A STUDY OF NEW ENGLAND SEISMICITY

Quarterly Earthquake Report
April-June, 2004

NEW ENGLAND
SEISMIC NETWORK

Weston Observatory
381 Concord Road
Weston, MA 02493

NEW ENGLAND SEISMIC NETWORK

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Notice

Network operation supported by the U.S. Geological Survey (USGS), Department of the Interior, under USGS award number 04HQAG0020. The views and conclusions contained in this document are those of the authors and should not be interpreted as necessarily representing the official policies, either expressed or implied, of the U.S. Government.

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Introduction

The New England Seismic Network (NESN) is operated by the Weston Observatory (WES) of Boston College. The mission of the NESN is to operate and maintain a regional seismic network with digital recording of seismic ground motions for the following purposes: 1) to determine the location and magnitude of earthquakes in and adjacent to New England and report felt events to public safety agencies, 2) to define the crust and upper mantle structure of the northeastern United States, 3) to derive the source parameters of New England earthquakes, and 4) to estimate the seismic hazard in the area.

This report summarizes the work of the NESN for the period April-June, 2004. It includes a brief summary of the network’s equipment and operation, and a short discussion of data management procedures. A list of participating personnel is given in Table 1. There were 2 earthquakes that occurred within or near the network during this reporting period. Phase information for these earthquakes is included in this report.

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Current Network Operation and Status

The New England Seismic Network of Weston Observatory of Boston College currently consists of 11 broadband three-component and 8 analog strong-motion stations. The coordinates of the stations are given in Table 2, and maps of the
weak- and strong-motion networks are shown in Figures 1 and 2, respectively. The 11 stations consist of Guralp CMG-40T three-component sensors. Ground motions recorded by these sensors are digitized at 100 sps with 16-bit resolution. Additional gain-ranging provides 126 dB dynamic range. These stations are operated in dialup mode with waveform segments of suspected events transmitted in digital mode to Weston Observatory for analysis and archiving. WES also maintains 8 SMA-1 strong-motion instruments in New England.

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Seismicity

There were 2 earthquakes that occurred in or adjacent to the NESN during this reporting period. A summary of the location data is given in Table 3. Figure 3 shows the locations of these events. Figure 4 shows the locations of all events since the beginning of network operation in October, 1975.

Table 4 gives the station phase data and detailed hypocenter data for each event listed in Table 3. In addition to NESN data, arrival time and magnitude data sometimes are contributed for seismic stations operated by the Geological Survey of Canada (GSC), the Lamont-Doherty Cooperative Seismographic Network, and the US National Seismic Network. Final locations for this section were computed using the program HYPO78. For regional events (those too far from the NESN to obtain accurate locations and magnitudes) phase data are given for NESN stations, but the entry in Table 3 lists the hypocenter and geographic location information adopted from the authoritative network. Accordingly, the epicenter is plotted on the maps using the entry from Table 3.

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Data Management

Recent event locations are available at http://aki.bc.edu/cgi-bin/NESN/recent_events.pl. Waveform data are saved in Nanometrics, ASCII, and SEED formats and are available by contacting, Anastasia Macherides Moulis, via email. Earthquake lists can be found at www.bc.edu/research/westonobservatory/northeast/ecdatalists/. Currently available on the Weston Observatory web page is the full catalog of northeastern U.S. earthquake activity to the present time. This will be updated as new Northeastern U.S. Seismic Network Quarterly Earthquake Reports are produced.

For more information on matters discussed in this report or general earthquake information (reports, maps, catalogs, etc.) consult our website www.bc.edu/westonobservatory or contact:

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Dina Smith  
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Weston, MA 02493

Voice: 617-552-8335 / FAX: 617-552-8388 / Email: dina.smith.1@bc.edu

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Explanation of Tables

Table 1: List of personnel operating the NESN

Table 2: List of Seismic and Strong Motion Stations

- Code = station name
- Lat = station latitude, degrees north
- Long = station longitude, degrees west
- Elev = station elevation in meters
- Location = geographic location
Table 3: Earthquake Hypocenter List

- Date = date event occurred, Yr (year)/Mo (month)/Dy (day)
- Time = origin time of event, Hr (hour):Mn (minute):Sec (second)

in UCT (Universal Coordinated Time, same as Greenwich Mean Time)
- Lat = event location, latitude north in degrees
- Long = event location, longitude west in degrees
- Depth = event depth in kilometers
- Mag = event magnitude
- Int = event epicentral intensity
- Location = event geographic location

