The Research Council of Norway (NFR)

NORSAR

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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					

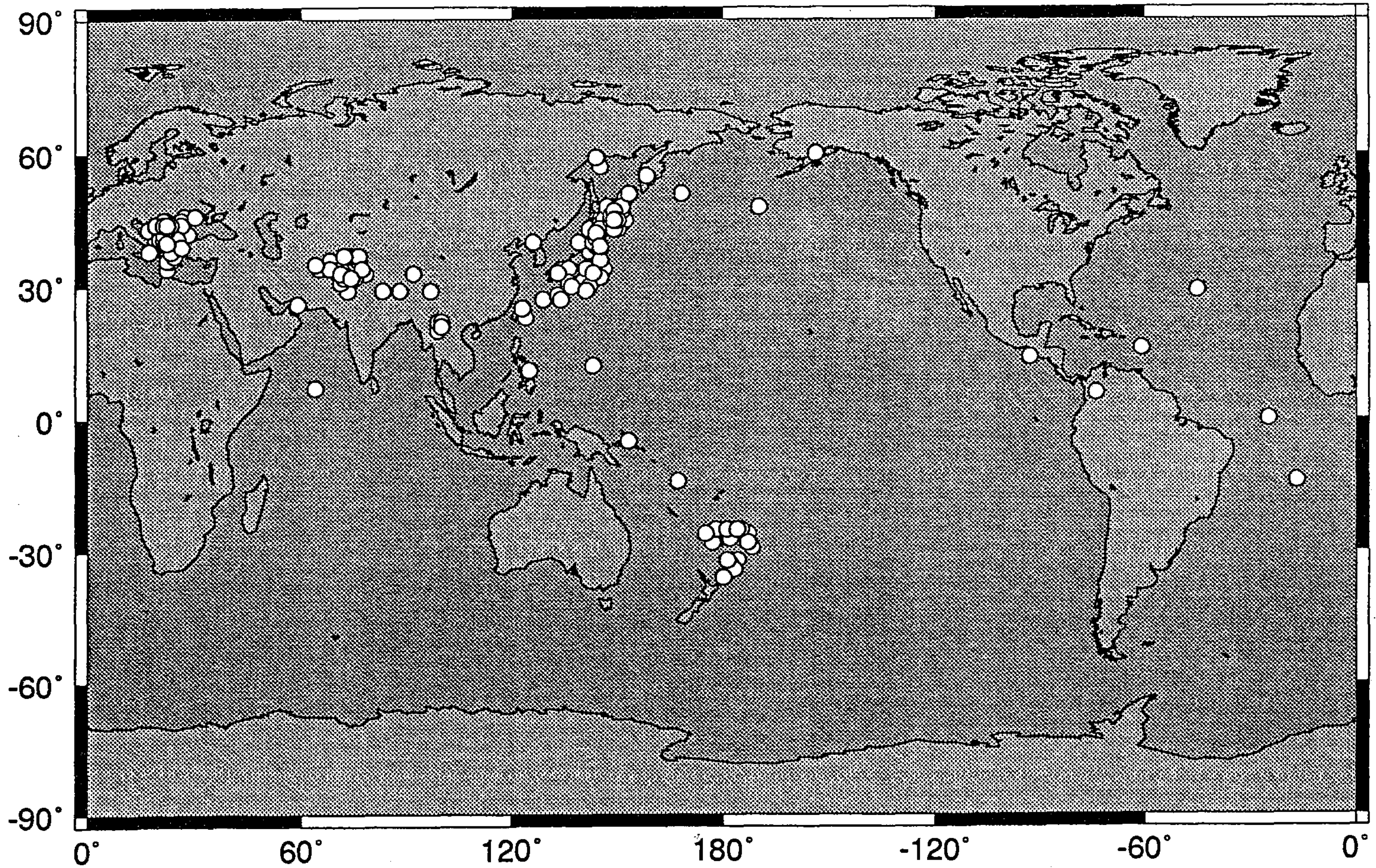

Fig. 7.2.1. This figure shows 207 events in the NORSAR bulletin for the period January - August 1995 for which there are no corresponding events in the REB of the GSETT-3 IDC.

