



NORSAR Scientific Report No. 2-98/99

Semiannual Technical Summary

1 October 1998 - 31 March 1999

Kjeller, May 1999

6.4 Global Seismic Threshold Monitoring: Internet Access and Examples of Results

Introduction

Data from the seismic stations in the International Monitoring System (IMS) network are currently processed continuously at the Prototype International Data Center (PIDC) in Arlington, Virginia, in support of the Comprehensive Nuclear Test Ban Treaty. The ability of this network to detect seismic events can be assessed using the Threshold Monitoring software developed at NORSAR. Daily results from the Threshold Monitoring component of the IMS are now available to the public via the PIDC internet site.

Location

The main PIDC web page is located at

<http://www.pidc.org/>

and is being developed and maintained by the PIDC staff. This page has a column of buttons on the left hand side. Clicking on Systems Status will bring up the Systems Status page, shown in Fig. 6.4.1. Click on Threshold Monitoring Status to get to the Threshold Monitoring Status page (shown in Fig. 6.4.2). Select the day of interest, and the next page (see Fig. 6.4.3) gives a choice of times for which Threshold Monitoring results may be viewed.

Threshold Monitoring Results

The results consist of three sets of maps and plots:

The “**detplot**” map shows the average and worst case worldwide thresholds for the given hour. The IMS should be able to detect any event that is larger than the threshold level at any given time. In the case of a large event, this ability is degraded in the vicinity of the event (and to a lesser extent worldwide).

“**Status**” plots of the data from each station used in Threshold Monitoring show when and if each station was functioning during that hour. By viewing these traces, one can immediately see peaks corresponding to larger events which may have been detected.

The status of each station is also shown on the “**uptime**” map, along with any large events found in the Reviewed Event Bulletin (REB) during that hour.

Examples for a time interval on 4 March 1999 are shown in Figs. 6.4.4, 6.4.5, and 6.4.6. Note the severe degradation of detection capability shown in Fig. 6.4.4. This was caused by an m_b 5.78 event in the Celebes Sea at 08:51:58. Note also that a number of stations were down, as shown in Figs. 6.4.5 and 6.4.6. See Fig. 6.4.10 for a list of the REB events which occurred during this time interval.

A “quiet” time interval, 1 May 1999 between 23:00 and midnight, is shown in Fig. 6.4.7. Scandinavia has a particularly low threshold in this example. This region is well served by seismic arrays, all of which are operating during this time interval (see Figs. 6.4.8 and 6.4.9).

The Threshold Monitoring software and results are described thoroughly in the Threshold Monitoring Operations Manual (Taylor *et al.*, 1998).

Outstanding Issues

The Threshold Monitoring software is robust, and has recently been shown to be Y2K compatible. However, the results are converted for internet access before the REB has been checked for events. This means that there are currently no events listed on the maps which are available on the web (see Figs. 6.4.6 and 6.4.10). We hope that this problem will be rectified in the near future, so that available REB data will be displayed automatically.

L. Taylor
T. Kværna

References

Taylor, L. T. Kværna, and F. Ringdal (1998). Threshold Monitoring Operations Manual. NORSAR Contribution No. 639.



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[Vision](#) [Tour](#) [Staff](#) [Community](#) [Documents](#) [News & Info](#)

[Data Products](#)

Systems Status

Systems Status

[Networks](#)

[Index](#)

[Help](#)

SYSTEMS STATUS	TECHNOLOGY	
	Seismic-Acoustic	Radionuclide
	Network Status	
	Link Status	
	Processing Status	Processing Status
	AutoDRM Status	
	Threshold Monitoring Status	

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Fig. 6.4.1. "Systems Status" web page (<http://www.pidc.org/systatusbox/System.html>) showing the link to the "Threshold Monitoring Status" web page in red.



[Home](#)

[Data Products](#)

[Systems Status](#)

[Networks](#)

[Index](#)

[Help](#)

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[Vision](#) [Tour](#) [Staff](#) [Community](#) [Documents](#) [News & Info](#)

Threshold Monitoring

The Threshold Monitoring System is a tool for monitoring the detection performance of the primary seismic network. There are three kinds of plots: (1) the *desplot* displays provide the average and worst-case (pointwise) network detection capability for the analyzed hour; (2) the *status* displays provide detailed information on the noise levels, signals, and data gaps for the primary seismic stations; and (3) the *uptime* plots display a world map with information on station availability. To access these plots for a particular day, click on the corresponding date in the calendar below