Table 4: Earthquake detailed hypocenter and phase data list

Table Header: detailed hypocenter data

- Geographical location
- DATE = date event occurred, yr/mo/dy (year/month/day)
- ORIGIN = event origin time (UCT) in hours, minutes, and seconds
- LAT N = latitude north in degrees and minutes
- LONG W = longitude west in degrees and minutes
- DEPTH = event depth in kilometers
- MN = Nuttli Lg phase magnitude with amplitude divided by period
- MC = signal duration (coda) magnitude

WES: 2.23 Log(FMP) + 0.12Log(Dist) - 2.36 (Rosario, 1979)
MIT: 2.21 Log(FMP) - 1.7 (Chaplin et al., 1980)

- ML = local magnitude

WES: calculated from Wood-Anderson seismograms (Ebel, 1982)
GSC (Geological Survey of Canada): Richter Lg magnitude

- GAP = largest azimuthal separation, in degrees, between stations
- RMS = root mean square error of travel time residual in seconds
- ERH = standard error of epicenter in kilometers
- ERZ = standard error of event depth in kilometers
- Q = solution quality of hypocenter
  A = excellent
  B = good
  C = fair
  D = poor

Table Body: earthquake phase data

- STN = station name
- DIST = epicentral distance in kilometers
- AZM = azimuthal angle in degrees measured clockwise between true north and vector pointing from epicenter to station
- Description of onset of phase arrival
  I = impulsive
  E = emergent
  R = phase
  P = first P arrival
  S = first S arrival

- M = first motion direction of phase arrival
  U = up or compression
  D = down or dilatation

- K = weight of arrival
  0 = full weight (1.0)
  1 = 0.75 weight
  2 = 0.50 weight
  3 = 0.25 weight
  4 = no weight (0.0)

- HRMN = hour and minute of phase arrival
- SEC = second of phase arrival
- TCLM = calculated travel time of phase in seconds
- RES = travel time residual (error) of phase arrival
- WT = weight of phase used in hypocentral solution
- AMX = peak-to-peak ground motion, in millimeters, of the maximum envelope amplitude of vertical-component signal, corrected for system response
- PRX = period in seconds of the signal from which amplitude was measured
- XMAG = Nuttli magnitude recorded at station
- FMP = signal duration (coda), in seconds, measured from first P arrival
- FMAG = coda magnitude recorded at station

Table 5: Microearthquakes and other non-locatable events

- Date = date event occurred, Yr (year)/Mo (month)/Dy (day)
- Sta = nearest station recording event
- Arrival Time = phase arrival time, Hr (hour):Mn (minute):Sec (second)
# TABLE 1

**WESTON OBSERVATORY PERSONNEL**

<table>
<thead>
<tr>
<th>Name</th>
<th>Network Position</th>
<th>voice phone</th>
<th>email address</th>
</tr>
</thead>
<tbody>
<tr>
<td>John E. Ebel</td>
<td>Principal Investigator</td>
<td>617-552-8319</td>
<td><a href="mailto:ebel@bc.edu">ebel@bc.edu</a></td>
</tr>
<tr>
<td>Alan Kafka</td>
<td>Research Seismologist</td>
<td>617-552-8300</td>
<td><a href="mailto:kafka@bc.edu">kafka@bc.edu</a></td>
</tr>
<tr>
<td>Anastasia Macherides Moulis</td>
<td>Seismic Analyst</td>
<td>617-552-8325</td>
<td><a href="mailto:macherid@bc.edu">macherid@bc.edu</a></td>
</tr>
<tr>
<td>Edward Johnson</td>
<td>Project Engineer</td>
<td>617-552-8332</td>
<td><a href="mailto:johnson@bc.edu">johnson@bc.edu</a></td>
</tr>
<tr>
<td>Dina Smith</td>
<td>Assistant to the Director</td>
<td>617-552-8335</td>
<td><a href="mailto:dina.smith.1@bc.edu">dina.smith.1@bc.edu</a></td>
</tr>
<tr>
<td>Weston Observatory</td>
<td></td>
<td>617-552-8300</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>617-552-8388 (FAX)</td>
<td></td>
</tr>
</tbody>
</table>