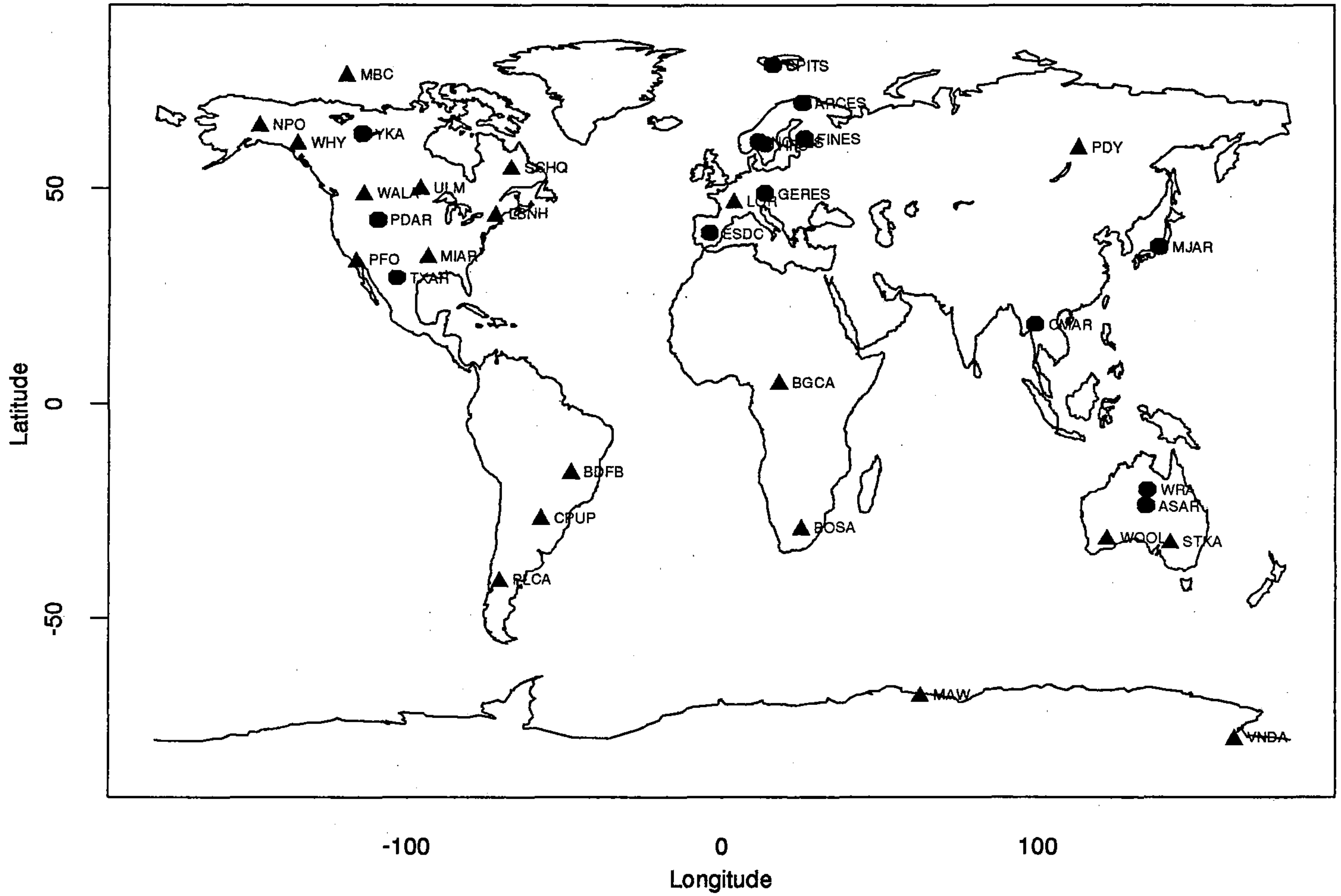

Fig. 7.2.2. This figure shows the GSETT-3 primary station network as of 26 August 1995. Array stations and 3-C stations are marked as circles and triangles, respectively. The figure is taken from the IDC Performance Report for the period 13-26 August 1995.