<p>May 99</p> <table border="0" style="width: 100%; text-align: center;"> <tr><td>Su</td><td>Mo</td><td>Tu</td><td>We</td><td>Th</td><td>Fr</td><td>Sa</td></tr> <tr><td></td><td></td><td></td><td></td><td></td><td></td><td><u>1</u></td></tr> <tr><td><u>2</u></td><td><u>3</u></td><td></td><td></td><td></td><td></td><td></td></tr> </table>	Su	Mo	Tu	We	Th	Fr	Sa							<u>1</u>	<u>2</u>	<u>3</u>						<p>April 99</p> <table border="0" style="width: 100%; text-align: center;"> <tr><td>Su</td><td>Mo</td><td>Tu</td><td>We</td><td>Th</td><td>Fr</td><td>Sa</td></tr> <tr><td></td><td></td><td></td><td></td><td><u>1</u></td><td><u>2</u></td><td><u>3</u></td></tr> <tr><td><u>4</u></td><td><u>5</u></td><td><u>6</u></td><td><u>7</u></td><td><u>8</u></td><td><u>9</u></td><td><u>10</u></td></tr> <tr><td><u>11</u></td><td><u>12</u></td><td><u>13</u></td><td><u>14</u></td><td><u>15</u></td><td><u>16</u></td><td><u>17</u></td></tr> <tr><td><u>18</u></td><td><u>19</u></td><td><u>20</u></td><td><u>21</u></td><td><u>22</u></td><td><u>23</u></td><td><u>24</u></td></tr> <tr><td><u>25</u></td><td><u>26</u></td><td><u>27</u></td><td><u>28</u></td><td><u>29</u></td><td><u>30</u></td><td></td></tr> </table>	Su	Mo	Tu	We	Th	Fr	Sa					<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>	<u>9</u>	<u>10</u>	<u>11</u>	<u>12</u>	<u>13</u>	<u>14</u>	<u>15</u>	<u>16</u>	<u>17</u>	<u>18</u>	<u>19</u>	<u>20</u>	<u>21</u>	<u>22</u>	<u>23</u>	<u>24</u>	<u>25</u>	<u>26</u>	<u>27</u>	<u>28</u>	<u>29</u>	<u>30</u>		<p>March 99</p> <table border="0" style="width: 100%; text-align: center;"> <tr><td>Su</td><td>Mo</td><td>Tu</td><td>We</td><td>Th</td><td>Fr</td><td>Sa</td></tr> <tr><td></td><td><u>1</u></td><td><u>2</u></td><td><u>3</u></td><td><u>4</u></td><td><u>5</u></td><td><u>6</u></td></tr> <tr><td><u>7</u></td><td><u>8</u></td><td><u>9</u></td><td><u>10</u></td><td><u>11</u></td><td><u>12</u></td><td><u>13</u></td></tr> <tr><td><u>14</u></td><td><u>15</u></td><td><u>16</u></td><td><u>17</u></td><td><u>18</u></td><td><u>19</u></td><td><u>20</u></td></tr> <tr><td><u>21</u></td><td><u>22</u></td><td><u>23</u></td><td><u>24</u></td><td><u>25</u></td><td><u>26</u></td><td><u>27</u></td></tr> <tr><td><u>28</u></td><td><u>29</u></td><td><u>30</u></td><td><u>31</u></td><td></td><td></td><td></td></tr> </table>	Su	Mo	Tu	We	Th	Fr	Sa		<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>	<u>9</u>	<u>10</u>	<u>11</u>	<u>12</u>	<u>13</u>	<u>14</u>	<u>15</u>	<u>16</u>	<u>17</u>	<u>18</u>	<u>19</u>	<u>20</u>	<u>21</u>	<u>22</u>	<u>23</u>	<u>24</u>	<u>25</u>	<u>26</u>	<u>27</u>	<u>28</u>	<u>29</u>	<u>30</u>	<u>31</u>																								
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[Data Products](#) [Systems Status](#) [Networks](#) [Index](#) [Help](#)

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Fig. 6.4.2. "Threshold Monitoring Status" web page. The most recent months are shown, and each day for which data are available is a clickable link. There are no data available before 9 December 1998.

