57	63	36	30	40	61	38	36	39	21	13	5	1091	May 15 Monday
136	6	15	41	41	49	73	71	49	60	56	62	43	54	48	28	38	28	24	8	11	16	8	3	17	849	May 16 Tuesday
137	7	8	35	47	46	70	69	71	56	45	57	43	57	37	29	25	36	24	35	30	12	22	9	5	875	May 17 Wednesday
138	20	23	42	44	43	58	80	80	39	56	55	51	55	67	55	33	17	33	36	25	12	23	14	1	962	May 18 Thursday
139	4	7	41	48	43	54	68	51	47	65	55	67	49	49	24	41	53	20	6	19	12	6	7	12	848	May 19 Friday
140	8	2	17	28	27	37	25	19	11	23	11	12	33	17	24	24	18	11	24	14	12	13	9	21	440	May 20 Saturday
141	14	16	11	16	19	22	20	23	12	9	3	14	24	21	20	7	23	10	18	4	9	11	20	2	348	May 21 Sunday
142	19	21	41	27	62	76	71	75	51	64	61	59	61	39	28	25	13	19	24	16	20	2	1	12	887	May 22 Monday
143	9	4	56	38	42	78	67	68	56	51	76	97	81	71	43	51	25	22	30	3	8	10	8	2	996	May 23 Tuesday
144	14	7	35	56	84	73	62	45	73	55	59	81	82	73	48	45	40	40	23	41	28	10	31	7	1112	May 24 Wednesday
145	2	18	40	67	43	105	67	77	48	86	39	73	55	57	59	33	61	49	32	18	53	25	57	14	1178	May 25 Thursday
146	29	17	35	34	46	61	62	50	70	64	40	60	61	47	42	32	20	25	11	23	11	7	15	10	872	May 26 Friday

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APA .FKX Hourly distribution of detections

Day	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Sum	Date
147	4	4	26	12	17	18	9	13	22	20	15	38	45	57	32	46	36	41	19	35	22	21	9	22	583	May 27 Saturday
148	12	21	54	49	38	17	43	51	41	51	30	43	44	26	49	61	58	50	44	53	36	28	40	27	966	May 28 Sunday
149	31	30	37	35	54	89	79	75	78	64	76	66	92	71	77	83	49	52	48	49	36	17	45	34	1367	May 29 Monday
150	42	52	60	65	74	95	75	60	43	40	48	56	57	30	32	23	46	14	9	5	3	2	6	11	948	May 30 Tuesday
151	9	17	32	32	48	41	45	51	38	46	40	79	54	53	50	32	25	12	30	22	11	3	4	15	789	May 31 Wednesday
152	4	5	24	21	31	47	52	79	54	37	35	37	53	26	35	21	15	9	3	8	6	11	3	6	622	Jun 01 Thursday
153	6	10	25	28	45	50	40	41	49	41	44	47	44	29	29	22	21	15	3	14	5	4	9	6	627	Jun 02 Friday
154	4	3	7	13	13	26	15	12	16	17	12	7	27	14	20	2	1	2	19	16	19	1	4	10	280	Jun 03 Saturday
155	0	2	16	2	7	6	9	14	17	9	4	23	7	7	10	11	6	9	3	9	5	3	2	5	186	Jun 04 Sunday
156	6	11	18	21	24	54	50	50	42	16	30	34	31	51	32	17	23	23	9	13	6	5	3	15	584	Jun 05 Monday
157	9	8	32	36	52	52	43	41	69	45	32	49	31	63	25	10	13	10	7	15	7	1	2	7	659	Jun 06 Tuesday
158	8	11	27	0	0	27	43	0	43	65	80	106	40	27	38	22	18	10	8	3	2	9	8	5	600	Jun 07 Wednesday
159	14	16	41	38	32	54	72	60	59	45	68	67	74	36	38	21	23	22	8	12	6	7	6	9	828	Jun 08 Thursday
160	8	12	34	31	40	46	75	62	56	45	51	68	33	35	30	18	23	10	10	12	6	6	18	12	741	Jun 09 Friday
161	11	13	16	18	15	22	33	23	32	45	34	26	20	31	30	23	19	7	26	4	11	8	4	8	479	Jun 10 Saturday
162	4	6	3	13	13	19	2	10	16	11	17	12	10	12	21	8	5	13	1	9	4	5	7	0	221	Jun 11 Sunday
163	0	3	2	16	21	15	13	17	19	11	19	12	13	13	14	5	22	14	1	5	7	3	7	6	258	Jun 12 Monday
164	6	10	27	24	27	56	86	99	63	59	100	77	36	41	42	24	14	18	4	18	7	7	4	10	859	Jun 13 Tuesday
165	13	8	43	38	44	64	93	114	48	64	98	70	78	34	25	32	26	23	11	10	10	7	5	5	963	Jun 14 Wednesday
166	23	7	21	27	38	101	72	77	53	66	80	61	54	45	38	22	21	9	11	11	9	12	15	27	900	Jun 15 Thursday
167	31	31	55	45	42	46	86	70	28	57	74	49	30	27	37	8	35	8	4	5	6	5	6	8	793	Jun 16 Friday
168	8	8	10	4	15	32	16	27	26	25	38	30	25	13	22	13	10	4	5	4	6	13	0	1	355	Jun 17 Saturday
169	5	4	3	2	8	11	12	13	15	7	13	10	5	10	11	3	21	12	2	13	1	10	0	0	191	Jun 18 Sunday
170	0	0	0	0	25	43	81	68	34	30	31	54	45	32	35	30	20	27	7	12	6	4	1	1	586	Jun 19 Monday
171	5	18	27	46	53	54	50	57	38	56	45	53	44	34	28	19	11	9	10	7	4	12	5	8	693	Jun 20 Tuesday
172	0	19	20	34	39	47	58	44	35	31	46	35	41	34	22	27	26	11	7	0	18	17	11	11	633	Jun 21 Wednesday
173	6	16	24	33	44	65	39	108	54	49	39	31	28	44	4	11	16	11	24	26	9	6	11	15	713	Jun 22 Thursday
174	2	16	15	24	38	66	49	53	56	39	58	53	40	23	28	25	32	19	13	9	15	5	17	13	708	Jun 23 Friday
175	5	9	10	9	31	16	16	23	16	34	4	19	14	28	48	32	27	18	22	2	7	0	3	1	394	Jun 24 Saturday
176	5	4	4	8	18	19	29	18	8	6	8	8	15	16	18	16	12	19	2	9	5	1	1	5	254	Jun 25 Sunday
177	9	2	10	29	49	33	77	77	34	56	52	48	47	33	30	31	18	19	12	9	14	20	9	2	720	Jun 26 Monday
178	15	21	27	45	52	69	88	33	57	61	43	86	66	81	38	25	42	28	13	14	16	8	9	22	959	Jun 27 Tuesday
179	17	18	38	46	43	49	42	44	43	35	57	43	47	45	41	23	34	27	22	7	4	11	4	9	749	Jun 28 Wednesday
180	21	20	17	44	35	58	44	44	28	34	28	28	41	48	34	27	26	13	35	5	8	9	0	7	654	Jun 29 Thursday
181	5	7	17	22	44	56	48	26	44	54	32	66	70	40	23	35	33	13	13	16	16	19	15	7	721	Jun 30 Friday
182	5	9	16	26	49	16	44	17	13	28	30	28	23	9	21	17	14	10	23	10	3	2	5	4	422	Jul 01 Saturday
183	4	5	6	9	14	6	21	15	21	22	12	3	15	7	0	0	0	0	0	5	5	11	3	3	187	Jul 02 Sunday
184	9	22	16	36	17	54	59	53	61	53	42	49	51	42	15	30	9	11	16	8	18	2	9	2	684	Jul 03 Monday
185	9	5	25	31	41	52	66	40	61	68	83	99	28	29	42	16	21	14	11	1	8	1	14	3	768	Jul 04 Tuesday
186	7	10	21	42	40	57	58	52	73	39	63	50	38	39	28	23	14	27	12	5	4	13	16	5	736	Jul 05 Wednesday
187	2	16	29	26	49	56	71	37	52	42	68	40	56	41	32	32	34	16	28	14	7	3	1	3	755	Jul 06 Thursday
188	8	19	20	27	42	59	53	45	55	58	51	40	59	27	32	18	29	11	29	8	7	10	15	6	728	Jul 07 Friday
189	3	0	10	12	18	9	23	14	7	30	24	14	16	31	18	10	11	7	5	12	4	2	0	7	287	Jul 08 Saturday
190	6	1	10	9	15	18	12	7	18	10	10	24	20	9	29	9	9	12	2	0	7	5	4	7	253	Jul 09 Sunday
191	4	6	29	14	52	56	79	79	38	41	61	52	47	29	18	27	15	17	7	3	8	5	6	12	705	Jul 10 Monday
192	7	16	18	32	50	67	57	76	70	76	90	45	48	53	31	17	20	13	15	14	9	10	9	8	851	Jul 11 Tuesday
193	3	6	18	31	38	67	67	87	88	40	43	53	55	45	30	28	19	10	15	17	1	4	11	11	787	Jul 12 Wednesday
194	9	9	35	33	41	75	104	112	55	83	93	64	43	37	28	19	15	14	9	9	10	6	8	1	912	Jul 13 Thursday
195	13	15	11	33	32	72	55	75	49	79	35	76	54	53	29	23	14	26	7	6	11	10	9	10	797	Jul 14 Friday
196	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	Jul 15 Saturday
197	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Jul 16 Sunday
198	0	0	0	0	0	0	15	70	49	43	63	41	47	27	30	9	8	16	5	14	4	7	12	8	468	Jul 17 Monday
199	4	3	21	36	42	73	61	99	49	57	39	35	41	36	21	26	13	9	8	6	7	7	6	16	715	Jul 18 Tuesday
200	7	10	5	33	44	62	64	72	71	66	68	61	29	28	30	19	14	17	7	15	8	24	19	30	803	Jul 19 Wednesday
201	18	13	49	48	51	82	81	74	65	69	50	54	50	34	35	29	14	25	7	4	13	6	2	7	880	Jul 20 Thursday
202	7	15	8	23	29	80	49	58	36	37	71	64	39	28	25	25	25	7	11	20	16	1	10	6	690	Jul 21 Friday

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APA .FKX Hourly distribution of detections

Day	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Sum	Date
203	3	8	8	10	22	22	15	5	10	17	74	14	32	9	20	8	22	10	9	3	6	7	1	2	337	Jul 22 Saturday
204	0	12	1	12	18	13	9	6	19	19	19	21	18	9	11	2	15	16	4	8	2	0	8	6	248	Jul 23 Sunday
205	17	5	16	20	44	69	79	59	65	29	70	51	44	51	33	23	24	9	10	17	5	7	9	3	759	Jul 24 Monday
206	8	14	25	28	43	68	62	52	43	36	47	47	55	45	33	16	8	8	7	5	6	1	13	6	676	Jul 25 Tuesday
207	4	10	19	27	44	75	75	65	68	62	51	49	55	33	12	23	22	12	15	14	6	3	16	14	774	Jul 26 Wednesday
208	14	15	29	26	37	57	81	40	53	92	63	104	78	55	70	14	8	25	15	0	19	6	4	7	912	Jul 27 Thursday
209	7	2	12	15	28	49	49	47	42	51	42	68	65	40	35	19	28	27	9	20	0	0	5	7	667	Jul 28 Friday
210	3	5	7	12	12	14	25	15	21	18	23	29	9	10	16	5	22	19	15	3	5	4	0	2	294	Jul 29 Saturday
211	4	4	19	5	12	15	13	6	7	15	11	9	11	10	15	8	8	2	7	5	6	1	0	1	194	Jul 30 Sunday
212	0	2	14	26	26	56	49	34	34	38	31	45	40	25	24	8	10	9	13	1	8	3	1	1	498	Jul 31 Monday
213	9	7	21	33	44	59	44	37	41	39	48	49	43	33	17	24	17	12	9	5	6	19	3	0	619	Aug 01 Tuesday
214	13	16	13	33	47	76	50	64	54	51	40	35	38	34	15	19	21	15	5	5	0	3	3	9	659	Aug 02 Wednesday
215	6	11	25	27	40	50	49	24	28	36	37	22	38	17	22	16	11	15	14	0	7	7	7	2	511	Aug 03 Thursday
216	6	21	30	28	47	57	40	44	37	30	46	58	22	27	22	21	21	27	11	14	0	9	0	8	626	Aug 04 Friday
217	5	14	9	24	19	7	17	9	15	23	16	36	11	14	16	23	23	12	0	8	0	20	2	1	324	Aug 05 Saturday
218	1	5	4	12	19	16	10	6	9	16	9	17	14	16	14	10	16	14	0	7	0	17	17	1	250	Aug 06 Sunday
219	1	7	27	31	30	41	38	16	24	31	24	38	44	34	34	24	21	20	17	8	8	2	0	4	524	Aug 07 Monday
220	10	5	21	40	46	61	86	65	49	41	72	50	56	31	20	19	30	20	8	12	6	5	5	3	761	Aug 08 Tuesday
221	1	3	25	34	32	55	51	57	63	42	48	41	46	35	23	22	16	21	18	6	9	4	9	6	667	Aug 09 Wednesday
222	9	4	26	30	22	78	64	53	62	50	48	25	64	37	27	18	17	11	27	6	13	17	13	26	747	Aug 10 Thursday
223	20	34	48	52	53	60	103	101	88	71	57	65	47	30	19	43	25	14	13	17	23	17	14	3	1017	Aug 11 Friday
224	2	11	12	9	20	29	25	22	23	47	23	17	17	21	15	8	16	8	5	12	5	8	8	0	363	Aug 12 Saturday
225	6	2	3	13	6	11	23	2	14	10	10	22	21	25	10	11	9	9	25	3	14	0	8	1	258	Aug 13 Sunday
226	8	17	21	17	36	48	44	39	23	35	42	41	42	37	25	20	11	10	7	9	1	1	0	0	534	Aug 14 Monday
227	7	11	32	26	40	67	62	34	34	29	28	31	50	45	32	13	17	22	7	8	6	2	5	3	611	Aug 15 Tuesday
228	0	12	26	28	29	62	65	39	52	31	49	60	46	25	33	30	23	9	21	4	5	3	3	14	669	Aug 16 Wednesday
229	2	8	23	37	37	41	51	65	55	58	48	47	32	34	27	49	17	15	13	2	8	20	8	6	703	Aug 17 Thursday
230	2	10	30	32	45	47	66	59	35	73	54	55	41	32	41	24	31	15	10	9	14	12	9	4	750	Aug 18 Friday
231	4	9	21	29	26	23	19	23	17	18	16	18	26	17	24	25	10	22	15	5	5	8	15	12	407	Aug 19 Saturday
232	6	11	4	26	19	21	25	31	20	18	33	55	46	36	30	28	27	7	14	21	8	13	1	6	506	Aug 20 Sunday
233	4	11	20	38	46	50	55	77	51	84	53	70	35	54	26	31	32	11	19	10	3	5	8	10	803	Aug 21 Monday
234	8	13	28	41	35	71	72	75	39	79	61	54	35	45	25	33	12	4	5	4	9	2	5	7	762	Aug 22 Tuesday
235	5	5	13	41	43	57	50	54	37	62	80	59	54	38	34	26	27	17	11	7	18	9	11	4	762	Aug 23 Wednesday
236	1	26	26	33	60	58	52	56	36	64	57	73	60	40	34	14	21	14	4	13	10	1	0	3	756	Aug 24 Thursday
237	0	10	26	21	43	40	43	42	33	59	40	63	32	30	28	32	21	18	5	8	2	10	5	5	616	Aug 25 Friday
238	4	9	19	8	22	9	14	21	27	30	32	16	25	16	13	16	24	6	14	4	1	6	3	0	339	Aug 26 Saturday
239	7	3	7	14	12	10	27	20	15	16	17	9	22	7	32	9	11	11	5	20	4	6	5	1	290	Aug 27 Sunday
240	3	14	22	27	40	75	65	56	32	35	53	53	47	47	34	16	29	6	10	23	5	8	6	3	709	Aug 28 Monday
241	1	5	21	42	30	73	75	61	38	56	67	50	31	27	31	24	18	8	17	18	15	6	11	4	729	Aug 29 Tuesday
242	6	13	17	27	69	58	53	40	38	42	53	48	51	52	25	25	18	16	9	16	12	5	4	1	698	Aug 30 Wednesday
243	4	5	25	20	37	45	51	43	42	37	36	41	42	30	19	15	20	15	11	8	8	11	3	13	581	Aug 31 Thursday
244	4	12	33	24	41	44	65	63	69	54	76	46	48	29	9	17	18	18	11	8	1	9	2	4	705	Sep 01 Friday
245	2	8	16	23	6	18	12	4	13	18	11	29	18	17	17	8	9	14	7	8	8	0	5	8	279	Sep 02 Saturday
246	0	3	6	5	13	27	16	21	8	13	13	2	12	15	18	15	11	16	1	4	11	1	0	1	232	Sep 03 Sunday
247	6	21	15	27	21	54	44	33	32	47	60	27	35	31	24	11	23	15	6	8	1	11	9	1	562	Sep 04 Monday
248	1	19	37	36	59	50	42	56	43	72	42	63	30	47	39	11	22	19	11	9	4	7	3	4	726	Sep 05 Tuesday
249	1	10	23	29	25	40	36	64	38	48	74	62	55	21	34	28	18	16	18	21	3	6	12	19	701	Sep 06 Wednesday
250	31	30	36	40	31	64	65	61	60	48	34	54	61	40	21	15	26	15	4	11	1	4	22	16	790	Sep 07 Thursday
251	7	14	34	44	42	61	68	105	57	84	77	68	50	29	31	26	20	25	17	13	23	7	7	12	921	Sep 08 Friday
252	6	5	28	18	20	10	15	12	17	25	23	39	19	13	19	6	17	19	5	11	7	11	4	2	351	Sep 09 Saturday
253	3	5	13	9	18	32	17	10	22	22	16	19	23	13	17	13	10	2	11	3	4	12	2	2	298	Sep 10 Sunday
254	2	8	25	27	41	66	89	94	75	93	93	67	47	42	21	16	16	11	5	10	0	0	1	3	852	Sep 11 Monday
255	4	6	20	40	30	54	73	64	55	65	41	35	45	35	37	11	24	11	9	6	7	0	1	0	673	Sep 12 Tuesday
256	12	13	14	30	43	69	64	73	41	41	47	55	41	46	46	26	21	14	12	10	12	2	3	0	735	Sep 13 Wednesday
257	10	15	28	24	40	51	55	70	48	70	65	58	33	41	39	17	20	34	19	0	3	10	3	1	754	Sep 14 Thursday
258	3	2	20	26	28	65	34	77	63	81	97	77	61	47	26	32	29	15	14	17	16	21	5	11	867	Sep 15 Friday

Table 3.5.5 (Page 3 of 4)

APA .FKX Hourly distribution of detections

Day	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Sum	Date
259	13	17	37	29	25	18	20	20	34	14	12	22	40	17	25	17	8	7	11	17	6	12	6	10	437	Sep 16 Saturday
260	4	10	5	14	18	11	19	26	5	10	23	15	15	18	17	12	23	18	2	18	5	5	5	6	304	Sep 17 Sunday
261	14	11	13	36	33	58	80	67	62	60	70	61	45	46	26	26	15	14	7	6	9	12	8	9	788	Sep 18 Monday
262	12	16	19	22	35	65	48	55	78	86	60	63	53	57	31	8	16	18	21	18	11	12	8	15	827	Sep 19 Tuesday
263	2	12	20	33	33	73	50	57	32	52	43	53	61	42	37	41	16	13	10	9	8	4	0	9	710	Sep 20 Wednesday
264	7	1	29	38	46	49	38	30	42	38	60	29	58	36	50	10	18	11	8	13	15	0	2	5	633	Sep 21 Thursday
265	0	10	17	39	44	49	45	45	43	63	61	49	52	40	31	31	22	17	29	12	7	5	6	12	729	Sep 22 Friday
266	2	7	31	27	23	16	10	20	30	19	23	25	27	21	24	10	26	16	22	3	5	11	1	4	403	Sep 23 Saturday
267	5	1	16	7	19	18	16	12	5	19	5	16	33	25	18	16	25	19	9	10	16	10	1	4	325	Sep 24 Sunday
268	4	0	12	32	27	30	22	1128181			1	31	0	0	0	0	0	0	0	0	0	0	0	0	469	Sep 25 Monday
269	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Sep 26 Tuesday
270	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Sep 27 Wednesday
271	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Sep 28 Thursday
272	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Sep 29 Friday
273	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Sep 30 Saturday
APA	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23		
Sum	1889	2362	4082	4824	5863	8028	8259	7773	7130	7688	7506	7750	7052	5956	5155	3911	3912	3194	2610	2364	2023	1881	1851	1803	114866	Total sum
177	11	13	23	27	33	45	47	44	40	43	42	44	40	34	29	22	22	18	15	13	11	11	10	10	649	Total average
119	11	14	26	31	39	56	57	54	49	53	52	53	47	39	31	25	24	19	15	14	11	10	10	10	753	Average workdays
58	10	11	17	19	21	23	25	22	22	23	22	25	25	22	24	16	19	16	15	12	11	11	11	10	433	Average weekends

Table 3.5.5.(Page 4 of 4) Daily and hourly distribution of Apatity array detections. For each day is shown number of detections within each hour of the day, and number of detections for that day. The end statistics give total number of detections distributed for each hour and the total sum of detections during the period. The averages show number of processed days, hourly distribution and average per processed day.

SPI .FKX Hourly distribution of detections

Day	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Sum	Date
91	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Apr 01 Saturday
92	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Apr 02 Sunday
93	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Apr 03 Monday
94	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Apr 04 Tuesday
95	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Apr 05 Wednesday
96	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Apr 06 Thursday
97	0	0	0	0	0	0	0	0	0	0	0	0	10	27	13	9	21	11	33	20	21	23	37	16	241	Apr 07 Friday
98	0	0	0	0	0	0	0	0	13	36	32	59	43	44	32	22	31	43	30	42	28	45	27	14	541	Apr 08 Saturday
99	14	17	21	22	23	9	18	20	15	22	26	13	40	23	26	29	43	24	25	27	27	15	19	41	559	Apr 09 Sunday
100	26	40	13	18	13	32	39	37	22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	240	Apr 10 Monday
101	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Apr 11 Tuesday
102	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Apr 12 Wednesday
103	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Apr 13 Thursday
104	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Apr 14 Friday
105	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Apr 15 Saturday
106	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Apr 16 Sunday
107	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Apr 17 Monday
108	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Apr 18 Tuesday
109	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Apr 19 Wednesday
110	0	0	0	0	0	0	0	54	33	36	57	14	31	33	38	59	36	24	65	49	55	45	116	58	803	Apr 20 Thursday
111	92	93	75	54	63	70	79	81	76	50	74	59	68	41	85	75	44	63	51	43	70	48	39	35	1528	Apr 21 Friday
112	49	56	48	51	50	45	51	68	38	40	35	34	22	21	39	17	38	42	29	19	14	37	45	28	916	Apr 22 Saturday
113	23	27	12	23	47	44	43	20	50	22	24	23	24	6	31	34	52	12	19	21	25	27	33	40	682	Apr 23 Sunday
114	31	20	33	22	32	43	33	39	28	22	33	46	35	15	38	60	36	38	49	36	38	32	23	27	809	Apr 24 Monday
115	19	41	38	18	40	40	43	55	32	26	32	58	25	29	36	36	53	44	52	82	35	18	43	32	927	Apr 25 Tuesday
116	39	15	47	28	21	25	27	31	54	49	47	19	39	32	50	55	39	71	46	48	23	67	49	59	980	Apr 26 Wednesday
117	27	38	34	71	49	51	47	27	28	38	65	36	43	29	28	41	63	60	38	63	46	26	29	59	1036	Apr 27 Thursday
118	38	46	18	37	35	41	34	51	34	37	60	37	34	28	87	61	53	97	86	16	61	53	86	47	1177	Apr 28 Friday
119	48	40	35	41	51	34	38	17	28	33	34	50	24	30	53	48	38	45	64	26	28	42	30	13	890	Apr 29 Saturday
120	14	29	15	19	35	23	43	58	34	16	47	27	19	28	45	34	21	25	21	58	52	39	34	35	771	Apr 30 Sunday
121	37	37	29	34	26	20	44	39	39	27	26	37	62	37	11	52	23	27	39	29	25	19	15	27	761	May 01 Monday
122	25	6	17	21	39	14	43	21	24	15	31	30	18	14	14	21	42	31	23	42	28	21	22	26	588	May 02 Tuesday
123	39	19	27	26	14	19	24	20	24	29	42	25	17	14	9	15	18	20	12	14	14	19	19	17	496	May 03 Wednesday
124	22	29	25	29	13	11	16	17	16	13	18	27	9	24	43	36	44	16	26	12	13	29	19	25	532	May 04 Thursday
125	29	23	23	27	41	25	38	40	32	38	1	15	17	33	26	51	32	28	44	22	24	39	17	30	695	May 05 Friday
126	39	39	24	24	13	6	18	21	32	44	29	28	30	49	24	12	29	22	12	14	13	30	35	28	615	May 06 Saturday
127	15	24	23	13	13	19	29	11	23	29	26	26	34	18	29	41	49	22	17	27	33	38	28	41	628	May 07 Sunday
128	35	32	46	34	24	15	29	25	50	36	27	35	35	42	43	30	42	58	87	36	49	31	48	35	924	May 08 Monday
129	49	38	43	25	26	44	20	24	27	18	31	17	49	27	22	22	33	29	28	15	45	44	37	28	741	May 09 Tuesday
130	50	52	34	33	26	21	10	4	13	22	18	9	22	29	33	10	29	37	13	23	35	24	28	35	610	May 10 Wednesday
131	38	21	33	39	17	57	17	32	14	27	30	35	23	76	31	69	43	84	21	15	31	31	33	39	856	May 11 Thursday
132	32	38	29	28	28	14	32	41	31	27	17	23	25	28	37	25	30	33	27	33	23	37	41	31	710	May 12 Friday
133	54	21	26	49	25	25	43	37	31	29	40	60	32	26	60	35	48	52	60	42	25	28	58	77	983	May 13 Saturday
134	49	43	40	32	31	29	30	33	43	38	36	33	29	13	36	42	39	29	28	32	15	25	31	34	790	May 14 Sunday
135	21	22	45	39	20	25	39	31	39	19	36	24	18	40	40	38	16	33	17	54	49	26	44	29	764	May 15 Monday
136	27	29	25	28	29	32	17	28	38	11	34	31	24	24	20	18	5	33	17	8	33	28	39	23	601	May 16 Tuesday
137	26	12	20	11	50	45	27	14	22	37	16	28	28	27	20	15	19	18	25	24	16	16	15	9	540	May 17 Wednesday
138	28	19	13	17	24	15	22	19	11	26	24	39	14	27	20	21	11	27	33	14	41	24	31	22	542	May 18 Thursday
139	14	15	11	19	23	14	14	23	21	19	10	22	27	34	48	21	26	29	36	29	23	30	31	34	573	May 19 Friday
140	38	33	22	19	13	40	21	19	15	22	29	32	32	42	35	34	32	22	27	28	39	32	39	38	703	May 20 Saturday
141	11	25	49	22	38	28	41	17	17	23	29	49	20	29	9	22	37	27	18	31	27	15	16	19	619	May 21 Sunday
142	17	24	24	36	52	23	31	32	29	28	34	18	28	6	16	31	17	17	15	28	23	20	11	15	575	May 22 Monday
143	5	23	19	33	17	26	22	26	20	21	37	25	50	37	26	51	41	15	11	57	13	13	19	11	618	May 23 Tuesday
144	17	20	40	18	26	20	6	24	18	35	14	33	30	11	7	17	26	16	12	16	18	4	17	33	478	May 24 Wednesday
145	10	35	21	27	28	49	19	28	21	35	29	22	24	18	23	66	75	2	0	16	35	19	45	43	690	May 25 Thursday
146	43	33	52	23	20	30	25	0	21	8	8	23	36	28	21	22	22	11	6	29	28	20	16	29	554	May 26 Friday

Table 3.5.6 (Page 1 of 4)

SPI .FKX Hourly distribution of detections

Day	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Sum	Date
147	13	17	32	27	36	18	24	27	37	36	43	23	20	45	42	32	24	24	28	14	19	48	10	17	656	May 27 Saturday
148	11	11	28	20	23	35	14	9	11	26	21	23	24	8	19	25	19	21	16	27	31	27	12	12	473	May 28 Sunday
149	19	17	9	13	17	12	6	17	10	27	28	4	15	15	30	15	13	7	19	18	24	19	14	9	377	May 29 Monday
150	25	12	7	10	18	13	11	11	4	9	8	16	18	22	11	3	24	21	8	17	17	23	10	14	332	May 30 Tuesday
151	26	12	15	10	9	18	10	12	15	15	10	22	28	14	27	9	18	21	20	11	18	9	26	14	389	May 31 Wednesday
152	15	6	21	14	23	17	20	11	15	14	27	22	21	29	30	31	20	29	14	14	8	8	26	18	453	Jun 01 Thursday
153	21	17	12	23	19	25	13	33	39	25	33	29	36	33	23	24	26	27	37	15	13	7	13	34	577	Jun 02 Friday
154	10	14	18	13	15	19	17	14	25	30	31	37	54	0	18	38	19	43	29	28	29	21	31	37	590	Jun 03 Saturday
155	28	33	45	30	25	21	17	45	32	15	27	30	19	15	29	17	21	25	24	14	27	18	54	28	639	Jun 04 Sunday
156	64	40	41	58	68	69	52	62	25	25	49	30	31	25	22	14	35	45	36	24	49	20	16	20	920	Jun 05 Monday
157	34	22	14	26	38	35	32	12	18	23	27	35	20	36	29	43	27	20	36	25	36	26	29	29	672	Jun 06 Tuesday
158	27	33	14	28	29	16	21	31	25	23	42	29	33	28	29	38	35	33	34	22	19	41	20	47	697	Jun 07 Wednesday
159	21	19	32	34	31	24	25	32	22	27	28	27	34	41	48	26	40	27	21	15	16	25	14	14	643	Jun 08 Thursday
160	23	51	18	33	18	52	20	16	31	23	25	26	25	23	44	19	28	38	29	29	24	41	24	34	694	Jun 09 Friday
161	20	29	33	33	33	37	28	33	17	22	24	14	19	22	34	19	29	23	25	23	38	24	26	13	618	Jun 10 Saturday
162	10	19	14	23	39	25	32	30	41	30	23	39	40	20	37	56	40	42	34	34	25	33	36	36	758	Jun 11 Sunday
163	23	31	42	17	13	23	27	35	32	29	32	40	19	41	35	33	21	35	25	27	36	27	34	31	708	Jun 12 Monday
164	15	22	17	34	23	38	35	31	47	32	44	25	29	19	14	22	29	20	25	32	12	38	22	27	652	Jun 13 Tuesday
165	14	12	14	21	24	25	19	18	27	24	30	38	25	20	46	16	21	23	14	22	27	27	24	34	565	Jun 14 Wednesday
166	33	23	16	30	35	32	30	22	16	20	17	23	25	31	22	19	27	5	17	28	14	29	20	20	554	Jun 15 Thursday
167	23	18	22	19	16	32	40	21	20	27	18	20	24	39	17	28	33	32	36	31	48	41	6	34	645	Jun 16 Friday
168	36	45	38	29	23	42	49	67	32	28	49	44	26	38	34	31	24	43	29	33	36	32	27	19	854	Jun 17 Saturday
169	12	25	35	33	27	15	20	29	30	47	30	37	25	35	36	26	29	25	28	24	36	28	15	28	675	Jun 18 Sunday
170	11	26	20	16	32	37	20	25	32	43	27	24	28	34	27	21	27	18	25	18	17	12	30	19	589	Jun 19 Monday
171	15	15	14	29	26	15	23	14	31	36	32	24	39	32	26	32	23	14	12	24	22	0	0	0	498	Jun 20 Tuesday
172	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Jun 21 Wednesday
173	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Jun 22 Thursday
174	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Jun 23 Friday
175	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Jun 24 Saturday
176	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Jun 25 Sunday
177	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Jun 26 Monday
178	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Jun 27 Tuesday
179	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Jun 28 Wednesday
180	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Jun 29 Thursday
181	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Jun 30 Friday
182	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Jul 01 Saturday
183	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Jul 02 Sunday
184	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Jul 03 Monday
185	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Jul 04 Tuesday
186	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Jul 05 Wednesday
187	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Jul 06 Thursday
188	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Jul 07 Friday
189	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Jul 08 Saturday
190	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Jul 09 Sunday
191	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Jul 10 Monday
192	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Jul 11 Tuesday
193	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Jul 12 Wednesday
194	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Jul 13 Thursday
195	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Jul 14 Friday
196	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Jul 15 Saturday
197	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Jul 16 Sunday
198	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Jul 17 Monday
199	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Jul 18 Tuesday
200	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Jul 19 Wednesday
201	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Jul 20 Thursday
202	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Jul 21 Friday

Table 3.5.6 (Page 2 of 4)

SPI .FKX Hourly distribution of detections

Day	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Sum	Date
203	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Jul 22 Saturday
204	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Jul 23 Sunday
205	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Jul 24 Monday
206	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Jul 25 Tuesday
207	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Jul 26 Wednesday
208	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Jul 27 Thursday
209	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Jul 28 Friday
210	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Jul 29 Saturday
211	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Jul 30 Sunday
212	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Jul 31 Monday
213	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Aug 01 Tuesday
214	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Aug 02 Wednesday
215	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	50	48	27	34	163	Aug 03 Thursday
216	46	49	69	68	40	43	51	41	48	27	23	25	35	28	15	42	26	33	35	42	33	36	46	64	965	Aug 04 Friday
217	67	72	79	64	71	86	70	67	46	50	57	44	33	39	37	20	39	48	38	37	69	43	40	46	1262	Aug 05 Saturday
218	57	50	34	72	63	70	35	52	43	62	45	30	50	38	43	32	35	43	42	43	56	36	37	33	1101	Aug 06 Sunday
219	58	34	50	28	29	36	47	57	48	37	44	33	31	35	47	43	37	49	34	32	17	30	40	41	937	Aug 07 Monday
220	47	50	40	31	31	53	61	43	32	38	31	19	23	30	20	32	20	26	24	49	54	41	39	43	877	Aug 08 Tuesday
221	59	55	63	52	41	64	44	59	37	42	35	41	50	23	41	27	30	45	42	60	41	61	42	61	1115	Aug 09 Wednesday
222	26	46	47	31	50	41	44	42	43	27	46	51	21	27	30	21	32	16	33	23	45	39	31	43	855	Aug 10 Thursday
223	45	23	39	23	26	36	36	35	32	25	24	31	15	21	36	45	44	36	36	47	36	34	48	43	816	Aug 11 Friday
224	56	57	43	40	50	42	46	53	62	55	41	41	34	59	26	40	50	57	81	54	40	52	38	18	1135	Aug 12 Saturday
225	43	16	38	41	41	34	20	39	38	28	32	45	34	53	43	67	55	50	63	62	50	73	59	55	1079	Aug 13 Sunday
226	41	66	60	68	44	67	82	67	49	48	69	70	44	26	37	30	34	25	29	41	38	58	51	32	1176	Aug 14 Monday
227	51	54	56	53	52	39	29	36	28	25	21	36	24	29	28	43	49	36	58	86	77	31	25	26	992	Aug 15 Tuesday
228	18	34	16	19	22	22	65	34	40	38	47	35	17	26	23	47	37	49	30	31	40	42	45	42	819	Aug 16 Wednesday
229	23	60	29	61	44	63	36	45	35	37	48	42	29	39	53	67	43	67	49	27	28	43	64	57	1089	Aug 17 Thursday
230	61	72	67	54	54	52	40	26	33	46	49	21	36	43	31	28	16	43	23	38	55	40	40	49	1017	Aug 18 Friday
231	45	38	47	46	29	42	25	33	26	35	21	38	10	29	22	26	34	32	16	26	31	32	46	44	773	Aug 19 Saturday
232	49	43	59	49	22	34	39	37	37	48	44	50	35	39	28	35	35	40	55	37	32	58	42	58	1005	Aug 20 Sunday
233	96	95	92	65	64	57	76	77	68	54	49	73	73	24	13	50	64	73	82	84	57	51	57	69	1563	Aug 21 Monday
234	82	76	96	85	89	62	60	88	55	56	62	58	77	47	54	59	60	49	49	48	55	52	58	55	1532	Aug 22 Tuesday
235	56	62	78	115	108	79	87	64	78	85	81	84	58	60	57	73	74	59	59	46	66	55	50	74	1708	Aug 23 Wednesday
236	95	80	77	82	67	63	40	48	60	50	47	40	35	61	64	63	74	39	52	68	76	95	75	74	1525	Aug 24 Thursday
237	71	35	55	41	40	54	66	80	38	43	0	56	42	70	68	58	58	64	39	74	67	58	48	67	1292	Aug 25 Friday
238	65	75	73	49	74	94	71	72	70	67	70	53	64	70	86	80	77	72	90	74	70	93	76	104	1789	Aug 26 Saturday
239	74	91	99	85	105	88	99	71	82	68	58	63	76	102	74	55	69	41	75	80	62	55	36	54	1762	Aug 27 Sunday
240	45	58	55	56	70	88	86	89	27	50	39	31	38	24	38	40	28	39	17	13	33	31	8	36	1039	Aug 28 Monday
241	19	13	25	30	33	19	26	27	41	37	28	34	37	39	15	36	47	43	24	49	26	73	42	34	797	Aug 29 Tuesday
242	46	42	33	47	43	28	28	31	22	43	42	25	34	23	28	14	27	29	28	26	18	8	25	21	711	Aug 30 Wednesday
243	25	22	28	18	23	43	45	36	37	39	30	52	46	29	36	46	47	43	57	50	43	63	59	43	960	Aug 31 Thursday
244	79	107	114	107	108	118	87	75	65	66	72	79	68	50	57	51	68	76	72	43	57	58	65	63	1805	Sep 01 Friday
245	53	35	57	63	85	56	91	55	54	48	52	66	47	26	51	49	56	48	66	88	51	66	73	64	1400	Sep 02 Saturday
246	45	53	67	73	70	61	52	87	73	48	77	65	79	80	84	66	79	73	77	74	78	82	73	74	1690	Sep 03 Sunday
247	49	45	56	72	66	51	70	59	46	90	100	81	89	81	107	102	91	83	82	70	80	90	67	78	1805	Sep 04 Monday
248	47	46	100	90	88	93	82	76	72	76	82	71	75	89	94	78	113	86	79	92	94	8	0	0	1731	Sep 05 Tuesday
249	0	0	0	0	0	0	58	92	74	46	60	67	101	77	69	75	43	48	65	88	67	68	64	79	1241	Sep 06 Wednesday
250	71	52	78	69	78	76	76	81	66	68	77	103	69	91	83	98	98	66	80	70	82	107	100	117	1956	Sep 07 Thursday
251	114	92	94	114	132	125	98	116	108	91	77	55	73	74	91	75	105	101	92	95	79	104	114	108	2327	Sep 08 Friday
252	122	135	127	136	150	126	139	121	91	90	86	86	65	84	85	77	87	102	87	143	115	135	112	110	2611	Sep 09 Saturday
253	75	0	0	0	0	0	0	0	120	112	99	129	114	96	96	76	95	75	80	82	85	68	99	53	1554	Sep 10 Sunday
254	64	54	45	81	73	53	54	72	86	56	77	101	71	50	26	69	94	67	116	90	92	105	72	64	1732	Sep 11 Monday
255	66	73	57	57	40	82	87	107	101	99	117	90	70	77	111	69	69	73	79	86	87	87	109	86	1979	Sep 12 Tuesday
256	69	66	76	84	74	75	80	103	66	56	101	82	84	83	82	109	104	94	149	127	129	117	124	162	2296	Sep 13 Wednesday
257	113	122	127	139	97	58	85	46	91	54	61	70	50	37	54	45	74	59	71	56	48	40	63	34	1694	Sep 14 Thursday
258	36	41	49	68	49	68	62	59	67	64	67	74	58	69	41	56	47	58	65	68	61	65	29	63	1384	Sep 15 Friday

Table 3.5.6 (Page 3 of 4)

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SPI .FKX Hourly distribution of detections

Day  00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23  Sum Date

259  87 60 42 62 60 76 51 87 83 74 93100 52 47 62 62 95 64 50 64142122126114 1875 Sep 16 Saturday
260  87 57 46 64 89 75 88 72 50 59 43 43 59 54 63 54 45 63 75 80 43 50 45 27 1431 Sep 17 Sunday
261  84 31 70 76 49 64 40 62 54 51 53 45 33 69 38 39 43 67 42 60 66 54 60 41 1291 Sep 18 Monday
262  42 47 60 46 45 50 52 57 63 65 59 60 37 49 51 65 59 62 42 43 43 39 35 66 1237 Sep 19 Tuesday
263  66 76 76101 69 85 54 56 44 50 42 80121 85 78 62 87106138111117 97113125 2039 Sep 20 Wednesday
264 112150160128 97106 74 93 83 45 50 35 56 48 47 64 66 62 44 53 36 41 33 52 1735 Sep 21 Thursday
265  59 52 65 69 48 33 23 47 30 37 21 32 50 40 48 37 41 34 50 51 56 38 37 40 1038 Sep 22 Friday
266  30 37 34 46 42 30 31 44 48 34 25 27 46 38 30 38 45 39 35 34 41 45 42 46  907 Sep 23 Saturday
267  49 51 77 87 63 60 46 44 50 78 94 93 80 56 60 47 74 55 82 60 55 49 41 43 1494 Sep 24 Sunday
268  45 43 46 80 72 63 68 73 58 48 62 59 70 64 56 46 74100 91 67 71 51 34 34 1475 Sep 25 Monday
269  45 22 36 29 23 29 30 61 89 50 31 33 49 38 50 44 24 43 40 47 34 49 47 45  988 Sep 26 Tuesday
270  51 60 64 54 62 35 67 65 76 82116 84 93 71 79 52 75 69 51 64 96 89 68 64 1687 Sep 27 Wednesday
271  57 59 71 42 41 33 37 40 60 35 46 40 54 46 40 84 58 75 54 31 73 36 69 56 1237 Sep 28 Thursday
272  46 38 35 36 40 33 46 77100 32 44 68 85 67 71 75 97 96 81 73127 86 66105 1624 Sep 29 Friday
273  74102 87 92 73 87 67 78 70 70 78 61 66 88 91 81 60 63 67 56 75 73 89 64 1812 Sep 30 Saturday

SPI  00 01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23

Sum    5030  5398  5263  5439  4936  5246  4895  5220  5369  5339  5364  5377
    5153  5306  5236  5173  5223  5250  5072  5150  5477  5360  5538  5276  126090 Total sum

125  41 40 42 43 42 42 41 44 42 39 42 42 41 39 41 42 44 43 43 43 44 43 42 43 1009 Total average

 84  41 40 43 43 40 41 41 44 41 38 41 40 40 39 40 42 43 44 43 43 45 42 42 44  999 Average workdays

 41  42 40 41 42 44 43 41 42 42 42 43 45 41 39 42 41 45 41 42 43 44 44 43 42 1013 Average weekends
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Table 3.5.6. (Page 4 of 4) Daily and hourly distribution of Spitsbergen array detections. For each day is shown number of detections within each hour of the day, and number of detections for that day. The end statistics give total number of detections distributed for each hour and the total sum of detections during the period. The averages show number of processed days, hourly distribution and average per processed day.