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# TABLE 2

**SEISMIC STATIONS OF THE NEW ENGLAND SEISMIC NETWORK**

<table>
<thead>
<tr>
<th>Code</th>
<th>Lat</th>
<th>Long</th>
<th>Elev (m)</th>
<th>Location</th>
<th>Operator</th>
</tr>
</thead>
<tbody>
<tr>
<td>BCX</td>
<td>42.35</td>
<td>-71.17</td>
<td>61.0</td>
<td>Chestnut Hill, MA</td>
<td>WES</td>
</tr>
<tr>
<td>BRYW</td>
<td>41.91</td>
<td>-71.53</td>
<td>380.0</td>
<td>Smithfield, RI</td>
<td>WES</td>
</tr>
<tr>
<td>FFD</td>
<td>43.47</td>
<td>-71.65</td>
<td>131.0</td>
<td>Franklin Falls Dam, NH</td>
<td>WES</td>
</tr>
<tr>
<td>HNH</td>
<td>-72.28</td>
<td>180.0</td>
<td></td>
<td>Hanover, NH</td>
<td>WES</td>
</tr>
<tr>
<td>QUA2</td>
<td>42.28</td>
<td>168.0</td>
<td></td>
<td></td>
<td>WES</td>
</tr>
<tr>
<td>TRY *</td>
<td>42.73</td>
<td>-73.67</td>
<td>131.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>44.71</td>
<td>-67.45</td>
<td>35.0</td>
<td></td>
<td>Machias, ME</td>
<td>WES</td>
</tr>
<tr>
<td>VT1</td>
<td>44.33</td>
<td>-72.75</td>
<td>410.0</td>
<td>Waterbury, VT</td>
<td>WES</td>
</tr>
<tr>
<td></td>
<td>-71.32</td>
<td>60.0</td>
<td></td>
<td>Weston, MA</td>
<td>WES</td>
</tr>
<tr>
<td>WL</td>
<td>44.56</td>
<td>-69.57</td>
<td>85.0</td>
<td>Waterville, ME</td>
<td></td>
</tr>
<tr>
<td>41.31</td>
<td>-72.93</td>
<td>10.0</td>
<td></td>
<td>New Haven, CT</td>
<td>WES</td>
</tr>
<tr>
<td>-68.01</td>
<td></td>
<td>175.0</td>
<td></td>
<td>Presque Isle, ME</td>
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</table>

* = not in operation during this quarter

**STRONG MOTION STATIONS OF THE NEW ENGLAND SEISMIC NETWORK**

<table>
<thead>
<tr>
<th>Code</th>
<th>Lat</th>
<th>Long</th>
<th>Location</th>
<th>Operator</th>
</tr>
</thead>
<tbody>
<tr>
<td>SM1</td>
<td>44.90</td>
<td>-67.25</td>
<td>Dennysville, ME</td>
<td>WES</td>
</tr>
<tr>
<td>SM3</td>
<td>41.45</td>
<td>-71.33</td>
<td></td>
<td>WES</td>
</tr>
<tr>
<td>SM5</td>
<td>42.66</td>
<td>-71.32</td>
<td>Westford, MA</td>
<td>WES</td>
</tr>
<tr>
<td>SM6</td>
<td>42.30</td>
<td>-71.34</td>
<td>Lowell, MA</td>
<td>WES</td>
</tr>
<tr>
<td>SM8</td>
<td>44.48</td>
<td>-69.61</td>
<td>North Vassalboro, ME</td>
<td></td>
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</table>

* indicates Mc rather than Mn.

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# TABLE 3

**NEW ENGLAND AND ADJACENT REGIONS**

April-June, 2004

<table>
<thead>
<tr>
<th>Date</th>
<th>Time (UTC)</th>
<th>Lat</th>
<th>Long</th>
<th>Depth (km)</th>
<th>Mag Int</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>M/D/Y</td>
<td>Hr:Min:Sec</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>05/24</td>
<td>08:58:28.88</td>
<td>43.5055</td>
<td>-70.9663</td>
<td>2.80</td>
<td>1.9</td>
<td>NH-ME BORDER, 15KM NE OF FARMINGTON, NH</td>
</tr>
<tr>
<td>06/22</td>
<td>10:17:52.95</td>
<td>45.175</td>
<td>-69.1236</td>
<td>9.47</td>
<td>2.0</td>
<td>ME, 9.5KM (6MI) NE OF DOVER-FOXCROFT</td>
</tr>
</tbody>
</table>