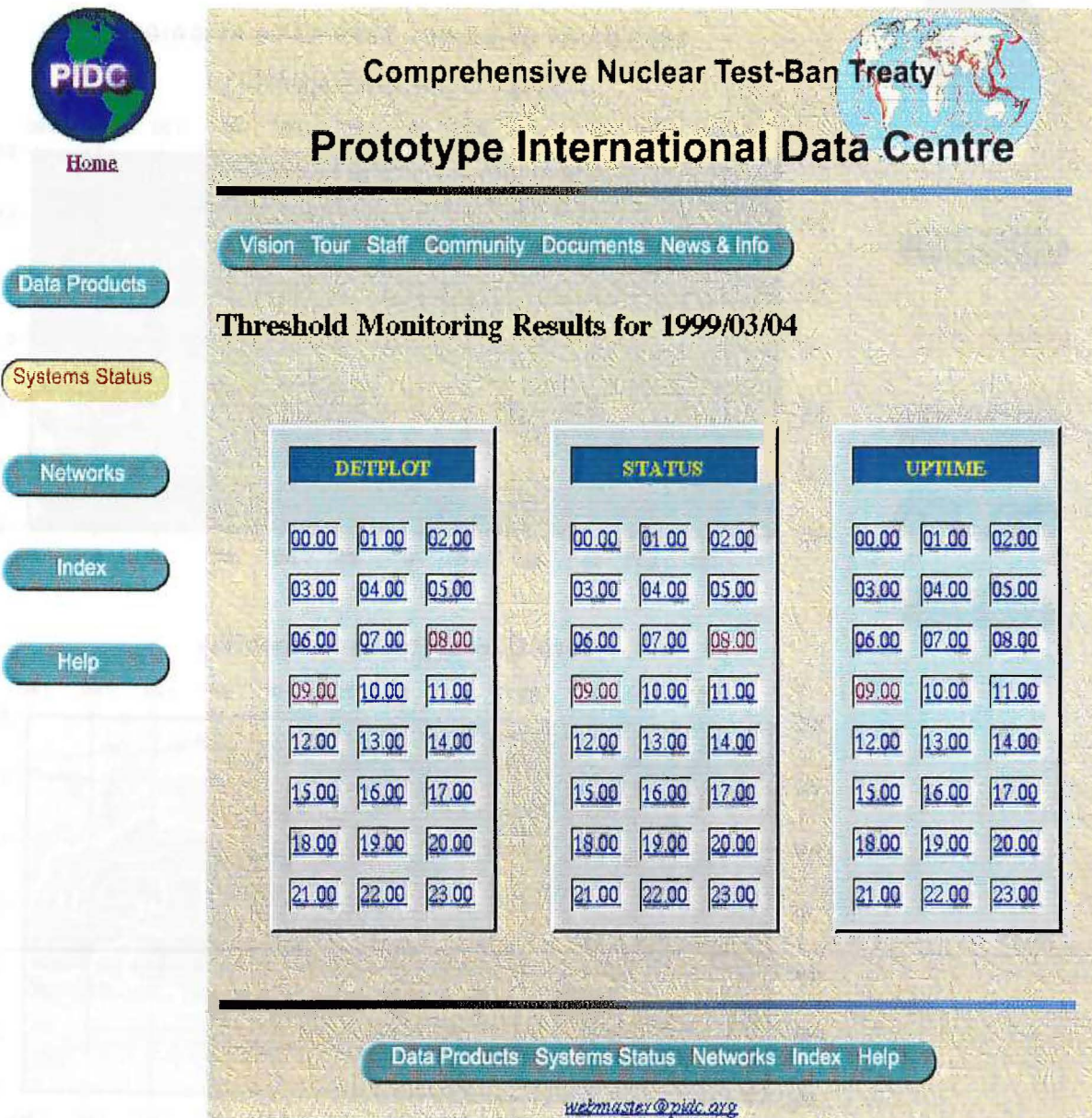


Fig.6.4.3. "Threshold Monitoring Results for 1999/05/03" is an example of the sort of page one can expect to see if one clicks on a particular day in the calendar shown in Fig. 6.4.2. This page contains the links to the results for 4 March 1999. Threshold Monitoring results consist of three displays for each hour of the day. The "detplot" display is a pair of maps showing the average and worst-case detection thresholds. The status of each individual IMS station is shown in the "status" plots and the "uptime" map.