HFS .FKX Hourly distribution of detections

Day	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Sum	Date
91	1	2	3	1	8	7	4	5	10	5	2	0	2	8	2	0	4	2	8	2	5	6	3	2	92	Apr 01 Saturday
92	1	6	7	6	13	5	4	5	4	4	2	3	1	3	0	3	1	4	6	2	6	6	16	25	133	Apr 02 Sunday
93	36	62	88	76	68	36	25	52	42	35	31	44	51	46	31	20	9	2	3	10	24	36	49	42	918	Apr 03 Monday
94	58	75	83	68	64	51	70	51	51	22	25	31	8	11	7	7	4	15	6	2	3	0	0	0	712	Apr 04 Tuesday
95	0	0	0	0	0	0	0	0	0	0	19	22	19	43	8	6	2	4	1	3	2	3	1	16	149	Apr 05 Wednesday
96	27	28	14	15	29	19	15	20	37	49	39	55	40	52	28	3	6	2	3	0	6	6	0	1	494	Apr 06 Thursday
97	3	5	2	17	51	2	4	5	8	8	16	20	13	8	3	3	3	3	10	4	7	5	16	5	221	Apr 07 Friday
98	2	6	4	4	4	13	16	9	21	18	15	13	15	15	8	14	3	6	5	5	3	5	11	19	234	Apr 08 Saturday
99	17	44	49	81	108	95	68	21	7	12	6	7	9	6	14	1	11	12	3	7	0	11	16	50	655	Apr 09 Sunday
100	85	137	118	108	94	67	33	13	10	9	6	10	3	14	4	4	0	4	4	4	5	3	2	5	742	Apr 10 Monday
101	0	6	4	1	3	9	8	10	9	4	8	10	28	14	12	6	8	3	5	2	5	7	1	1	164	Apr 11 Tuesday
102	4	0	5	6	3	11	12	5	5	5	4	27	36	21	19	5	2	3	8	1	1	3	1	3	190	Apr 12 Wednesday
103	3	3	13	10	15	7	3	4	1	11	12	7	8	0	7	13	7	14	2	8	8	1	8	3	168	Apr 13 Thursday
104	7	5	1	4	6	6	7	10	7	15	10	15	2	4	17	5	2	2	0	7	9	4	1	7	153	Apr 14 Friday
105	2	3	2	1	5	11	8	15	6	7	10	32	17	18	16	23	1	5	3	1	2	2	5	9	204	Apr 15 Saturday
106	4	3	3	2	0	9	2	14	7	5	12	23	5	17	4	5	4	1	4	4	8	1	0	1	138	Apr 16 Sunday
107	2	13	2	6	7	5	2	14	26	8	8	3	11	34	6	9	5	20	7	3	6	5	6	2	210	Apr 17 Monday
108	8	1	4	4	15	10	8	3	3	19	5	7	22	10	7	10	3	6	4	6	6	2	4	3	170	Apr 18 Tuesday
109	1	2	6	2	14	6	2	4	0	17	5	11	15	8	14	7	1	5	6	1	1	1	2	1	132	Apr 19 Wednesday
110	1	1	1	2	1	5	2	6	9	7	3	15	10	9	18	7	4	7	5	1	4	3	4	4	129	Apr 20 Thursday
111	35	29	14	7	0	1	3	6	10	10	8	4	12	6	9	6	4	12	3	4	17	2	3	0	205	Apr 21 Friday
112	0	0	0	0	0	0	0	0	6	2	3	8	2	5	1	0	0	9	8	4	0	5	5	1	59	Apr 22 Saturday
113	2	6	2	19	5	19	15	10	12	9	4	11	5	3	16	5	5	7	6	4	4	2	1	6	178	Apr 23 Sunday
114	3	3	8	6	7	4	9	4	3	2	7	9	4	13	6	18	2	14	3	1	2	3	2	2	135	Apr 24 Monday
115	3	2	2	2	6	3	3	2	19	16	11	3	10	42	11	4	9	3	0	3	4	2	0	3	163	Apr 25 Tuesday
116	3	1	9	0	0	0	0	5	0	3	10	14	11	13	4	1	3	3	6	5	3	4	1	2	101	Apr 26 Wednesday
117	3	1	3	8	5	4	5	2	5	7	5	7	19	10	8	3	4	2	1	8	3	1	1	3	118	Apr 27 Thursday
118	6	10	0	2	1	8	8	9	9	6	6	14	19	7	9	7	10	23	10	5	9	11	4	4	197	Apr 28 Friday
119	7	1	4	7	8	5	10	4	5	7	6	12	10	22	12	8	5	6	11	2	4	7	7	16	186	Apr 29 Saturday
120	11	19	7	20	13	18	9	19	5	3	13	19	6	5	8	21	23	4	12	11	4	9	27	32	318	Apr 30 Sunday
121	26	22	36	17	5	20	9	6	13	1	8	5	10	11	21	26	9	2	2	3	10	7	5	10	284	May 01 Monday
122	5	2	7	3	10	11	15	14	14	6	7	14	14	9	13	7	6	7	5	2	2	3	3	4	183	May 02 Tuesday
123	1	2	15	8	4	7	4	7	12	9	21	27	11	23	2	4	2	5	0	4	1	13	3	3	188	May 03 Wednesday
124	12	3	9	6	7	4	7	7	14	14	20	10	19	29	14	13	13	4	4	6	6	5	4	1	231	May 04 Thursday
125	4	2	3	4	29	12	6	3	11	18	19	18	12	11	18	13	8	17	7	3	2	1	5	16	242	May 05 Friday
126	7	4	14	8	2	7	8	13	8	11	5	12	5	2	13	15	15	8	9	7	11	8	5	6	203	May 06 Saturday
127	7	2	4	9	6	12	6	14	9	14	10	8	19	5	14	11	9	6	10	2	3	4	8	3	195	May 07 Sunday
128	8	6	1	19	2	7	6	3	12	11	11	3	8	6	16	11	10	24	30	8	1	2	5	7	217	May 08 Monday
129	5	17	3	3	2	4	5	9	5	10	10	12	14	7	14	9	6	7	7	7	5	3	1	1	166	May 09 Tuesday
130	5	4	3	2	6	3	4	1	9	17	14	2	10	12	20	11	5	11	2	5	0	5	10	9	170	May 10 Wednesday
131	3	4	1	1	6	3	1	6	6	4	2	21	6	6	18	12	6	12	1	5	4	1	9	5	143	May 11 Thursday
132	5	6	8	12	12	15	7	6	3	14	13	13	13	3	14	11	13	7	12	11	7	16	10	15	246	May 12 Friday
133	13	9	14	14	20	9	23	19	33	58	37	0	6	8	22	16	12	14	28	14	8	25	8	21	431	May 13 Saturday
134	15	9	24	19	19	14	22	15	11	20	14	4	18	8	14	6	9	6	10	5	2	10	9	9	292	May 14 Sunday
135	15	8	6	11	11	1	6	5	16	10	7	19	5	20	22	8	6	14	1	4	11	0	8	2	216	May 15 Monday
136	10	13	2	7	11	4	1	5	14	5	9	18	7	9	14	0	5	2	15	1	21	13	12	14	212	May 16 Tuesday
137	14	4	8	13	17	7	17	14	7	6	9	25	12	1	12	12	16	12	5	15	4	3	4	6	243	May 17 Wednesday
138	12	4	8	5	1	8	12	8	10	5	8	12	10	13	17	17	5	12	8	4	2	1	1	6	189	May 18 Thursday
139	4	11	6	9	0	9	15	14	6	3	12	14	9	2	7	3	10	12	0	0	0	0	0	0	146	May 19 Friday
140	0	0	0	0	0	0	9	7	7	4	9	6	5	6	10	11	8	10	16	11	28	22	30	11	210	May 20 Saturday
141	16	6	41	18	15	8	10	15	12	4	7	7	7	9	6	14	4	9	10	11	6	14	3	5	257	May 21 Sunday
142	5	3	7	4	19	8	3	3	4	16	12	22	19	11	25	12	7	5	5	6	7	6	8	8	225	May 22 Monday
143	1	2	2	14	4	9	9	14	22	9	15	11	6	6	18	24	22	5	3	3	6	12	1	2	220	May 23 Tuesday
144	4	6	5	7	5	7	7	19	18	8	39	28	42	33	24	19	13	11	7	4	6	6	3	5	326	May 24 Wednesday
145	6	10	1	9	7	11	7	14	5	23	10	27	21	44	46	11	12	6	10	4	9	8	3	5	309	May 25 Thursday
146	3	3	16	16	13	22	32	3	8	7	6	19	19	12	10	13	13	7	8	3	21	4	3	6	267	May 26 Friday

Table 3.5.7 (Page 1 of 4)

HFS .FKX Hourly distribution of detections

Day	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Sum	Date
147	5	11	2	4	2	16	14	15	14	14	13	9	8	37	27	17	15	9	15	20	12	26	20	7	332	May 27 Saturday
148	4	7	14	9	10	5	18	11	19	7	14	6	4	9	14	10	13	20	6	4	12	15	7	0	238	May 28 Sunday
149	5	7	4	6	1	9	10	8	2	8	8	5	2	10	7	17	9	4	14	1	9	0	5	3	154	May 29 Monday
150	3	3	12	7	24	6	8	8	13	13	2	6	13	21	14	10	13	18	3	10	3	9	0	2	221	May 30 Tuesday
151	10	6	0	5	3	3	6	3	14	5	4	9	16	29	8	18	12	14	72	5	8	1	3	3	257	May 31 Wednesday
152	4	6	3	3	3	2	9	2	6	2	14	6	13	18	17	11	14	13	15	5	3	1	1	4	175	Jun 01 Thursday
153	4	7	3	8	2	4	7	6	6	8	11	14	13	11	4	10	8	6	4	5	4	0	5	2	152	Jun 02 Friday
154	0	0	0	0	0	0	0	9	15	32	37	16	30	27	22	18	32	31	16	5	8	15	10	16	339	Jun 03 Saturday
155	18	21	15	2	13	7	6	10	13	6	4	6	10	11	4	9	5	4	4	2	4	2	5	4	185	Jun 04 Sunday
156	2	6	3	1	5	6	5	20	7	7	17	21	7	11	13	10	15	4	4	2	9	9	6	10	200	Jun 05 Monday
157	7	1	6	8	13	5	2	4	1	2	5	6	3	14	2	17	3	7	10	15	4	6	14	10	165	Jun 06 Tuesday
158	4	9	8	7	2	1	17	8	14	11	9	8	7	14	21	8	3	8	4	1	7	8	6	10	195	Jun 07 Wednesday
159	7	3	3	5	2	0	1	5	3	20	23	39	18	22	17	8	7	3	6	4	10	10	7	16	239	Jun 08 Thursday
160	22	0	4	1	3	9	3	4	7	7	6	20	26	10	16	9	4	12	9	1	1	4	12	7	197	Jun 09 Friday
161	0	5	4	7	7	10	3	9	8	2	8	12	6	12	8	10	11	6	3	9	0	0	1	6	147	Jun 10 Saturday
162	3	3	6	5	7	14	10	8	6	10	10	9	10	6	4	12	14	18	13	15	13	4	11	3	214	Jun 11 Sunday
163	8	2	4	5	6	7	11	6	5	12	7	34	19	16	13	2	0	0	0	0	3	11	18	20	209	Jun 12 Monday
164	15	2	11	2	5	1	5	2	8	3	8	18	11	20	31	15	37	0	3	5	5	9	5	2	223	Jun 13 Tuesday
165	5	0	7	7	10	21	21	6	6	10	7	24	13	9	12	17	19	11	8	4	1	2	1	4	225	Jun 14 Wednesday
166	18	17	13	8	7	11	3	11	5	3	17	18	3	19	8	16	9	2	8	6	1	10	1	9	223	Jun 15 Thursday
167	3	4	2	2	8	12	11	19	21	16	12	28	11	23	21	28	7	13	9	14	13	2	1	3	283	Jun 16 Friday
168	9	9	10	0	8	7	12	8	13	7	23	7	20	17	24	12	22	19	11	20	8	13	3	4	286	Jun 17 Saturday
169	3	6	15	4	6	5	4	9	2	10	7	10	8	10	12	10	5	15	8	11	8	5	7	7	187	Jun 18 Sunday
170	3	9	5	11	13	11	8	12	45	11	11	19	11	24	24	23	10	3	11	10	6	2	5	2	289	Jun 19 Monday
171	3	14	2	4	18	9	11	7	11	15	12	1	0	0	0	0	0	16	19	7	11	17	6	7	190	Jun 20 Tuesday
172	3	5	3	4	14	11	10	7	3	0	8	13	20	33	10	17	13	4	12	6	10	7	1	2	216	Jun 21 Wednesday
173	3	12	0	10	7	4	2	14	14	4	5	10	18	10	21	19	17	15	25	6	8	6	2	7	239	Jun 22 Thursday
174	2	5	8	3	6	5	15	9	16	19	8	34	24	20	9	17	19	2	16	17	16	8	3	13	294	Jun 23 Friday
175	5	3	9	6	3	3	13	27	15	11	17	26	17	18	5	17	18	30	24	19	7	11	15	11	330	Jun 24 Saturday
176	7	11	4	2	2	21	8	17	25	22	21	23	17	15	18	28	27	22	15	18	12	7	6	6	354	Jun 25 Sunday
177	8	1	11	4	15	24	15	12	6	15	31	9	8	16	16	13	20	18	8	10	14	17	3	5	299	Jun 26 Monday
178	9	2	1	4	13	15	23	10	12	15	17	21	12	21	30	27	16	16	6	2	1	2	2	2	279	Jun 27 Tuesday
179	5	1	8	23	19	26	10	18	33	29	31	48	36	28	19	24	10	10	7	7	7	7	4	2	412	Jun 28 Wednesday
180	2	5	12	23	21	29	6	27	10	19	14	12	37	7	30	19	21	3	10	15	8	3	2	18	353	Jun 29 Thursday
181	7	1	7	4	9	17	36	15	17	17	8	19	20	14	11	24	20	24	12	16	6	6	8	1	319	Jun 30 Friday
182	2	3	3	2	13	14	8	9	25	21	9	5	8	29	18	28	23	21	13	14	10	8	22	4	312	Jul 01 Saturday
183	5	7	0	6	14	5	9	8	17	11	14	26	16	14	21	16	15	38	13	15	18	4	6	5	303	Jul 02 Sunday
184	9	11	6	6	15	18	10	16	13	8	19	23	18	31	31	11	18	8	11	9	26	10	14	6	347	Jul 03 Monday
185	5	4	4	16	17	32	13	29	3	6	20	32	44	30	17	13	37	16	23	10	13	4	14	3	405	Jul 04 Tuesday
186	10	6	6	12	4	9	9	25	18	35	54	34	37	29	32	16	34	6	14	10	21	3	1	7	432	Jul 05 Wednesday
187	3	3	0	4	6	28	13	8	14	3	23	24	16	8	31	12	20	15	11	12	7	10	0	3	274	Jul 06 Thursday
188	2	5	3	17	16	16	12	10	4	17	11	32	23	30	24	19	14	11	5	4	17	9	9	8	318	Jul 07 Friday
189	3	2	3	6	6	41	23	10	19	27	17	34	18	9	16	14	16	33	16	13	10	3	17	2	358	Jul 08 Saturday
190	13	3	23	4	3	7	12	11	4	7	20	27	25	18	31	23	44	29	20	15	24	8	3	4	378	Jul 09 Sunday
191	9	3	7	2	5	7	26	4	8	3	2	0	4	25	31	43	23	27	23	21	14	5	9	16	317	Jul 10 Monday
192	7	0	4	5	8	5	9	7	13	9	9	15	10	26	15	19	17	13	9	11	7	13	16	12	259	Jul 11 Tuesday
193	2	15	6	2	9	9	9	9	18	20	19	20	22	13	21	31	34	16	11	25	11	13	9	5	349	Jul 12 Wednesday
194	11	5	5	9	6	8	18	45	23	20	11	19	4	27	16	22	21	29	22	17	8	6	4	2	358	Jul 13 Thursday
195	1	1	5	18	21	6	10	14	16	17	19	23	22	26	18	15	24	21	6	13	9	8	12	8	333	Jul 14 Friday
196	2	8	6	6	7	6	15	6	12	31	22	21	30	15	14	13	12	21	17	38	9	12	16	20	359	Jul 15 Saturday
197	26	45	35	50	51	25	16	25	30	20	24	27	23	15	6	17	21	14	4	27	2	10	3	28	544	Jul 16 Sunday
198	51	47	61	52	39	28	17	11	9	20	25	28	21	41	36	37	8	14	13	17	12	8	4	12	611	Jul 17 Monday
199	5	6	8	20	22	16	6	10	10	7	8	18	15	14	10	9	6	7	15	12	14	10	65	17	330	Jul 18 Tuesday
200	16	3	1	3	11	7	2	6	8	6	10	13	12	13	21	10	17	8	15	8	6	6	4	7	213	Jul 19 Wednesday
201	6	3	4	7	7	13	3	6	14	15	9	21	9	9	11	16	17	12	5	5	8	6	6	13	225	Jul 20 Thursday
202	2	7	8	2	6	6	2	11	14	7	15	10	6	20	11	9	5	8	8	6	5	2	8	1	179	Jul 21 Friday

Table 3.5.7 (Page 2 of 4)

HFS .FKX Hourly distribution of detections

Day	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Sum	Date
203	8	3	14	3	4	0	19	28	18	16	22	23	9	45	25	24	18	3	17	25	17	1	9	3	354	Jul 22 Saturday
204	6	10	2	10	9	6	13	13	20	13	24	40	36	17	10	14	16	18	12	15	8	3	1	2	318	Jul 23 Sunday
205	8	7	1	3	1	6	13	7	5	16	15	14	11	15	18	6	16	6	15	22	13	0	2	5	225	Jul 24 Monday
206	1	5	5	10	6	9	14	25	10	2	27	10	21	15	27	28	32	18	22	8	19	11	13	8	346	Jul 25 Tuesday
207	8	10	10	15	26	24	13	16	10	22	28	6	17	15	19	25	24	29	24	16	25	13	7	18	420	Jul 26 Wednesday
208	6	9	11	21	23	24	22	7	7	4	9	9	22	15	33	44	21	14	13	8	6	6	18	3	355	Jul 27 Thursday
209	1	4	1	8	10	10	13	16	9	15	17	16	6	9	32	22	12	17	19	15	15	15	8	6	296	Jul 28 Friday
210	18	6	10	2	3	4	8	9	26	14	22	20	17	15	22	17	17	18	15	15	21	1	10	3	313	Jul 29 Saturday
211	8	5	9	4	0	34	18	18	16	24	41	18	38	16	24	26	23	14	11	18	4	19	8	7	403	Jul 30 Sunday
212	33	37	21	29	25	2	1	7	11	18	14	17	15	21	9	20	9	14	10	18	7	0	14	4	356	Jul 31 Monday
213	5	17	43	18	11	2	2	4	6	9	7	9	24	27	6	10	12	4	8	12	2	4	5	5	252	Aug 01 Tuesday
214	1	45	21	12	16	6	1	3	7	5	9	12	14	16	6	17	4	10	6	12	3	8	6	0	240	Aug 02 Wednesday
215	4	13	18	22	9	3	9	12	12	9	5	12	10	13	30	6	8	25	6	1	11	8	12	5	263	Aug 03 Thursday
216	5	3	10	9	3	5	8	2	2	7	10	4	17	15	25	13	6	10	10	13	18	11	7	14	227	Aug 04 Friday
217	10	12	9	7	13	12	9	4	10	19	11	13	9	8	21	19	17	22	11	10	9	20	14	17	306	Aug 05 Saturday
218	14	23	18	10	16	19	4	8	12	10	13	15	19	8	15	17	19	17	6	12	6	5	4	18	308	Aug 06 Sunday
219	11	2	7	10	4	1	7	6	0	5	6	14	6	13	14	3	9	8	4	10	6	3	3	4	156	Aug 07 Monday
220	11	10	6	3	4	5	3	7	6	2	5	14	20	22	1	10	11	8	7	13	2	2	2	3	177	Aug 08 Tuesday
221	1	2	3	8	5	3	1	8	5	6	11	5	6	13	8	14	4	6	3	4	8	1	5	7	137	Aug 09 Wednesday
222	10	2	1	4	2	3	8	3	7	10	8	39	40	1	11	24	5	5	7	8	5	10	4	8	225	Aug 10 Thursday
223	11	8	5	14	5	2	2	4	5	24	20	16	14	6	11	10	7	7	7	4	4	8	7	2	203	Aug 11 Friday
224	4	2	14	16	18	7	9	14	13	15	8	13	25	10	13	18	5	12	21	29	17	20	18	22	343	Aug 12 Saturday
225	11	19	21	17	15	19	11	19	17	23	22	14	12	11	7	15	20	13	16	8	19	10	12	4	355	Aug 13 Sunday
226	7	6	4	7	13	7	2	2	6	9	4	8	9	2	15	5	3	7	15	2	3	2	10	4	152	Aug 14 Monday
227	2	4	7	13	5	6	5	4	4	4	9	8	18	18	15	6	3	6	5	6	2	3	2	6	161	Aug 15 Tuesday
228	6	3	10	12	2	6	6	2	4	15	24	28	15	6	24	23	13	12	7	3	1	9	2	22	255	Aug 16 Wednesday
229	22	4	4	5	0	11	4	1	3	5	10	22	14	20	7	10	15	8	5	4	13	9	9	18	223	Aug 17 Thursday
230	8	2	13	9	13	9	3	2	11	31	17	25	11	23	9	7	4	4	6	10	11	8	11	11	258	Aug 18 Friday
231	8	9	8	8	13	0	11	5	8	6	6	5	17	10	8	15	7	10	19	11	19	16	20	13	252	Aug 19 Saturday
232	15	15	8	22	10	10	12	9	4	13	7	10	13	5	2	3	4	14	15	14	12	11	4	4	236	Aug 20 Sunday
233	14	4	12	3	6	4	0	5	6	10	3	7	11	10	10	13	9	7	12	2	4	2	0	1	155	Aug 21 Monday
234	2	11	4	2	4	23	14	17	4	5	1	10	39	13	18	12	5	8	2	2	1	0	10	4	211	Aug 22 Tuesday
235	4	6	9	7	3	12	15	30	25	3	6	5	8	9	4	15	18	7	6	5	6	2	5	4	214	Aug 23 Wednesday
236	6	6	15	0	10	3	10	3	17	3	21	24	13	8	8	14	11	9	1	2	6	11	3	1	205	Aug 24 Thursday
237	2	1	9	10	4	2	4	5	4	22	5	28	21	11	17	13	13	12	11	9	12	4	6	13	238	Aug 25 Friday
238	6	9	20	12	18	18	13	18	5	2	13	4	11	11	11	13	11	6	24	15	22	18	10	6	296	Aug 26 Saturday
239	33	6	17	15	12	15	4	13	5	12	3	10	8	10	3	6	6	10	15	9	6	5	2	10	235	Aug 27 Sunday
240	11	2	11	13	6	0	0	5	0	1	15	19	9	26	11	19	6	3	3	2	7	1	6	3	179	Aug 28 Monday
241	9	4	4	10	4	0	1	5	7	17	7	11	5	18	17	8	10	6	8	10	2	7	12	7	189	Aug 29 Tuesday
242	15	1	3	9	8	6	6	3	12	9	10	8	20	15	16	16	7	13	7	0	3	11	5	12	215	Aug 30 Wednesday
243	5	3	1	10	7	2	5	5	18	4	8	12	3	15	8	11	4	14	13	3	5	8	8	5	177	Aug 31 Thursday
244	3	3	4	7	6	9	12	7	22	4	7	14	2	12	11	6	7	4	1	5	2	5	2	5	160	Sep 01 Friday
245	14	3	16	8	3	2	3	2	9	7	4	11	4	1	1	6	5	7	7	7	12	4	5	4	145	Sep 02 Saturday
246	6	12	12	11	12	9	8	3	5	14	12	10	9	13	0	13	8	1	6	8	8	3	10	14	207	Sep 03 Sunday
247	11	5	9	7	24	2	9	12	12	7	8	15	24	8	13	4	4	11	3	3	4	3	6	4	208	Sep 04 Monday
248	9	3	5	2	2	13	2	8	10	8	6	16	15	16	24	10	14	9	3	11	10	3	1	3	203	Sep 05 Tuesday
249	5	8	2	6	9	2	4	14	11	5	14	13	10	11	14	9	17	6	4	4	13	8	6	12	207	Sep 06 Wednesday
250	5	2	10	20	3	9	3	5	17	9	11	7	18	12	15	5	14	8	7	2	2	7	5	11	207	Sep 07 Thursday
251	13	8	3	11	12	2	1	2	4	18	8	6	5	4	10	6	12	6	7	23	8	4	7	11	191	Sep 08 Friday
252	5	7	5	10	5	9	6	4	9	10	6	6	14	26	2	5	2	12	18	25	16	18	17	19	256	Sep 09 Saturday
253	24	8	20	12	10	18	14	16	7	13	16	9	4	15	10	14	2	8	7	7	6	6	6	10	262	Sep 10 Sunday
254	6	11	9	6	10	9	4	10	8	8	13	9	17	5	10	6	14	3	4	2	10	2	3	6	185	Sep 11 Monday
255	4	2	11	14	5	4	3	10	5	17	4	11	9	12	26	6	20	10	9	3	14	10	3	1	213	Sep 12 Tuesday
256	1	6	5	28	14	10	6	9	24	11	8	21	19	12	27	8	8	10	6	1	2	8	7	1	252	Sep 13 Wednesday
257	6	12	8	24	24	9	14	9	4	12	9	9	17	34	13	15	13	22	5	3	5	6	3	7	283	Sep 14 Thursday
258	1	6	5	10	6	11	13	13	16	3	6	16	6	19	33	5	12	18	5	4	7	8	2	2	227	Sep 15 Friday

Table 3.5.7 (Page 3 of 4)

HFS .FKX Hourly distribution of detections

Day	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Sum	Date
259	8	15	4	8	13	19	8	13	17	19	11	10	5	19	13	13	11	19	8	15	10	16	13	13	300	Sep 16 Saturday
260	9	6	14	6	11	7	14	8	9	21	10	14	16	17	9	13	17	17	17	6	11	9	6	3	270	Sep 17 Sunday
261	15	6	5	14	12	5	5	8	6	5	29	2	12	15	6	5	12	16	7	12	28	8	8	3	244	Sep 18 Monday
262	8	15	5	11	32	27	11	18	29	5	7	13	5	19	12	11	9	18	6	6	26	10	19	12	334	Sep 19 Tuesday
263	11	6	6	12	9	6	8	3	2	4	6	11	8	7	16	6	19	9	4	10	2	5	9	6	185	Sep 20 Wednesday
264	3	5	5	25	8	11	3	6	8	20	9	8	16	10	26	29	31	16	33	10	19	7	2	6	316	Sep 21 Thursday
265	7	1	4	8	24	5	6	2	10	4	8	22	12	7	18	19	3	27	17	3	3	1	7	4	222	Sep 22 Friday
266	3	6	5	8	6	7	6	8	5	5	8	6	8	7	7	21	17	4	13	11	9	9	10	7	196	Sep 23 Saturday
267	13	10	12	20	9	6	0	1	8	7	4	11	8	11	11	12	15	13	21	13	12	8	11	10	246	Sep 24 Sunday
268	7	8	3	7	22	14	14	23	8	4	7	24	26	7	18	18	26	79	17	17	16	30	52	16	463	Sep 25 Monday
269	4	3	1	8	14	21	7	27	12	16	6	15	32	18	13	12	33	46	37	14	7	44	32	3	425	Sep 26 Tuesday
270	7	1	10	7	20	14	13	11	3	2	14	20	23	6	19	34	34	38	36	23	4	23	54	14	430	Sep 27 Wednesday
271	8	8	14	6	17	19	16	1	8	10	3	8	11	15	15	55	43	16	17	21	27	6	5	9	358	Sep 28 Thursday
272	5	6	3	6	31	14	12	10	29	14	3	22	16	3	8	33	8	7	0	0	0	3	5	12	250	Sep 29 Friday
273	3	2	3	5	2	10	3	7	5	4	16	2	8	5	16	6	16	3	7	5	5	2	8	1	144	Sep 30 Saturday
HFS	00	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23		
Sum	1582	1611	1798	1968	2142	1985	1783	1905	2074	2118	2292	2831	2687	2778	2723	2506	2237	2165	1871	1589	1569	1386	1486	1443	48529	Total sum
183	9	9	10	11	12	11	10	10	11	12	13	15	15	15	15	14	12	12	10	9	9	8	8	8	265	Total average
123	8	9	9	11	12	10	9	10	11	11	12	16	15	16	16	14	12	11	9	7	8	7	7	7	257	Average workdays
60	8	9	11	10	11	12	10	11	12	13	13	13	12	13	13	13	12	12	11	11	9	9	9	10	266	Average weekends

Table 3.5.7. (Page 4 of 4) Daily and hourly distribution of Hagfors array detections. For each day is shown number of detections within each hour of the day, and number of detections for that day. The end statistics give total number of detections distributed for each hour and the total sum of detections during the period. The averages show number of processed days, hourly distribution and average per processed day

3.6 IMS operation

The Intelligent Monitoring System (IMS) was installed at NORSAR in December 1989 and was operated at NORSAR from 1 January 1990 for automatic processing of data from ARCESS and NORESS. A second version of IMS that accepts data from an arbitrary number of arrays and single 3-component stations was installed at NORSAR in October 1991, and regular operation of the system comprising analysis of data from the 4 arrays ARCESS, NORESS, FINESS and GERESS started on 15 October 1991. As opposed to the first version of IMS, the one in current operation also has the capability of locating events at teleseismic distance.

Data from the Apatity array were included on 14 December 1992, and from the Spitsbergen array on 12 January 1994. Detections from the Hagfors array were available to the analysts and could be added manually during analysis from 6 December 1994. After 2 February 1995, Hagfors detections were also used in the automatic phase association.

The operational stability of IMS has been very good during the reporting period. In fact the IMS event processor (pipeline) has had no downtime of its own; i.e., all data available to IMS have been processed by IMS.

Phase and event statistics

Table 3.6.1 gives a summary of phase detections and events declared by IMS. From top to bottom the table gives the total number of detections by the IMS, the number of detections that are associated with events automatically declared by the IMS, the number of detections that are not associated with any events, the number of events automatically declared by the IMS, the total number of events defined by the analyst, and finally the number of events accepted by the analyst without any changes (i.e., from the set of events automatically declared by the IMS)

Due to reductions in the FY94 funding for IMS activities (relative to previous years), new criteria for event analysis were introduced from 1 January 1994. Since that date, only regional events in areas of special interest (e.g, Spitsbergen, since it is necessary to acquire new knowledge in this region) or other significant events (e.g, felt earthquakes and large industrial explosions) were thoroughly analyzed. Teleseismic events were analyzed as before.

To further reduce the workload on the analysts and to focus on regional events in preparation for Gamma-data submission during GSETT-3, a new processing scheme was introduced on 2 February 1995. The GBF (Generalized Beamforming) program is used as a pre-processor to IMS, and only phases associated to selected events in northern Europe are considered in the automatic IMS phase association. All detections, however, are still available to the analysts and can be added manually during analysis.

There is one exception to the new rule for automatic phase association: all detections from the Spitsbergen array are passed directly on to the IMS. This allows for thorough analysis of all events in the Spitsbergen region.

	Apr 95	May 95	Jun 95	Jul 95	Aug 95	Sep 95	Total
Phase detections	67747	86293	66994	52292	90234	103062	466622
- Associated phases	4006	6298	5266	2314	6015	8113	32012
- Unassociated phases	63741	79995	61728	49978	84219	94949	434610
Events automatically declared by IMS	888	1603	1283	476	1710	2549	8509
No. of events defined by the analyst	50	111	131	55	62	106	515
No. of events accepted without modifications	0	0	1	0	0	0	1

Table 3.6.1. IMS phase detections and event summary.

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B. Ferstad
B.Kr. Hokland
L.B. Loughran
B. Paulsen

4 Improvements and Modifications

4.1 NORSAR

NORSAR data acquisition

The final phase of the NORSAR refurbishment has comprised installation of short period seismometers in the Short Period Vaults — SPVs.

The technical challenge of installing new equipment in the more than 25 year old vaults has been almost overwhelming. The SPV sites are in remote mountain areas with no access roads and no AC power. DC power is obtained through the old buried cables, which are up to 14 km long. Thus DC power supply has been the largest problem. The new seismometer installation requires DC power to the amplifier, the digitizer, the GPS clock and the modems. Numerous experiments and tests have been performed to find and acquire modems, batteries and other electronics necessary to control and operate the seismometer, amplifier and digitizer at the lowest possible power consumption.

The Teledyne Brick Amplifiers 57010-0107 were delivered in July 1995, and the new Teledyne Geotech 20171-0104 instruments were delivered in August 1995.

Patton Electronics modems for transmission of data between the SPV and the Central Terminal Vault — CTV — were delivered in August and October 1995.

During September/October 1995, old electronics and seismometer equipment from 7 CTVs, 7 LPVs (Long Period Vaults) and 42 SPVs have been removed. The sites have thereafter been refurbished with new moisture-resistant paint and new lids.

All electronics have been prepared and mounted in sealed boxes at the Maintenance Center at Hamar for a "plug-in" mode of installation. This has reduced the time of installation, and has allowed completion of the installation during November 1995. The CTV, LPV and SPV sites have been completely rebuilt with respect to instrumentation.

See NORSAR Sci. Rep No. 2-93/94 and NORSAR Sci. Rep No. 2-94/95 for a detailed description of the installations within SPVs and LPVs.

The Science Horizons XAVE data acquisition system has been operating satisfactorily during the intermediate installation period. A block diagram of the digitizer and communication controller components is found in NORSAR Sci. Rep No 2-94/95.

An example of recording from the new instrumentation is shown in Fig. 4.1. A test period with different combinations of gain resulted in using the Brick amplifier together with a gain of 10 in the AIM24 digitizer. This gave the best signal-to-noise ratio for frequencies above 2 Hz.

The NORSAR array has 42 short period seismometers, logically grouped into 7 subarrays. For data requests from stations that participate in GSETT-3, it is usual to have one name that signifies the full array and then individual station names of the individual components. For NORSAR it is suggested that **NORSAR** signify the full array, NAO signify all components of subarray 01A, a.s.o. See table 4.1 for the site naming convention for the NORSAR array.

