A STUDY OF NEW ENGLAND SEISMICITY

Quarterly Earthquake Report

October - December, 2007

NEW ENGLAND SEISMIC NETWORK

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Award #04HQAG0020

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and Dina Smith
Notice

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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 October - December, 2007. 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 23 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 12 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 12 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. Weston Observatory also maintains 8 SMA-1 strong-motion instruments in New England.

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Seismicity

There were 23 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/ecatalogs/. 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 web site www.bc.edu/westonobservatory or contact:

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Dina Smith
Weston Observatory
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Weston, MA 02493

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Explanation of Tables

Table 1: List of personnel operating the NESN

Table 2: List of Seismic and Strong Motion Stations

1. Code = station name
2. Lat = station latitude, degrees north
3. Long = station longitude, degrees west
4. Elev = station elevation in meters
5. Location = geographic location
6. Operator = network operator

Table 3: Earthquake Hypocenter List

1. Date = date event occurred, Yr (year)/Mo (month)/Dy (day)
2. Time = origin time of event, Hr (hour)/Mn (minute)/Sec (second)
   in UCT (Universal Coordinated Time, same as Greenwich Mean Time)
3. Lat = event location, latitude north in degrees
4. Long = event location, longitude west in degrees
5. Depth = event depth in kilometers
6. Mn = Nutti Magnitude
7. Mc = Coda Magnitude
8. Int = event epicentral intensity
9. Location = event geographic location
Table 4: Earthquake detailed hypocenter and phase data list

1. Geographic location
2. DATE = date event occurred, yr/mo/dy (year/month/day)
3. ORIGIN = event origin time (UCT) in hours, minutes, and seconds
4. LAT N = latitude north in degrees and minutes
5. LONG W = longitude west in degrees and minutes
6. DEPTH = event depth in kilometers
7. MN = Nutti Lg phase magnitude with amplitude divided by period
8. SC = 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)
9. ML = local magnitude
   WES: calculated from Wood-Anderson seismograms (Ebel, 1982)
   GSC (Geological Survey of Canada): Richter Lg magnitude
10. GAP = largest azimuthal separation, in degrees, between stations
11. RMS = root mean square error of travel time residual in seconds
12. ERH = standard error of epicenter in kilometers
13. ERZ = standard error of event depth in kilometers
14. Q = solution quality of hypocenter
   A = excellent
   B = good
   C = fair
   D = poor

Table Body: earthquake phase data

1. STN = station name
2. DIST = epicentral distance in kilometers
3. AZM = azimuthal angle in degrees measured clockwise between true north and vector pointing from epicenter to station
4. Description of onset of phase arrival
   I = impulsive
   E = emergent
5. R = phase
   P = first P arrival
   S = first S arrival
6. M = first motion direction of phase arrival
   U = up or compression
   D = down or dilatation
7. 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)
8. HRMN = hour and minute of phase arrival
9. SEC = second of phase arrival
10. TCAL = calculated travel time of phase in seconds
11. RES = travel time residual (error) of phase arrival
12. WT = weight of phase used in hypocentral solution
13. AMX = peak-to-peak ground motion, in microns, of the maximum envelope amplitude of vertical-component signal, corrected for system response
14. PRX = period in seconds of the signal from which amplitude was measured
15. XMG = Nutti magnitude recorded at station
16. FMP = signal duration (coda), in seconds, measured from first P arrival
17. FMAG = coda magnitude recorded at station

Table 5: Microearthquakes and other non-locatable events

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

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TABLE 1

WESTON OBSERVATORY PERSONNEL

<table>
<thead>
<tr>
<th>Name</th>
<th>Position</th>
<th>voice phone</th>
<th>email address</th>
</tr>
</thead>
<tbody>
<tr>
<td>John E. Ebel</td>
<td>Observatory Director, Seismologist, 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 Mousis</td>
<td>Seismologist, Analyst</td>
<td>617-552-8325</td>
<td><a href="mailto:macherid@bc.edu">macherid@bc.edu</a></td>
</tr>
<tr>
<td>Dina Smith</td>
<td>Associate Director of Operations, Seismologist</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>Michael Hagerty</td>
<td>New England Seismic Network Manager, Seismologist</td>
<td>617-552-8337</td>
<td><a href="mailto:hagertmb@bc.edu">hagertmb@bc.edu</a></td>
</tr>
<tr>
<td>Weston Observatory</td>
<td></td>
<td>617-552-8300</td>
<td>617-552-8388 (FAX)</td>
</tr>
</tbody>
</table>