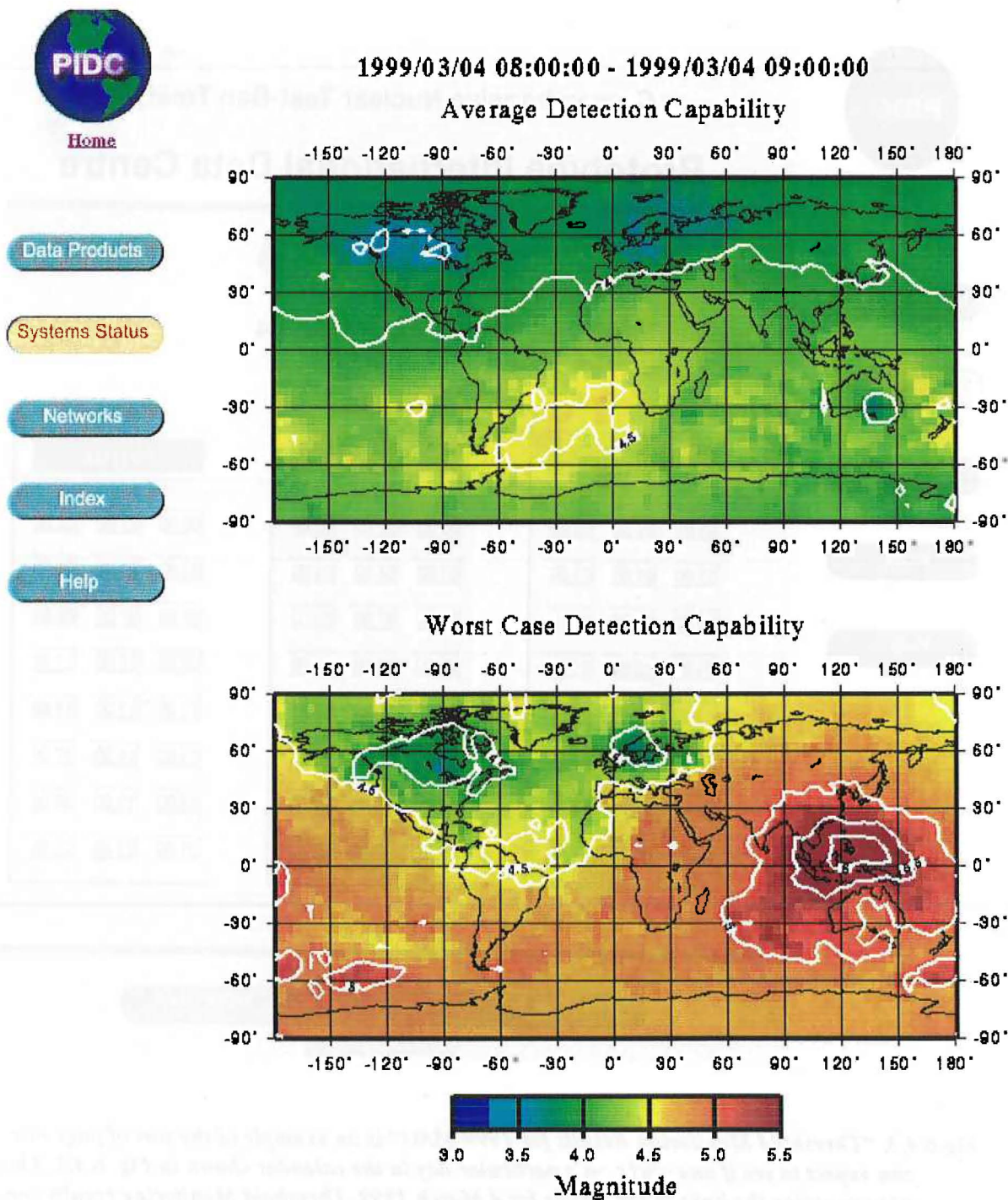


Fig. 6.4.4. Average and Worse Case detection capabilities for the one hour interval between 08:00 and 09:00 on 4 March 1999. This was displayed by clicking on "08.00" in the "detplot" panel of the web page shown in Fig. 6.4.3. There was a large event in the Celebes Sea (m_b 5.8) at 08:51:58, causing a major degradation in the ability of the IMS to detect smaller events in that part of the world.