Table 4.1.1. NORSAR site naming. The table shows original subarray names, ISC codes of the center instrument in each subarray and suggested names of each of the 6 SPV sites.

Old	(Sub)array name	Site names
	NORSAR	All sites within NORSAR
01A	NAO	NA1-00, NA1-01, NA1-02, NA1-03, NA1-04, NA1-05
01B	NBO	NB1-00, NB1-01, NB1-02, NB1-03, NB1-04, NB1-05
02B	NB2	NB2-00, NB2-01, NB2-02, NB2-03, NB2-04, NB2-05
02C	NC2	NC2-00, NC2-01, NC2-02, NC2-03, NC2-04, NC2-05
03C	NC3	NC3-00, NC3-01, NC3-02, NC3-03,NC3-04, NC3-05
04C	NC4	NC4-00, NC4-01, NC4-02, NC4-03, NC4-04, NC4-05
06C	NC6	NC6-00, NC6-01, NC6-02, NC6-03, NC6-04, NC6-05

NORSAR detection processing

The NORSAR detection processor has been continuously updated for the differences in acquisition system, and has been running satisfactorily. To maintain consistent detection capability, the NORSAR beam tables have not been changed.

Detection statistics for the NORSAR array are given in section 2.

NORSAR event processing

The routine processing of NORSAR events as described in NORSAR Sci. Rep No 2-93/94 has been continuously updated for the differences in acquisition system, and has been running satisfactorily.

J. Fyen

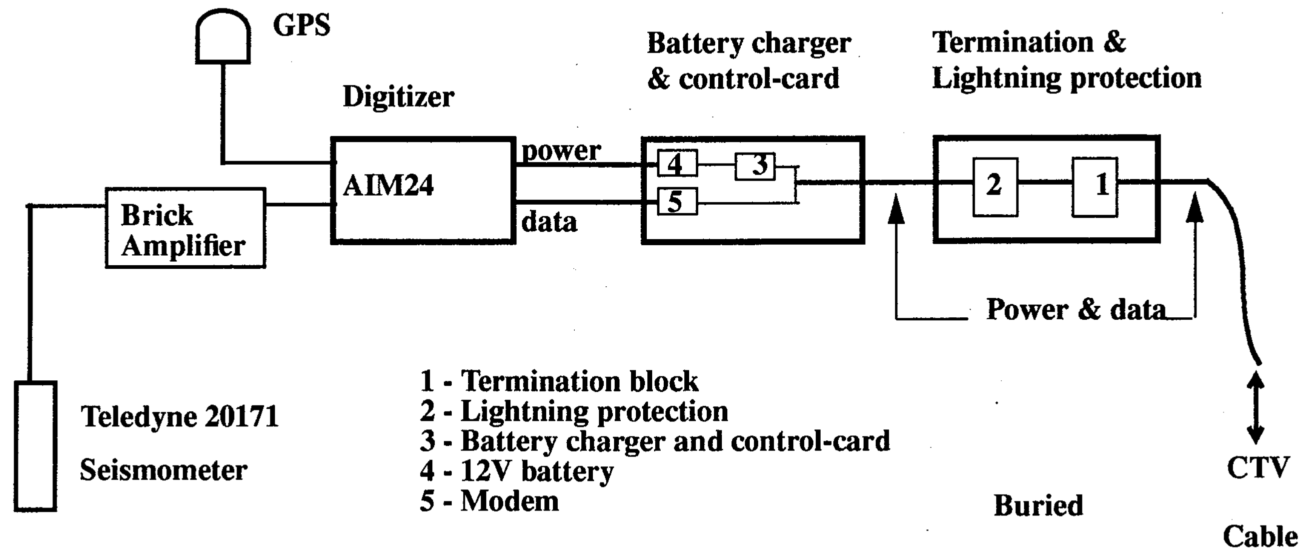

Fig. 4.1.1. Schematic illustration of remote SPV electronics. The buried cable between the SPV and the CTV is used for both power and data. The GPS antenna is installed outside the vault, inside a vertical PVC sewage pipe with a lid. The four boxes with electronics all fit into the original zinc-tank vaults. The sensitivity of the 20171-0104 seismometer is 650 V/m/s, and a damping of 0.707 is used. The gain of the Brick amplifier is 39.8, and an additional gain of 10 is used in the AIM24 digitizer.

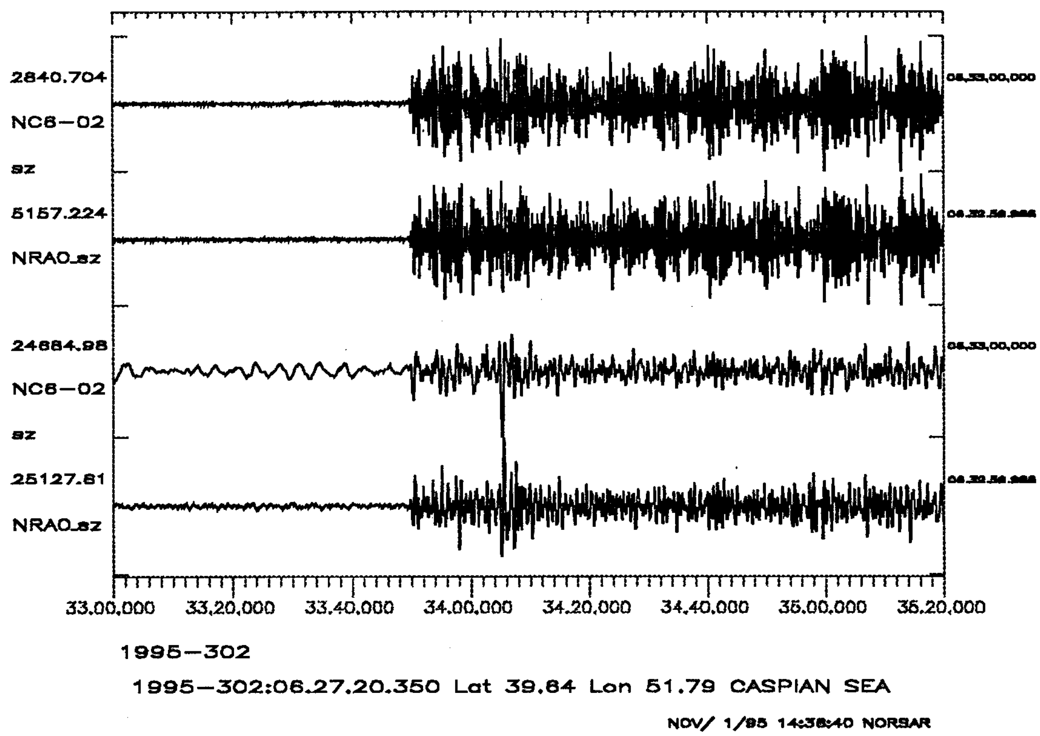

Figure 4.1.2 A Caspian event as recorded by the new short-period instrumentation at NC6-02/sz which is co-located with NRA0/sz. The two lower traces are original data after DC offset removal. The two upper traces are filtered 2 - 4 Hz.

5 Maintenance Activities

Activities in the field and at the Maintenance Center

This section summarizes the activities at the Maintenance Center (NMC) Hamar, and includes activities related to monitoring and control of the NORSAR teleseismic array, as well as the NORESS, ARCESS, FINESS, GERESS, Apatity, Spitsbergen and Hagfors small-aperture arrays.

Activities involve preventive and corrective maintenance, planning and activities related to the refurbishment of the NORSAR teleseismic array.

NORSAR

Visits to subarrays in connection with:

- Removal of Guralp broadband instrument, LPV 06C, at completion of test period
- Installation of overvoltage protection at all subarrays
- Repair of power supplies at remote sites after heavy thunderstorm
- Maintenance work on the CTVs and LPVs
- Installation of GPS clocks in LPVs
- Installation of JB-boxes and GPS clocks at remote sites

NORESS

- Repair of Hub 14 digital card which had been damaged by lightning
- Repair of fiber optical link to remote sites C7 and D7
- Repair of LF-DC synchronized clock
- Repair of broken power supply a remote site B4
- Replacement of CPU card and repair of broken power supply at remote site C5.
- Repair of fiber optical link and power supply are remote sites

ARCESS

- UPS unit found to be defective. Switched to bypass position (July 95)

Spitsbergen

- Charged batteries and replaced a defective windmill (April 95)
- Replacement of fuse on RD6 remote digitizer no. 2. RD6 no. 1 found to be defective
- Replacement of RD6 digitizer no. 1 (May 95)
- Installation of Guralp broadband seismometer in borehole B4
- Failure of NORAC data collection device. Sent to NORSAR for repair (June 95)

- NORAC reinstalled in Longyearbyen (July 95). No data received in Longyearbyen over the radiolink due to low battery voltage at the site.

NMC

- Continued the NORSAR refurbishment work

Additional details for the reporting period are provided in Table 5.1.

P.W. Larsen
K.A. Løken

Subarray/ area	Task	Date
	April 1995	
NORSAR	Disconnected Guralp broadband instrument from borehole CPV 06C. Test period ended.	27/4
Spitsbergen	Replaced windmill and charged the batteries	6-8/4
	Checked battery voltage and acid level in batteries Replaced fuse on RD6 remote digitizer no. 2. RD6 no. 1 found to be defective	19-21/4
NMC	NORSAR refurbishment work continued .	April
	May 1995	
NORSAR		
03C	Reset CIMs at 03C due to power failure	8-10/5
Sptisbergen	Replaced RD6 digitizer no. 1 Installed Guralp broadband seismometer in borehole B4	8-10/5
NMC	Continued NORSAR refurbishment work	May
	June 1995	
NORSAR		
01A	Installed new modem	8/6
02B	Installed overvoltage protection	1/6
	Reset CIM2 data collection device	29/6
03C	Installed overvoltage protection	1/6
04C	Installed overvoltage protection 220V AC power failure due to lightning	12/6
06C	Installed overvoltage protection. Adjusted gain	2/6
	Installed overvoltage protection. Adjusted gain	6/6
	Installed overvoltage protection. Adjusted gain. Modem failure due to lightning	7/6
	Reset CIM2 data collection device	29/6

Subarray/ area	Task	Date
Spitsbergen	Failure with the NORAC data collection device. Sent to NORSAR for repair	20/6
NMC	Continued NORSAR refurbishment work	June
	July 1995	
NORSAR	A heavy thunderstorm over the array damaged all power supplies for the remote sites	18/7
02C	Communications problems between site 02C and NDPC Replaced modem at 02C, but still problems due to defective communication line.	25/7 26/7
06C	Pointed out cable 06CSP01 in connection with cultivation	4/7
NORESS	Repaired Hub 14 digital interface card which had been damaged by lightning Repaired fiber optical link to remote sites C7 and D7	19/7 27/7
ARCESS	The UPS unit was found to be defective, probably damaged by overvoltage on the main 220 V AC line. The UPS was switched to bypass position	17/7
Spitsbergen	NORAC reinstalled in Longyearbyen. No data received in Longyearbyen over the radio link due to low battery voltage at the site	6/7
NMC	Continued NORSAR refurbishment work	July
	August 1995	
NORSAR	NORSAR refurbishment work continued at all CTV, LPV and remote sites	August
01B	Repaired broken power supply in CIM master unit Site 01B shut down. Started maintenance of the CTV and LPV (NORSAR refurbishment)	3/8 21/8

Subarray/ area	Task	Date
02B	Site 02B shut down. Started maintenance of the CTV and LPV. Installed GPS clock in LPV (NORSAR refurbishment)	28-29/8
02C	Site 02C shut down. Started maintenance of the CTV and LPV. Installed BPS and JB-boxes at all remote sites (NORSAR refurbishment)	22-25/8
03C	Site 03C shut down. Started maintenance of CTV and LPV (NORSAR refurbishment)	29/8
04C	Visited site due to failure on main 220 V AC power line.	4/8
NORESS	Repaired LF-DC synchronized clock	8/8
NMC	Continued NORSAR refurbishment work.	August
	September 1995	
NORSAR	NORSAR refurbishment work continued at all CTV, LPV and remote sites	September
01A	Site 01A shut down. Started maintenance of CTV and LPV. Installed JB-boxes and GPS at all remote sites. (NORSAR refurbishment)	7/9
04C	Site 04C shut down. Started maintenance of CTV and LPV. Installed JB-boxes and GPS at all remote sites. (NORSAR refurbishment)	5/9
NORESS	Repaired broken power supply at remote site B4 Replaced CPU card and repaired broken power supply at remote site C5. Replaced fiber optical link and power supply at remote site D6.	17/9 18/9
NMC	Continued the NORSAR refurbishment work	September

Table 5.1. Activities in the field and the NORSAR Maintenance Center during 1 April - 30 September 1995.

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7 Summary of Technical Reports / Papers Published

7.1 Analysis of data recorded at the Spitsbergen array

Introduction

This report presents results from analysis of data recorded at the Spitsbergen array (SPITS) from events in the Svalbard region during the period July through December 1994. Through this period 1258 seismic events in the Svalbard region were manually checked and located using data from the SPITS array.

Recording Performance

Since the installation of the Spitsbergen array in 1992, the SPITS data have been processed at NORSAR in the following way:

- From 11 December 1992 data from SPITS were included in the manual Intelligent Monitoring System (IMS) analysis when the data quality allowed for it. During the manual review of the automatic IMS results from the processing of data from the other arrays in the northern European region, the NORSAR analysts manually added the relevant SPITS data for the events already defined by the IMS.
- From 12 January 1994 the SPITS data were fully integrated in the IMS and automatically processed in the same way as the data from the other arrays.

Only data that have been manually checked are included in the analysis and shown in the maps in this report.

As indicated in Fig. 7.1.1 the recording performance from July through December 1994 was very good with no month except August having less than 90% uptime. The low uptime in August reflects the field work performed during 22-31 August, when cables were put in trenches, the S-500 seismometers were replaced with Guralp extended short-period (CMG3ES) seismometers and new batteries were installed. Also, a three-component Guralp broad band instrument (CMG-3T) was installed at site B4.

The gain factor and filtering of the new instrumentation was changed on 19 November. For the short period instruments the gain was changed from 6.1 μV/bit to 0.61 μV/bit, and for the broad band instrument the new gain was set to 1.2 μV/bit. At this visit also the high-pass filter corner frequency was changed from 10 to 2 seconds for the short-period instruments. The effect of this change is that we get better on scale recordings of regional seismic events, as can be seen in the difference between the 8 October and 24 November recordings in Figs. 7.1.8 and 7.1.9.

Detections and Locations

The total number of automatically determined event locations for which data from the SPITS array were used was 1378 events during the 6 months from 1 July through 31 December 1994, whereas the number of manually reviewed locations where SPITS data were used was 1258.

An overview of the Svalbard region is shown in Fig. 7.1.2, showing the location of the SPITS array and the KBS three-component station. In the same figure the four main mining sites (Pyramiden, Barentsburg, Svea and Gruve 3 & 7) are indicated.

Figs. 7.1.3 and 7.1.4 show the locations of reviewed seismic events in the period covered as well as those recorded on the array since the installation. The Mohns Ridge and the Knipovitch Ridge show a relatively high seismic activity as should be expected for these parts of the mid-Atlantic spreading ridge system. Possibly more interesting are the clusters of seismic activity on and off shore Svalbard:

1) In the northeast, Nordaustlandet shows a dispersed seismic activity at a relatively high rate, and with a possible E - W lineation over the central part.
2) In the Heerland area east of the Svea mine the seismic activity is very high and concentrated within a relatively small area.
3) East of the southern tip of Svalbard, in Storfjorden, a high activity seismic cluster in a relatively small area is found. The activity seems to extend in a northeasterly direction from this cluster.
4) Southeast of Egdeøya (in the Barents Sea) a more dispersed seismic activity is seen.

Some of the seismic clusters above have been recognized by earlier investigators (Bungum et al, 1982; Mitchell et al, 1990), notably the Heer Land zone and the Nordaustlandet seismicity, but also the more dispersed seismicity described under 3) above.

It is also of interest to observe that the Barents Sea south and east of the zone described under 4) seems to be void of seismic activity, and this is also the case for the off shore areas east of the Svalbard Archipelago.

The clustering of seismic events was so intriguing that a cluster analysis of the database was performed in terms of location, magnitude and time of day as shown in Fig. 7.1.5. From this figure it can be concluded that the seismicity shows a clear geographic clustering in the areas mentioned above, but that no clear clustering can be observed in the time of day distribution. This lack of time clustering around certain hours is a very good indicator that the data are real earthquakes and not man-made events, that tend to cluster in certain "firing" hours.

A very crude analysis of the Gutenberg-Richter recurrence parameters was attempted with the M_L magnitudes calculated. Most of the events in the area 76°N - 80°N and 10°E - 25°E had no magnitudes assigned, or had an m_b magnitude assigned. There were 61 earthquakes with M_L magnitudes greater than or equal to 2.0. The regression analysis yielded a relation

$$\log N = 4.06 + 1.25 \cdot M_L \quad (1)$$

which for the area under consideration tentatively would indicate return periods of 9 years for magnitude 4 and above and 150 years for magnitude 5 and above. As seen from Fig. 7.1.6 the b value is stable; however, the small amounts of data and the different tectonic environments covered (spreading ridge, oceanic crust and continental crust) certainly warrants further investigations with more data in order to obtain more reliable return periods.

Data examples

The broad band capability of the new extended short-period Guralp sensors is demonstrated through the records shown in Fig. 7.1.7 of the Chinese nuclear test on 7 October 1994. Figs 7.1.8 and 7.1.9 show SPITS recordings from events on the Knipovitch Ridge and Zone 3 (see list above), respectively. These two events occurred before and after the sensors were changed, and the difference in data quality should be evident. The new Guralp extended short-period sensors provide resolution also of the lower frequencies, where the larger earthquakes are particularly rich in energy. The smaller nearby earthquakes do not have sufficient low frequent energy to exceed the background noise, and hence must be filtered before the signal can be recognized.

C. Lindholm

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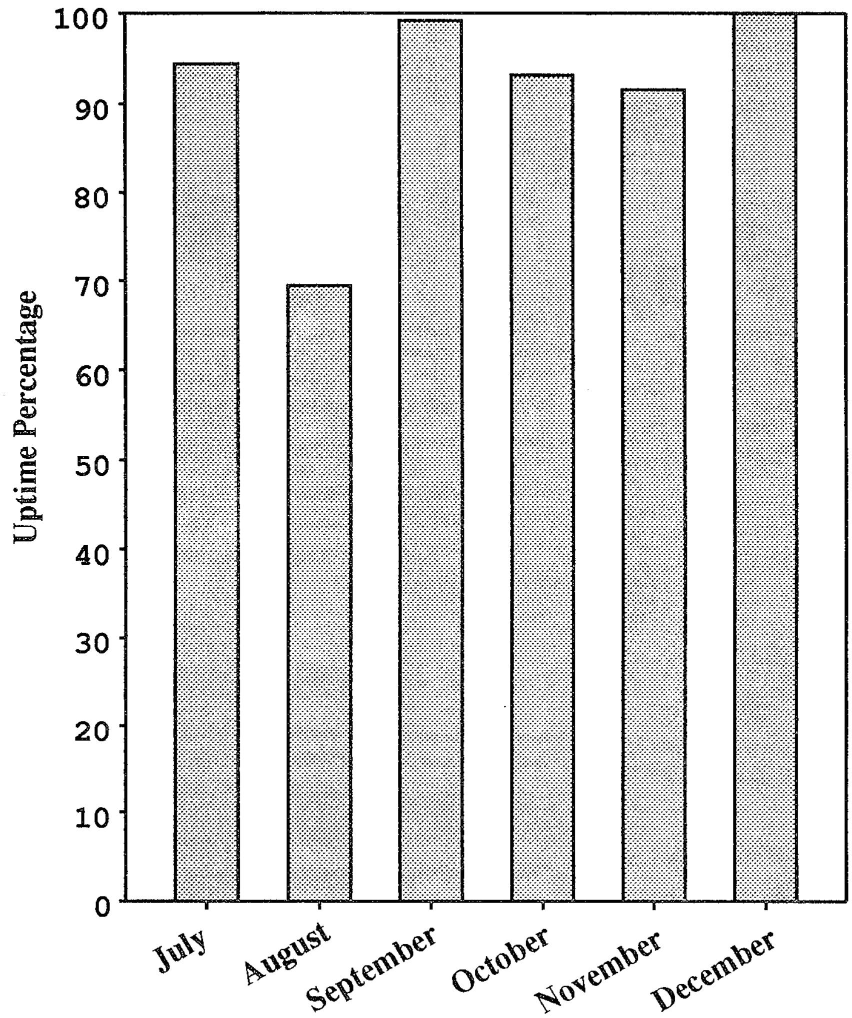

Fig. 7.1.1. Monthly uptime in percent for the SPITS on-line data recording during July-December 1994, taking into account all factors (field installations, transmission line, and data center operation) that affect the recording uptime.

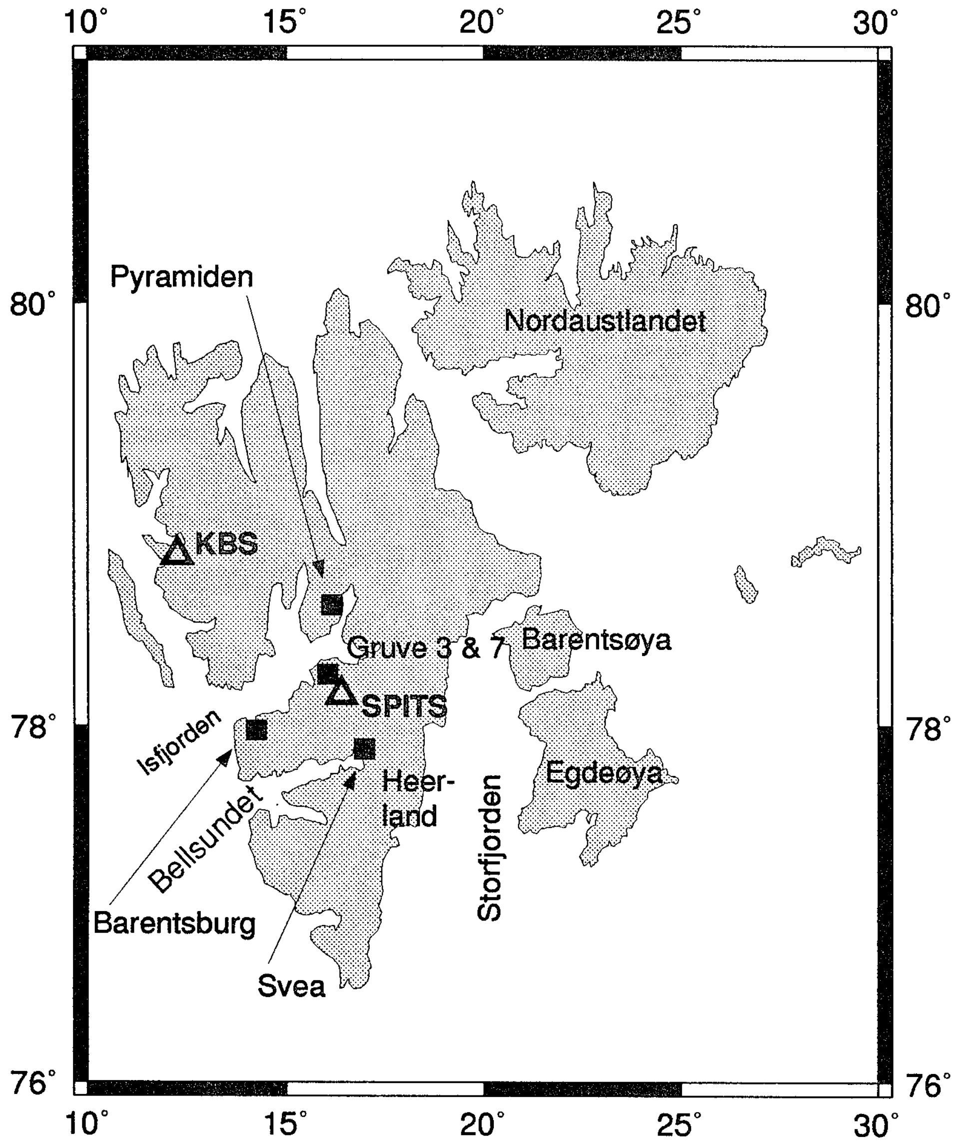

Fig. 7.1.2. Geographic names in the Svalbard region for main sites and areas mentioned in the text.

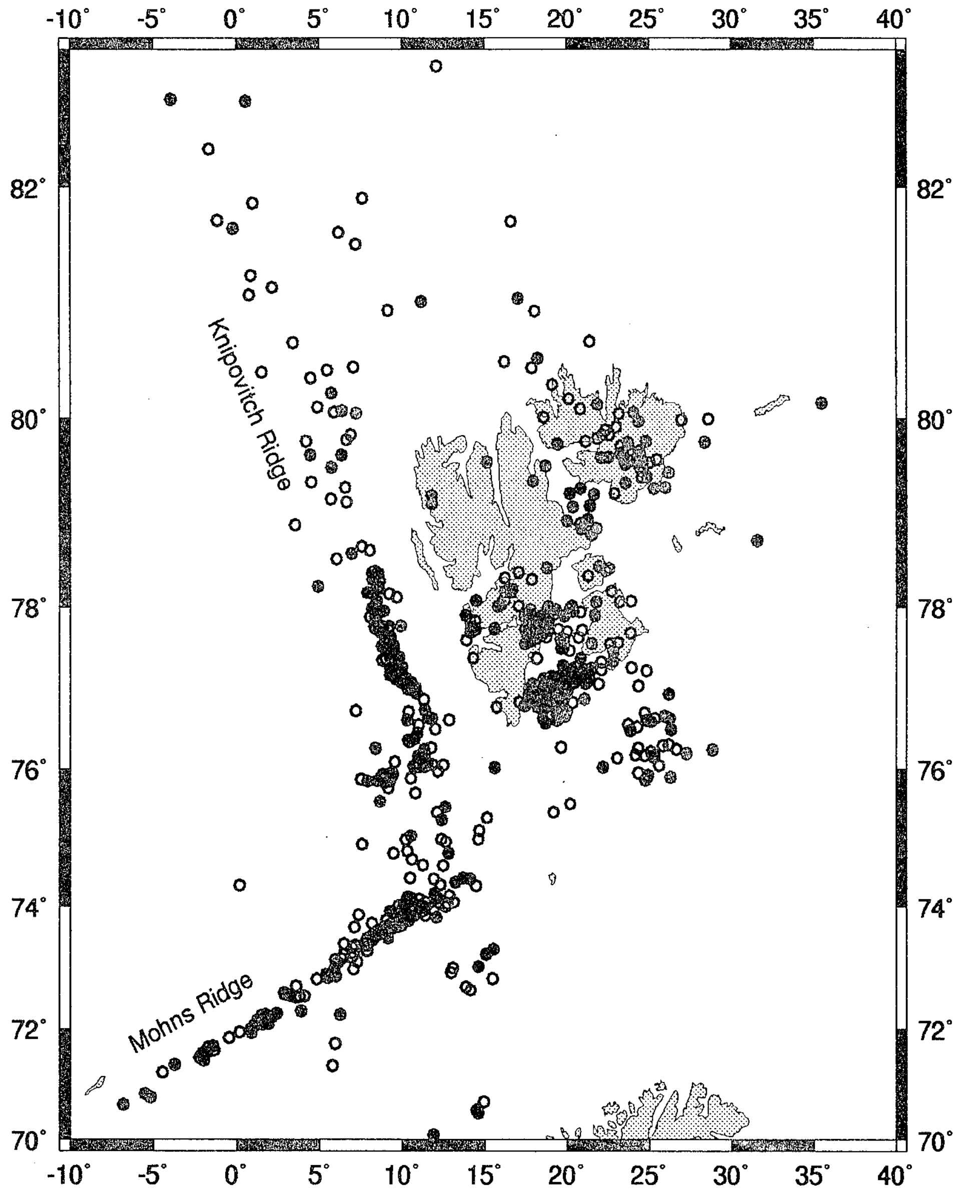

Fig. 7.1.3. Events located with data from the SPITS array in the six month period July through December 1994. Filled symbols represent epicenters within this reporting period, whereas open circles represent epicenters from before this reporting period.

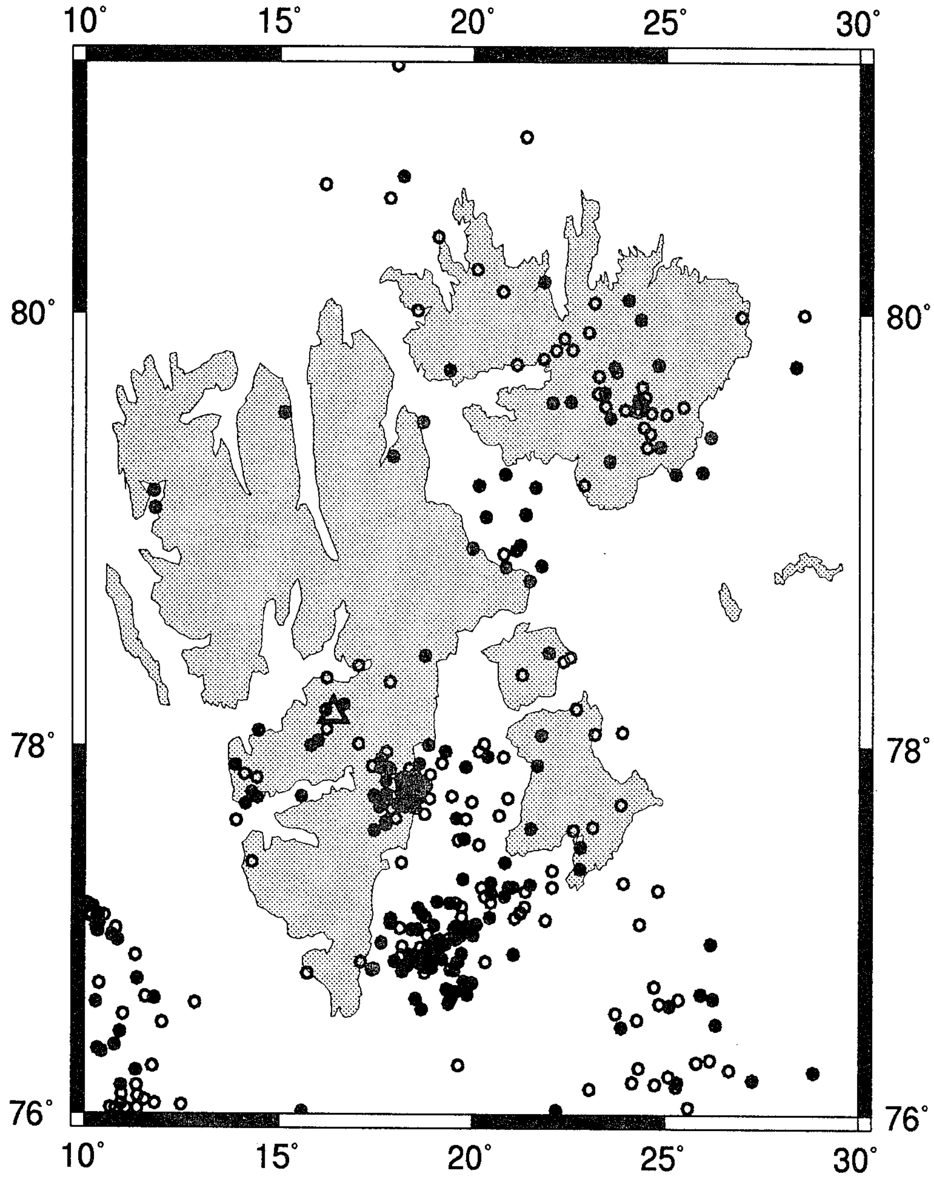

Fig. 7.1.4. Events located with data from the SPITS array in the six month period July through December 1994. Filled symbols represent epicenters within this reporting period, whereas open circles represent epicenters from before this reporting period.

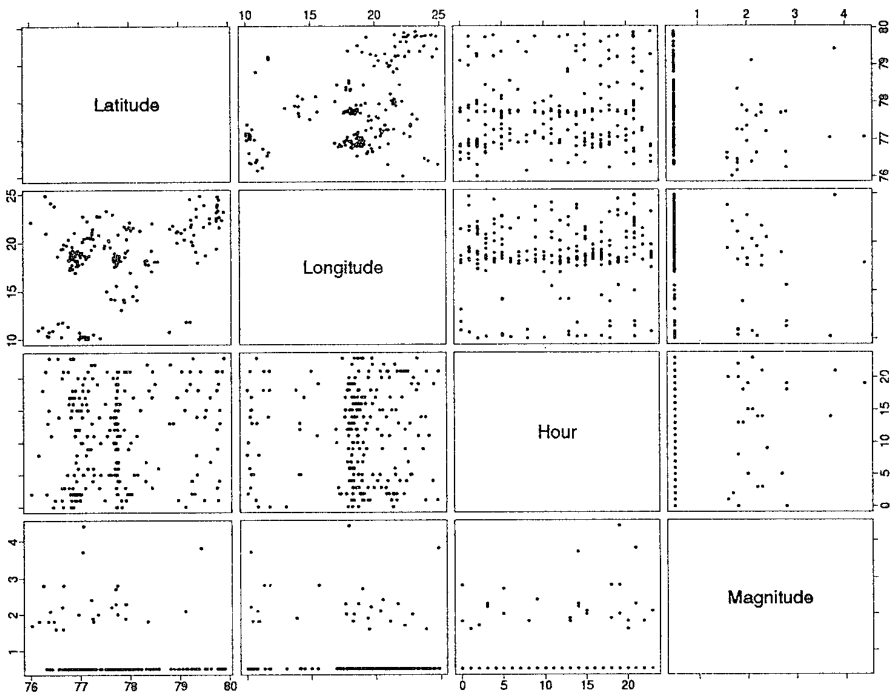

Fig. 7.1.5. Cluster plot of the seismic events in the region 76°N - 80°N and 10°E - 25°E. A strong correlation between any two of the four parameters latitude, longitude, hour of the day and magnitude would have been revealed here.

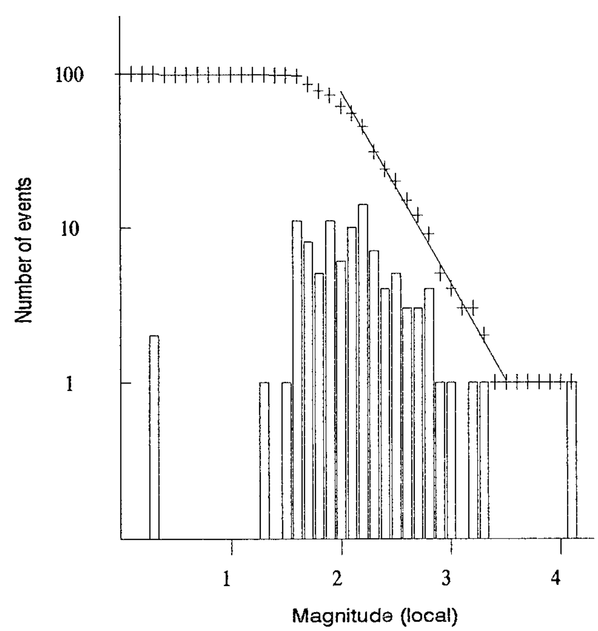

Fig. 7.1.6. Recurrence relation based on M_L magnitudes and a small sample of events (61) from the region 76°N - 80°N and 10°E - 25°E.

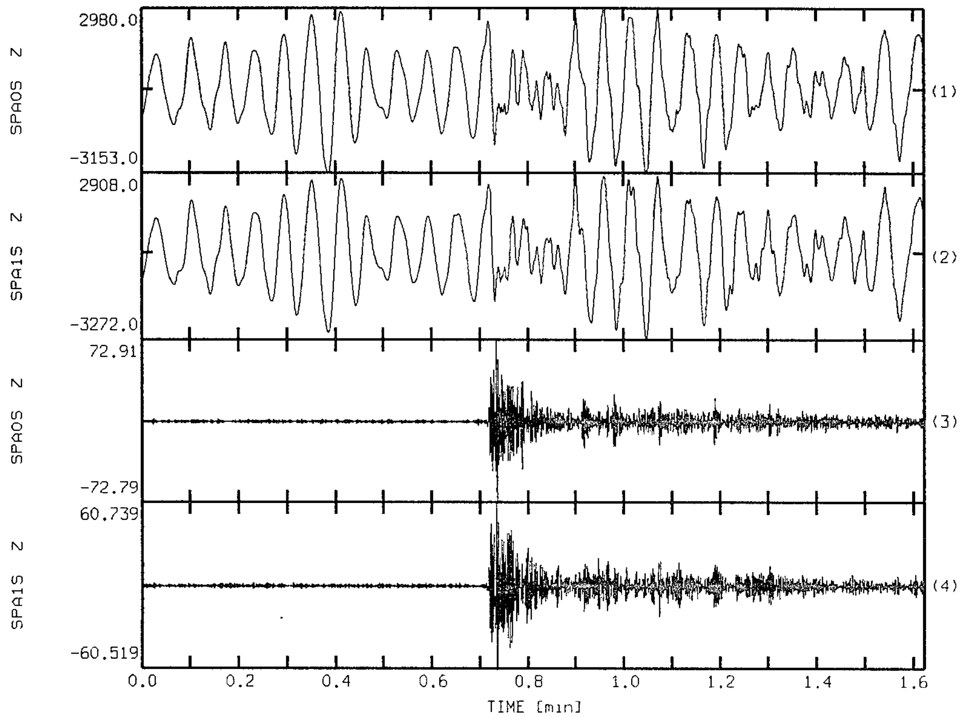

Fig. 7.1.7. Recording of the October 7, 1994, Chinese nuclear test at the SPITS array. The upper two records are unfiltered short-period channels for vertical instruments at sites A0 and A1, and the lower two records are the 4-8 Hz bandpass filtered records for the same two sensors.