https://www.bc.edu/research/westonobservatory/nesc07d.html
# 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>
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<tr>
<td>BCX  *</td>
<td>42.3350</td>
<td>-71.1705</td>
<td>61.0</td>
<td>Chestnut Hill, MA</td>
<td>WES</td>
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<tr>
<td>BRYW</td>
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<td>-71.5342</td>
<td>107</td>
<td>Smithfield, RI</td>
<td>WES</td>
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<tr>
<td>FFD</td>
<td>43.4700</td>
<td>-71.6539</td>
<td>131</td>
<td>Franklin Falls Dam, NH</td>
<td>WES</td>
</tr>
<tr>
<td>HNM</td>
<td>43.7051</td>
<td>-72.2865</td>
<td>180</td>
<td>Hanover, NH</td>
<td>WES</td>
</tr>
<tr>
<td>QUA2</td>
<td>42.2790</td>
<td>-72.3521</td>
<td>168</td>
<td>Belchertown, MA</td>
<td>WES</td>
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<tr>
<td>TRY</td>
<td>42.7305</td>
<td>-73.6658</td>
<td>131</td>
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<tr>
<td>EMNWW</td>
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<td>-67.4580</td>
<td>34</td>
<td>Machias, ME</td>
<td>WES</td>
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<td>VT1</td>
<td>44.3317</td>
<td>-72.7536</td>
<td>125</td>
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<td>WES</td>
<td>42.3848</td>
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<tr>
<td>WVL</td>
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<td>-69.6575</td>
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<td>YLE</td>
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<td>-72.9209</td>
<td>10</td>
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<tr>
<td>PQI</td>
<td>46.6701</td>
<td>-68.0133</td>
<td>175</td>
<td>Presque Isle, ME</td>
<td>WES</td>
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</table>

* = not in operation during this quarter

# TABLE 3

**HYPOCENTERS FOR EARTHQUAKES IN NEW ENGLAND AND ADJACENT REGIONS**

**October - December, 2007**

<table>
<thead>
<tr>
<th>Date M/D/Y</th>
<th>Time (UTC) Hr:Min:Sec</th>
<th>Lat</th>
<th>Long</th>
<th>Depth (km)</th>
<th>Mn</th>
<th>Mc</th>
<th>Int</th>
<th>Location</th>
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<tbody>
<tr>
<td>10/01/07</td>
<td>16:42:10.31</td>
<td>47.03</td>
<td>-76.84</td>
<td>19.14</td>
<td>3.6</td>
<td>3.5</td>
<td></td>
<td>PQ, 82.3KM NW OF MANIWAKI</td>
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<tr>
<td>10/02/07</td>
<td>05:06:49.59</td>
<td>45.01</td>
<td>-70.04</td>
<td>09.70</td>
<td>2.3</td>
<td>2.0</td>
<td></td>
<td>ME, 10 KM E OF CARRABASSETT</td>
</tr>
<tr>
<td>10/02/07</td>
<td>16:52:10.30</td>
<td>43.95</td>
<td>-70.02</td>
<td>17.18</td>
<td>2.4</td>
<td>2.2</td>
<td></td>
<td>ME, 4.8KM NW OF BRUNSWICK</td>
</tr>
<tr>
<td>10/07/07</td>
<td>06:47:28.42</td>
<td>49.94</td>
<td>-67.44</td>
<td>05.22</td>
<td>2.8</td>
<td>3.3</td>
<td></td>
<td>PQ, 80 KM SW OF SEPT ILES</td>
</tr>
<tr>
<td>10/08/07</td>
<td>11:15:16.75</td>
<td>42.81</td>
<td>-71.02</td>
<td>00.70</td>
<td>1.3</td>
<td>1.8</td>
<td></td>
<td>MA, MERRIMAC</td>
</tr>
<tr>
<td>10/09/07</td>
<td>14:05:29.84</td>
<td>44.62</td>
<td>-70.77</td>
<td>10.33</td>
<td>2.0</td>
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<td>ME, 14.7KM WNW OF RUMFORD</td>
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<tr>
<td>10/13/07</td>
<td>05:53:32.04</td>
<td>46.52</td>
<td>-75.12</td>
<td>02.35</td>
<td>2.6</td>
<td>3.2</td>
<td></td>
<td>PQ, NEAR LAC-SAGUAY</td>
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<tr>
<td>10/15/07</td>
<td>01:06:27.30</td>
<td>44.49</td>
<td>-68.14</td>
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<td>0.5</td>
<td>1.6</td>
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<td>ME, 10KM NE OF BAR HARBOR</td>
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<tr>
<td>10/15/07</td>
<td>18:21:27.88</td>
<td>45.96</td>
<td>-73.42</td>
<td>00.04</td>
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<td>2.3</td>
<td></td>
<td>PQ, SOUTH OF JOLIETTE</td>
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<tr>
<td>10/16/07</td>
<td>23:57:35.74</td>
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<td>ME, 15.5KM NW OF SANFORD</td>
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<td>42.54</td>
<td>-71.50</td>
<td>00.48</td>
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<td>MA, 1.94KM SW OF LITTLETON COMMON</td>
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<tr>
<td>10/19/07</td>
<td>10:04:47.04</td>
<td>42.55</td>
<td>-71.48</td>
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<td>0.9</td>
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<tr>
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<td>NH, 5.2KM ENE OF BENNINGTON</td>
</tr>
<tr>
<td>10/24/07</td>
<td>21:49:16.94</td>
<td>45.80</td>
<td>-72.01</td>
<td>00.03</td>
<td>2.5</td>
<td>2.6</td>
<td></td>
<td>PQ, 5KM W OF ASBESTOS</td>
</tr>
<tr>
<td>10/28/07</td>
<td>09:47:18.66</td>
<td>46.52</td>
<td>-77.14</td>
<td>03.41</td>
<td>3.5</td>
<td>3.5</td>
<td></td>
<td>ON, 53KM NNE OF PETAWAWA</td>
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<tr>
<td>11/06/07</td>
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<td>-74.98</td>
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<td>3.8</td>
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<td>08.04</td>
<td>1.8</td>
<td>2.7</td>
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<td>00.07</td>
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<td>2.4</td>
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<td>2.6</td>
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<tr>
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<td>07.44</td>
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<td>3.3</td>
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<td>03.44</td>
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<td>2.4</td>
<td></td>
<td>VT, 21KM NW OF ST. JOHN'SBURG</td>
</tr>
<tr>
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<td>45.06</td>
<td>-66.83</td>
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<td>1.5</td>
<td>2.3</td>
<td></td>
<td>NB, PASSAMAQUODDY BAY</td>
</tr>
<tr>
<td>DATE</td>
<td>ORIGIN</td>
<td>LAT N</td>
<td>LONG W</td>
<td>DEPTH</td>
<td>MH</td>
<td>MC</td>
<td>ML GAP</td>
<td>RMS</td>
</tr>
<tr>
<td>------</td>
<td>--------</td>
<td>------</td>
<td>--------</td>
<td>-------</td>
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<tr>
<td>20001001</td>
<td>E</td>
<td>41.35</td>
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<td>3.50</td>
<td>0.30</td>
<td>1.50</td>
<td>0.50</td>
<td>0.20</td>
</tr>
</tbody>
</table>