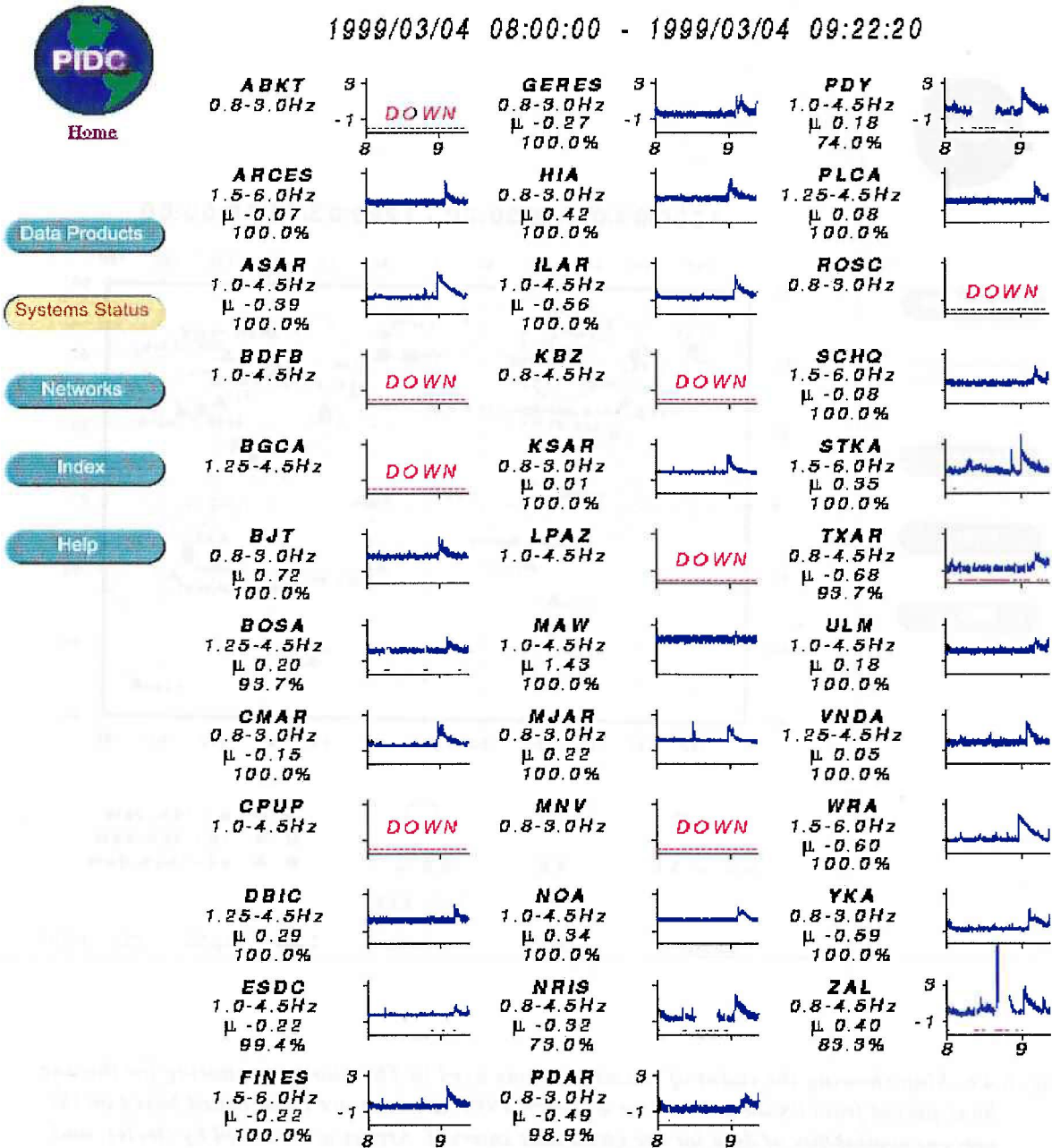



Fig. 6.4.5. Plots showing the status of each seismic station used in Threshold Monitoring for the hour starting at 08:00 on 4 March 1999. Periods of down time are shown in red, and stations which were down for the entire hour are listed as DOWN. In order to include all events originating within the hour in question, an extra 22 minutes and 20 seconds are included to account for possible travel time delays. The Celebes Sea event originating at 08:51:58 is therefore shown for all functioning stations.



Home

Data Products

Systems Status

Networks

Index

Help

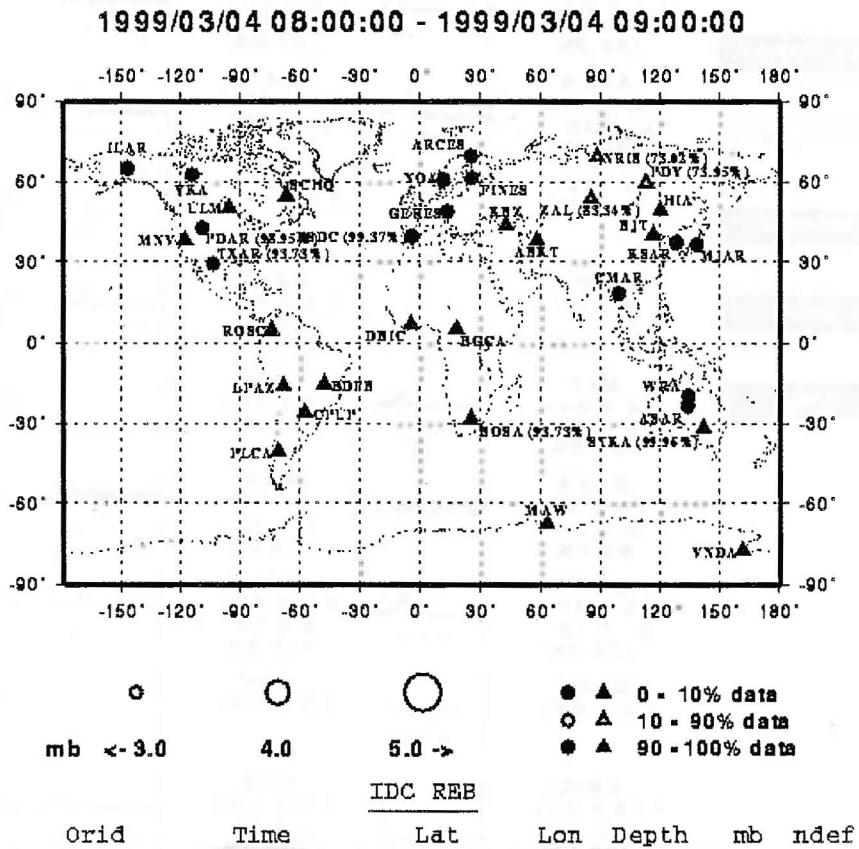


Fig. 6.4.6. Map showing the status of seismic stations used in Threshold Monitoring for the one hour period from 08:00 to 09:00 on 4 March 1999. Stations are color coded based on the percent availability of data for the given time interval. Arrays are marked by circles, and three-component stations by triangles. This is the appearance of the “uptime” display immediately after Threshold Monitoring processing. The Reviewed Events Bulletin has not been completed at this stage, and the Celebes Sea event originating at 08:51:58 is not yet listed. See Fig. 6.4.10 for the “uptime” map after the REB events are included.