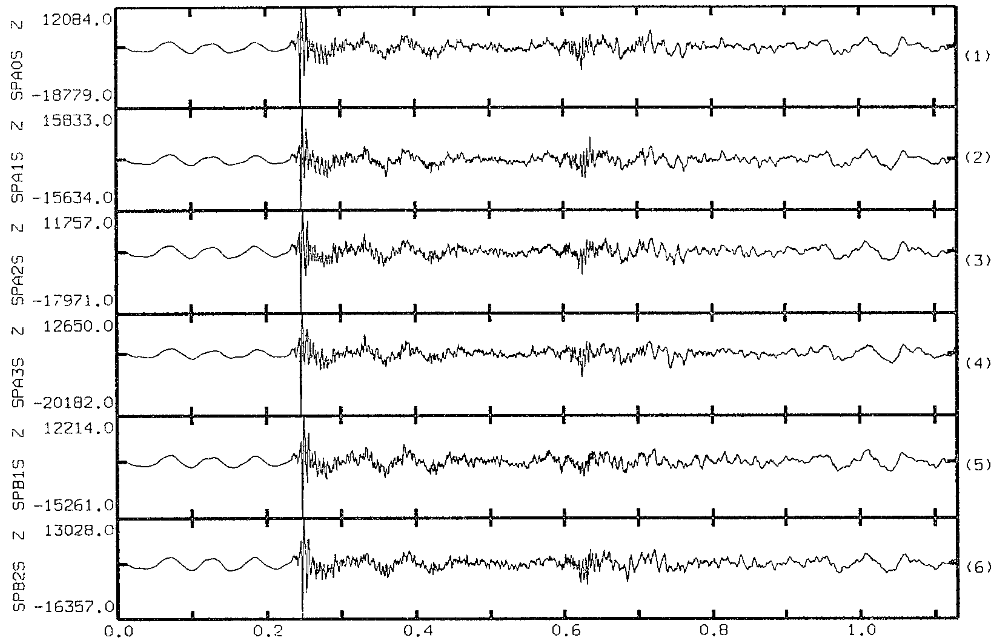

Fig. 7.1.8. Recording at SPITS of the 8 October 1994, 3.5 m_b earthquake on the Knipovitch Ridge (78.2^{o}N, 7.8^{o}E)

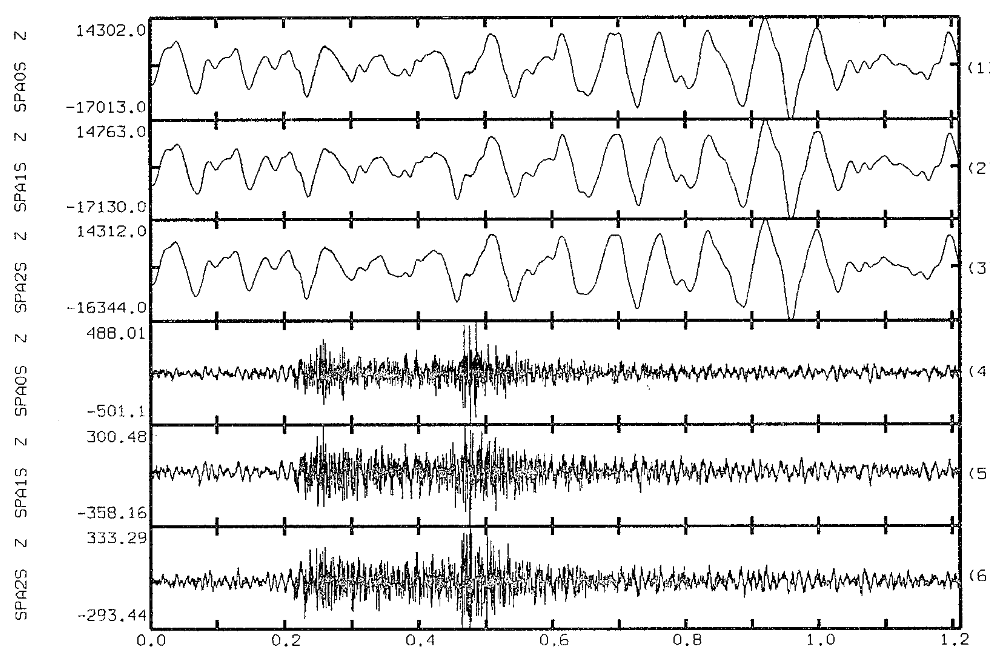

Fig. 7.1.9. Recording at SPITS of a 24 November 1994 earthquake off shore and south of the Heer Land Zone (77.1^{o}N, 17.9^{o}E). The upper three channels are raw short-period recordings, whereas the lower three traces are 2 - 15 Hz band pass filtered data for the same three instruments.

7.2 A comparison of the NORSAR array monthly bulletin with the Reviewed Event Bulletin (REB) of the GSETT-3 IDC

Introduction

The NORSAR teleseismic array has during the fall of 1995 undergone a complete technical refurbishment with respect to its electronic field components (seismometers, analog-to-digital converters and communications interfaces). Following completion of this effort, the NORSAR array will be used as an Alpha (primary) station in GSETT-3 and thus be among the stations that determine the event detection capability of the GSETT-3 network.

In order to assess the future contributions of the NORSAR array in GSETT-3, we have compared the REB issued by the GSETT-3 IDC with the NORSAR array bulletin for the period January - August 1995. The NORSAR bulletin is issued on a monthly basis and comprises events detected and located by the NORSAR teleseismic array on a stand-alone basis. During January - August 1995 the NORSAR array was operated in a temporary configuration, using the old HS-10 short period seismometers and Nanometrics RD-6 18-bit digitizers.

The comparison between the REB and the NORSAR monthly bulletin involved the determination of events in the REB that were not in the NORSAR bulletin, events that were clearly common but where the event solutions differed substantially, and events in the NORSAR bulletin for which there were no counterparts in the REB. Only events in the latter category are dealt with in this short contribution.

Analysis and discussion

Table 7.2.1 lists 207 events from the NORSAR bulletin during January - August 1995 for which there are no corresponding events in the GSETT-3 REB. The events in this table are plotted in Fig. 7.2.1. Most of the events are seen to cluster in four areas: the Balkans, Hindukush, Japan and the Kuriles, and the Fiji-Tonga-Kermadec area.

Based on their long experience with data from the NORSAR array, our analysts believe all 207 events in Table 7.2.1 to be real ones. Note, however, that the event epicenters may have an uncertainty of up to several hundred kilometers, as they are based on apparent velocities and arrival azimuths measured at one array station only. Only 11 of these 207 events are confirmed by the PDE bulletin, and the relevant PDE solutions are also given in Table 7.2.1.

For an event to appear in the REB it must have defining P-phases from three or more primary stations of the GSETT-3 network. The primary stations of the GSETT-3 network as of 26 August 1995 are shown in Fig. 7.2.2. The estimated detection capability of this network is shown in Fig. 7.2.3. The theoretical detection threshold for all four regions named above are seen in Fig. 7.2.3 to be at magnitude 4 and above, in terms of a 90% probability of P-wave detection at three primary stations in the GSETT-3 network.

By inspecting the magnitudes for the events in Table 7.2.1, one finds that the large majority of the events have magnitudes below the theoretical detection threshold of the GSETT-3 network in place by the end of the time interval under study. A few events in the Balkan area, however, do have NORSAR magnitudes slightly above the GSETT-3 network threshold. These events are from the Greece earthquake sequence in May 1995, which has been studied in detail by Ringdal (1995). The fact that a few events above the 90% threshold have not been reported is of course not necessarily a contradiction, and as shown in the mentioned paper, the REB detectability for the Balkan area is consistent with the theoretical estimates inferred from Fig. 7.2.3. Some events in the Japan-Kuriles region have NORSAR magnitudes of the order of the network threshold or slightly above, but again, this is to be expected. In general, our data confirm the validity of the theoretically estimated GSETT-3 detection capability.

Conclusion

Taking into account the uncertainty in the magnitude estimates, one may conclude that this investigation has qualitatively confirmed the theoretical detection thresholds of the GSETT-3 network in the four regions considered. Also, it shows that introduction of the NORSAR teleseismic array in the GSETT-3 primary network in the near future holds promise that more events from these four regions will enter the REB. In this connection, it should be noted that the on-going implementation of an improved NORSAR detector algorithm (Fyen et al, 1995) might add further events from areas where the NORSAR array is especially sensitive.

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References

Fyen, J., F. Ringdal & B. Paulsen (1995): Development of improved NORSAR time delay corrections. Semiannual Technical Summary, 1 April - 30 September 1995, NORSAR Sci. Rep. 1-95/96, Kjeller, Norway.

Ringdal, F. (1995): Magnitude estimation at the IDC — a case study. Semiannual Technical Summary, 1 April - 30 September 1995, NORSAR Sci. Rep. 1-95/96, Kjeller, Norway.

Table 7.2.1. This table lists 207 events from the NORSAR monthly bulletin for the period January - August 1995 for which there are no corresponding entries in the REB of the GSETT-3 IDC. PDE event solutions for 11 of these events are also given in the table.

NORSAR					PDE				
Date	Origin Time	Lat	Lon	M_b	Origin Time	Lat	Lon	Depth	M_b
January									
04	10.59.12	33N	78E	3.5					
08	11.14.27	29N	88E	3.7					
08	17.49.20	46N	149E	3.9					
09	02.51.38	46N	148E	4.2					
10	17.59.22	34N	77E	3.9					
11	15.01.28	27S	179E	3.7					
12	02.38.22	31N	141E	3.8					
13	06.32.36	44N	151E	4.2					
13	08.03.21	31N	140E	3.9					
13	23.05.02	47N	149E	3.8					
14	12.14.00	32N	75E	3.7					
16	07.36.09	26S	173W	3.8					
17	18.58.23	45N	147E	4.0					
17	22.53.30	41N	142E	3.8					
18	14.23.01	46N	148E	4.1					
19	10.01.21	47N	148E	4.3					
19	18.17.58	32S	176W	3.9					
23	08.03.45	33N	92E	4.0	08.03.35	32N	93E	33	3.8
25	13.55.57	43N	146E	3.9					
26	01.36.13	32S	179W	3.5					
31	14.32.46	29N	83E	3.9					
February									
01	16.12.24	34N	136E	4.1					
11	21.15.32	33S	178W	3.6					
12	12.22.31	43N	149E	4.0					
22	08.55.22	29N	73E	4.2					
25	19.45.46	40N	126E	3.3					
26	14.47.46	26S	179W	3.6					

NORSAR					PDE				
Date	Origin Time	Lat	Lon	M_b	Origin Time	Lat	Lon	Depth	M_b
March									
03	00.12.09	44N	150E	3.7					
03	22.36.30	39N	145E	3.8					
05	07.59.35	42N	28E	3.3					
09	04.48.45	60N	154W	4.4					
13	02.30.36	44N	150E	3.7					
14	13.15.41	45N	152E	4.0					
15	22.41.53	47N	151E	3.9					
17	18.22.39	27S	178W	3.7					
18	10.20.10	25S	179W	3.7					
18	12.53.19	48N	150E	3.8					
22	06.57.14	51N	168E	3.8					
24	23.49.11	38N	142E	3.9					
25	23.14.42	34S	177W	3.8					
26	15.56.49	32S	179W	3.7					
26	17.05.40	43N	143E	3.9	17.05.25	39N	144E	33	4.1
29	12.51.08	36N	76E	4.0					
30	02.30.09	39N	25E	3.2					
30	15.26.48	31N	71E	3.7					
31	04.15.40	46N	27E	3.2					
April									
04	11.17.29	35N	145E	4.2	11.17.37	36N	144E	33	4.4
04	11.44.02	34N	146E	4.0					
05	03.18.39	29N	97E	3.8					
08	08.34.15	55N	158E	4.1					
10	00.14.52	36N	68E	3.3					
10	04.08.30	39N	22E	3.1					
11	07.36.24	36N	22E	3.4					
11	09.10.53	34N	71E	3.6					
13	06.33.25	32S	179W	4.0					
14	08.11.46	43N	142E	3.9					

NORSAR					PDE				
Date	Origin Time	Lat	Lon	M_b	Origin Time	Lat	Lon	Depth	M_b
16	00.36.16	45N	145E	3.8					
17	03.20.10	34N	141E	3.7					
17	15.21.49	32S	179W	3.7					
18	01.20.40	39N	144E	3.8					
18	03.55.19	50N	152E	4.0					
20	13.40.35	43N	150E	4.0					
21	01.58.45	14S	167E	4.1					
21	05.19.24	11N	125E	4.8					
22	10.39.34	11N	125E	4.4					
22	11.42.01	41N	144E	3.9					
22	22.33.46	16N	61W	3.8					
23	18.11.53	44N	145E	3.4					
24	18.13.08	23N	124E	3.8					
24	21.47.04	31N	136E	3.8					
25	23.22.59	37N	74E	3.8					
28	17.02.30	45N	149E	3.4					
28	17.02.50	45N	149E	3.6					
30	10.51.23	28S	177E	3.1					
May									
03	22.33.28	42N	22E	3.0	22.33.06	41N	24E	33	
05	11.04.13	26N	59E	3.7					
15	00.31.47	44N	22E	3.5	00.30.56	40N	22E	10	
15	04.58.41	34N	22E	3.8					
15	05.55.29	44N	21E	3.8					
15	06.15.52	44N	21E	3.4					
15	12.03.54	41N	20E	3.3					
15	13.01.42	36N	23E	3.8					
15	13.51.37	44N	22E	3.3					
15	13.58.33	36N	23E	4.2					
15	15.47.19	45N	21E	3.5					
16	04.27.59	46N	27E	3.5					

NORSAR					PDE				
Date	Origin Time	Lat	Lon	M_b	Origin Time	Lat	Lon	Depth	M_b
16	04.39.21	44N	21E	4.3					
16	15.01.03	43N	19E	3.2					
17	01.56.02	44N	21E	3.3					
17	02.04.12	45N	22E	3.3					
17	10.07.57	41N	20E	3.8					
17	10.22.16	44N	21E	3.3					
17	11.35.10	36N	22E	3.3					
17	11.37.35	44N	21E	4.2	11.36.45	40N	22E	10	
17	12.17.25	42N	21E	3.0					
17	15.51.51	45N	22E	3.3					
17	16.04.04	44N	22E	3.4					
17	17.00.34	43N	20E	3.6					
17	17.10.38	37N	22E	3.3					
17	17.31.58	41N	19E	3.3					
17	22.51.53	40N	139E	3.7					
18	07.21.51	44N	21E	3.7					
18	12.40.04	43N	20E	3.4					
19	08.21.17	36N	23E	3.6					
19	19.00.19	44N	21E	3.5					
20	20.21.46	44N	22E	3.2					
21	08.43.52	45N	26E	3.1					
21	17.03.29	29S	172W	3.5					
22	00.25.53	32N	145E	3.7					
22	03.46.28	43N	20E	3.5					
22	19.05.42	34N	65E	3.6					
22	20.54.35	36N	22E	3.4					
24	06.18.40	44N	21E	3.7					
24	06.30.30	41N	20E	3.2					
24	08.57.41	41N	20E	3.3					
24	09.14.41	43N	17E	2.7					
24	10.34.49	43N	19E	3.1					

NORSAR					PDE				
Date	Origin Time	Lat	Lon	M_b	Origin Time	Lat	Lon	Depth	M_b
24	10.46.16	43N	20E	3.4					
24	11.43.20	37N	24E	3.5					
24	15.08.22	43N	17E	2.7					
24	15.58.40	38N	23E	3.2					
24	16.19.29	43N	21E	2.9					
24	19.29.39	43N	20E	3.0					
24	20.20.12	46N	148E	3.8					
25	01.41.13	44N	22E	3.2					
25	04.34.55	38N	17E	3.1					
25	21.37.42	42N	20E	3.3					
25	23.12.31	41N	20E	3.2					
26	08.56.50	30N	137E	3.7					
26	11.31.24	41N	21E	2.9					
26	22.55.52	33N	133E						
27	06.21.45	28S	173W	3.6					
27	09.33.48	32N	72E	3.7					
28	03.02.43	57N	145E	3.6					
28	03.35.18	32S	179W	3.2					
28	09.58.18	25N	123E	4.0					
28	19.05.09	25S	178E	3.7					
29	01.28.09	21N	99E	3.9					
30	05.39.49	34N	68E	3.7					
30	10.54.13	45N	146E	3.9					
30	14.27.51	26S	175E	3.5					
June									
03	09.21.31	34N	68E	3.8					
05	18.33.18	44N	26E	3.2					
06	01.13.39	43N	145E	3.9					
11	17.20.17	41N	25E	3.6	17.20.11	40N	22E	10	
12	05.28.06	41N	21E	3.3					
12	12.49.18	41N	21E	3.0					

NORSAR					PDE				
Date	Origin Time	Lat	Lon	M_b	Origin Time	Lat	Lon	Depth	M_b
13	10.06.01	27N	129E	4.0					
14	09.43.17	44N	21E	3.6					
15	01.11.55	36S	180E	3.9					
15	01.15.25	45N	21E	3.3					
16	01.32.11	30N	142E	3.8					
16	16.40.50	41N	21E	3.0	16.39.21	34N	25E	10	
17	07.05.45	45N	148E	3.7					
18	01.48.24	45N	150E	3.6					
19	05.03.57	48N	151E	4.0					
26	10.55.45	45N	148E	3.9					
27	06.34.27	43N	22E	3.1	06.33.54	40N	21E	5	3.7
28	00.25.27	14N	93W	4.0					
30	09.18.22	51N	153E	3.7					
July									
01	22.41.35	59N	144E	3.7					
02	08.48.58	36N	145E	3.8					
04	06.59.25	48N	147E	3.8					
08	07.38.57	40N	143E	3.8					
08	08.04.51	41N	144E	3.8					
08	08.53.40	42N	144E	3.8					
09	20.57.37	7N	64E	3.7					
10	09.38.36	33N	71E	3.7					
10	11.34.27	37N	76E	3.4					
10	13.52.48	20N	99E	3.7					
10	14.11.54	42N	21E	3.3					
11	04.53.25	34N	77E	3.6					
11	22.21.41	21N	100E	3.9					
11	22.32.08	25S	179W	3.3					
11	23.18.39	20N	99E	3.8					
12	00.03.12	22N	99E	3.8					
12	00.07.47	32N	74E	3.5					

NORSAR					PDE				
Date	Origin Time	Lat	Lon	M_b	Origin Time	Lat	Lon	Depth	M_b
12	00.51.17	22N	100E	3.6					
12	01.51.56	21N	100E	3.9					
12	22.15.14	14S	17W	3.6					
17	23.44.59	44N	19E	3.2					
21	07.16.04	43N	149E	3.8					
22	05.12.12	28N	133E	4.3					
23	15.11.26	29N	141E	4.1					
26	09.20.08	48N	170W	4.1					
27	08.26.31	46N	148E	3.9					
28	19.57.31	44N	21E	3.4	19.56.41	40N	21E	10	3.8
29	14.05.16	25S	175W	3.6					
29	16.16.16	47N	149E	3.7					
30	22.47.47	39N	26E	3.0					
31	04.35.42	44N	23E	3.1					
August									
01	12.35.38	12N	143E	4.7					
01	13.47.19	33N	143E	3.6					
03	22.27.56	29N	45W	3.6					
06	19.28.32	45N	150E	4.0					
07	15.01.20	0S	25W	4.0					
08	18.20.11	44N	22E	3.2					
09	05.01.57	39N	145E	4.0					
12	01.10.11	35N	64E	3.5					
15	00.47.18	6N	74W	4.0					
17	04.38.03	40N	22E	3.2	04.38.15	42N	23E	10	
17	18.13.34	5S	153E	4.3					
17	20.23.41	37N	72E	3.6					
18	02.03.38	25S	176W	3.5					
18	09.21.49	46N	30E	3.3					
20	01.06.10	27N	134E	3.9					
28	07.26.04	45N	149E	3.9					

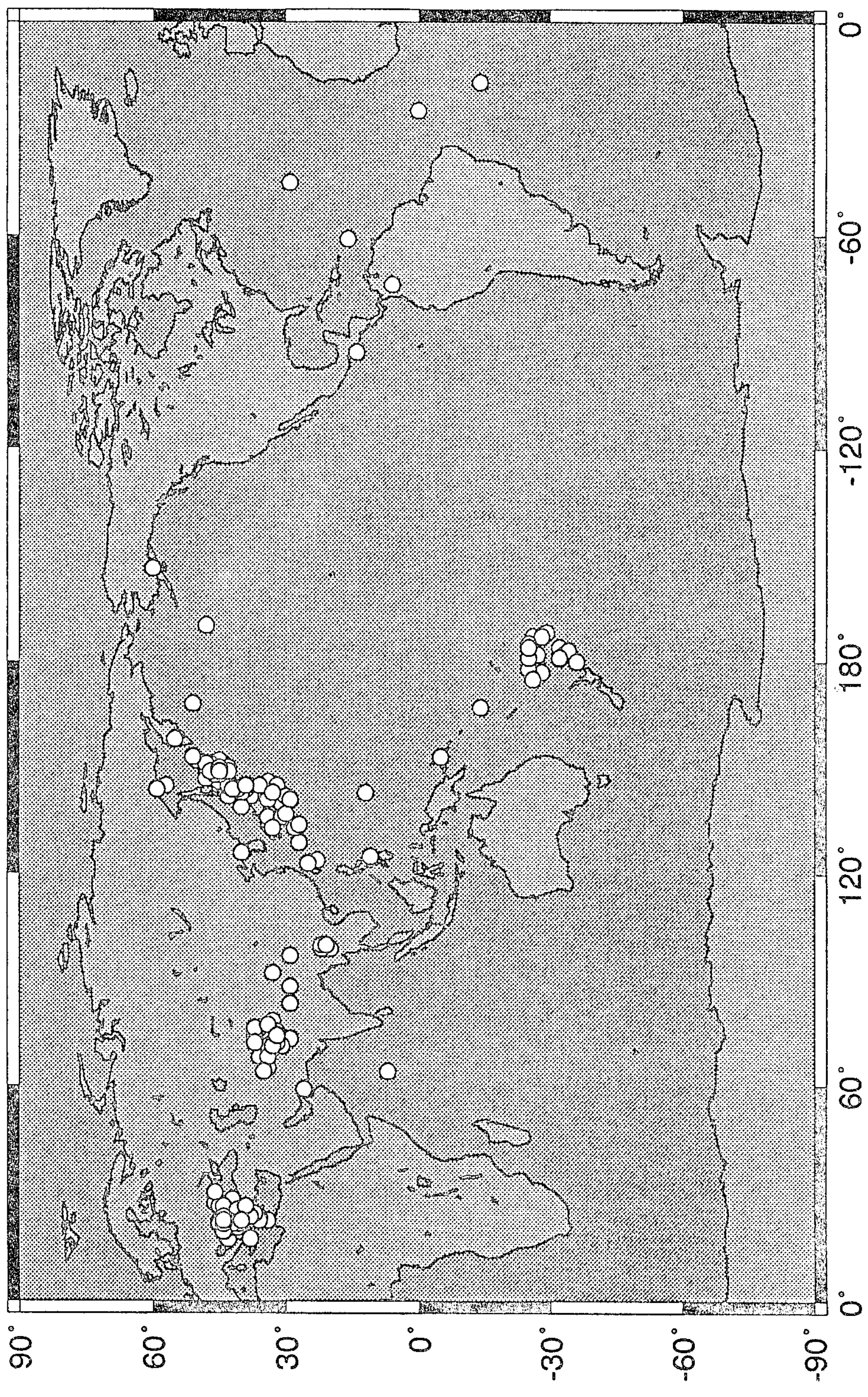

Fig. 7.2.1. This figure shows 207 events in the NORSAR bulletin for the period January - August 1995 for which there are no corresponding events in the REB of the GSETT-3 IDC.

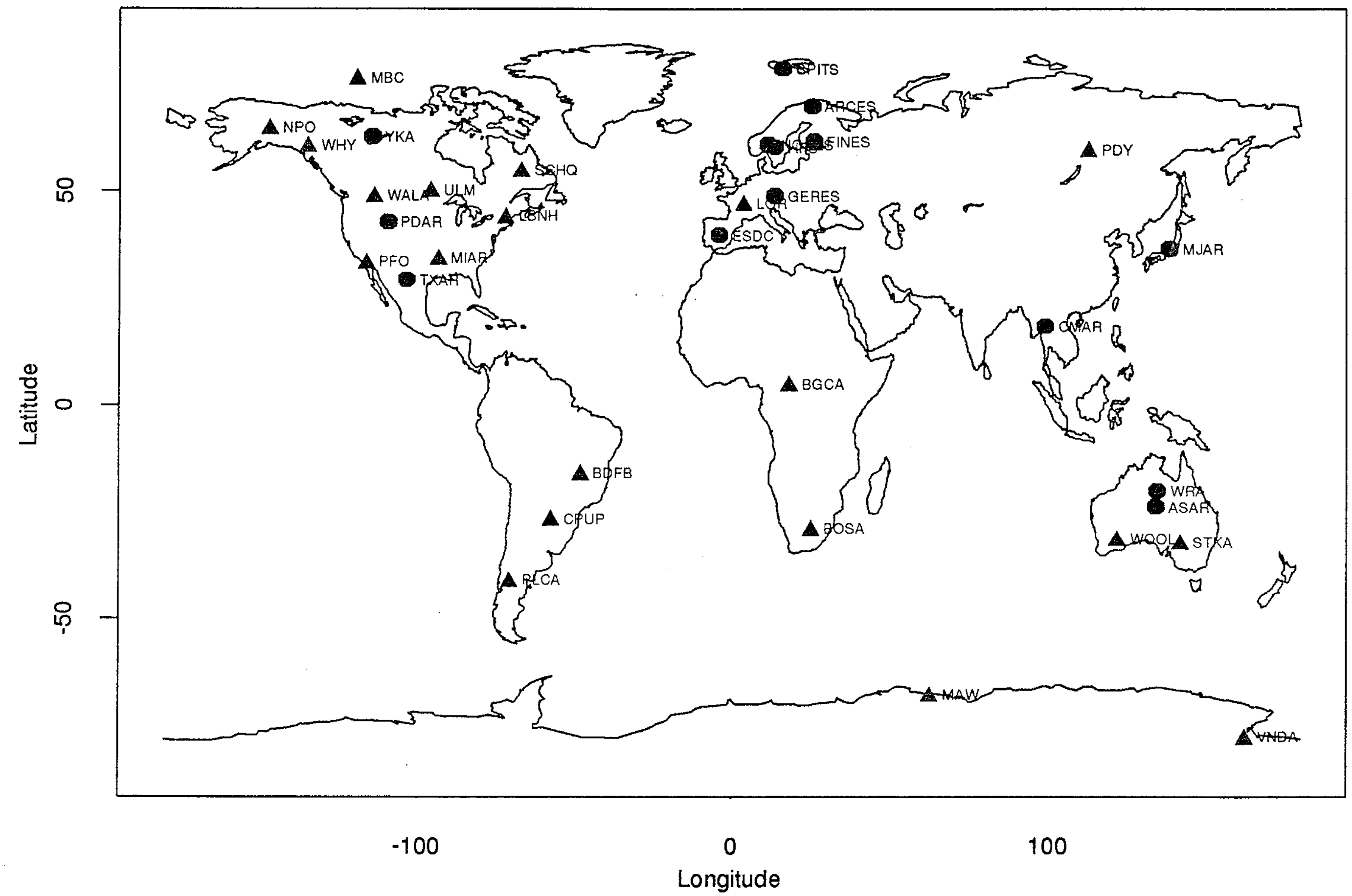

Fig. 7.2.2. This figure shows the GSETT-3 primary station network as of 26 August 1995. Array stations and 3-C stations are marked as circles and triangles, respectively. The figure is taken from the IDC Performance Report for the period 13-26 August 1995.

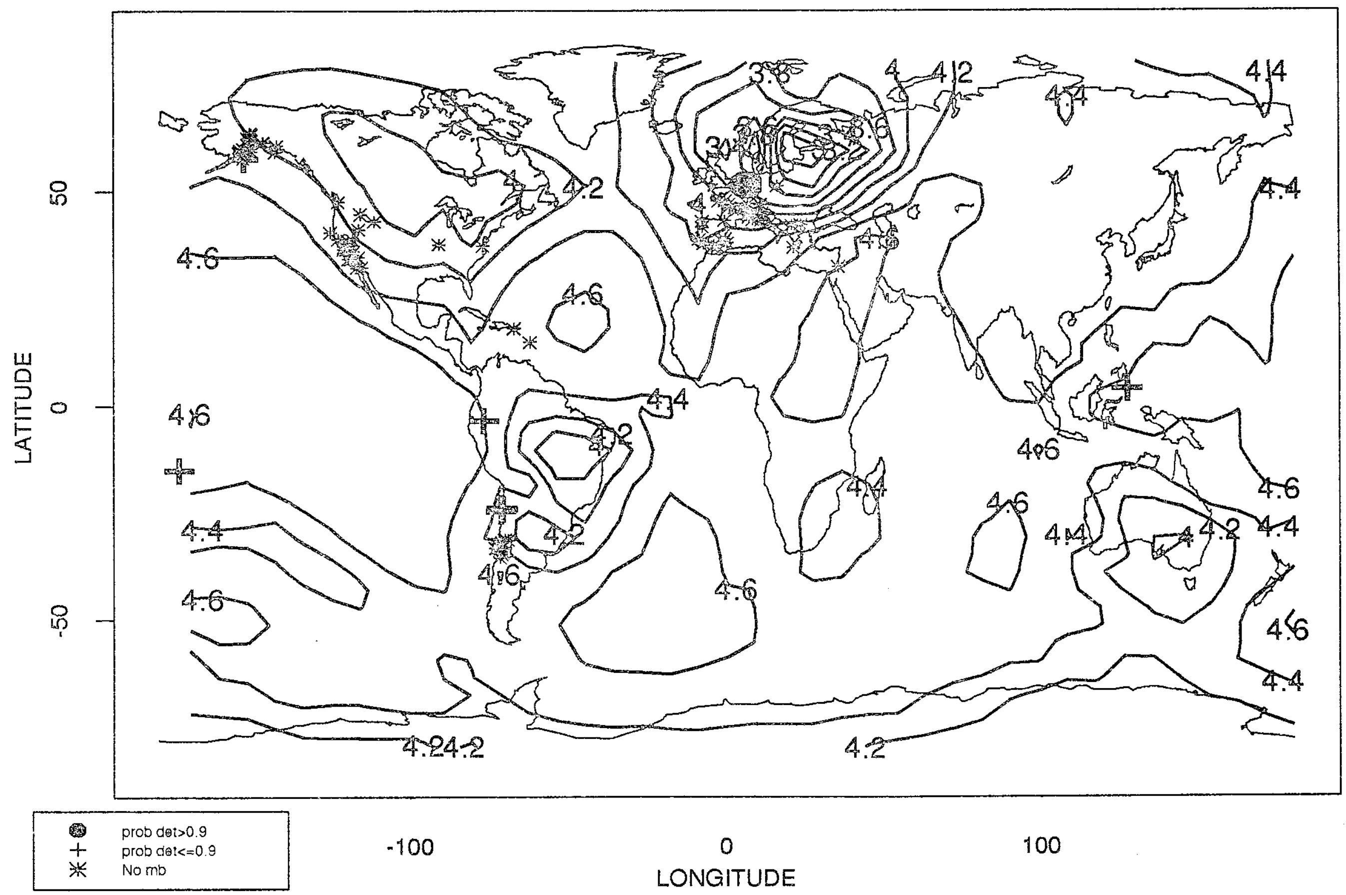

Fig. 7.2.3. The map shows the estimated detection capability of the GSETT-3 primary station network shown in Fig. 7.2.2. The contours show the detection capability in terms of 90% probability for P-wave detections on three GSETT-3 primary stations. The solid circle, plus signs and asterisks denote events found in the QED, but not in the REB (see the IDC Performance Report for the period 13-26 August 1995, from which this figure is reproduced, for further details).

7.3 Development of improved NORSAR time delay corrections

Introduction

The large aperture NORSAR array began operation in 1970, and comprised initially a configuration of 22 subarrays distributed over a diameter of 100 km. After six years of experimental operation, the array was modified on 1 October 1976 to a reduced configuration which was more suitable for an automated, operational system, and the 7 best subarrays (in the NE part of the original array) were selected for this purpose. This configuration is still in operation today, with each subarray comprising 6 SP and one 3-component BB seismometer over an area 8 km in diameter. The total aperture of NORSAR is now 60 km (Fig. 7.3.1).

A complete technical refurbishment of the NORSAR array was carried out during 1992-1995, and the array will in 1996 be ready for participation in the GSETT-3 experiment. However, in order to take full advantage of the NORSAR capabilities, it is desirable to update the beam deployment and revise the time delay anomalies taking into account the improved precision made possible from the increased sampling rate (40 Hz against previously 20 Hz) and the accumulated data base of reference events. This paper gives a progress report on the work carried out until now and should be seen in connection with previous reports on this subject (Fyen, 1995a, 1995b).

Procedure

The main points of revising the NORSAR beam deployment, as described in more detail in Fyen (1995a) are summarized as follows:

Data base development

We are compiling a data base of several hundred well-recorded and well-located events, dating back to the initial NORSAR establishment in 1970. Emphasis is on obtaining a good geographical distribution of epicenters. Among the events of special interest here will of course be the known nuclear explosions, especially the large number of PNEs in the former Soviet Union.

Reference locations

We have primarily made use of ISC or PDE location estimates for reference purposes. In cases where more accurate locations have been published (e.g., in recent literature or in local bulletins), these locations will be used. Additionally, location of recent events calculated by the GSETT-3 IDC is a helpful supplement.

Channel correlation

The reference events are systematically analyzed using a semi-automated channel correlation procedure, and verified by an experienced analyst. The correlation is based on the first cycle(s) of the P-signal, in an optimum filter band. A resampling procedure is applied before the correlation in order to improve the timing resolution.

Consistency checking of the delay anomalies

By using several reference events from nearby locations, it will be possible to make a systematic search for outliers. This procedure ensures that the data are consistent to the extent possible.

Interpolation in inverse velocity space

As originally done by IBM in the LASA/NORSAR development (Berteussen, 1974), the data base of time delay anomalies will, if necessary, be subjected to two-dimensional interpolation in inverse velocity space, to obtain anomaly estimates for regions in which no events have been recorded. For many regions, we expect the coverage to be dense enough so that interpolation is unnecessary.

Beam deployment

A revised beam deployment for NORSAR is being developed on the basis of the results of this study. The beamforming gain at various frequencies has been compared to the previous beams, so as to quantify the improvements achieved by this project.

Use of single-sensor anomalies

In contrast to the original time delay anomalies for NORSAR, which were developed only for subarray beams, the new set of delays are compiled as far as possible on an individual seismometer basis. This implies that even detection at the subarray level should be significantly improved, especially at high frequencies. However, in some regions the SNRs of the reference events are insufficient for single sensor analysis, and subarray beams are used in these cases.

For further details on NORSAR detection processing, slowness estimation and measurement of time delay anomalies, reference is made to Fyen (1995a).

Data analysis

Data base

The data base analyzed so far comprises 55 reference events, as listed in Table 7.3.1. The events are distributed globally, but for some areas several close events have been analyzed in order to compare the consistency of the results.

Correlation procedure

For each event, an interactive correlation procedure was carried out, as described by Fyen (1995a) and illustrated in Figs. 7.3.2 and 7.3.3. The first of these figures illustrates time picks within one subarray, whereas the second figure shows time-aligned traces from the entire array after automatic waveform correlation. It is seen that the correlation is excellent for the first two cycles, whereas scattering effects cause the remainder of the wavetrain to be far less coherent across the array.

Location anomalies

For each event, a plane wave was fitted by least squares, using the final time picks. This enabled us to calculate an "uncalibrated" location based on observed azimuth and velocity (using IASPEI tables to convert velocity to distance). Fig. 7.3.4 compares these uncalibrated locations with the "true" location of the reference events. Not unexpectedly, the azimuth is relatively more reliable than the distance, but even the azimuth needs correction in some cases. The location errors are generally quite consistent over limited areas, implying that consistent correction will be possible to apply.

SNR gains

We expect that the SNR gains achieved by the new time delay corrections will be significant for events of dominant high frequencies. The new time delays will make full array processing feasible in a filter band as high as 2-4 Hz, as compared to the current 1.2-3.2 Hz filter. Fig. 7.3.5 shows the relative SNR on the array beam for the 55 reference events using 2-4 Hz filter with the new corrections and 1.2-3.2 Hz for the old corrections. In some cases, a gain by a factor of 5 (0.7 m_b units) is observed. It is also seen that for some events (with low-frequency signal content) the 1.2-3.2 filter is still better than 2-4 Hz. This shows that it will be necessary to apply a set of narrow band filters for optimum detectability, similar to what is done for the NORESS-type arrays.

The new time delays are in general not expected to give large gains in the 1.2-3.2 Hz band for areas where the old calibration data base is well developed. For example, Fig. 7.3.6 shows array beam (new and old time delays) for a scaled-down signal (a factor of 200) from a Lop Nor explosion. The SNR for the new set is slightly better, but not by a large amount. Nevertheless, the new time delays should give significant gain in the 1.2-3.2 Hz band for areas where the old data base is less well established, and this will be investigated further.

Future plans

The data base will be extended to comprise several hundred well-recorded events, using the same analysis procedures as described above. This is expected to provide significantly more accurate azimuth/velocity estimates for detected events world wide, and would also contribute to improved detectability by enabling full NORSAR array processing in additional high-frequency filter bands.

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Event	Year	Doy	hh	mm	sec	Lat	Lon	Vel	Azi
nao71157b	1971	157	04	02	57.3	49.98	77.74	13.14	76.11
nao71310	1971	310	22	00	00.1	51.47	179.11	17.53	8.17
nao72265	1972	265	15	30	00.2	37.08	-116.04	18.79	318.32
nao73137	1973	137	16	00	00.0	39.79	-108.37	17.69	313.80
nao73157	1973	157	13	00	00.1	37.25	-116.35	18.78	318.63
nao73172	1973	172	14	44	59.3	37.08	-115.99	18.79	318.29
nao74138	1974	138	02	34	55.4	26.99	71.80	14.99	102.01
nao75051	1975	051	05	32	57.6	49.76	78.09	13.16	76.00
nao75070	1975	070	05	42	57.6	49.76	78.23	13.17	75.92
nao75117	1975	117	05	36	57.3	49.94	79.02	13.19	75.15
nao75159	1975	159	03	26	57.6	49.75	78.08	13.17	76.06
nao75170	1975	170	13	00	00.1	37.35	-116.32	18.76	318.65
nao75181	1975	181	03	26	57.3	49.98	78.92	13.19	75.13
nao75224	1975	224	15	00	00.0	70.76	127.12	13.50	26.95
nao75302	1975	302	04	46	57.3	49.92	78.91	13.19	75.16
nao76015	1976	015	04	46	57.3	49.80	78.25	13.17	75.82
nao76080	1976	080	04	34	00.0	41.76	88.67	14.45	76.04
nao76211	1976	211	04	59	58.0	47.81	48.10	12.20	105.43
nao76310	1976	310	03	59	56.9	61.52	112.73	13.83	42.60
nao77132	1977	132	11	17	50.0	39.29	117.71	16.81	56.14
nao77161	1977	161	00	40	58.9	39.62	117.99	16.77	55.79
nao77170	1977	170	11	47	23.9	47.12	151.09	17.53	28.45
nao77222	1977	222	22	00	02.0	50.95	110.78	14.80	53.11
nao77330	1977	330	22	46	52.0	39.47	117.99	16.80	55.86
nao77347	1977	347	01	14	20.5	17.33	-54.91	16.76	257.46
nao78066a	1978	066	02	48	39.1	31.92	137.62	19.88	44.45
nao78066b	1978	066	02	48	47.6	31.99	137.61	19.88	44.45
nao78102	1978	102	03	42	03.7	56.52	-152.61	16.54	349.97
nao78143	1978	143	07	50	28.3	31.07	130.10	19.41	50.81

Event	Year	Doy	hh	mm	sec	Lat	Lon	Vel	Azi
nao78204	1978	204	14	42	39.5	22.19	121.42	20.58	61.88
nao78205	1978	205	08	06	17.0	26.61	-88.82	18.42	291.83
nao78221	1978	221	17	59	58.1	63.65	125.34	14.10	34.36
nao78264	1978	264	14	59	57.6	66.53	86.26	12.65	47.40
nao78290c	1978	290	13	59	58.0	63.21	63.26	12.16	62.06
nao78357	1978	357	11	23	13.7	23.17	122	20.40	60.96
nao79017	1979	017	07	59	55.8	47.87	48.06	12.20	105.25
nao79059	1979	059	21	27	06.6	60.74	-141.56	15.64	344.40
nao79082	1979	082	19	32	30.9	18.02	-69.04	18.01	270.53
nao79236	1979	236	16	59	28.9	41.16	108.13	15.84	62.01
nao79237	1979	237	08	44	04.5	10.72	-41.68	16.73	241.38
nao79277	1979	277	15	59	58.0	60.66	71.44	12.47	63.78
nao79297	1979	297	05	59	56.7	47.79	48.11	12.20	105.34
nao79327	1979	327	23	40	29.7	4.81	-76.20	22.03	270.09
nao80084	1980	084	03	59	50.3	52.94	-167.70	17.32	359.28
nao80124	1980	124	03	30	54.5	9.95	43.16	15.52	141.15
nao81306	1981	306	21	10	25.5	12.18	92.87	19.32	91.30
nao82001	1982	001	18	51	02.6	26.84	142.74	21.83	42.41
nao82098	1982	098	02	41	16.9	18.51	86.31	17.40	93.75
nao82100	1982	100	16	25	34.5	17.45	-83.47	19.79	282.62
nao82172	1982	171	23	52	30.2	-20.40	40.57	24.40	145.75
nao82182	1982	182	07	41	53.7	51.39	-179.94	17.56	7.57
nao83093	1983	093	02	50	02.8	8.80	-83.11	22.01	278.00
nao83094	1983	094	02	51	34.5	5.71	94.72	21.13	92.90
nao83102	1983	102	12	07	54.4	-4.84	-78.09	24.27	267.06
nao83274	1983	274	12	57	59.5	45.50	150.78	17.80	29.27
nao84004	1984	004	22	40	41.8	45.40	151.31	17.87	28.84

Table 7.3.1. List of events used in this study.