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TABLE 4

EARTHQUAKE PHASE DATA LIST
NEW ENGLAND AND ADJACENT REGIONS
April-June, 2004

B4524A.XX

SOUTHEAST MAINE CRUSTAL MODEL
04/24/2004 RR-HK BORDER, 15 km (24.14km) NE OF FARMINGTON, ME

<table>
<thead>
<tr>
<th>DATE</th>
<th>ORIGIN LAT W</th>
<th>LONG W</th>
<th>DEPTH</th>
<th>MN</th>
<th>MC</th>
<th>MGAP</th>
<th>RMM</th>
<th>ERH</th>
<th>ERI</th>
<th>Q</th>
</tr>
</thead>
<tbody>
<tr>
<td>04/24 858 25.88 43.30</td>
<td>70 57.98 2.80</td>
<td>1.9</td>
<td>.0</td>
<td>145 .24</td>
<td>1.2</td>
<td>1.9</td>
<td>B</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

M4.65 RH (6 MI) RR OF DOVER-FOXCROFT

<table>
<thead>
<tr>
<th>DATE</th>
<th>ORIGIN LAT W</th>
<th>LONG W</th>
<th>DEPTH</th>
<th>MN</th>
<th>MC</th>
<th>MGAP</th>
<th>RMM</th>
<th>ERH</th>
<th>ERI</th>
<th>Q</th>
</tr>
</thead>
<tbody>
<tr>
<td>04/22 1017 52.95 45-13.05</td>
<td>69 7.42 9.47</td>
<td>2.0</td>
<td>.0</td>
<td>96 .78</td>
<td>4.3</td>
<td>7.4</td>
<td>D</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

WVL 87.6 209 EP | 0 1018 6.17 13.22 14.19 | -.98 | 3.00 | 52 .17 | 1.9 |

UMN 142.9 113 EP | 0 1018 16.64 23.69 22.96 | .72 | 2.70 | 29 .16 | 2.0 |

MOG 181.2 94 P | 4 1019 20.90 27.95 22.69 | .25 | 0.00 |

PKI 137.0 28 EP | 0 1018 20.43 27.48 27.91 | -.46 | 2.49 | 26 .15 | 2.1 |

A11 239.9 340 P | 1 1018 28.45 35.50 34.93 | .96 | 1.56 |

A5 268.0 338 P | 3 1018 31.92 38.73 38.41 | .26 | 48 |

A21 279.7 351 P | 3 1018 33.59 40.64 39.85 | .78 | .44 |

A6 296.0 349 P | 3 1018 35.61 42.46 41.86 | .78 | 42 |

NHM 302.4 236 EP | 4 1018 45.73 52.78 42.65 | 10.10 | 0.00 |

DG 326.9 300 P | 3 1018 39.47 46.52 45.67 | .85 | .37 |

LWN 344.8 78 P | 3 1019 40.47 47.52 47.88 | .42 | .35 |

WES 361.1 209 EP | 4 1018 35.93 42.98 49.89 | -.62 | .00 |

GSQ 348.5 20 P | 4 1018 52.55 59.60 59.45 | .14 | 0.00 |

B4622A.XX

SOUTHEAST MAINE CRUSTAL MODEL

<table>
<thead>
<tr>
<th>DATE</th>
<th>ORIGIN LAT W</th>
<th>LONG W</th>
<th>DEPTH</th>
<th>MN</th>
<th>MC</th>
<th>MGAP</th>
<th>RMM</th>
<th>ERH</th>
<th>ERI</th>
<th>Q</th>
</tr>
</thead>
<tbody>
<tr>
<td>04/22 1018 52.85 45-13.05</td>
<td>70 57.98 2.80</td>
<td>1.9</td>
<td>.0</td>
<td>.24</td>
<td>1.2</td>
<td>1.9</td>
<td>B</td>
<td></td>
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</table>

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TABLE 5

MICROEARTHQUAKES AND OTHER NON-LOCATABLE EVENTS

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NESN Station Map

https://www.bc.edu/research/westonobservatory/nesnb04b.html
Figure 1: Map of stations of the New England Seismic Network (NESN) in operation during the period of this report. Also included are other Northeast U.S. and Canadian seismic stations in operation during this period.

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Figure 2: Map of strong-motion stations of the New England Seismic Network (NESN) in operation during the period of this report.

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Figure 3: Earthquake epicenters located by the NESN during the period of this report.

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NESN Cumulative Seismicity Map
Figure 4: Seismicity for period October, 1975 - June, 2004.

Acknowledgments
Our map database has been developed in-house using ArcView and in part basemap data provided by ESRI, Inc. (Arcdata Online), USGS GTOPO30 Elevation Data, and TIGER/Line '94, '95, and '97 (US Census Bureau) spatial data.

References


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