Home

Data Products

Systems Status

Networks

Index

Help

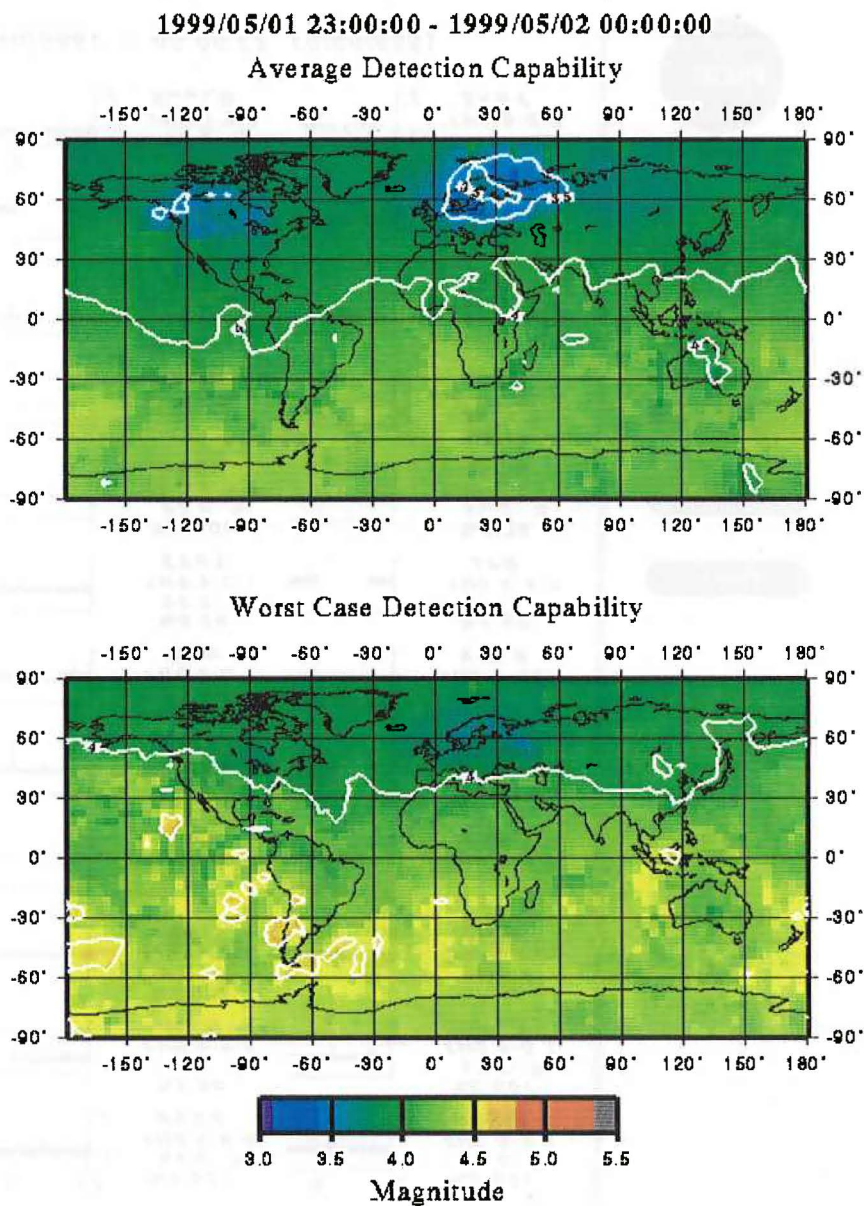


Fig. 6.4.7. Example of a time interval with a low threshold in Scandinavia. These “detplot” maps are from 1 May 1999 between 23:00 and midnight. It is common for threshold levels to be lower at night. Scandinavia is well covered by seismic arrays, but some other areas, such as South America, are not.