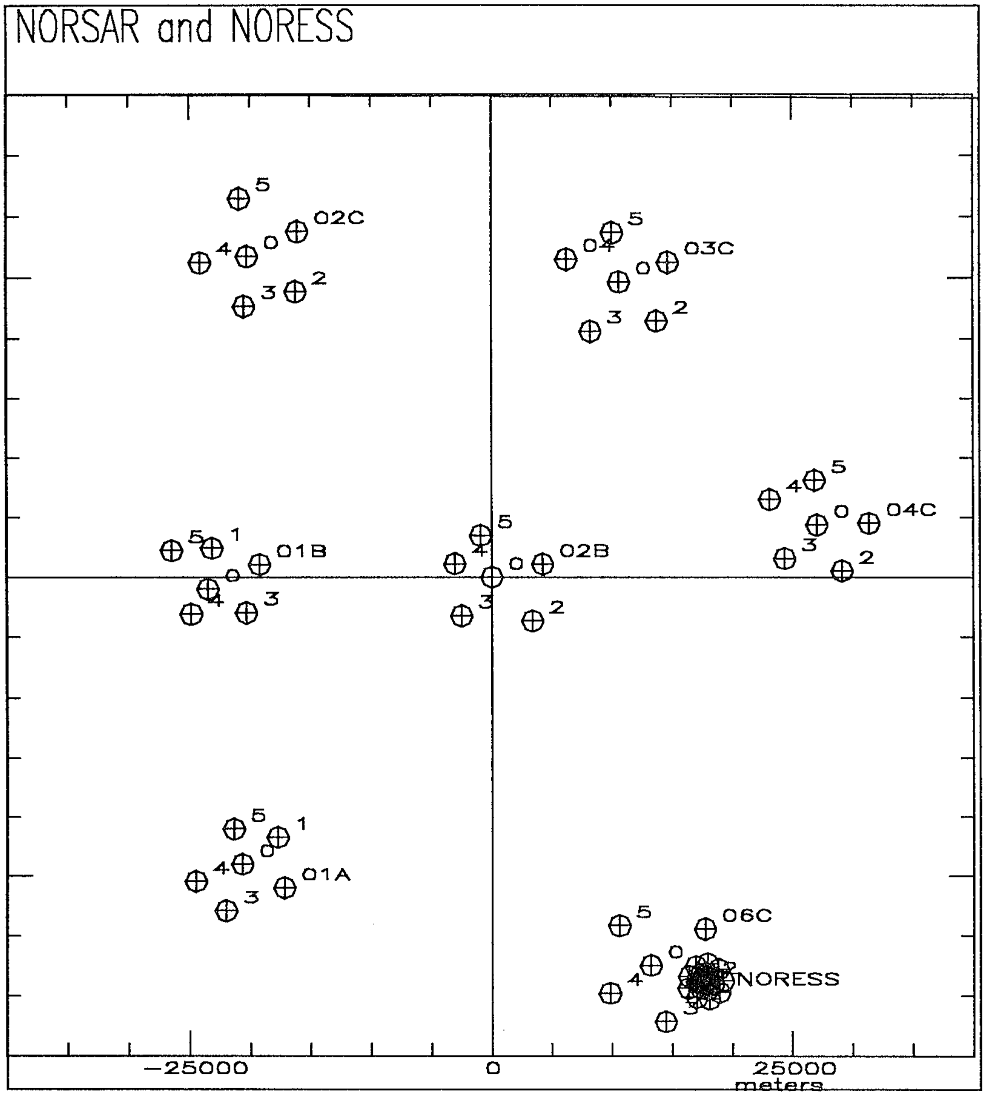

Fig. 7.3.1. Configuration of the large aperture array NORSAR and small aperture array NORESS. The NORESS array is co-located with the NORSAR subarray 06C. The diameter of NORSAR is about 60 km and the diameter of NORESS is about 3 km. Each instrument site is marked with a circle and a cross.

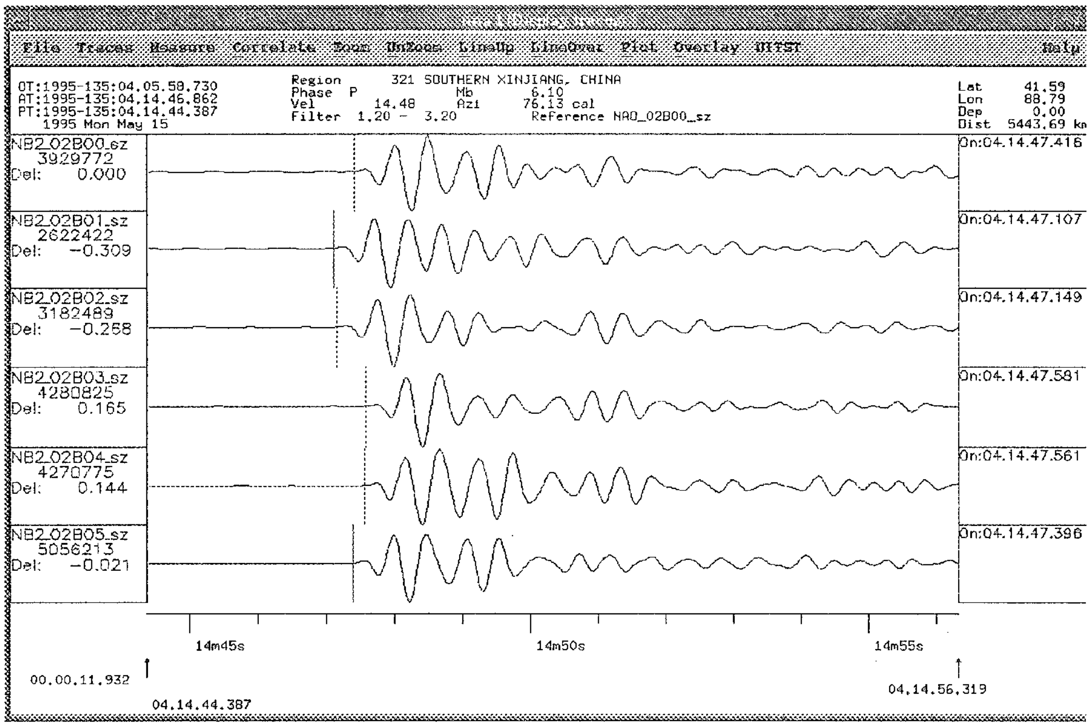

Fig. 7.3.2. NORSAR interactive tool for time picks. A trace-cursor containing the reference trace with reference arrivaltime mark is available to the user, but not visible on this figure. Using this cursor, the analyst can easily correlate the signals to find best arrival time pick.

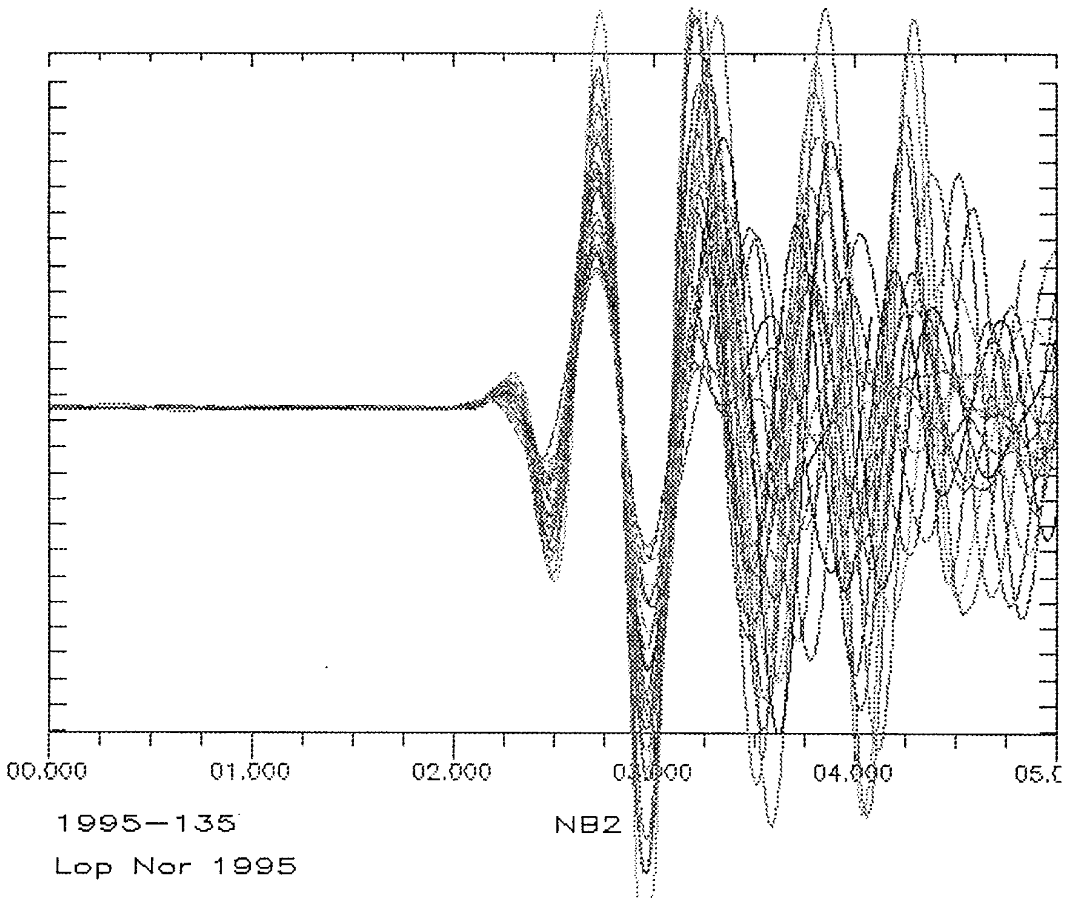

Fig. 7.3.3. NORSAR single sensors filtered 1.2-3.2 Hz and shifted with time delays picked by automatic correlation. Traces are plotted on top of each other in the same amplitude scale. The resulting least squares plane-wave fit gives: Observed velocity 16.44, azimuth 79.73; Calibrated velocity 17.37, azimuth 77.80; IASPEI velocity 14.48, azimuth 76.13.

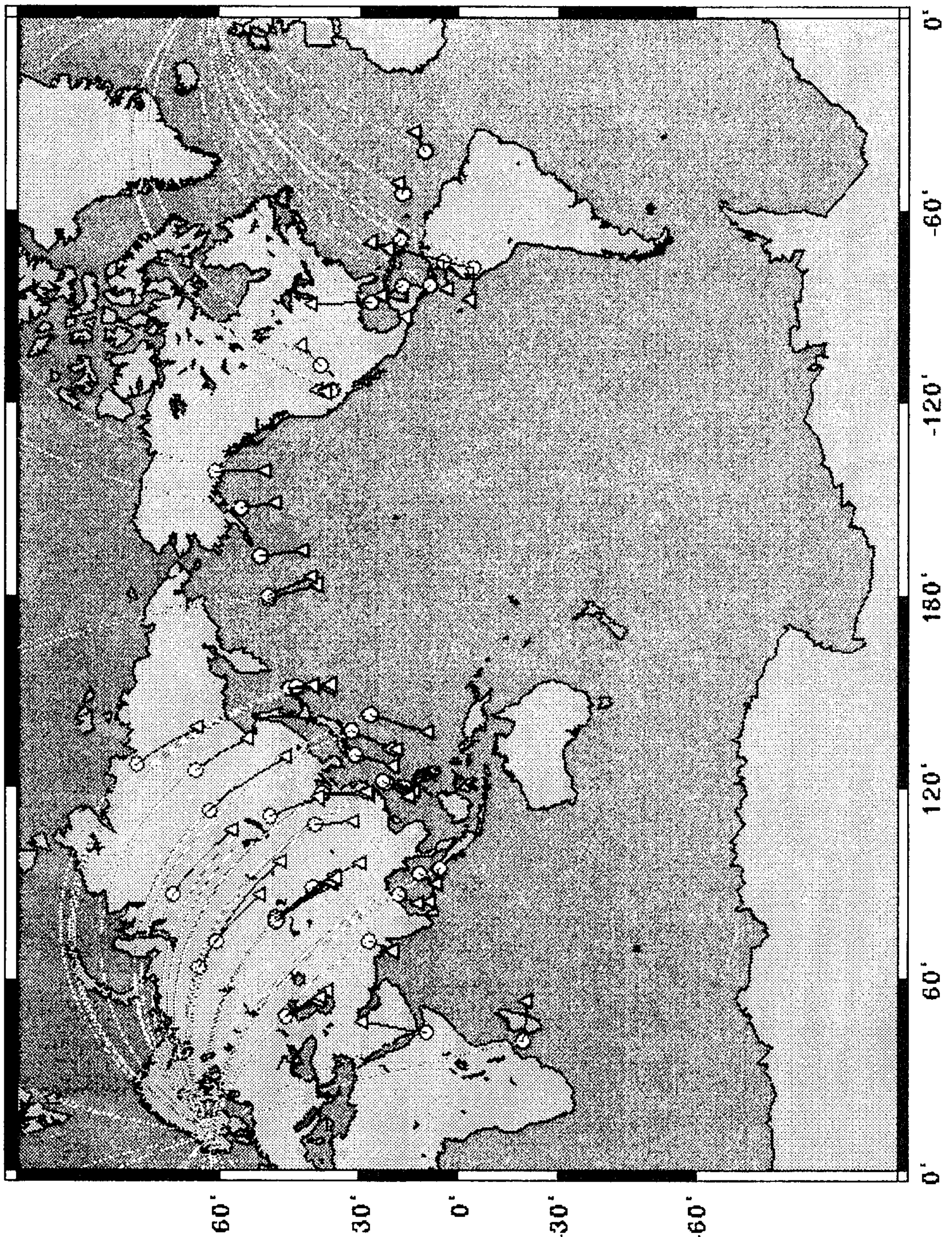

Fig. 7.3.4. Map of reference events used in analysis. The circles correspond to ISC/PDE locations. The triangles show locations corresponding to slownesses estimated by least squares fit to observed time delays.

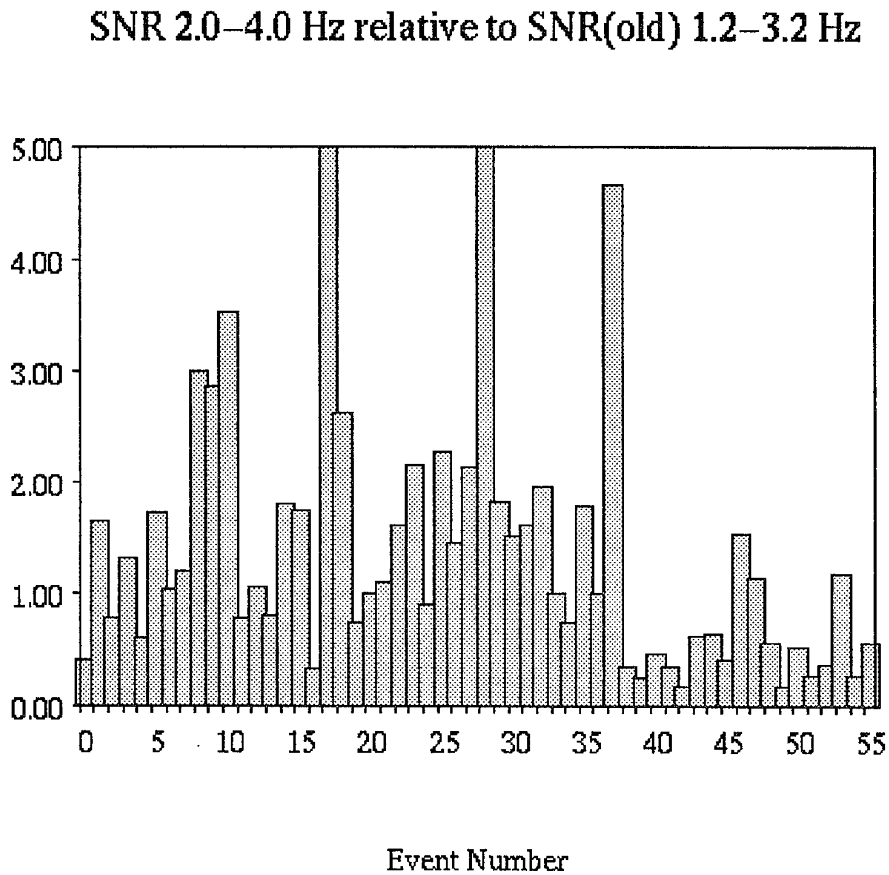

Fig. 7.3.5. Relative SNR between best beam using filter 2.0 - 4.0 Hz and new time delays and best beam using filter 1.2 - 3.2 Hz and old time delays.

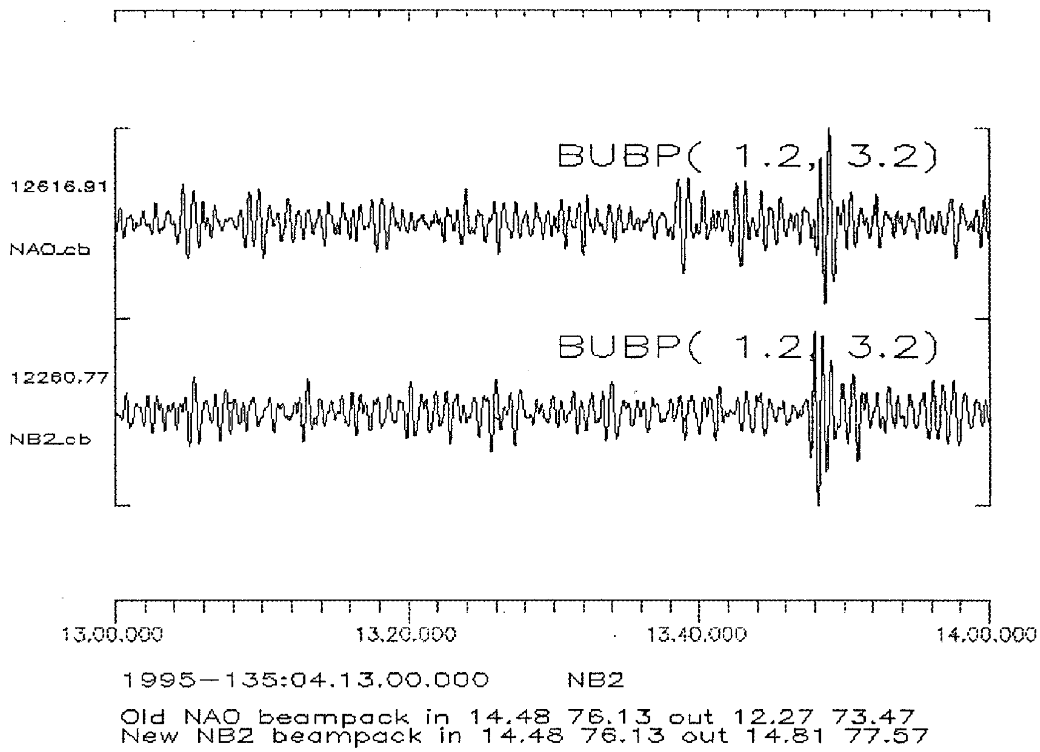

Fig. 7.3.6. NORSAR signal from the 15 May 1995 Lop Nor explosion scaled down by factor of 200 and added to noise preceding main onset. The upper trace shows resulting beam after beampacking using filter 1.2 - 3.2 and old time delay corrections. The observed velocity and azimuth is 12.27, 73.47. The lower trace is resulting beam from beampacking using new time delay corrections. Resulting observed velocity and azimuth is 14.84, 77.57. IASPEI theoretical values are 14.48, 76.13.

7.4 Automatic onset time estimation based on autoregressive processing

Introduction

In order to support the developments at the GSETT-3 IDC, we have during this reporting period been experimenting with the use of an autoregressive method for automatic onset time estimation, denoted AR-AIC. This method has for several years been operational in the processing of data from the Japanese national seismic network, and the software has been provided to us by scientists from the Japanese NDC.

In this paper we have adapted the Japanese method for application to GSETT-3 data, with emphasis on developing an automated procedure that includes new features such as multiple narrow-band filters, the concept of "usable bandwidth" and a quality measure of the estimated onset time.

IDC onset time estimation

We have investigated the automatic phase picking at the GSETT-3 IDC, and found that the automatic picks are consistently late compared to the onset times determined by the analysts. Fig. 7.4.1 shows some characteristic examples where the automatic onsets, denoted S, are all late. In order to quantify the bias of the automatic phase picking procedure at the IDC, we have in Fig. 7.4.2 plotted the time difference between manual and automatic onsets for all P-phases with SNR > 50 for the time period January-September 1995. We see that the automatic onsets are usually late for the entire time interval, and this behavior becomes even more pronounced during the last 3 months of the period.

A new signal processing package which is scheduled to be installed at the GSETT-3 IDC will hopefully take care of the deficiencies of the current procedure used for onset time estimation. It should be noted that the current onset estimation procedure has been adapted from the algorithm used for automatic arrival time picking at NORSAR (Mykkeltveit & Bungum, 1984), and also that our experience is that the implementation at NORSAR does not provide such delayed onsets.

Autoregressive method

We will first give a brief description of the Japanese autoregressive method for onset time estimation, and for details we refer to Kamigaichi (1994), GSE/JAPAN/40 (1992), Yokota et al (1981) and Maeda (1985).

Generally speaking, autoregressive (AR) models are employed to represent the seismic waves, and Akaike's Information Criterion (AIC) is used to determine the AR order and to estimate the arrival times of the seismic signals.

Fig. 7.4.3 illustrates the basic concepts of the method:

- An initial onset is given, either from the time of the declared STA/LTA-based signal detection or from another onset time estimator. The original data is shown in the lower panel of Fig. 7.4.3.
- AR coefficients are computed from data in two windows, one located in the noise preceding the initial onset (F-window) and another located within the signal (S-window).
- The data are filtered with two prediction error filters, derived from the AR coefficients of the F- and S-windows, respectively (see 2nd and 3rd panel of Fig. 7.4.3).
- Finally, the Akaike Information Criterion (AIC) (see upper panel) is applied as a criterion to estimate the optimal division point of the time series. This division point will be the minimum of the AIC-curve, and is taken to be the onset of the seismic signal.

The F-window was in this study defined to start 7 s ahead of the initial onset, whereas the S-window started 1 s after the initial onset. Both windows had a length of 4 s. As seen from Fig. 7.4.3, the AIC was computed for a 12 s interval, starting 7 s ahead of the initial onset. This parameterization can, of course, be adjusted to accommodate different types of applications of the method.

We will in the following discuss the AIC onset time estimation utilizing the AR-coefficients of both F- and S-windows. There is also an option for utilizing the AR-coefficients of the F-window only. This option will in the text be referred to as AIC_F or AR-AIC_F.

Performance for high SNR teleseismic signals

As a first evaluation of AR-AIC, we analyzed teleseismic GSETT-3 data with high SNR, primarily P-phases from the Chinese nuclear test on 17 August 1995. First, we picked the phase onsets manually on the raw unfiltered waveforms using the NORSAR analysis tool, EP, with high resolution graphics (Fyen, 1989). Secondly, we ran the AR-AIC method on the same data set, using the automatic onsets from the IDC processing as the initial start time. The results are shown is shown in Fig. 7.4.4, and we see that there is an excellent correspondence between the manual and AR-AIC onset estimates for these high SNR teleseismic signals. The mean time difference is less than 2 milliseconds and the standard deviation is 0.04 s. As a result of this close correspondence, we will in the following use these AR-AIC onsets as the reference. The reason for this change of reference is purely due to convenience, as we in this way avoided retyping the manual onsets.

In Fig. 7.4.5, we show the time difference between the AR-AIC onsets and the automatic (SigPro) time picks at the IDC. As expected from the results given in Fig. 7.4.2, the automatic onsets are consistently late, with a mean time difference of 0.45 s.

Similarly, we compared the analyst reviewed IDC picks with the AR-AIC onset (and indirectly also the manual picks using the EP program). The results are shown in Fig. 7.4.6, and we see that for this data set the manual picks at the IDC are often early, with a mean of about 0.2 s. We also see from the figure that there is a sub-set of the data which is in quite close agreement, whereas another sub-set is about 0.3 s early. We do not know the reason for this time difference, but there are two factors that can be of importance. One is the limited time the IDC analysts are able to spend on refining the time picks due to the daily workload. Another possible source of error is the compensation for the group delay of the bandpass filters used prior to the phase picking. This is a topic that should be revisited, as the current procedure for time adjustment due to the group delay of the bandpass filters clearly has deficiencies.

Implementation of AR-AIC for processing of GSETT-3 data

From applying the AR-AIC method to signals with various frequency contents, signal-to-noise ratios and complexities, we found that some preprocessing was necessary to ensure stable performance of AR-AIC. In particular, an assessment of the usable bandwidth of the signal, followed by bandpass filtering and decimation was necessary when processing low SNR signals, especially at low frequencies. Once the onset time was estimated, we found it helpful to calculate an accompanying quality measure. The idea behind this quality measure was to have a tool that could be used to automatically distinguish between "good" and "bad" onsets, and possibly also to get an associated uncertainty. The flowchart for automatic operation of AR-AIC is given in Fig. 7.4.7. We will in the following describe in more detail the procedures for the assessment of the usable signal bandwidth and the quality of the AR-AIC onset.

Usable bandwidth

The estimation of the usable bandwidth of the signal was done by filtering the signal with a set of relatively narrow bandpass filters, and then for each of these filters we computed the maximum SNR (STA/LTA) within a time interval around the initial onset. The usable bandwidth was then estimated from a comparison between the maximum SNR's of the different filter bands. Specifically,

- We estimated the maximum SNR within the time interval (s-2,s+3) sec. for a set of narrow bandpass filers, where s is the initial onset time. The 3rd order Butterworth filters used in this study were (in Hz): 0.5-1.5, 0.8-1.8, 1.0-2.0, 1.5-3.0, 2.0-4.0, 3.0-5.0, 4.0-6.0, 6.0-8.0, 8.0-10.0, 10.0-16.0, 14.0-20.0. The high end of the filter bands were limited by the Nyquist frequency.
- We then found the filter band providing the highest SNR, called SNR_{max}. If the neighboring filters had SNRs within a factor 5 of SNR_{max} and at the same time had SNR > 4.5, then the usable bandwidth was extended to include these neighboring filter bands.

An example illustrating the algorithm is given in Table 7.4.1. It should be noticed that no rigorous testing has been conducted to come up with the parameters of this algorithm, but they are derived from experiments with limited data sets and from our experience with processing of seismological data.

After having estimated the usable bandwidth of the signal, we filtered the data with a 2nd order Butterworth filter for this bandwidth, and then decimated the data in accordance with the high cutoff frequency of the bandpass filter. The necessity of doing filtering and decimation for processing of low SNR signals is illustrated in Fig. 7.4.8. This signal does only have a usable SNR in the filter band 1.0-2.0 Hz, as shown in the lower panel. The result from applying AR-AIC to the unfiltered data is shown in the upper panel, where S is the initial onset time and A is the

AR-AIC onset. The second panel shows the result after filtering, but without decimation, and, finally, the third panel shows the result after both filtering and decimation. Obviously, the AR-AIC onset after filtering and decimation gives the best result.

We have also made some preliminary tests on how the application of this 2nd order causal Butterworth filter for the usable bandwidth influenced the arrival time estimates. The high SNR P-phases that were previously analyzed as shown in Fig. 7.4.4, were bandpass filtered and decimated prior to AR-AIC processing. The time differences between AR-AIC computed on unfiltered data and data filtered in the usable bandwidth are shown in Fig. 7.4.9. For this data set we can see that there is no need to introduce any corrections for the filter. But before drawing any definite conclusions on the filter effects on the onset time estimates, we need to investigate more thoroughly the effect of varying SNR, bandwidth, filter order and signal frequency content.

Quality of the onset time estimates

The uncertainty of manually determined phase onsets is obviously dependent on the SNR of the signal. In addition, manual phase picks are often accompanied with a flag indicating the instantaneous or emergent nature of the arrival.

We have during our work with the AR-AIC method found that it would be very valuable to attach to the automatically determined onsets some additional parameters that can subsequently be used to derive associated picking uncertainties. In addition, we would like to know the degree of success of the estimation procedure, e.g. in terms of a flag indicating whether the algorithm truly succeeded or possibly failed.

The human observation of a seismic phase is attributed to an amplitude increase and/or a change in the frequency content of the data. If the trace is properly filtered, an amplitude increase should be observable. In this study, we have therefore decided to derive additional signal parameters from the time domain data, filtered in the band that provides the highest SNR. To analyze the amplitude increase we found it convenient to create the envelope of the data from the bandpass filtered trace and its Hilbert transformed counterpart. The Hilbert envelope was gently smoothed with a lowpass filter. This procedure is illustrated in Fig. 7.4.10.

We defined the following set of measurements to be made on the envelope:

- $NOISE_{max}$ was taken to be the maximum of the envelope within a 3 second interval preceding the automatically estimated onset.
- $AMP_{0.5}$, $AMP_{1.0}$, $AMP_{2.0}$, $AMP_{3.0}$ and $AMP_{5.0}$ were the maximum of the envelope within 0.5, 1.0, 2.0, 3.0 and 5.0 seconds after the onset, respectively. The corresponding (quality) signal-to-noise ratios $QSNR_{0.5,...,5.0}$ were defined to be $AMP_{0.5,...,5.0}$/ $NOISE_{max}$.
- $T_{QSNR1.5}$ was the time from the onset to the point where QSNR exceeded 1.5. $QSNR_{fp}$ was the signal to noise ratio of the first local peak of the Hilbert envelope in an interval from $T_{QSNR1.5}$ to 5 seconds after the onset. T_{fp} were the time from the onset to the first local peak, and T_{max} were the time from the onset to the point where the maximum QSNR was found (within 5 seconds of the onset).

When searching for the best frequency band for bandpass filtering, we searched among the same filters as those used for determining the usable bandwidth, but we did now use $QSNR_{3.0}$ as the criterion for determining the best filter.

In order to get an idea on how to use the envelope measurements to quantify the quality of the automatic AR-AIC onsets, we analyzed a limited data set of 122 phases associated to events in the IDC Reviewed Event Bulletin (REB). The onsets of all phases were manually picked by using the EP program to get a reference for comparing the automatic onsets. Fig. 7.4.11 shows the difference between the AR-AIC, hereafter also denoted $AR\text{-}AIC_{F+S}$, onsets and the manual picks as a function of $QSNR_{2.0}$. The data points labelled **F** represent phases that we were unable to pick manually in a confident way, primarily due to low SNR. We see from the figure that for $QSNR_{2.0}$ lower than 5, the scatter increases significantly, as the algorithm had a tendency to make an early trigger. An interesting observation during our testing was that the $AR\text{-}AIC_F$ method, utilizing only the autoregressive coefficients of the preceding noise window, often gave the correct onset in the cases where $AR\text{-}AIC_{F+S}$ made the wrong decision. For this data set, we found that by using the time difference between the two types of AR-AIC onsets together with the quality measurements $QSNR_{0.5}$, $T_{QSNR1.5}$ and SNR_{max}, we were able to obtain a rule for identifying the cases where we should use the $AR\text{-}AIC_F$ onset instead of $AR\text{-}AIC_{F+S}$. The results are given in Fig. 7.4.12, and we clearly see that the scatter at low SNR is significantly reduced (except for the low quality **F** onsets).

In automatic operation of AR-AIC it is important to identify the cases where the method failed as well as the cases where the phase onsets are very uncertain. First of all, the phases that we were unable to pick manually, labelled **F**, should be identified as a low quality onset. From utilizing the quality measurements $T_{QSNR1.5}$, $QSNR_{5.0}$ and the time difference between the initial onset and the AR-AIC onset, we were able to categorize as low quality 20 out of 22 **F** onsets, while retaining 90 out of 100 acceptable onsets. The results are shown in Figs. 7.4.13 and 7.4.14. As expected, we see from Fig. 7.4.13 that the time difference between the manual and the automatic onsets decreases with increasing $QSNR_{2.0}$. As an illustration, we separated the data into two populations based on a $QSNR_{2.0}$ of 6, and found that the standard deviation was 0.15 s for the high SNR population and 0.5 s for the low SNR population.

We have with this example shown that it is possible to use the envelope quality measurements to indicate how well the automatic AR-AIC onsets match the manual picks, as well as a tool to identify low quality onsets. In addition, the envelope quality measurements were used to decide between the use of $AR\text{-}AIC_{F+S}$ and $AR\text{-}AIC_F$. A next step will be to analyze a larger data set that also contains detections that are unassociated to seismic events. In this way we can get a better picture of the operational performance of AR-AIC and the associated quality measurements.

Conclusions

We have in this study shown that by including processes like determination of usable bandwidth, filtering, decimation and quality assessments, the AR-AIC method for onset time estimation can be adapted to work on a wide range of seismic signals. In particular, we have found it convenient to be able to distinguish between *reliable* and *unreliable* onsets. In this way, we can avoid using erroneous arrival time data in the subsequent event location procedures, and thus being able to improve the location precision of the automatic processing system.

It is also our goal to be able to give more weight to the most reliable phase onsets. In the location procedure at the IDC this is done by associating the arrival times with a given uncertainty, currently being only a function of phase type. In order to investigate how the uncertainty of the AR-AIC onsets depends on the envelope quality measurements described above, it is necessary to analyze events for which ground truth information is available, e.g. in terms of accurate locations provided by local networks. During the next reporting period we plan to conduct such a study for a set of events located in the Japan area, with high quality locations provided by the Japanese National Seismic Network.