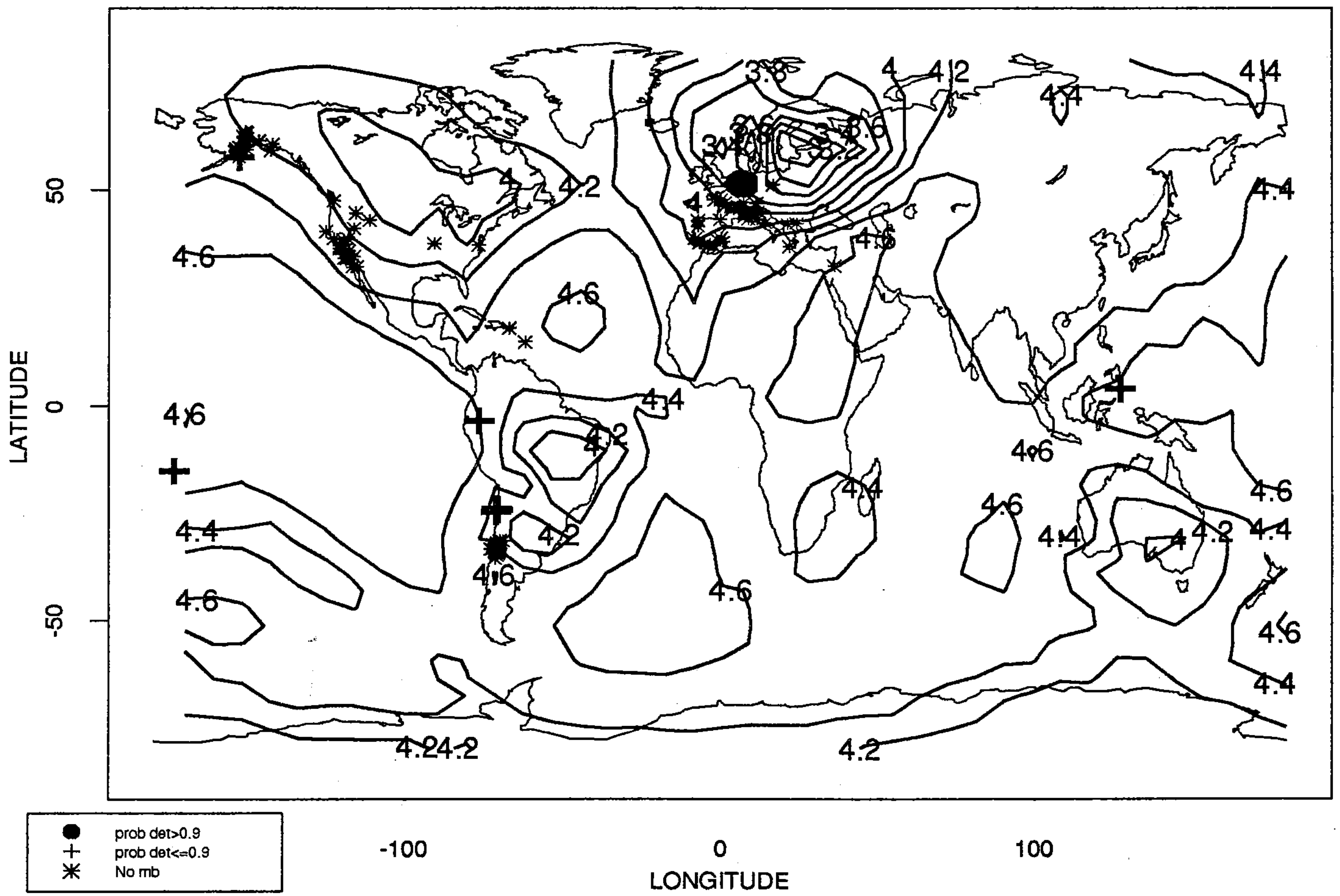

Fig. 7.2.3. The map shows the estimated detection capability of the GSETT-3 primary station network shown in Fig. 7.2.2. The contours show the detection capability in terms of 90% probability for P-wave detections on three GSETT-3 primary stations. The solid circle, plus signs and asterisks denote events 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).