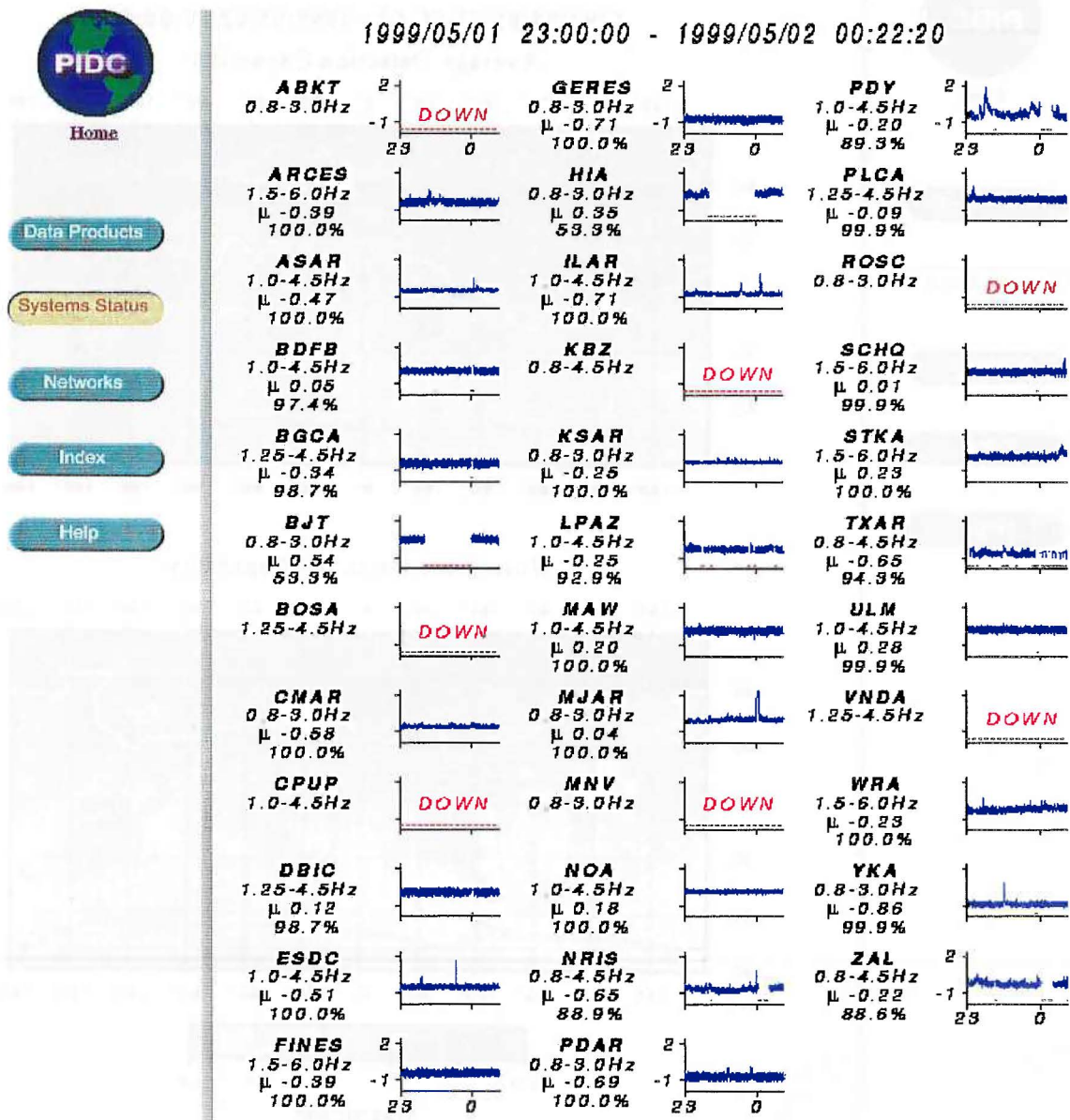


Fig. 6.4.8. Status plots for 1 May 1999 starting at 23:00. All stations in the vicinity of Scandinavia (ARCES, FINES, GERES, and NOA) show quiet conditions. No obvious event is recorded on more than one station.