T. Kværna

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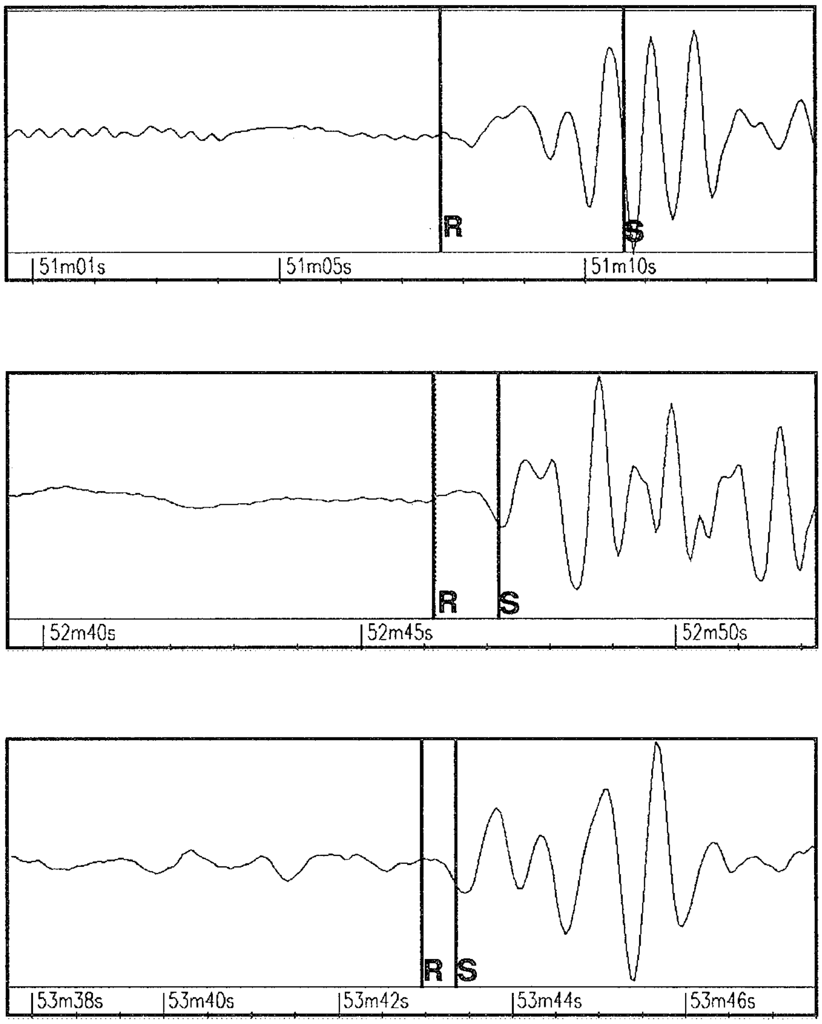
Table 7.4.1. Example illustrating the use of multiple narrow-band filters to arrive at a "usable bandwidth", as described in the text. In this case, the usable bandwidth is 1.5-5.0 Hz

Band	SNR	Comment
1.0-2.0 Hz	4.4	Below 4.5 and below a factor 5
1.5-3.0 Hz	5.0	OK
2.0-4.0 Hz	24.3	Maximum
3.0-5.0 Hz	6.1	OK
4.0-6.0 Hz	4.6	Below a factor 5



S — Automatic onsets (SigPro)
R — Analyst-reviewed onsets

*Fig. 7.4.1. Characteristic examples of automatic (**S**) and manual (**R**) onset time estimation at the IDC.*

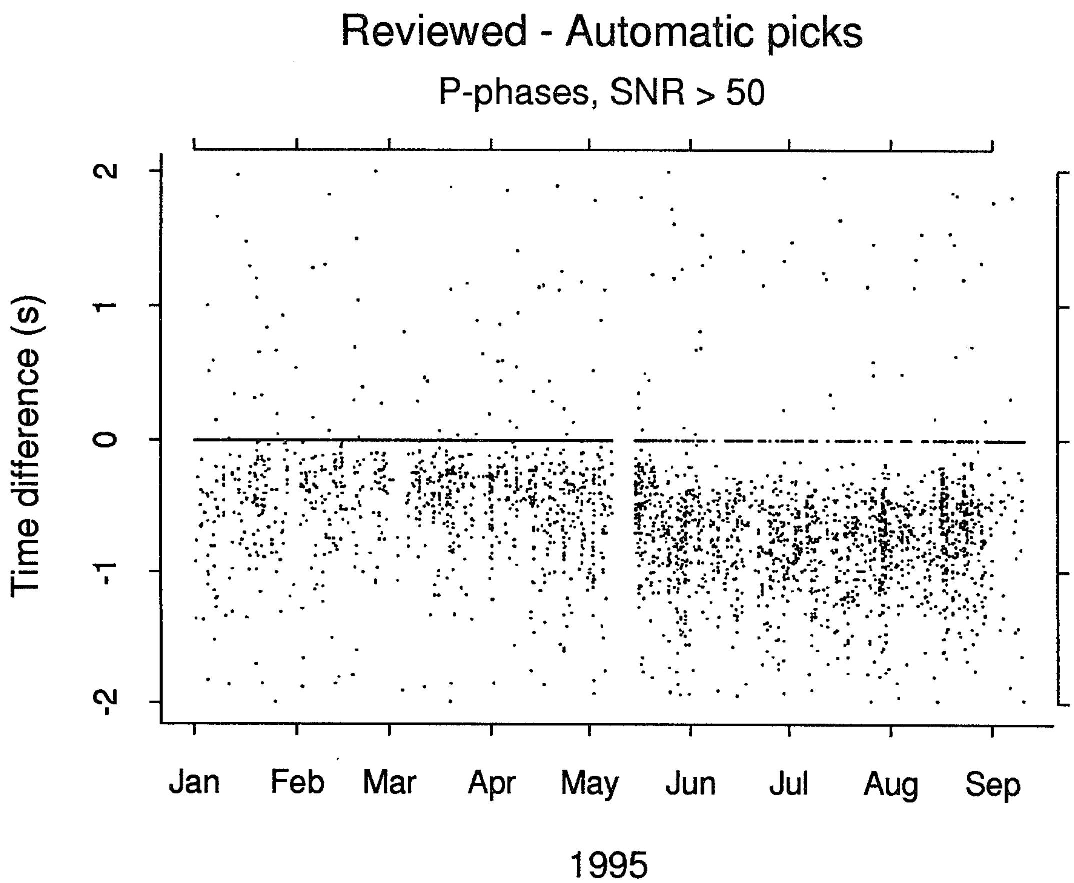


Fig. 7.4.2. Time difference between manually reviewed and automatic picks at the IDC for P-phases with SNR > 50 for the time period January-September 1995.

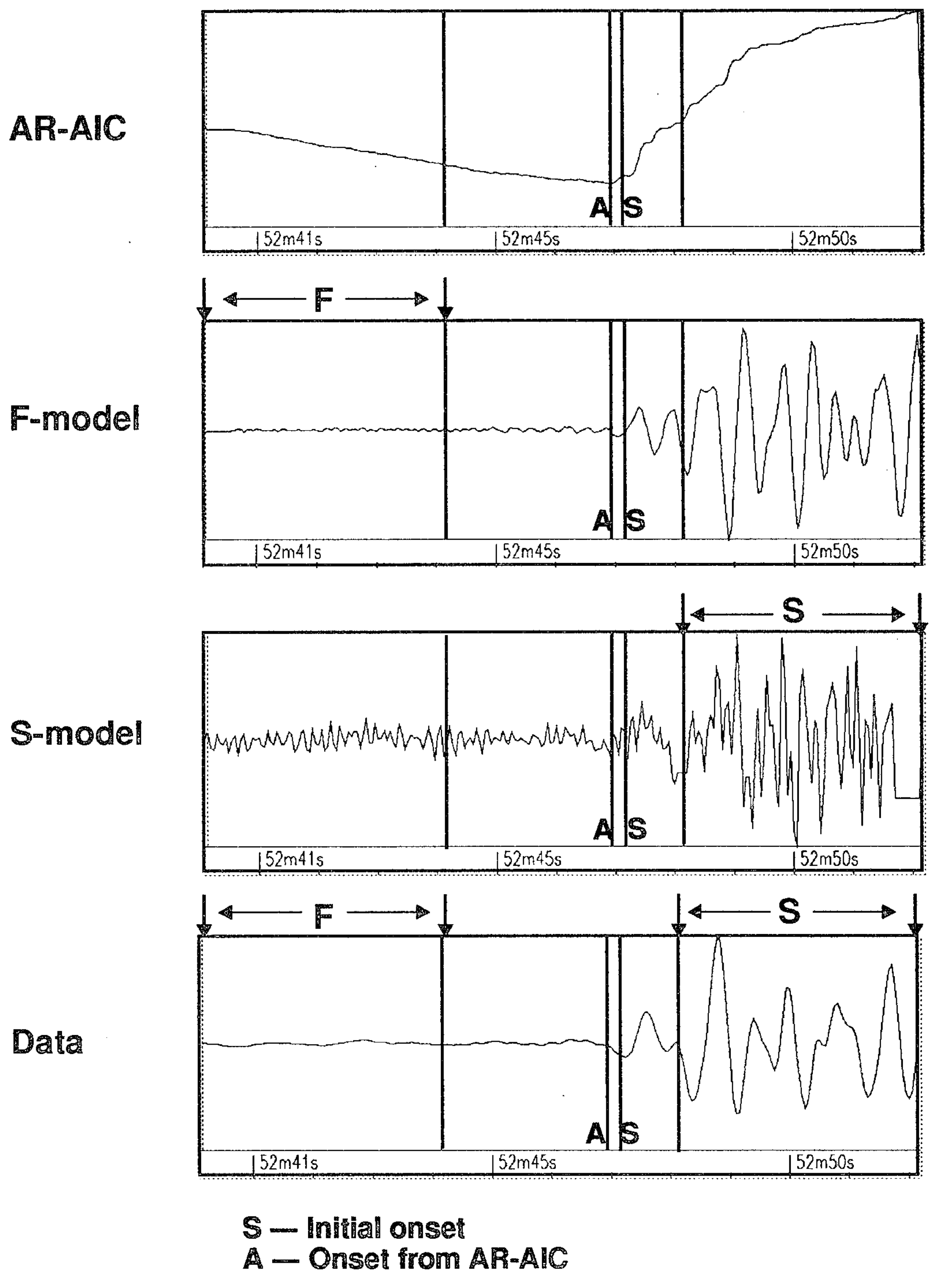


Fig. 7.4.3. Illustration of the basic concepts of onset time estimation using the AR-AIC method. The lower panel shows the data with a seismic signal. The third panel from the top shows the data filtered by a prediction error filter derived from the AR-coefficients of the 4 sec S-window positioned within the signal. The second panel from the top shows the data filtered by a prediction error filter derived from the AR-coefficients of the 4 sec F-window positioned in the noise preceding the signal. The upper panel shows the AIC used to estimate the optimal division of the time series. The minimum is taken to be onset of the seismic signal.

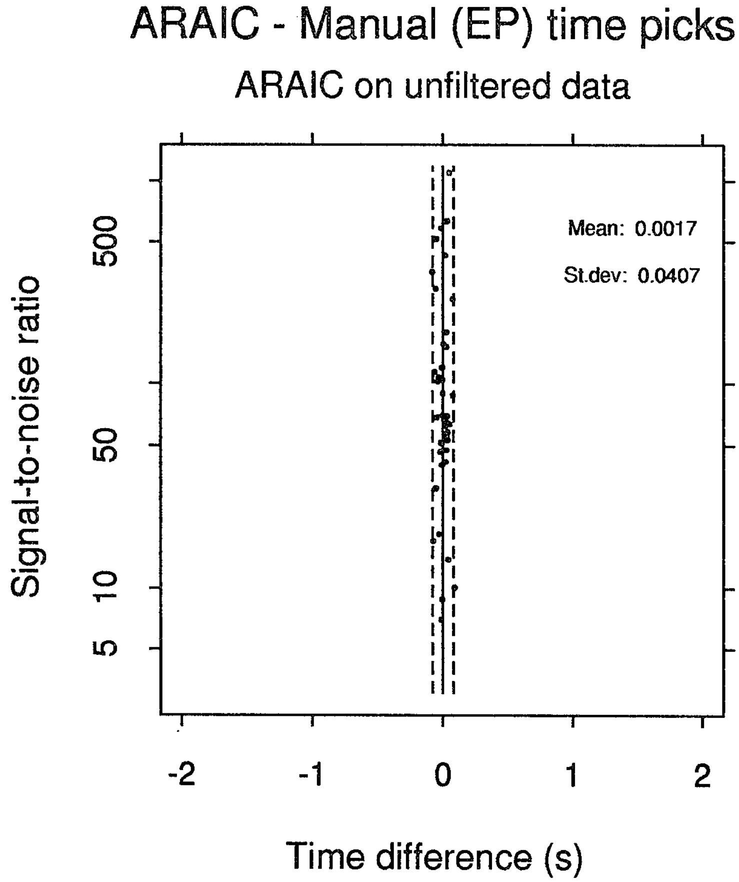


Fig. 7.4.4. Time difference between AR-AIC onsets estimated on unfiltered data and manually picked onsets (EP) for a set of high SNR teleseismic signals. The dashed lines indicate a distance of two standard deviations from the mean.

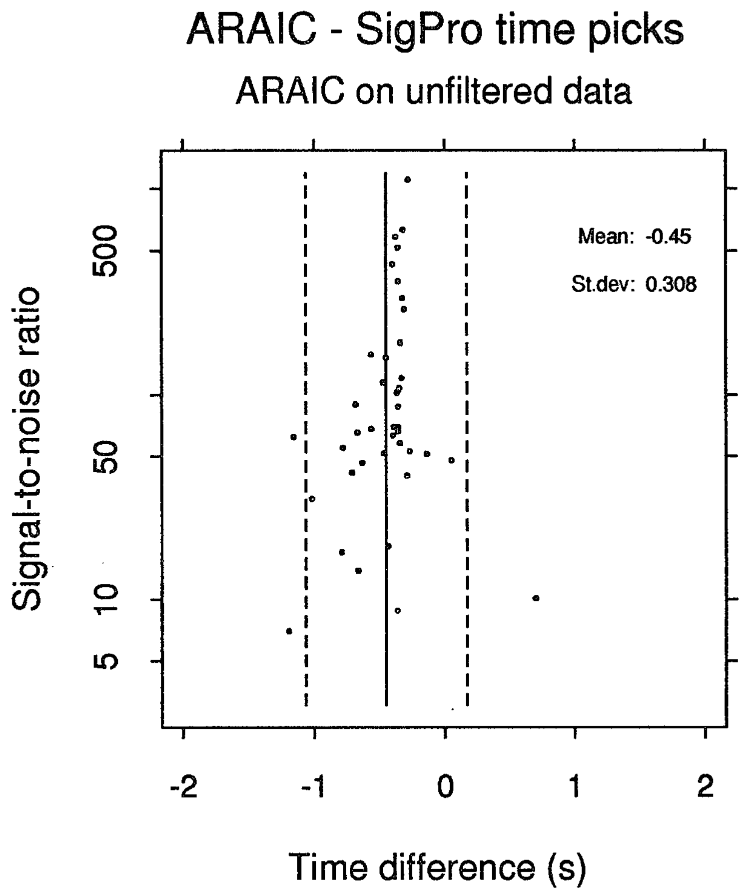


Fig. 7.4.5. Time difference between AR-AIC onsets estimated on unfiltered data and the automatic onsets provided by the signal processing at the IDC (SigPro). The data set is the same as in Fig. 7.4.4. Notice that the SigPro onsets are consistently late. The dashed lines indicate a distance of two standard deviations from the mean.

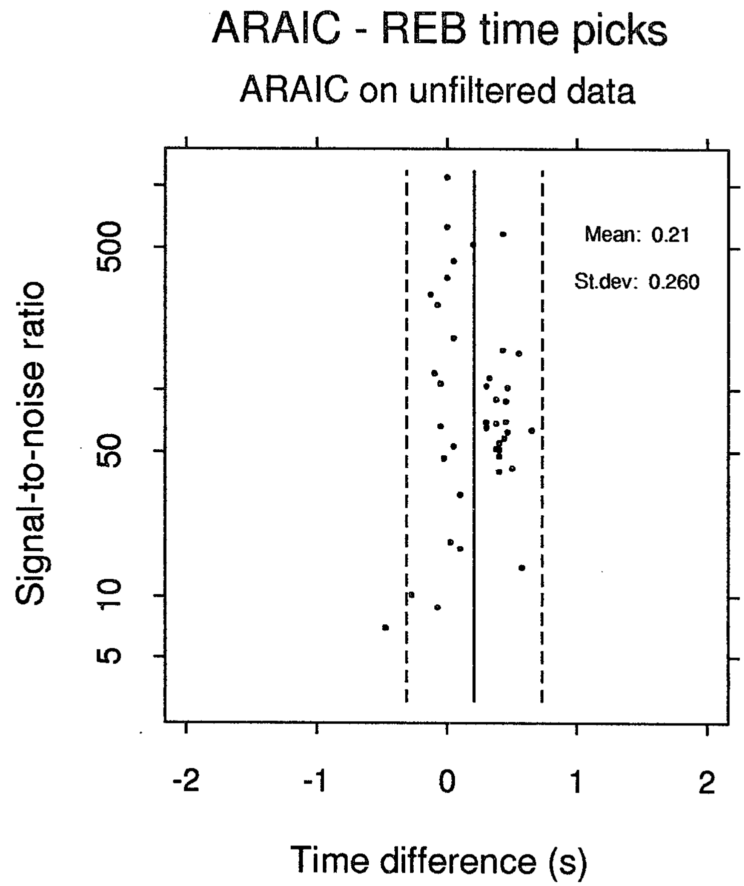


Fig. 7.4.6.Time difference between AR-AIC onsets estimated on unfiltered data and the analyst-reviewed picks at the IDC. The data set is the same as in Fig. 7.4.4. Notice that the analyst-reviewed picks at the IDC are often early. The dashed lines indicate a distance of two standard deviations from the mean.

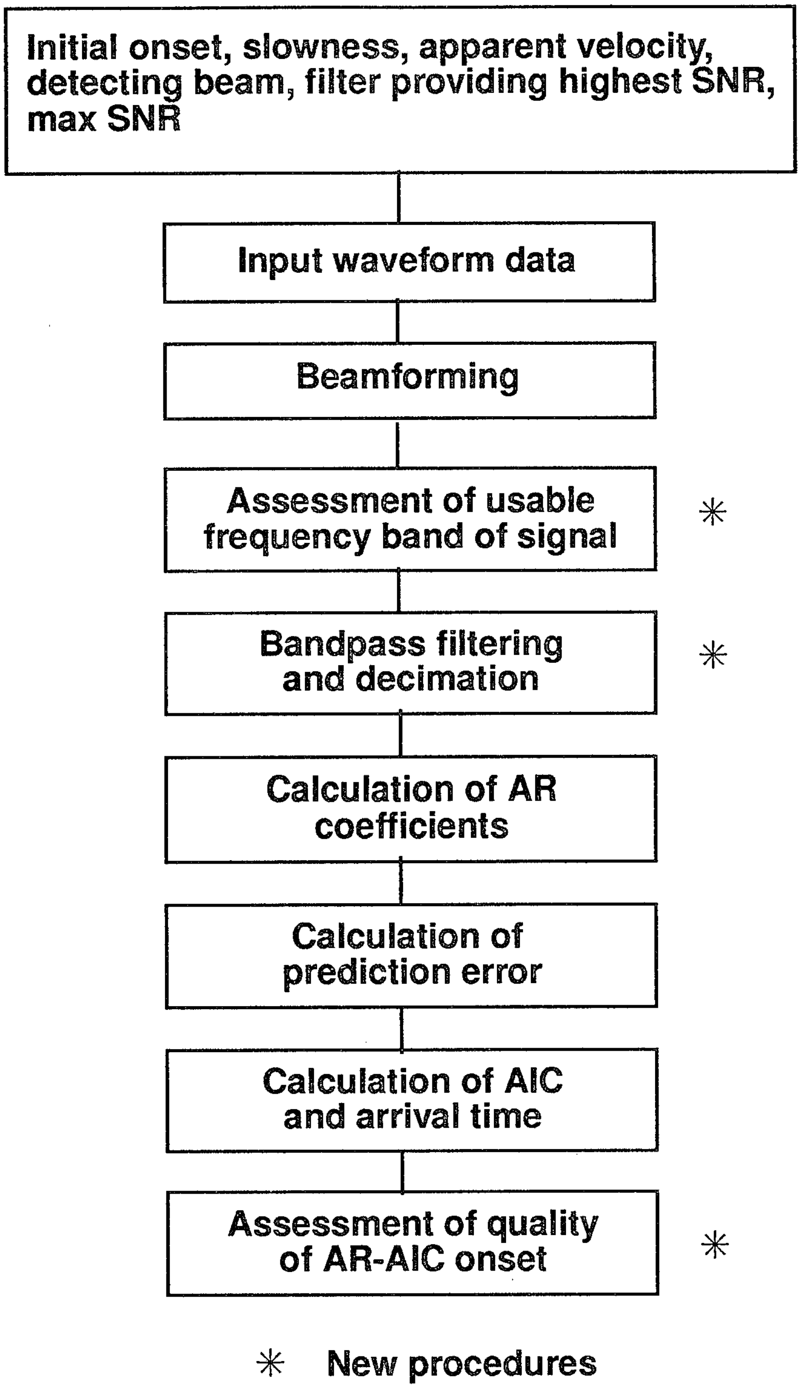


Fig. 7.4.7. Flowchart showing the different steps involved in the automatic operation of AR-AIC

AR-AIC
No filtering
No decimation

AR-AIC
Filtered
No decimation

AR-AIC
Filtered
Decimated

Filtered data
1-2 Hz

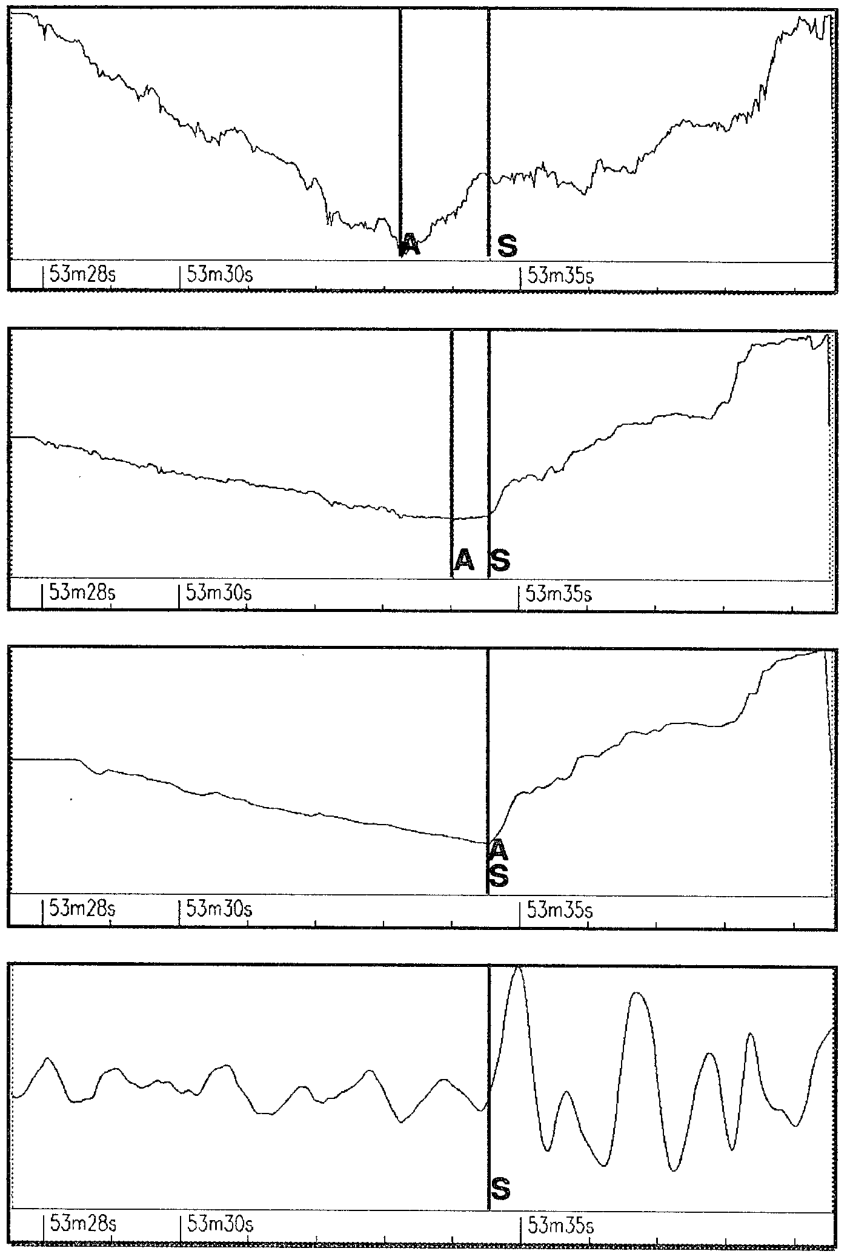


Fig. 7.4.8. Illustration of the necessity of doing filtering and decimation prior to onset time estimation by the AR-AIC method. S is the initial onset, and A represents the AR-AIC onset. The lower trace shows the data bandpass filtered in the usable bandwidth of 1-2 Hz. The top panel shows the AIC-curve after processing the raw data. The second panel shows the AIC-curve after processing the filtered data and the third panel shows the AIC-curve after processing the filtered and decimated data. Notice that both filtering and decimation were necessary to get the correct onset

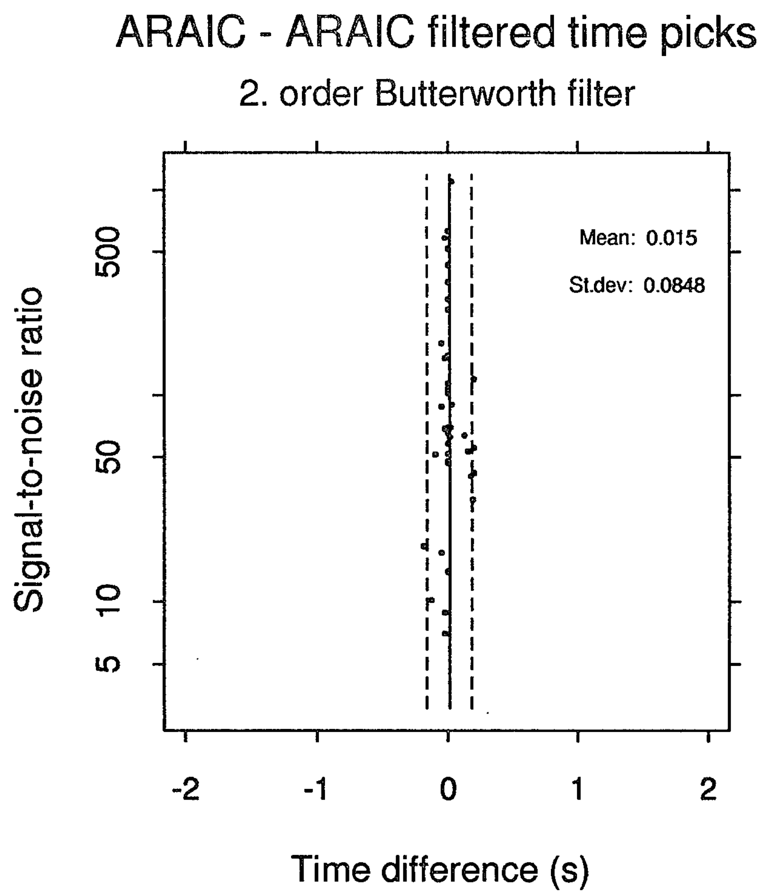


Fig. 7.4.9. Time difference between AR-AIC onsets estimated on high-SNR unfiltered data and the AR-AIC onsets estimated on data filtered in the usable frequency band. Notice the very small systematic bias. Although filtering introduces some scatter in the estimates, it is important to be aware that filtering is essential for processing low-SNR signals. The data set is the same as in Fig. 7.4.4. The dashed lines indicate a distance of two standard deviations from the mean.

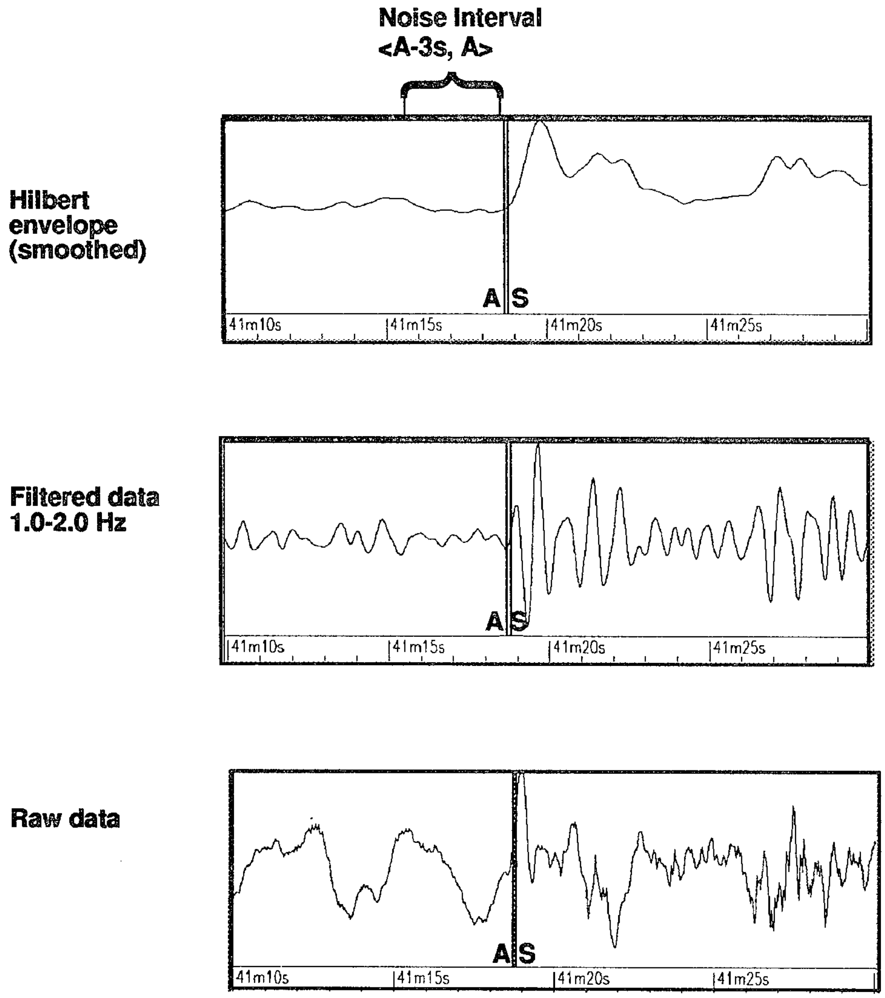


Fig. 7.4.10. Figure showing the raw data (lower panel), the data filtered in the best frequency band (middle panel) and the smoothed envelope (top panel) computed from the filtered time series and its Hilbert transformed counterpart. The 3 sec noise interval is indicated on the top panel.

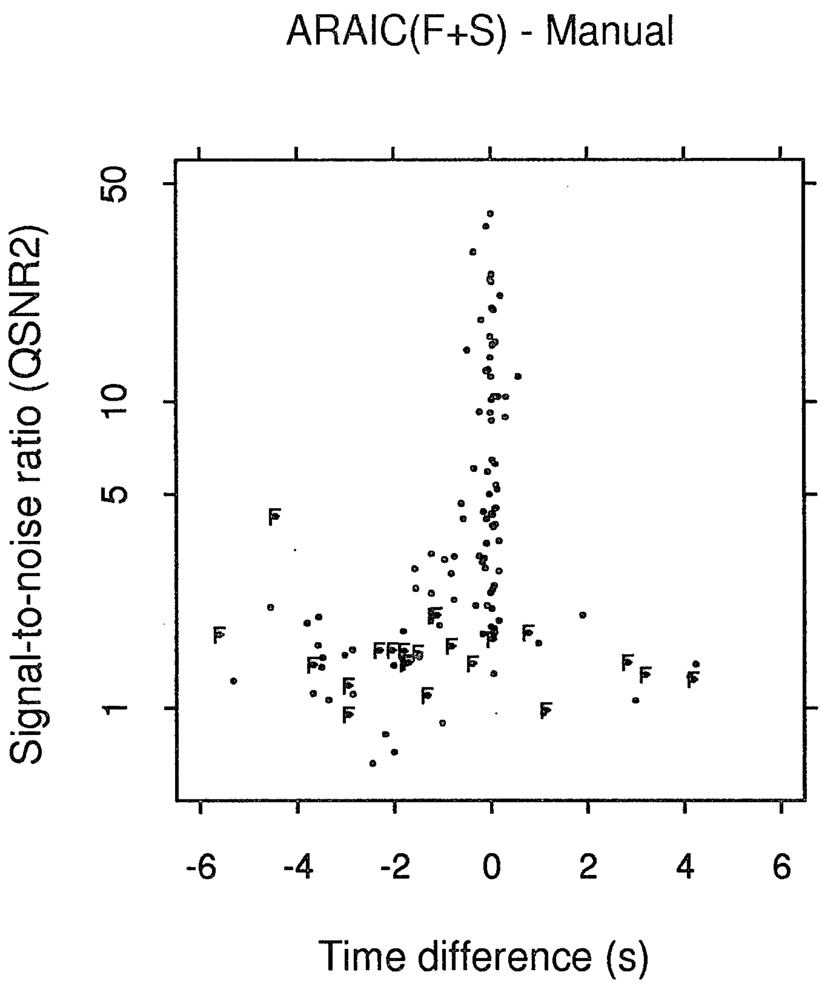


Fig. 7.4.11. Time difference between the AR-AIC$_{F+S}$ onsets and manually picked onsets shown as a function of QSNR$_{2.0}$. The data points labelled F represent phases that we were unable to pick in a confident way, primarily due to low SNR.

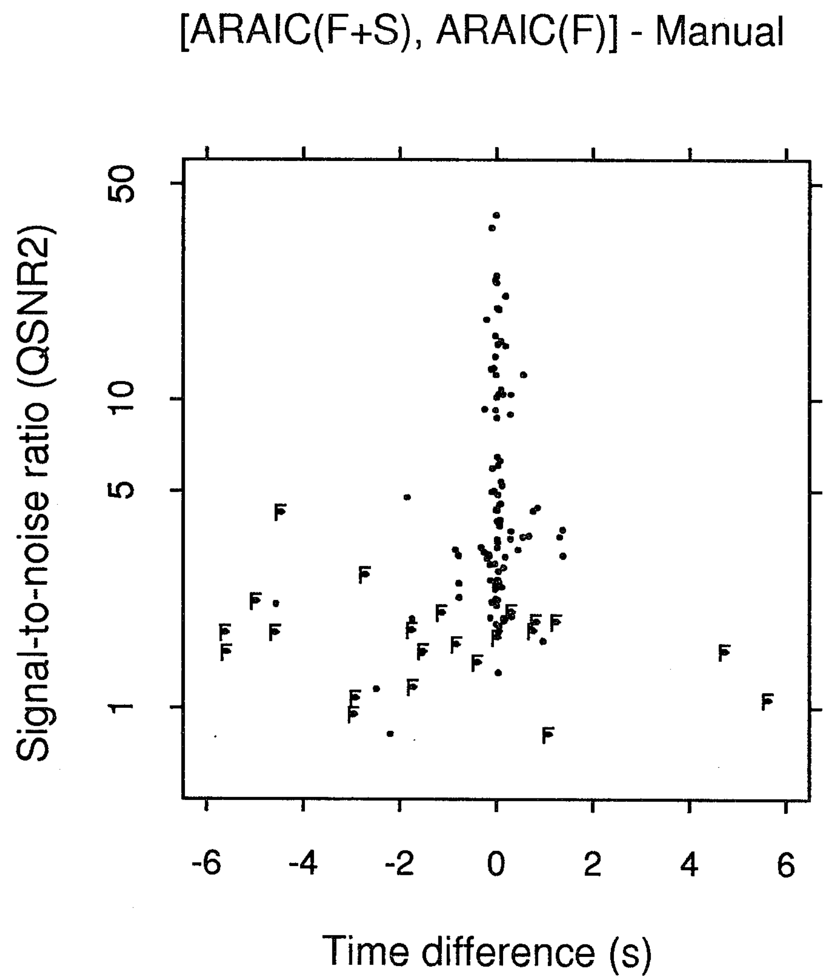


Fig. 7.4.12. Same as Fig. 7.4.11, but based on certain criteria of the quality measurements, the AR-AIC$_F$ onsets were used instead of the AR-AIC$_{F+S}$ onsets. See text for details.

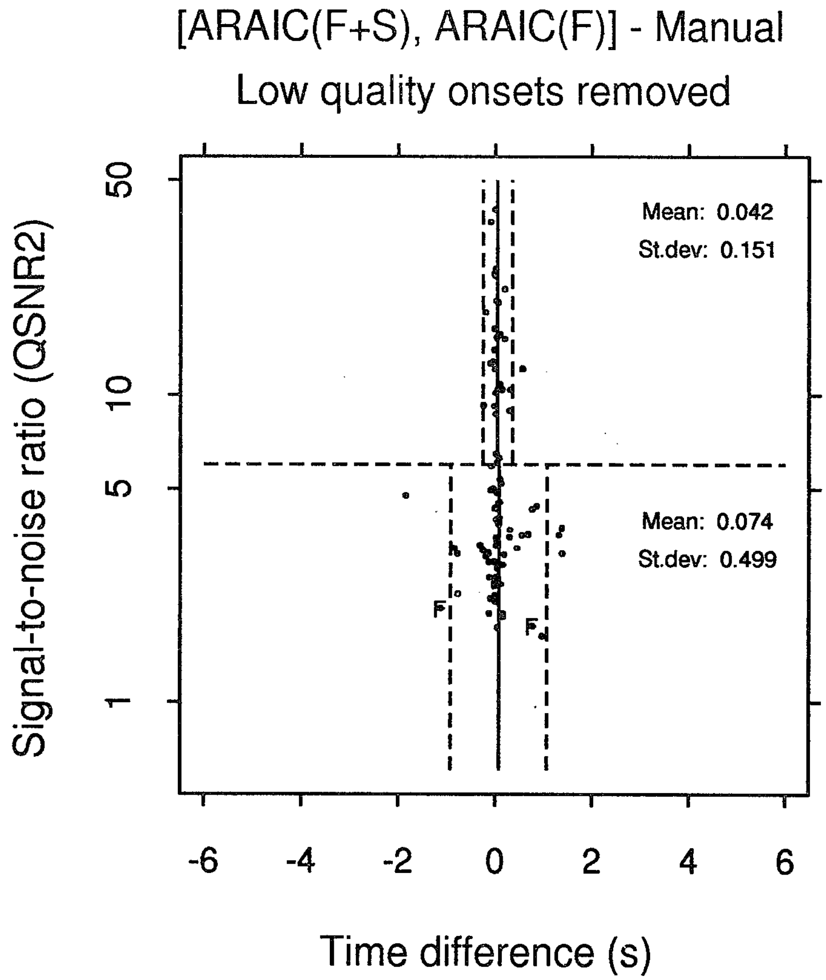


Fig. 7.4.13. Same as Fig. 7.4.12, but with low quality onsets removed. Notice the difference in the scatter between the high and low $QSNR_{2.0}$ populations. The dashed lines indicate a distance of two standard deviations from the mean.

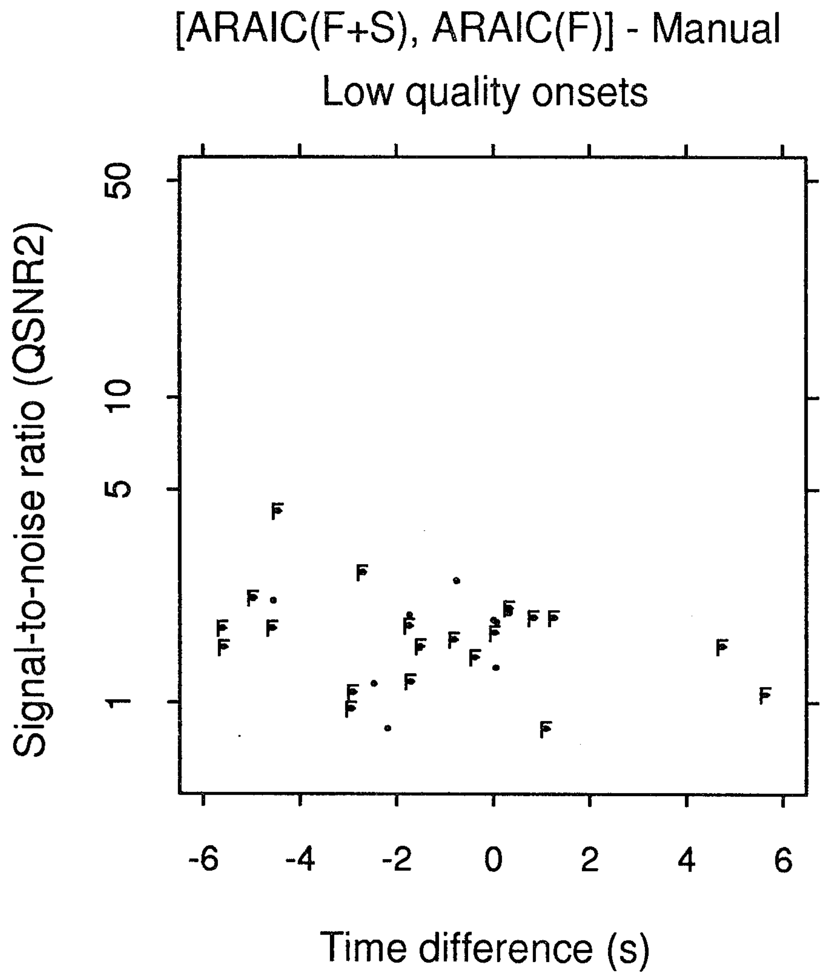


Fig. 7.4.14. This figure shows the data identified as low quality onsets by utilizing the envelope quality measurements

7.5 Recommendation on Auxiliary Seismic Stations for the IMS Network

This contribution is a lightly edited version of a paper prepared by the GSETT-3 Working Group on Planning (WGP) in preparation for the 42nd GSE session in Geneva during 27 November - 1 December 1995. The main purpose of this GSE meeting was to make a specific recommendation for the auxiliary seismic network of the International Monitoring System (IMS), which will be installed to verify compliance with a Comprehensive Test Ban Treaty.

Introduction

In its progress report of the 41st session, the GSE decided on a work plan for the GSE meeting from 27 November through 1 December. One of the tasks contained therein is to recommend a list of auxiliary stations for the seismic component of the IMS network based on the experience in GSETT-3.

In a letter to the GSE delegates on 26 September 1995, the GSE Chairman, Ola Dahlman, informed the GSE of the Ad Hoc Committee's expressed desire that the GSE submit, as one of the results of its forthcoming session, 27 November - 1 December, sufficient technical material to enable the IMS Expert Group, which is scheduled to meet the following two weeks, to agree on a list of auxiliary stations for the IMS. This will then facilitate subsequent decisions on the network by the Ad Hoc Committee.

In the same letter the GSE Chairman asked the Working Group on Planning to start work on a list of auxiliary stations, and to provide an initial recommendation for the auxiliary network at the beginning of the 42nd session. The status of this work was addressed at a GSE Convenors' meeting in Lahti, Finland, on 14 October 1995, and was also discussed in a coordination meeting between the Working Group on Evaluation (WGE) and the WGP in Paris on 7 November 1995.

This report provides the preliminary recommendation from the WGP and is intended as a basis for discussions during this GSE session. The network designs proposed herein will be reviewed and revised during the GSE session as additional information is received from GSE participants. Material on relevant experience from GSETT-3 will also be taken into account in the process of selecting a recommended IMS auxiliary network.

Much of the basis for the work of defining an IMS auxiliary station network was provided by the agreement reached in the Seismic Experts Group meetings held in Geneva during the week following the August 1995 GSE session. As a result of this work, there is already agreement in the NTB AHC on a specific 50-station primary seismic network for IMS (see CD/NTB/WP.269, pp. 4-9 and CD/1364, pp. 92-94). There is also agreement on the purposes of the auxiliary network, and on the basic principles/seismological procedures for selecting stations of an auxiliary seismic network to complement the IMS primary network in the best possible way (CD/NTB/WP.269, pp. 10-14).

Purposes of the Auxiliary Network

CD/NTB/WP.269 states that there are two principal purposes for the data that will be provided by the IMS auxiliary network:

- to improve the location accuracy of seismic events detected by the primary network
- to more finely characterize the seismic sources for purposes of event identification.

CD/NTB/WP.269 states that it is a goal to reduce the event location uncertainty to an area equivalent to less than 1,000 square kilometers, as a result of the combined use of primary and auxiliary station data at the IDC. CD/NTB/WP.269 also states that the auxiliary stations that are used to improve the event location, plus additional ones if full azimuthal coverage is lacking, will be used in the computation of source characterization parameters.

Station Selection Criteria and Procedures

CD/NTB/WP.269 states that

- auxiliary stations should primarily cover the seismically most active regions of the world, with emphasis on regions where earthquakes look explosion-like
- auxiliary stations should also be located in regions where there is extensive mining activity that produces large seismic signals
- auxiliary stations should further be located in areas where the azimuthal coverage of the primary station network is poor
- auxiliary stations should be selected from stations that are already available or can be adopted with a minimum of new investment.

Another factor to take into account in the selection process is the statement in CD/NTB/WP.269 that “stations in the auxiliary network should be able to act as a backup to stations in the primary network should an extended problem with a primary station arise”. This might be interpreted to mean that some of the auxiliary network stations should be especially selected so as to have signal detection capabilities similar to those of the primary network stations, so they could be useful substitutes for one or several primary stations in the same region.

Preparatory Work by the WGP

WGP has been compiling information on stations around the world that might be candidates for the IMS auxiliary network. As part of this survey, the WGP contacted all GSE delegations and asked for information on candidate stations in the various countries. In addition, updated lists of stations of the member networks of the FDSN have been obtained from various sources.

Information on worldwide mining activity has been obtained from various sources. This material shows that world minerals production is dominated by the United States, China, Chile and Russia. We have also obtained a list of eighteen other countries with major minerals production. Data on actual blasting practices are generally unavailable on a mine-by-mine basis. Therefore, regions having potential for large blast activity are best identified based on mine location and minerals production data. It must be noted here that we are only concerned with blasting activity that is detected and located by the primary seismic network. As an example here, this rules out some large, known shots in Canada, as it is known that these shots (of the order of 0.5 kt or more of chemical explosives) are not defined by the GSETT-3 Alpha network, and the IMS primary network will be even more sparse in the Canadian region.

The WGP has provided the WGE with four possible IMS auxiliary network designs; of 75, 100, 130 and 150 stations, respectively. According to the agreed division of labor between the WGP and the WGE, the WGE has made assessments as to which of these networks would be the most adequate for IMS. The WGE has focused on assessment of the expected event location uncertainties for the various designs, using different approaches, and on azimuthal coverage, using the so-called "octant approach". Their findings are presented in GSE/WGE/14, along with discussions of assumptions and limitations associated with this kind of assessment.

Network Recommendations

To accommodate all expert views expressed in CD/NTB/WP.269 regarding the number of stations in the IMS auxiliary seismic network, two possible designs are presented in the following (CD/NTB/WP.269, page 12: "Some experts expressed the view that up to 100 auxiliary stations would be needed, while others considered that between 100 and 150 stations would be necessary").

Table 7.5.1 lists 130 stations preliminarily proposed for the IMS auxiliary network, and in addition defines a subgroup of 100 stations, which in our view would be an optimum subset of this network. The two networks thus defined in this table are slightly revised relative to the 100- and 130-station networks that were provided to the WGE for their assessment, but the general capabilities of the corresponding networks are the same.

Table 7.5.1 provides details on the stations of these designs. The table gives the rationale for the inclusion of the various stations, in accordance with the station selection criteria and procedures outlined above. The meaning of the entries in the "Rationale" column of this table is as follows:

S : Station is in a seismically active region

M : Station is in an area of extensive mining

C : Station is in an area where the azimuthal coverage of the primary station network is poor

B : Station could serve as a backup for one or several primary stations (would then need to have continuous communications).

The "status" column of the table gives the operational status of the stations, with codes as follows:

ED : Existing digital station (note that communications link may not be in place)

PL : Planned digital station

PR : Proposed digital station

EA : Existing analog station

The proposed stations are shown as yellow triangles in Fig. 7.5.1, which also shows the IMS primary stations as dark blue squares. As seen in the figure, there is a distinction between the stations in the subgroup defining the 100-station network, and the additional 30 ones that are only in the proposed 130-station network (inverted triangles in the latter category). The stations are plotted against the background of world seismicity, here represented by 16,900 REB epicenters from 1 January 1995 through 11 November 1995.

Features of the 100-Station Design

- This design has 66 stations to cover the major seismic zones of the world. Some of these 66 stations also cover mining activity.
- 34 stations of this design are introduced to improve the overall azimuthal coverage, and/or located in regions of extensive mining activity.
- 13 out of these 100 stations have been assigned the role of providing backup for primary stations. These stations would need to have equipment for continuous transmission of data to the IDC.
- This design has a very limited coverage in ocean areas, and relies on synergy with the IMS hydroacoustic component for adequate performance in these areas.
- The location uncertainty area of this network design as simulated by the WGE is of the order of or smaller than 1,000 km^2 in the interior of all large landmasses except the Antarctica, but exceeds this number in the onshore parts of continental margin areas and in the oceans. It should be noted, however, that simulated network capabilities are generally on the optimistic side, due to several underlying idealistic assumptions made, one of which is that of a fully calibrated network.
- The worldwide octant coverage for this design is between 4 and 5. The WGE considers that a number of 5 or higher indicates good azimuthal coverage.
- Due to lack of digital stations in certain regions, some of the stations proposed to cover the seismically active regions are today analog stations (code EA in the table). These stations will need to be upgraded to comply with IMS standards.

Features of the 130-Station Design

- Relative to the 100-station design, stations have been added to improve the azimuthal coverage, and also to further improve the coverage of the seismicity zones. The coverage is especially improved in ocean areas by the addition of island stations. Some stations have also been added for better backup, in the sense discussed earlier.
- The event location uncertainties are further reduced (relative to those of the 100-station network), and nearly all of the landmasses are now inside the 1000 km^2 location uncertainty area contours, as shown in Fig. 7.5.2. Again, due care must be exercised in interpreting the simulation results.
- The average octant coverage for this design is above 5 globally.
- The WGE work has shown that the 150-station design has better performance than the 130-station design, but the improvements can be termed marginal, and thus perhaps not cost-effective.

Concluding Remarks

This paper has presented two options for an IMS auxiliary seismic network. Together with material that will be presented by others, this might facilitate the discussions in the GSE.

The question of redundancy in the auxiliary station network has not been considered explicitly in our work. Such redundancy might be needed to secure high data availability from all regions of the world.

The synergy with the hydroacoustic component of IMS has not been assessed quantitatively in this paper. It is expected that such synergy effects will be addressed in the expert meetings after the GSE meeting. Joint work by seismic and hydroacoustic experts may justify omitting some of the island stations from the 130-station design proposed in this paper.

Further work and discussion are needed to establish the exact locational capability of the networks and the operational status for the existing auxiliary stations proposed in this paper, and to check the progress of plans and proposals for the stations with status “PL” and “PR”, respectively, in the table. Further work is also needed to estimate the costs related to bringing stations and communications arrangements in line with the required IMS standards.

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Possible IMS Auxiliary Seismic Stations

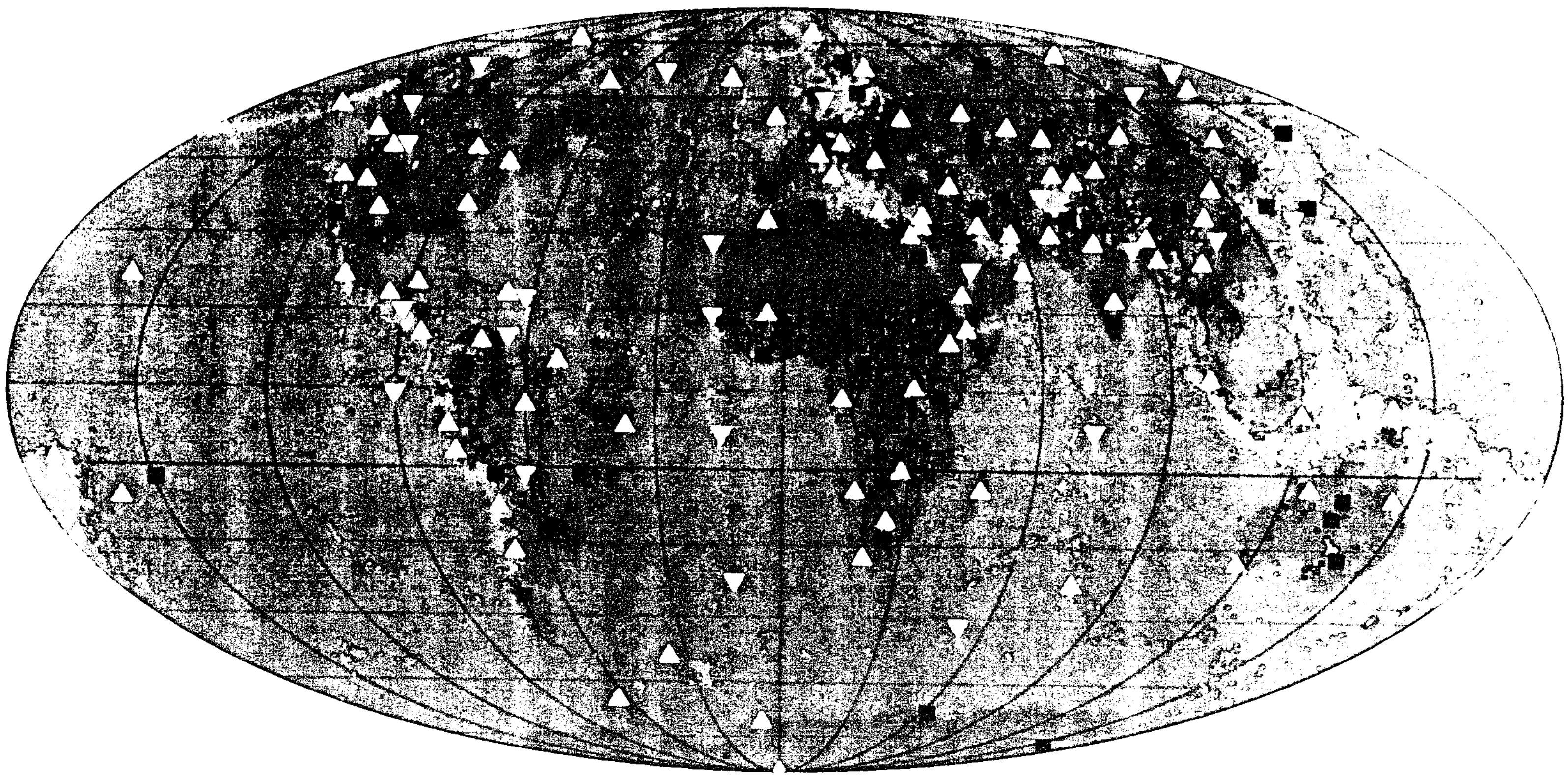

Fig. 7.5.1: The map shows the 50 IMS primary stations already agreed (dark blue squares) and the 130 auxiliary stations (yellow triangles) proposed in this paper.

Simulated event location uncertainty
Primary plus proposed 130-station auxiliary network

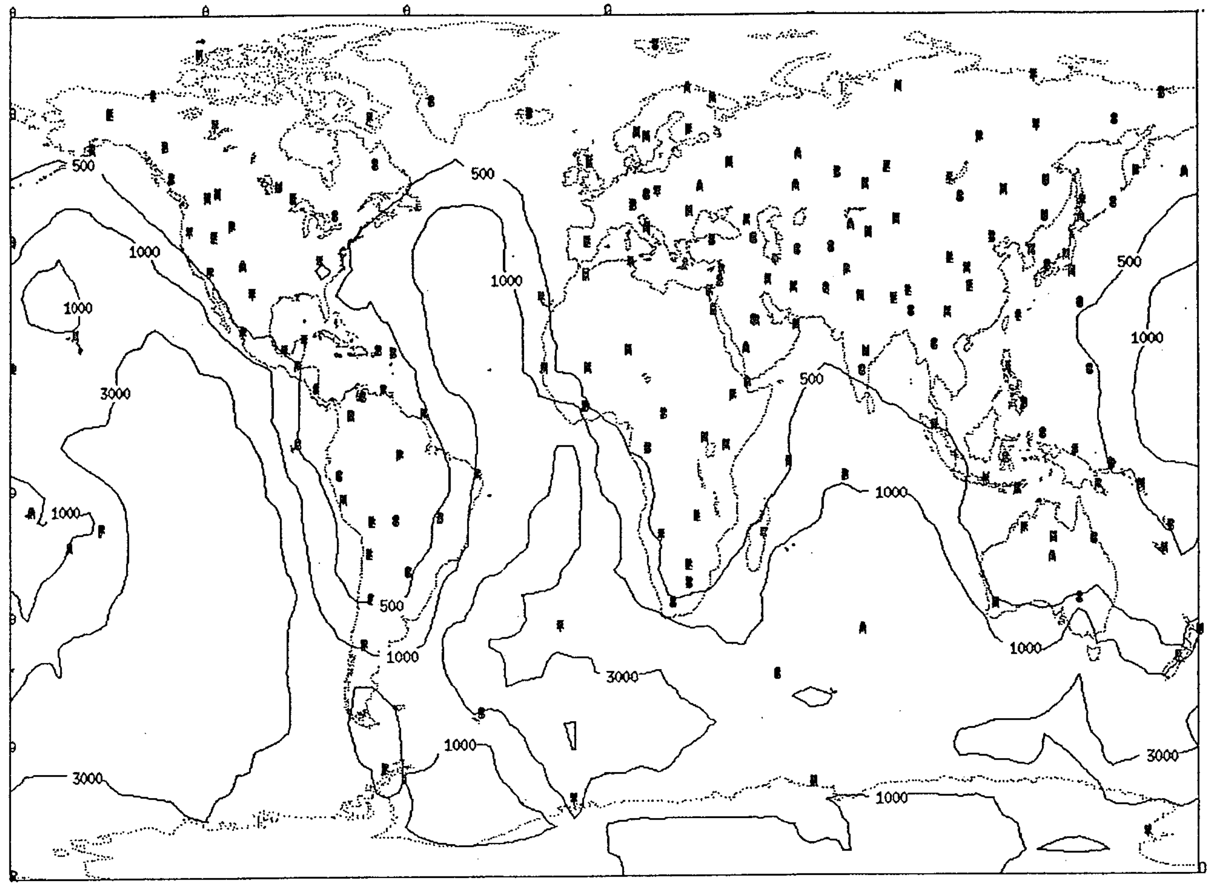

Fig. 7.5.2. This figure shows the simulated event location uncertainty of the network composed of the 50 primary stations already agreed and the 130 auxiliary stations proposed in this paper. The map was prepared by the WGE member Peder Johansson of Sweden.

Proposed IMS Auxiliary Stations

No.	Location	Station name and code	Station type	Lat	Long	Rationale	Status	100
North America								
1	Canada	Mould Bay MBC	3-C	76.242	-119.360	C	ED	x
2	Canada	Iqaluit FRB	3-C	63.747	-68.547	C	ED	x
3	Canada	Bella Bella BBB	3-C	52.185	-128.113	S	ED	x
4	Canada	Sadowa SADO	3-C	44.769	-79.142	M,C	ED	x
5	USA	Kodiac Island KDC	3-C	57.750	-152.490	S	PR	x
6	USA	Attu ATTU	3-C	52.800	172.700	S	ED	x
7	USA	Newport NEW	3-C	48.263	-117.120	S, M	ED	x
8	USA	Yreka YBH	3-C	41.730	-122.710	S	ED	x
9	USA	Elko ELK	3-C	40.745	-115.239	S,B	ED	x
10	USA	Albuquerque ALQ	3-C	34.946	-106.457	S,M	ED	x
11	USA	Ely EYMN	3-C	47.947	-91.508	M	ED	x
12	USA	Tuckaleechee Caverns TKL	3-C	35.658	-83.774	M,C	ED	x
13	Mexico	Islas Marias IMM	3-C	21.620	-106.580	S	PL	x
14	Mexico	Tepich TEYM	3-C	20.210	-88.340	C	PL	x
15	Mexico	Tuzandepeti TUVM	3-C	18.030	-94.420	S	PL	x
16	USA	San Juan SJG	3-C	18.110	-66.150	S	ED	x
17	Costa Rica	Las Juntas de Abangares JTS	3-C	10.290	-84.950	S	ED	x

No.	Location	Station name and code	Station type	Lat	Long	Rationale	Status	100
18	Canada	Dease Lake DLBC	3-C	58.417	-130.060	S,B	ED	
19	Canada	Inuvik INK	3-C	68.307	-113.520	S,C	ED	
20	Canada	Wateron Lakes WALA	3-C	49.060	-113.920	S	ED	
21	Guatemala	Rabir RDG	3-C	15.010	-90.470	S	EA	
22	United Kingdom	Barbuda BWI	3-C	17.665	-61.790	S	EA	
South America								
23	Venezuela	Santo Domingo SDV	3-C	8.890	-70.630	S	ED	x
24	France	Kourou KOG	3-C	5.207	-52.732	C	ED	x
25	Brazil	Pitinga PTGA	3-C	-3.060	-60.000	C	ED	x
26	Brazil	Rio Grande do Norte RGNB	3-C	-6.910	-36.950	C	PL	x
27	Peru	Cajamarca ?	3-C	-7.000	-78.000	S,M,B	New	x
28	Peru	Nana NNA	3-C	-11.990	-76.840	S,M	ED	x
29	Chile	Limon Verde LVC	3-C	-22.590	-68.930	S,M	PL	x
30	Argentina	Coronel Fontana CFA	3-C	-31.607	-68.239	S,B	ED	x
31	Venezuela	Puerto la Cruz PCRV	3-C	10.180	-64.640	S	EA	
32	Ecuador	Santa Cruz ?	3-C	-0.660	-90.230	S	PL	
33	Bolivia	San Ignacio SIV	3-C	-15.991	-61.072	S	EA	
Europe								
34	Iceland	Borgarnes BORG	3-C	64.750	-21.330	S	ED	x

No.	Location	Station name and code	Station type	Lat	Long	Rationale	Status	100
35	Norway	Spitsbergen SPITS	Array	78.178	16.370	S	ED	x
36	Russia	Apatity APAES	Array	67.610	32.990	M	ED	x
37	United Kingdom	Eskdalemuir EKA	Array	55.333	-3.159	C	ED	x
38	Switzerland	Davos ?	3-C	46.839	9.794	S,B	ED	x
39	Czech Republic	Vranov VRAC	3-C	49.308	16.594	M	ED	x
40	Russia	Michnevo MHV	3-C	54.960	37.770	M,C	ED	x
41	Romania	Muntele Rosu MLR	3-C	45.492	25.944	S	ED	x
42	Italy	L'Aquila AQU	3-C	42.354	13.405	S	ED	x
43	Greece	Anogia, Crete IDI	3-C	35.280	24.890	S	ED	x
44	Sweden	Hagfors HFS	Array	60.134	13.697	B	ED	
45	Denmark	Søndre Strømfjord SSGL	3-C	67.050	-50.300	C	PL	
Atlantic Ocean								
46	South Georgia Island	South Georgia ?	3-C	-54.000	-36.000	S	PR	x
47	Spain	Taburiente TRT	3-C	28.680	-17.910	C	ED	
48	United Kingdom	Tristan da Cunha ?	3-C	-37.000	-12.500	S,C	PR	
49	United Kingdom	Ascencion Island ASCN	3-C	-7.950	-14.380	S,C	ED	
Africa								
50	Morocco	Mldelt MDT	3-C	32.820	-4.610	S,B	ED	x
51	Egypt	Kottamya KEG	3-C	29.930	31.830	S	ED	x

No.	Location	Station name and code	Station type	Lat	Long	Rationale	Status	[illegible]
52	Ethiopia	Furi FURI	3-C	8.900	38.680	S,B	PL	x
53	Djibouti	Arta tunnel ATD	3-C	11.530	42.847	S	ED	x
54	Uganda	Mbarara ?	3-C	0.360	30.400	S	PL	x
55	Zambia	Lusaka LSZ	3-C	-15.280	28.190	S,M	ED	x
56	Namibia	Tsumeb TSUM	3-C	-19.130	17.420	C	ED	x
57	Botswana	Lobatse LBTB	3-C	-25.015	25.597	M,B	ED	x
58	South Africa	Sutherland SUR	3-C	-32.380	20.810	M	ED	x
59	Madagascar	Antananarivo TAN	3-C	-18.920	47.550	C	EA	x
60	Gabon	Bambay BAMB	3-C	-1.660	13.610	C	PL	x
61	Mali	Kowa KOWA	3-C	14.500	-4.020	C	PL	x
62	Senegal	M'Bour MBO	3-C	14.391	-16.955	C	ED	
Asia								
63	Russia	Arti ARU	3-C	56.430	58.563	M,C	ED	x
64	Armenia	Garni GNI	3-C	40.050	44.720	S	ED	x
65	Israel	Bar Giyora BGIO	3-C	31.722	35.092	S	ED	x
66	Lebanon	Bhannes BHL	3-C	33.900	35.650	S	PL	x
67	Saudi Arabia	Ab'ha ?	3-C	18.300	42.500	C	PR	x
68	Oman	Wadi Sarin WRAS	3-C	23.000	58.000	S	PL	x
69	Iran	Kerman KRM	3-C	30.280	57.070	S,B	PL	x

No.	Location	Station name and code	Station type	Lat	Long	Rationale	Status	100
70	Iran	Masjed-E-Solayman MSN	3-C	31.930	49.300	S	PL	x
71	Pakistan	Quetta QUE	3-C	30.190	66.950	S	PL	x
72	Kyrghyzstan	Ala-Archa AAK	3-C	42.640	74.490	S	ED	x
73	Kazakhstan	Kurchatov KURK	Array	50.715	78.621	M,B	ED	x
74	Kazakhstan	Borovoye BRVK	3-C	53.058	70.283	M,C	ED	x
75	India	New Delhi NDI	3-C	28.690	77.220	S	PR	x
76	India	Hyderabad HYB	3-C	17.420	78.550	M	ED	x
77	India	Shillong SHIO	3-C	25.570	91.880	S,B	PR	x
78	China	Baijiatuan BJT	3-C	40.020	116.170	M,C	ED	x
79	China	Kunming KMI	3-C	25.150	102.750	S,M	ED	x
80	China	Xi'an XAN	3-C	34.040	108.920	S,M,B	ED	x
81	China	Wulumuqi WMQ	3-C	43.820	87.700	S	ED	x
82	China	Lhasa LSA	3-C	29.700	91.150	S	ED	x
83	China	Wushi WUS	3-C	41.200	79.220	S	ED	x
84	Russia	Seymchan SEY	3-C	62.930	152.370	S,M	ED	x
85	Russia	Yuzhno-Sakhalinsk YSS	3-C	46.950	142.750	S,B	ED	x
86	Russia	Tiksi TIXI	3-C	71.660	128.870	C	ED	x
87	Russia	Talaya TLY	3-C	51.580	103.640	S,M	ED	x
88	Russia	Urgal URG	3-C	51.100	132.360	S	ED	x

No.	Location	Station name and code	Station type	Lat	Long	Rationale	Status	100
89	Japan	Aibetsu AIG	3-C	43.910	142.650	S	ED	x
90	Japan	Chichijima OGS	3-C	27.060	142.200	S	ED	x
91	Japan	Ishigakijima ISG	3-C	24.380	124.230	S	ED	x
92	Phillippines	Tagaytay TGY	3-C	14.100	120.940	S,M	ED	x
93	Phillippines	Davao DAV	3-C	7.090	125.570	S	ED	x
94	Indonesia	Sulawesi ?	3-C	-4.000	120.000	S	PR	x
95	Indonesia	Parapat PSI	3-C	2.700	98.920	S,M	ED	x
96	Indonesia	Jayapura JAY	3-C	-2.520	140.700	S	PL	x
97	Indonesia	Kupang KUG	3-C	-10.000	123.000	S	EA	x
98	Tadjikistan	Gissar ?	3-C	38.380	68.510	S	PR	
99	Saudi Arabia	Ar Rayn RAYN	3-C	23.600	45.600	C	PL	
100	Nepal	Everest EVN	3-C	27.960	86.820	S	ED	
101	China	Enshi ENH	3-C	30.270	109.490	S	ED	
102	Russia	Bilibino BILL	3-C	68.040	166.270	C	ED	
103	Russia	Yakutsk YAK	3-C	62.010	129.430	S	ED	
104	Russia	Simushir SIU	3-C	46.850	151.867	S	EA	
105	Japan	Hachijojima HCH	3-C	33.120	139.800	S	ED	
106	Japan	Shiraki SHK	3-C	34.530	132.680	S	ED	
107	Indonesia	Kalikatan KELI	3-C	-8.220	114.490	S	EA	

No.	Location	Station name and code	Station type	Lat	Long	Rationale	Status	100
108	Indonesia	Sarong SWI	3-C	0.860	131.260	S	EA	
Indian Ocean								
109	France	New Amsterdam Island AIS	3-C	-37.797	77.569	C	ED	x
110	France	Port Alfred CRZF	3-C	-46.430	51.861	C	ED	
111	United Kingdom	Diego Garcia ?	3-C	-7.30	72.40	S,C	PR	
Antarctica								
112	Antarctica	Palmer Station PMSA	3-C	-64.770	-64.070	C	ED	x
113	Antarctica	Georg Neumayer Base VNA	3-C	-70.610	-8.366	C	ED	x
114	Antarctica	South Pole SPA	3-C	0.00	115.000	C	ED	x
Oceania and Pacific Ocean								
115	Papua New Guinea	Port Moresby PMG	3-C	-9.410	147.150	S	ED	x
116	Australia	Narrogin NWAO	3-C	-32.927	117.233	M,C	ED	x
117	Australia	Fitzroy Crossing FITZ	3-C	-18.103	125.643	M,C,B	ED	x
118	Australia	Charters Towers CTA	3-C	-20.088	146.254	M,C	ED	x
119	USA	Guam GUMO	3-C	13.590	144.870	S	ED	x
120	Solomon Islands	Honiara HNR	3-C	-9.430	159.950	S	ED	x
121	France	Port Laguerre NOUC	3-C	-22.101	166.303	S	ED	x
122	Fiji Islands	Monasavu MSVF	3-C	-17.750	178.050	S	ED	x
123	New Zealand	Urewera URZ	3-C	-38.260	177.110	S	ED	x
124	Kermadec Islands	Raoul Island ?	3-C	-29.150	-177.520	S	PR	x

No.	Location	Station name and code	Station type	Lat	Long	Rationale	Status	100
125	Western Samoa	Afiamalu AFI	3-C	-13.910	-171.780	S	ED	x
126	Cook Islands	Rarotonga RAR	3-C	-21.210	-159.770	C	ED	x
127	USA	Kipapa KIP	3-C	21.423	-158.015	C	ED	x
128	Papua New Guinea	Bialla BIAL	3-C	-5.310	151.050	S	EA	
129	Vanuatu	Butte a Klehm BKM	3-C	-17.668	168.243	S	EA	
130	New Zealand	Rewhon EWZ	3-C	-43.512	170.853	S	ED	

Table 7.5.1. The table gives details on the 130 stations proposed for the IMS auxiliary network. The meaning of the colums "Rationale" and "Status" is explained in the text. The rightmost column labelled "100" identifies stations of an optimum 100-station subgroup of this 130-station network.

7.6 Magnitude estimation at the IDC — a case study

Introduction

Several recent papers have addressed the shortcomings of the currently available magnitude scales for the purposes of GSETT-3. Harjes (1995) has suggested that a "unified" magnitude scale should be developed for operational use at the IDC. Such a magnitude scale should have the following general characteristics:

- Consistent with current teleseismic m_b
- Applicable to "all" distance ranges
- Computed automatically
- Valid over large magnitude range (at least 2.0-6.5)

The primary purpose would be to develop a "generic" magnitude scale that could be used as a first estimate of m_b. Subsequent refinements would then be possible by introducing station/region-specific correction factors in areas where adequate data are available.

In the NORSAR Semiannual Technical Summary 1 October 94 - 31 March 95 Kværna and Ringdal (1995) described a possible approach to developing a unified magnitude scale, by using the IDC Threshold Monitoring system.

By analyzing selected IDC-reported events in detail, they found that the TM approach offers a consistent, automatically computed data set that is directly applicable to m_b estimation. Since upper limits on all non-detecting stations are provided, the method is easily expandable to include maximum-likelihood magnitude estimates. It was also pointed out that a similar approach can be used to estimate M_S, with upper 90% M_S limits provided automatically for events for which no surface waves are detected.

In this paper we follow up the general question of IDC magnitude estimation by analyzing a recent earthquake sequence in Greece during May-June 1995. This includes comparisons of IDC magnitudes in the Reviewed Event Bulletins to those of NORSAR and NEIC, with special view to network bias, recurrence statistics and detectability.

The Greece earthquake sequence May/June 1995

Several hundred earthquakes from the Greece area were recorded at the NORSAR array during May/June 1995. An example of a 12-hour period from the NORSAR monthly bulletin is given in Fig. 7.6.1. Many of these events were also listed in the IDC Reviewed Event Bulletin, using mostly the arrays in central/northern Europe as key stations in the location procedure. Fig. 7.6.2 shows epicenters for a two-week period as given in the biweekly IDC Performance Reports.

As can be seen from Fig. 7.6.1, the majority of the earthquakes were around $m_b = 4.0$ and lower, thus giving a good basis both for a detectability study and to investigate possible magnitude bias effects. As is well known (e.g., Ringdal, 1976), a network magnitude bias can be expected at low magnitudes unless maximum-likelihood techniques are applied.

Magnitude comparisons

Fig. 7.6.3 compares reported magnitudes from the three sources: NORSAR bulletin, IDC REB and NEIC PDE. The following observations are made:

- From plot a) we note that NORSAR and PDE magnitudes are consistent for the larger events, but there is a significant positive "network bias" in the PDE magnitudes for the smaller events. Once the NORSAR magnitude goes below 4.0, the PDE magnitude stays between 4.0 and 4.5, thus reflecting that only those stations with the highest amplitudes contribute to the average m_b.
- From plot b) we note that there is a bias also in the IDC magnitudes for the smaller events, although this plot has much more scatter than plot a).
- From plot c) we note that IDC magnitudes have a negative bias relative to PDE magnitudes. This is not surprising, and has been documented in many IDC Performance Reports. One possible reason is the dominance of high-frequency arrays in the IDC network. However, the large scatter between IDC and PDE magnitudes is a source of concern, and must be due to other reasons as well. It appears that the automatic algorithm at the IDC for magnitude computation needs significant improvement.

Recurrence statistics

Fig. 7.6.4 shows cumulative recurrence statistics for NORSAR and REB for the Greece sequence. The slope of the NORSAR plot is close to 1.0, whereas the REB slope is much steeper. The tendency of REB recurrence curves to show a slope significantly steeper than 1.0 has been observed in many IDC Performance Reports (see e.g. Fig. 7.6.5), and again we prescribe this to a network bias.

It might be noted that under the assumptions of a normal magnitude distribution and an exponential magnitude-frequency relationship (log N=a b*m), a single station or array will provide an unbiased estimate of the b-value (Ringdal, 1975). On the other hand, the a-value from a single-station or array will be biased due to station bias and station scatter. Therefore the b-value of approximately 1.0 inferred from the NORSAR plot should be close to the "real" b-value for this earthquake sequence. When maximum-likelihood magnitudes are implemented at the IDC, we would thus expect the recurrence slopes to become close to 1.0.

Detectability

Fig. 7.6.6 shows the estimated incremental detectability of the REB using NORSAR as a reference for the area and time period mentioned. Since NORSAR is currently not participating in GSETT-3, it can reasonably be used as an independent reference system for such an estimation. The 90% threshold is close to 4.2, which is in fact quite similar to the estimate inferred from the theoretical capability plots in the IDC Performance Reports. This consistency is encouraging.

F. Ringdal

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13	May	11.15.23.9	NB2	P	0.8	0.5	10	157	19	11.11.04	43N	21E	3.2	383	YUGOSLAVIA
13	May	11.16.13.5	NB2	P	0.5	0.4	13	123	38	11.09.02	32N	48E	3.7	347	WESTERN IRAN
13	May	11.19.47.1	NB2	P	1.1	0.6	10	158	19	11.15.31	43N	21E	3.3	383	YUGOSLAVIA
13	May	11.30.20.8	NB2	P	0.7	0.6	12	157	25	11.25.00	37N	23E	3.4	368	SOUTHERN GREECE
13	May	11.36.11.1	NB2	P	1.6	0.7	10	145	19	11.31.51	44N	26E	3.4	358	ROMANIA
13	May	11.43.08.1	NB2	P	0.7	0.6	9	140	18	11.39.01	46N	28E	3.2	358	ROMANIA
13	May	11.48.22.1	NB2	P	87.7	0.8	9	157	18	11.44.10	44N	21E	5.1	383	YUGOSLAVIA
13	May	11.57.46.3	NB2	P	0.7	0.5	10	160	21	11.53.09	41N	20E	3.2	391	ALBANIA
13	May	12.00.15.2	NB2	P	0.4	0.5	12	157	24	11.55.03	38N	23E	3.2	364	GREECE
13	May	12.09.28.5	NB2	P	0.8	0.6	22	91	83	11.57.04	5N	97E	3.9	706	NORTHERN SUMATERA
13	May	12.33.00.6	NB2	P	0.9	0.7	9	156	18	12.28.55	44N	21E	3.3	383	NORTHWESTERN BALKAN REGION
13	May	12.55.45.9	NB2	P	0.8	0.6	12	167	24	12.50.35	37N	18E	3.4	399	IONIAN SEA
13	May	13.09.57.5	NB2	P	0.6	0.6	12	159	26	13.04.25	36N	22E	3.5	400	MEDITERRANEAN SEA
13	May	13.36.58.8	NB2	P	0.9	0.5	10	158	19	13.32.43	43N	21E	3.3	383	YUGOSLAVIA
13	May	13.39.09.9	NB2	P	2.3	0.8	20	42	79	13.27.07	31N	141E	4.2	211	SOUTH OF HONSHU, JAPAN
13	May	13.46.41.8	NB2	P	1.1	0.6	10	161	19	13.42.25	43N	19E	3.3	383	NORTHWESTERN BALKAN REGION
13	May	13.54.39.7	NB2	P	0.6	0.6	12	159	26	13.49.07	36N	22E	3.5	400	MEDITERRANEAN SEA
13	May	13.57.50.0	NB2	P	0.8	0.6	9	146	18	13.53.45	45N	25E	3.3	358	ROMANIA
13	May	14.13.47.0	NB2	P	1.5	0.8	10	158	20	14.09.21	42N	21E	3.3	383	YUGOSLAVIA
13	May	14.21.21.2	NB2	P	13.7	0.8	9	157	18	14.17.09	44N	21E	4.3	383	YUGOSLAVIA
13	May	14.24.30.0	NB2	P	0.9	0.6	9	146	18	14.20.21	45N	26E	3.3	358	ROMANIA
13	May	14.30.54.5	NB2	P	1.6	0.6	12	159	26	14.25.21	36N	23E	4.0	400	MEDITERRANEAN SEA
13	May	15.03.15.4	NB2	P	0.7	0.8	10	157	20	14.58.47	42N	22E	3.0	383	NORTHWESTERN BALKAN REGION
13	May	15.09.43.7	NB2	P	1.3	0.7	9	157	18	15.05.31	44N	21E	3.4	383	YUGOSLAVIA
13	May	15.19.42.0	NB2	P	0.7	0.6	10	159	20	15.15.11	42N	21E	3.1	391	ALBANIA
13	May	15.30.33.8	NB2	P	4.7	0.8	10	158	19	15.26.14	43N	21E	3.8	383	NORTHWESTERN BALKAN REGION
13	May	15.34.57.9	NB2	P	3.8	0.7	12	159	28	15.29.10	34N	23E	4.4	400	MEDITERRANEAN SEA
13	May	15.44.02.4	NB2	PKPabc	0.7	0.5	27	22	153	15.23.58	35S	179E	3.7	179	SOUTH OF KERMADEC ISLANDS
13	May	15.57.50.5	NB2	P	0.5	0.6	9	147	17	15.53.54	46N	25E	3.1	358	ROMANIA
13	May	16.09.03.7	NB2	P	0.6	0.6	9	140	18	16.04.53	46N	28E	3.1	358	ROMANIA
13	May	16.19.19.3	NB2	P	0.4	0.5	9	157	18	16.15.09	44N	21E	3.0	383	NORTHWESTERN BALKAN REGION
13	May	16.43.27.0	NB2	P	1.0	0.6	10	158	20	16.39.02	42N	21E	3.3	383	NORTHWESTERN BALKAN REGION
13	May	17.15.46.8	NB2	P	4.1	0.8	10	158	19	17.11.25	43N	21E	3.7	383	NORTHWESTERN BALKAN REGION
13	May	17.54.40.0	NB2	P	0.9	0.6	9	155	18	17.50.35	44N	22E	3.3	383	YUGOSLAVIA
13	May	17.59.46.9	NB2	P	12.1	0.9	10	158	19	17.55.30	43N	21E	4.2	383	NORTHWESTERN BALKAN REGION
13	May	18.10.52.0	NB2	P	35.7	0.8	10	158	19	18.06.35	43N	21E	4.7	383	NORTHWESTERN BALKAN REGION
13	May	18.17.33.8	NB2	P	0.7	0.7	12	159	26	18.12.02	36N	22E	3.5	400	MEDITERRANEAN SEA
13	May	18.30.55.3	NB2	P	0.7	0.6	10	157	19	18.26.36	43N	21E	3.1	383	YUGOSLAVIA
13	May	18.40.30.0	NB2	P	3.2	0.7	12	156	25	18.35.12	38N	24E	4.0	368	SOUTHERN GREECE
13	May	18.44.48.2	NB2	P	0.2	0.4	9	148	17	18.40.51	46N	24E	3.0	358	ROMANIA
13	May	18.51.19.8	NB2	P	4.6	0.7	10	160	19	18.47.03	43N	20E	3.9	383	NORTHWESTERN BALKAN REGION
13	May	18.59.50.1	NB2	P	3.0	0.7	9	156	18	18.55.44	44N	21E	3.8	383	NORTHWESTERN BALKAN REGION
13	May	19.01.52.1	NB2	P	0.9	0.6	12	161	26	18.56.25	36N	21E	3.7	368	SOUTHERN GREECE
13	May	19.05.05.4	NB2	P	6.1	0.7	9	156	18	19.00.59	44N	21E	4.1	383	NORTHWESTERN BALKAN REGION
13	May	19.05.40.2	NB2	P	10.9	0.7	12	160	26	19.00.11	36N	22E	4.7	400	MEDITERRANEAN SEA
13	May	19.34.26.8	NB2	P	0.6	0.6	12	159	26	19.28.55	36N	22E	3.5	400	MEDITERRANEAN SEA
13	May	19.42.03.0	NB2	P	7.6	0.8	10	158	19	19.37.42	43N	21E	4.0	383	NORTHWESTERN BALKAN REGION
13	May	21.07.09.3	NB2	P	2.2	0.7	9	155	18	21.03.08	45N	21E	3.7	383	YUGOSLAVIA
13	May	21.13.32.8	NB2	P	49.8	0.8	24	83	94	21.00.19	0N	109E	6.0	261	KALIMANTAN
13	May	21.40.08.2	NB2	P	0.5	0.6	12	157	26	21.34.43	37N	24E	3.4	368	SOUTHERN GREECE
13	May	21.45.38.8	NB2	P	2.6	0.8	10	159	20	21.41.14	42N	21E	3.5	383	NORTHWESTERN BALKAN REGION
13	May	22.06.13.4	NB2	P	0.5	0.6	9	142	18	22.02.11	46N	27E	3.2	358	ROMANIA
13	May	22.33.49.3	NB2	P	1.6	0.6	9	154	18	22.29.47	45N	22E	3.6	358	ROMANIA
13	May	22.42.32.4	NB2	P	56.9	1.7	9	355	17	22.38.33	78N	4E	4.7	640	GREENLAND SEA
13	May	23.32.48.3	NB2	P	4.5	0.8	9	154	18	23.28.42	44N	22E	3.9	358	ROMANIA
13	May	23.51.50.0	NB2	P	5.7	0.6	9	156	18	23.47.41	44N	21E	4.1	383	NORTHWESTERN BALKAN REGION

Fig. 7.6.1. Excerpts from the NORSAR bulletin for a 12-hour period on 13 May 1995.