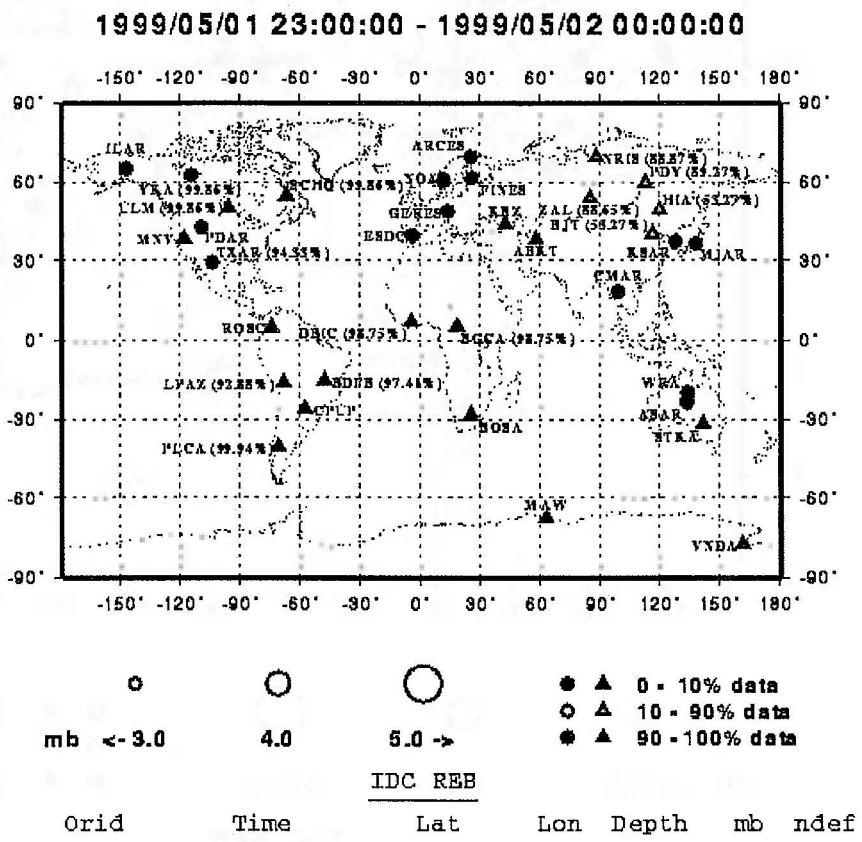
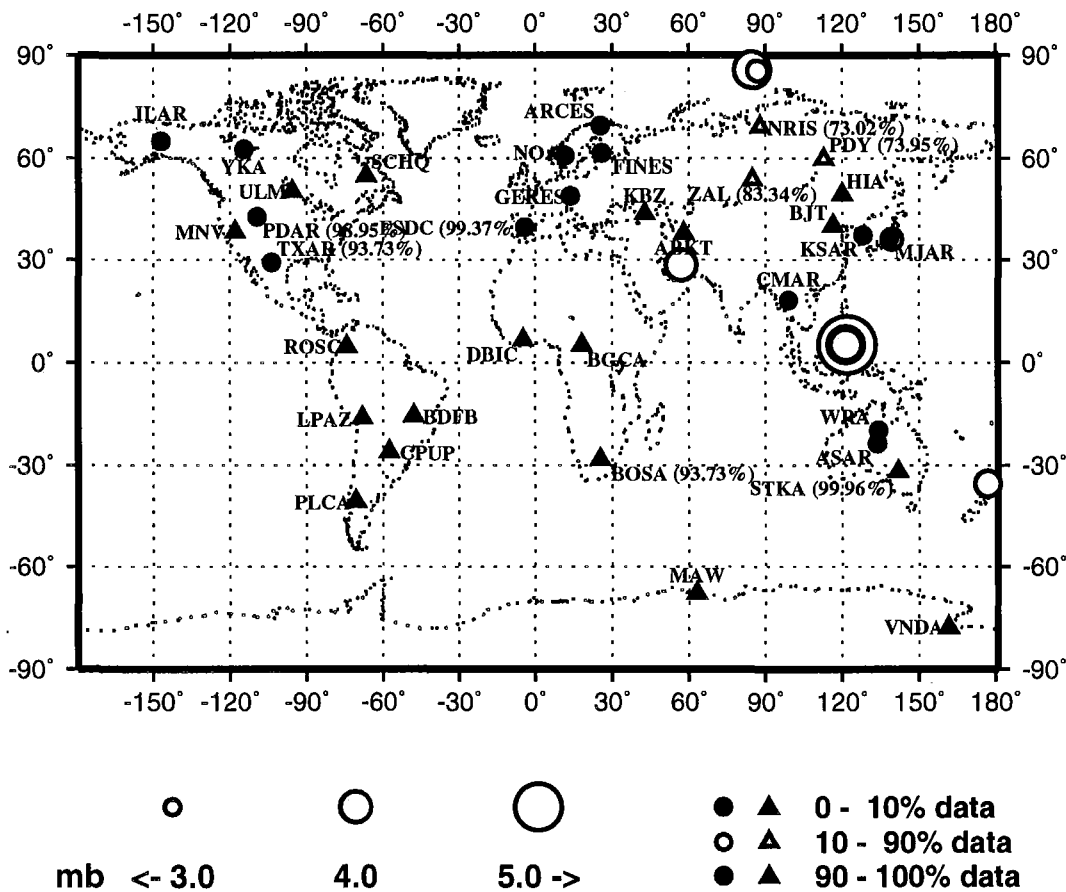


Fig. 6.4.9. "Uptime" map for 1 May 1999 between 23:00 and midnight. Note that most of the stations which are down are far from Scandinavia, and are all three component stations rather than arrays.

1999/03/04 08:00:00 - 1999/03/04 09:00:00



Orid	Time	Lat	Lon	Depth	mb	ndef
20363522	07:52:45	85.68	84.76	0.0	4.40	23
20363408	08:17:45	85.34	86.72	0.0	3.35	6
20363405	08:17:59	8.46	125.25	700.0	2.27	4
20363424	08:29:15	36.09	139.35	68.0	3.40	11
20363210	08:43:11	28.20	56.94	0.0	3.64	5
20367943	08:46:49	-35.42	176.92	22.0	3.62	5
20363277	08:51:58	5.39	121.90	0.0	5.78	49
20363321	09:06:50	5.19	121.69	0.0	4.30	9
20363326	09:16:07	5.41	121.72	0.0	4.11	5
20363204	09:19:38	28.43	57.06	40.7	4.03	17

Fig. 6.4.10. Appearance of the "uptime" map shown in Fig. 6.4.6 after events from the Reviewed Event Bulletin have been added to it. At present, these results are not available on the web. We hope this problem will be fixed in the near future.