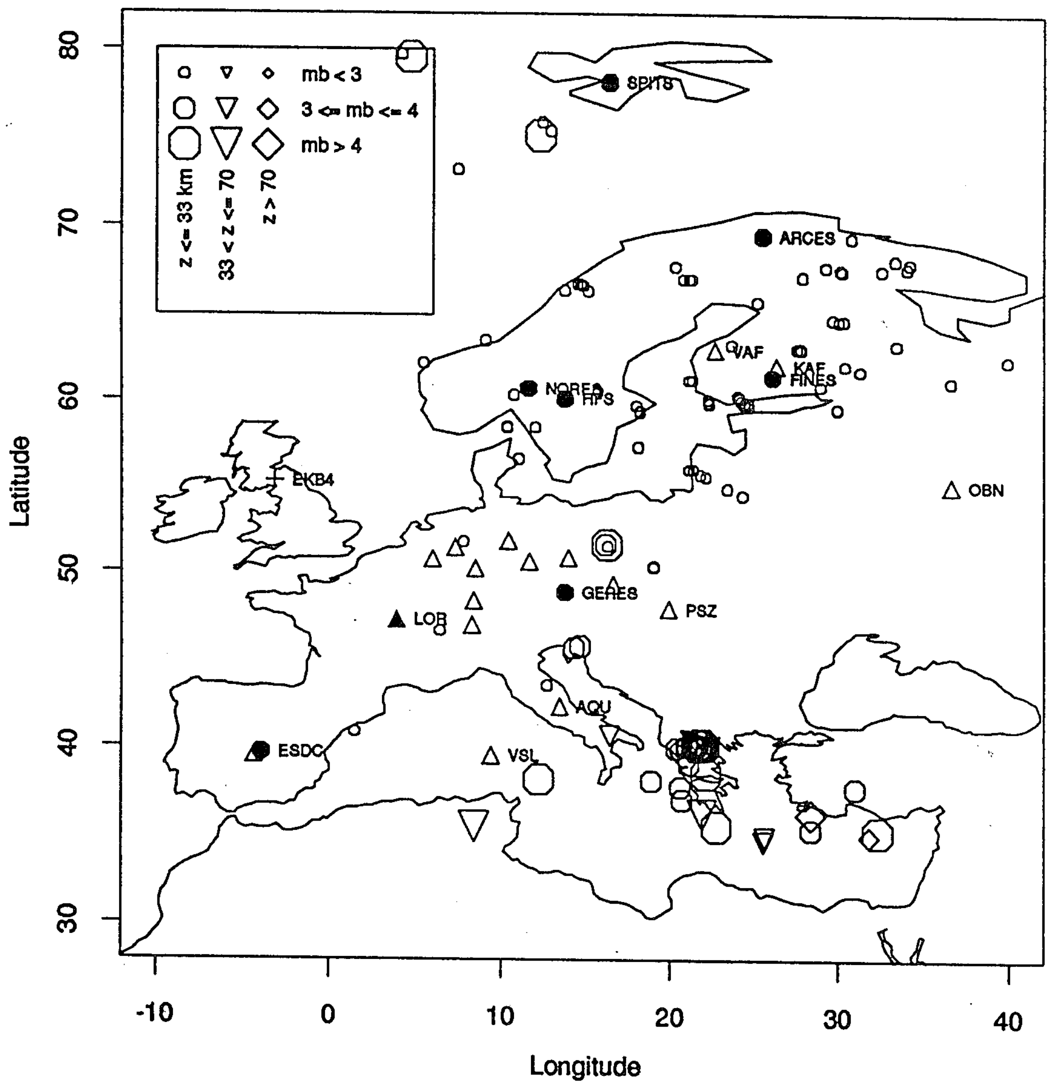


Fig. 7.6.2. REB events in Europe showing the depth and body-wave magnitudes ranges for a two-week period during the Greece sequence. The GSETT-3 stations are indicated as filled circles and triangles. The figure is taken from one of the IDC Performance Reports.

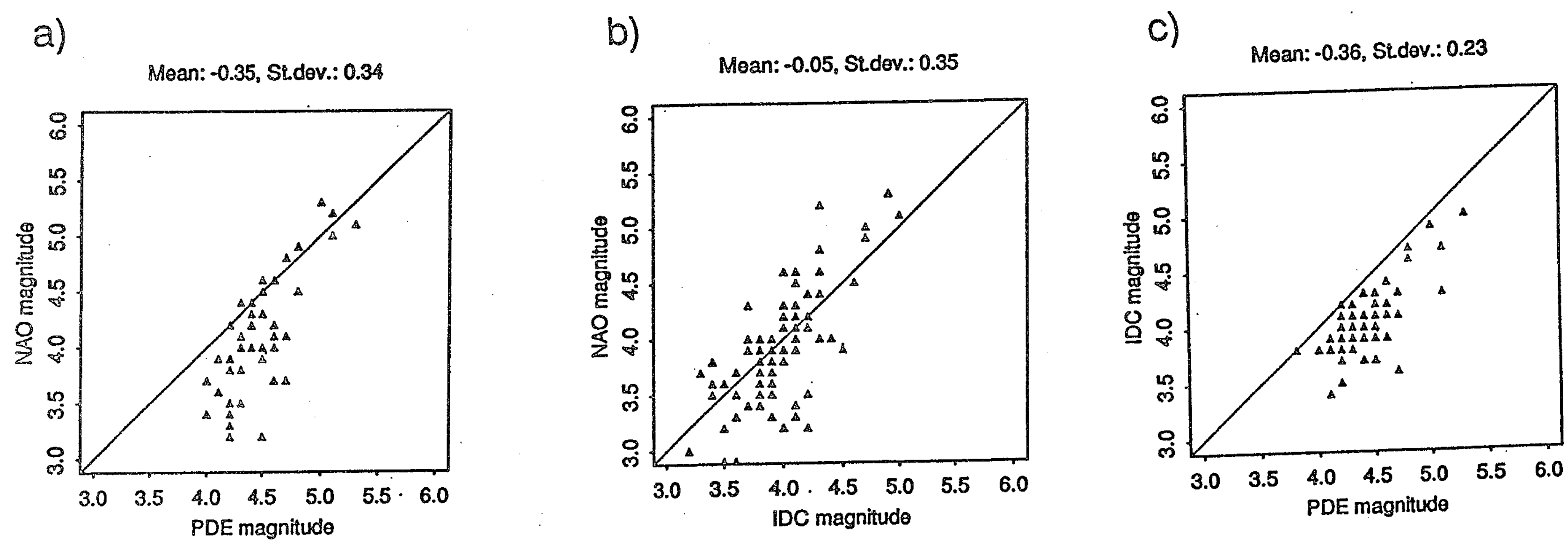
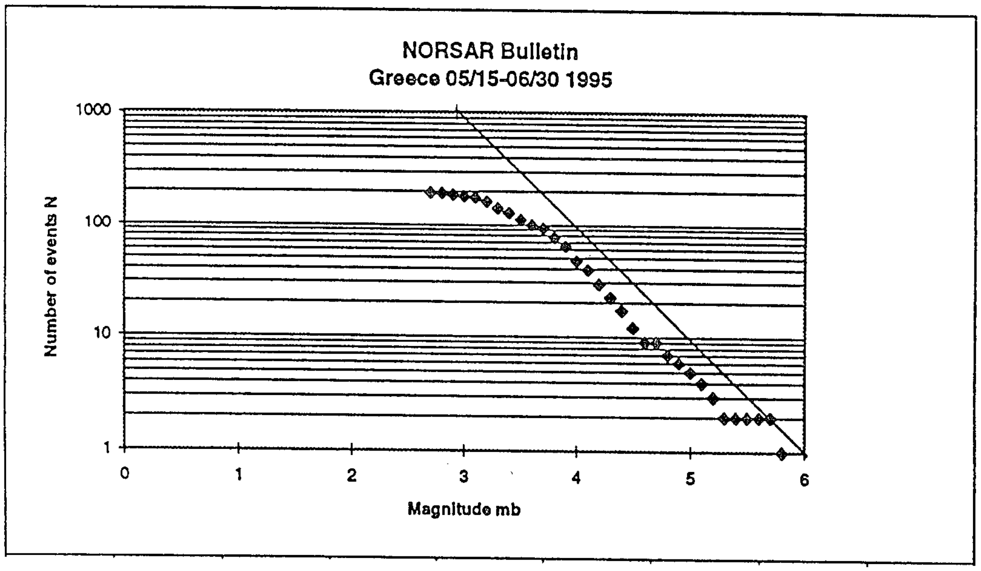


Fig. 7.6.3. Magnitude comparisons for various reporting agencies for the Greece earthquake sequence. Note the network magnitude bias, which is particularly pronounced in figure a) (NORSAR versus PDE magnitudes).

a)



b)

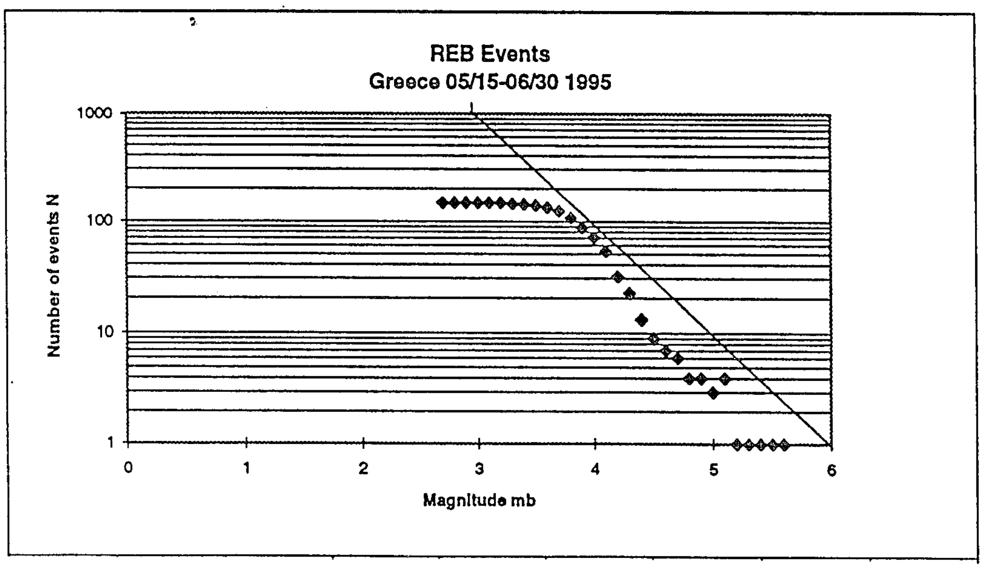


Fig. 7.6.4. Magnitude recurrence statistics for a) NORSAR and b) IDC for six weeks of the Greece earthquake sequence. The straight lines have a slope of 1.0. Note that the NORSAR slope is close to 1.0, whereas the IDC slope appears to be significantly steeper.

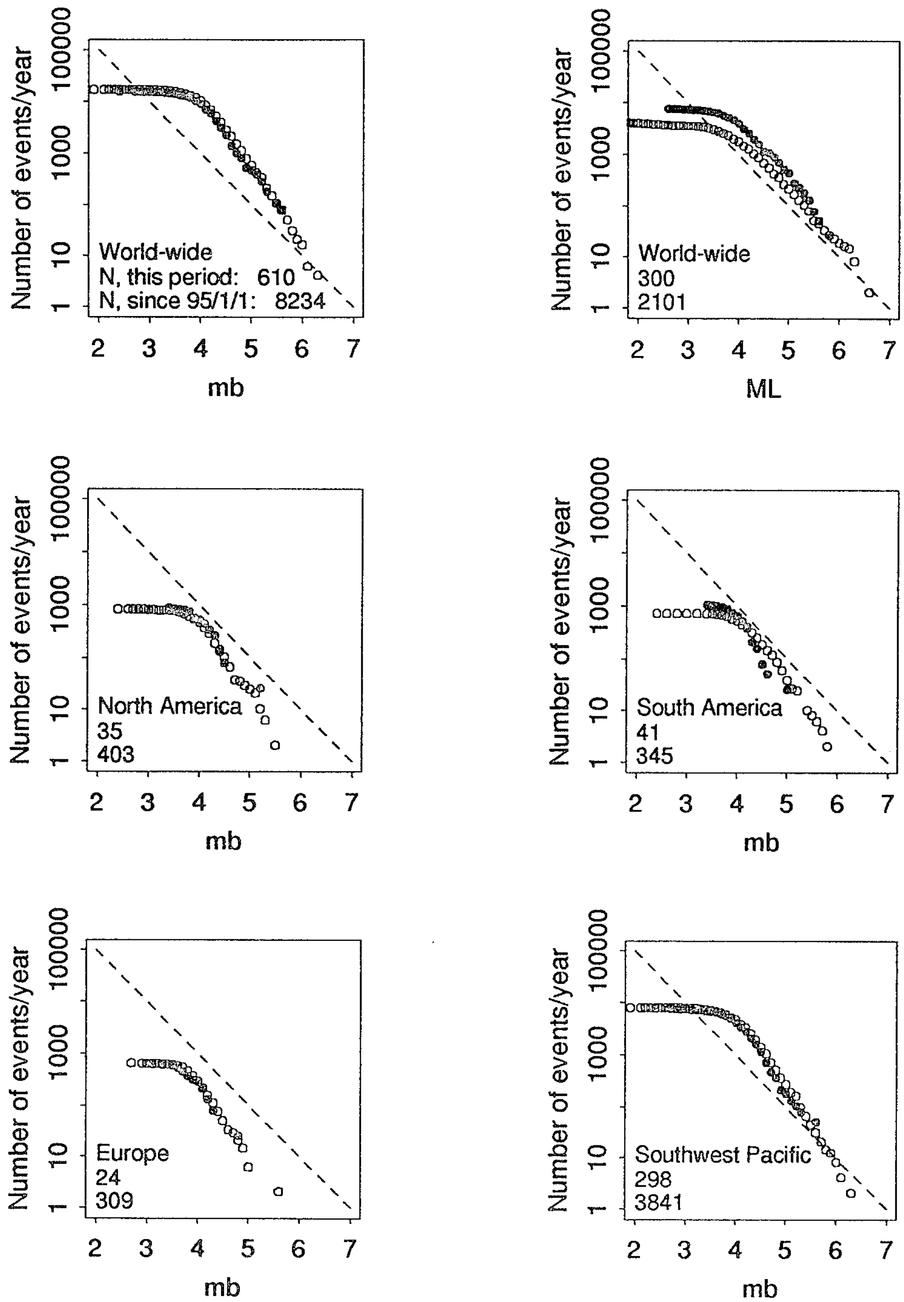


Fig. 7.6.5. Recurrence distribution of body-wave (m_b) and local (ML) magnitudes in the REB for selected regions, as taken from an IDC Performance Report. The stippled lines have a slope of 1.0. Note that the m_b recurrence curves have slopes significantly greater than 1.0 for all regions, which is ascribed to a network m_b estimation bias.

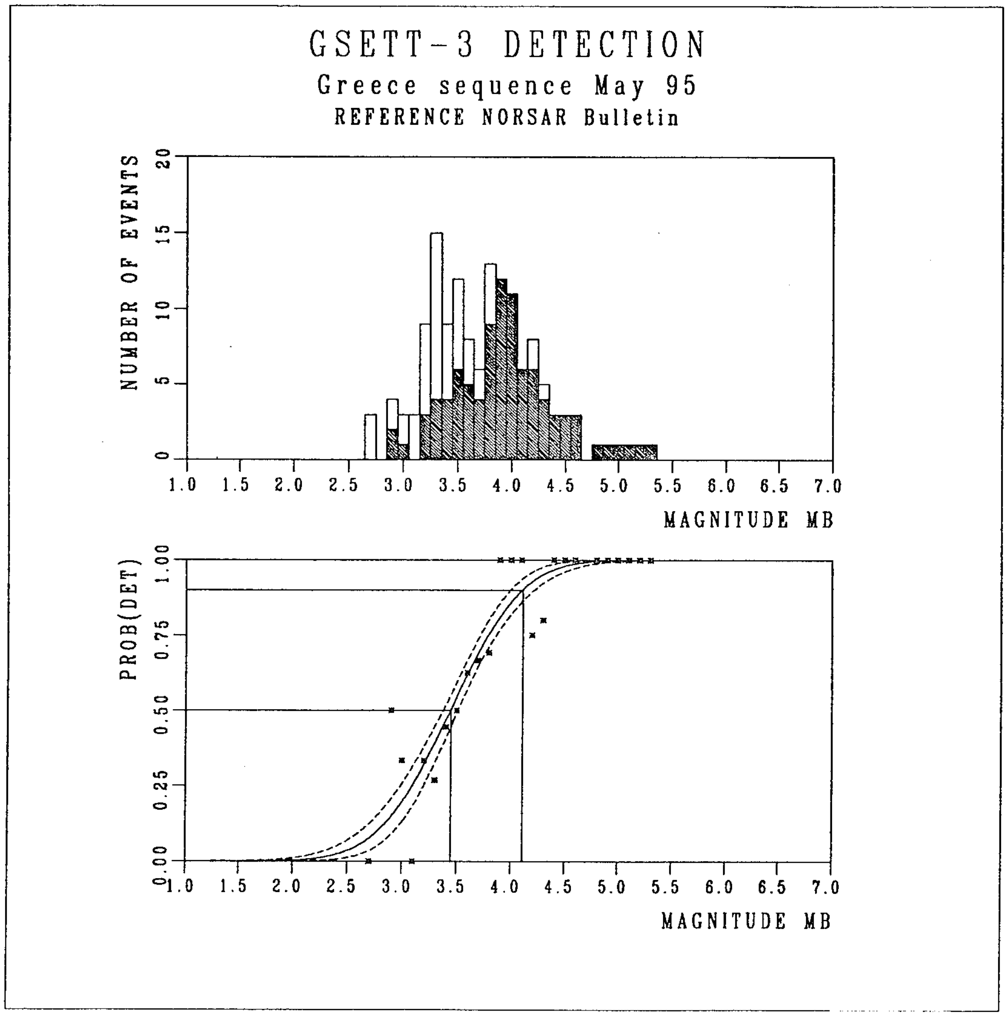


Fig. 7.6.6. Detectability estimate for the IDC REB for the Greece area using the NORSAR bulletin as a reference. The 90% detection threshold is $m_b = 4.2$, which is close to the theoretical estimate in the IDC Performance Reports.

7.7 An assessment of the estimated mean mislocation vectors for small-aperture arrays

Introduction

The objective of this study was to test the applicability of the estimated mean mislocation vectors for small-aperture arrays (Schweitzer, 1994; Schweitzer & Kværna, 1995) for use with different event-location procedures. The mean mislocation vectors were calculated in the slowness space and are now available for automatically estimated fk-results over a large range of azimuth and ray-parameter values. Additionally, mean standard deviations for the mislocation vectors could be defined as a function of the measured slowness values. All this information can now be used to increase the stability and quality of both phase association and event location based on automatically estimated fk-results.

Single-array locations

For the four arrays, ARCESS, FINESS, GERESS and NORESS, the data base of slowness correction vectors was sufficiently dense that these corrections could be applied for locating local and regional seismic events. In this way, the correction vectors could be used to improve the single-array locations.

The single-array location procedure RONAPP (Mykkeltveit & Bungum, 1984) uses the TTAZLOC algorithm (Bratt & Bache, 1988) and locates events with travel time and azimuth information as input data. Apparent velocities of the detected onsets are only used to identify the different seismic phases. The uncertainties of the estimated parameters (onset time, azimuth and apparent velocity) were calculated from the SNR and the quality of the fk-analysis. Therefore, correcting automatically estimated fk-results with mean mislocation vectors mainly influences the location algorithm in changing the azimuth of the observed phases. Only in some cases does correcting the apparent velocities lead to a change of the estimated phase type (and thereby also a shift to another travel-time table). The standard deviations of the mean mislocation vectors were not taken into account in this study.

To assess the mean mislocation vectors for the four arrays mentioned above, the whole data set for 1994 was reprocessed. Fig. 7.7.1 shows all 25,612 events defined and located by the four small-aperture arrays in the original single-array data analysis. The map clearly shows the concentration of the seismicity at known source regions. Additionally, we can see a more scattered distribution of events located at larger distances from the arrays. The two circles of events around NORESS and ARCESS are an unexplained artefact of the RONAPP recipes for these two arrays.

Fig. 7.7.2 shows the 24,946 relocated events after correcting the automatically estimated slowness values (phase velocity and azimuth) with the mean mislocation vectors. For the phases where a mislocation vector was unassociable, the original slowness values remained unchanged. The reduction of the number of defined and located seismic events by about 2.5% is mostly caused by a reduction of events far away from the arrays (to see the reduced number of artificial events scattered in the background, compare with Fig. 7.7.1).

Because most of the events located by the regional arrays are due to man-made activity, this large number of relocated events cannot be compared with independent bulletins. Therefore an evaluation of the results can only be done in a more qualitative way. It is clearly seen that the concentration of events around known source regions in Europe is much higher after introducing the slowness corrections. Especially the azimuthal scatter is smaller. This clearly shows the positive effect of correcting the observed apparent velocities and azimuth values with mean mislocation vectors.

Slowness residuals in the REBs

After 10 months of operating GSETT-3, the Reviewed Event Bulletins (REBs) contain a huge amount of (automatically) estimated ray parameter and azimuth values observed for the small-aperture arrays ARCESS, FINESS, GERESS and NORESS. Although these values are not always used in the final location of seismic events, ray parameter and azimuth play an important role during the identification and association process at the IDC. It is known that the single ray parameter and azimuth observation of a small-aperture array show a relatively large scatter and additionally often a systematic mislocation. For seismic events with only a few well-defined observations, this scatter will influence the starting location of the event location procedure. In addition, the phase association process will be influenced by the systematic array mislocations. Estimating mean mislocation vectors is part of a needed calibration of all GSETT-3 stations (Harjes et al, 1994). In this study such mean mislocation vectors were tested for application at the IDC.

All REB-events (1 Jan - 31 Oct 1995) located with at least 10 defining phases were investigated for onsets of the four small-aperture arrays. These events were assumed to have a location precision that allowed for investigation of slowness residuals. The ray parameter and azimuth residuals were transformed in a slowness-error vector. Whenever this vector was smaller than 6 sec/° and the travel time residual of the onset was smaller than 6 sec, this onset was defined as a valid association and the slowness vector was corrected with the mean mislocation vector. Fig. 7.7.3 shows the results for each investigated array. The blue line always shows the distribution of the slowness errors without any correction and the red line shows the distribution of the slowness errors after applying the corrections. The two distributions are normalized relative to the maximum of the occurring slowness errors. The corrected slowness values clearly show smaller errors and should therefore be used in the data processing at the IDC (see Table 7.7.1).

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Table 7.7.1. Some statistical parameters of observed and corrected slowness errors

Array	Number of events	Observed slowness errors		Slowness errors after correction	
		mean [sec/°]	median [sec/°]	mean [sec/°]	median [sec/°]
ARCESS	7183	1.767	1.476	1.350	0.963
FINESS	7746	2.164	1.897	1.830	1.407
GERESS	5142	1.732	1.404	1.547	1.135
NORESS	5308	2.071	1.812	1.783	1.351

RONAPP locations 1994 (25,612 events), original

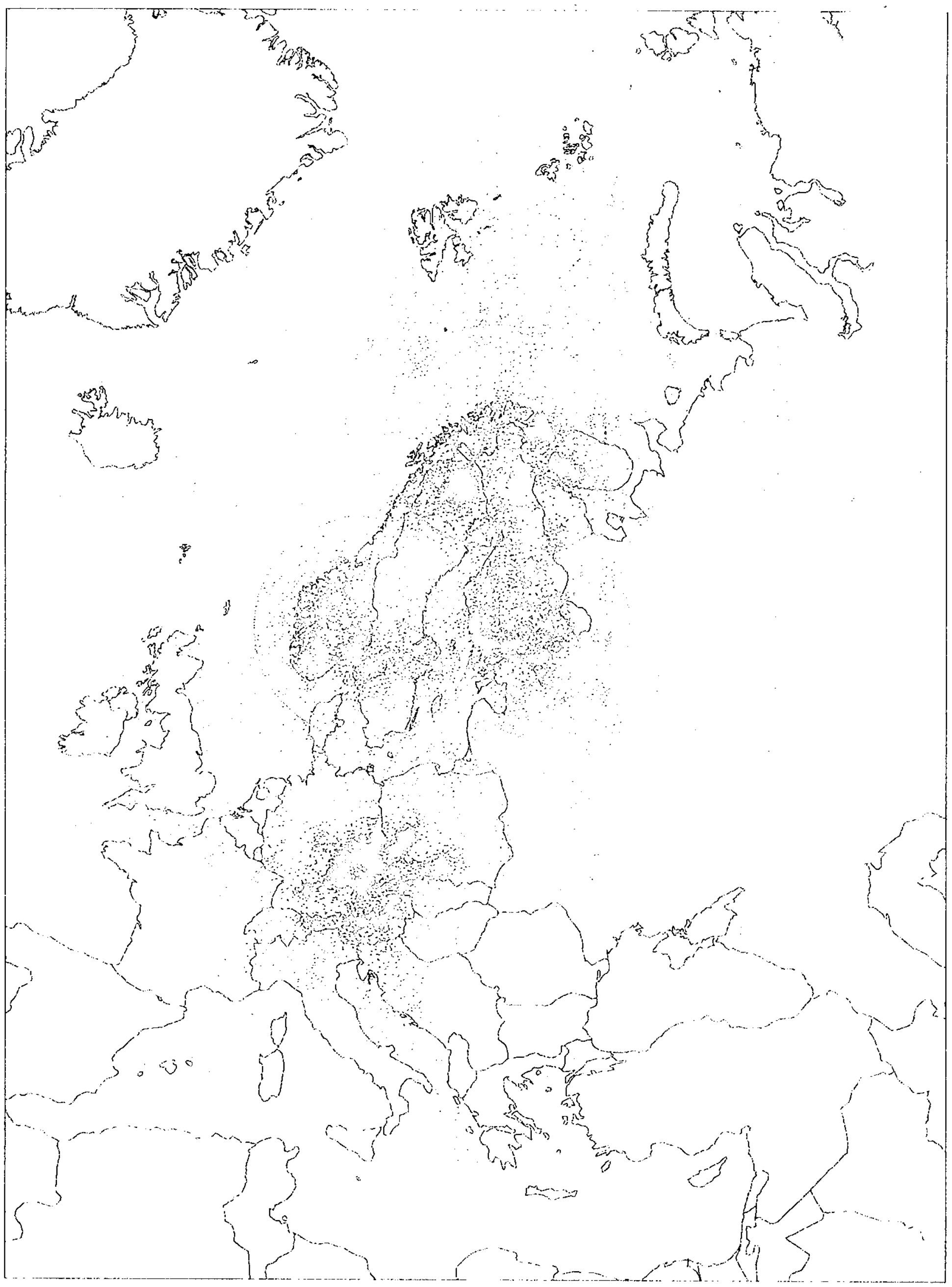

Fig. 7.7.1: All 25,612 events located during 1994 by ARCESS, FINESS, GERESS, and NORESS using the originally estimated apparent velocities and azimuth values.

RONAPP locations 1994 (24,946 events), corrected

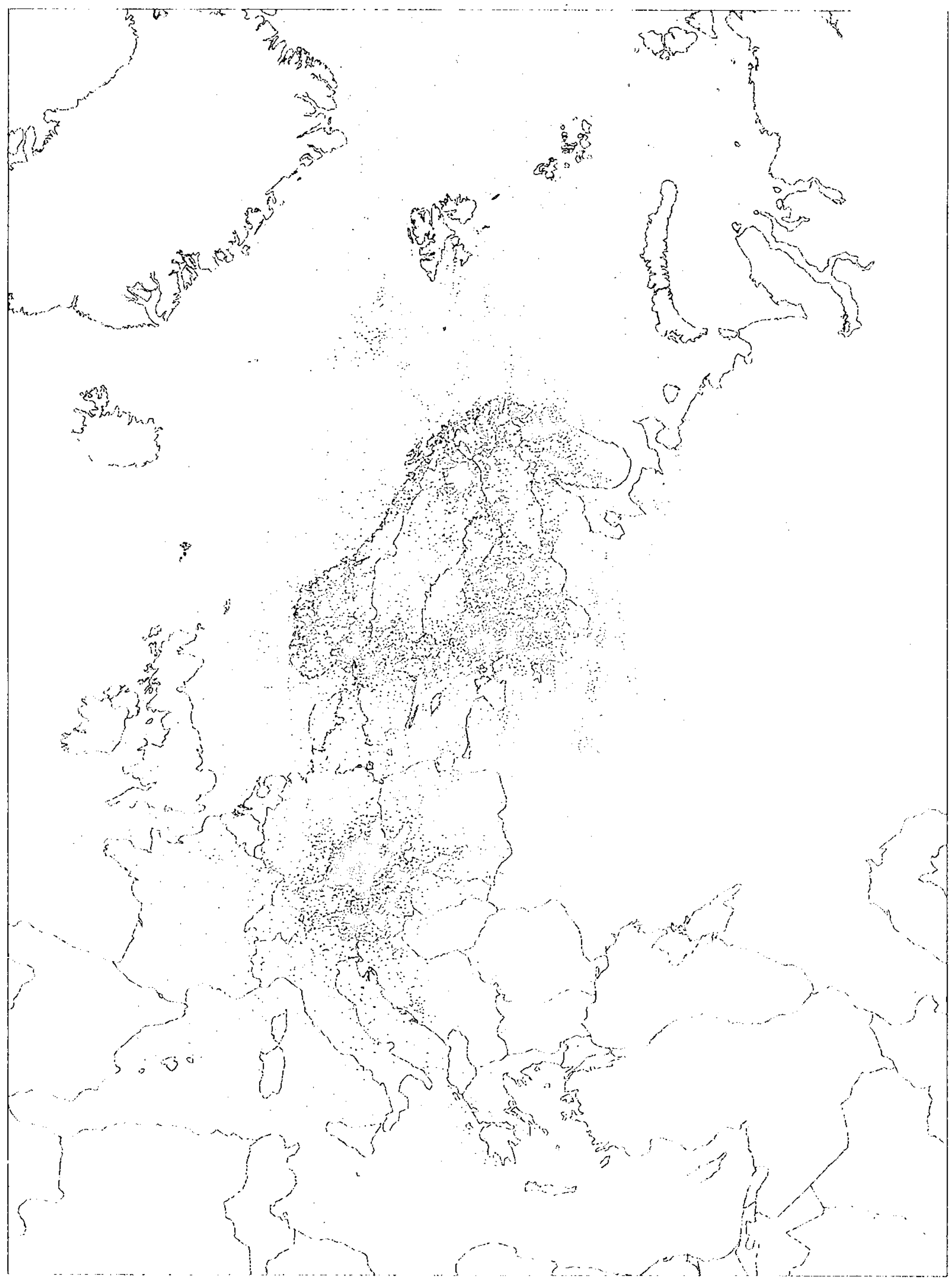

Fig. 7.7.2: All 24,946 events for 1994 located after correcting the apparent velocities and azimuth values with the mean mislocation vectors of ARCESS, FINESS, GERESS, and NORESS.

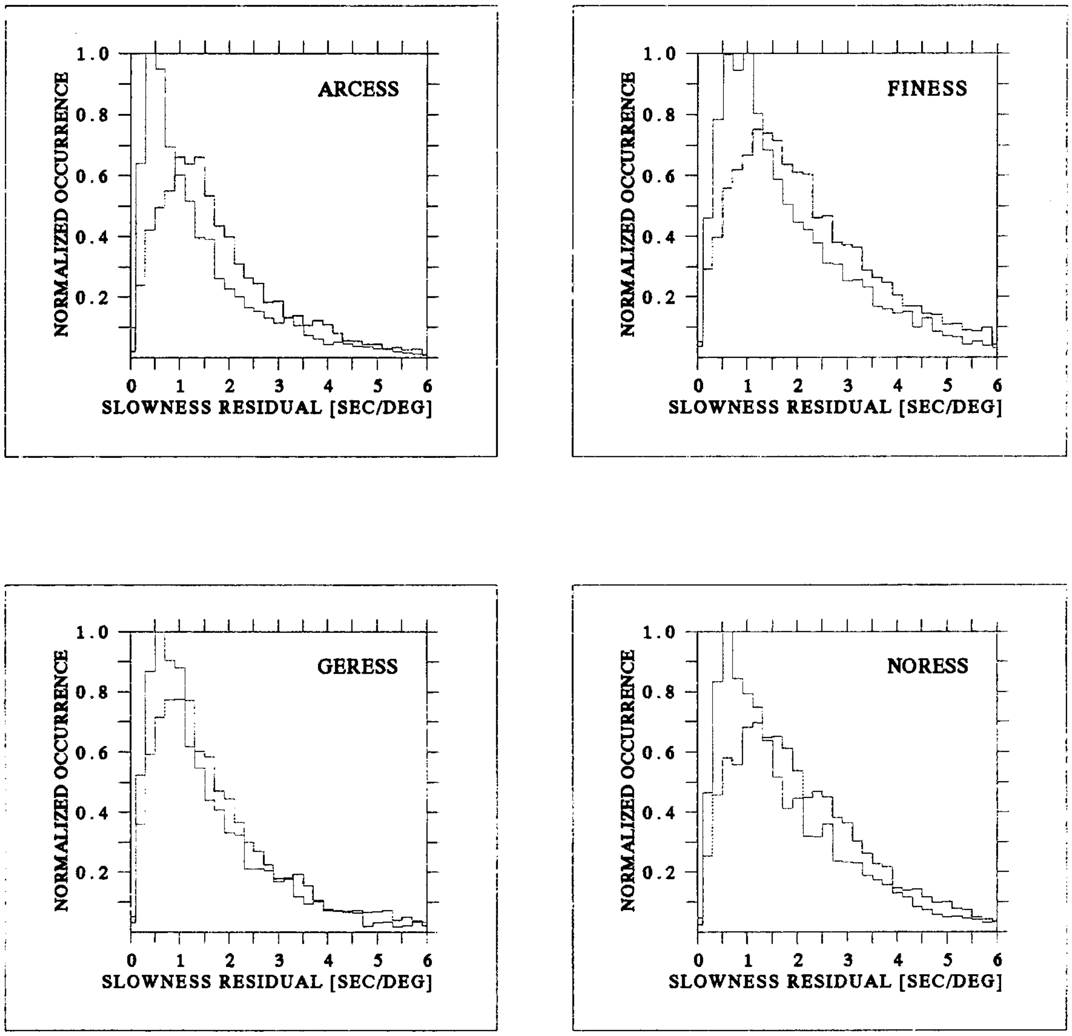

Fig. 7.7.3: Slowness residuals in the REBs for each of the investigated small aperture arrays. The blue line shows the original residuals and the red line shows the remaining residuals after applying the mean mislocation vectors. All distributions were normalized for each array separately.