**Table 4**

**EARTHQUAKE PHASE DATA LIST**

**NEW ENGLAND AND ADJACENT REGIONS**

October - December, 2007


<table>
<thead>
<tr>
<th>DATE</th>
<th>ORIGIN</th>
<th>LAT N</th>
<th>LONG W</th>
<th>DEPTH</th>
<th>MH</th>
<th>MC</th>
<th>ML GAP</th>
<th>RMS</th>
<th>ERR1</th>
<th>ERR2</th>
<th>ERQ</th>
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<td>0.20</td>
<td>0.10</td>
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<td>0.10</td>
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**NIST EPSH MHN M.XMG M.FMP**

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<tr>
<th>STH</th>
<th>DIST ASTH</th>
<th>RNM</th>
<th>HRNH</th>
<th>SEC</th>
<th>TORS</th>
<th>TCAL</th>
<th>RES</th>
<th>WT</th>
<th>AMX</th>
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<th>XHAG</th>
<th>FMP</th>
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<th>ANG</th>
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<td>7</td>
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<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**NESES - Weston Observatory - Boston College**

* indicates magnitude as calculated by Lamont Doherty Earth Observatory

^ indicates magnitude as calculated by Earthquakes Canada (Natural Resources Canada)

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RUN LABEL=

DATE ORIGIN LAT N LONG W DEPTH MN MC ML GAP RMS ERR ERI Q
200711070621 47.20 43.10.16 71.52.68 8.04 1.8 2.3 124 0.23 0.8 2.4
NS, 25SN WS OF CONCORD

HYP0VERSE 2000 (10/2006 VERSION) RUN ON The Nov 20 15:05:23 2007
RUN LABEL=

DATE ORIGIN LAT N LONG W DEPTH MN MC ML GAP RMS ERR ERI Q
2007111201641 50.02 42.58.28 71. 1.25 0.79 2.4 2.4 232 0.19 2.4 2.8
NS, 0.25SN WS OF ELETHK

HYP0VERSE 2000 (10/2006 VERSION) RUN ON Mon 0 No 26 12:52:09 2007
RUN LABEL=

DATE ORIGIN LAT N LONG W DEPTH MN MC ML GAP RMS ERR ERI Q
2007111222015 19.83 41.41.26 71-33.65 19.04 1.4 2.3 320 0.05 1.4 1.7
NZ, 12.9Km W OF WARWICK

https://www.bc.edu/research/westonobservatory/nesnb07d.html
TABLE 5

MICROEARTHQUAKES AND OTHER NON-LOCATABLE EVENTS

<table>
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<th>Date</th>
<th>Sta</th>
<th>Arrival Time</th>
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<td>Yr/Mo/Dy</td>
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None recorded this period.

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NESN Station Map
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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NESN Quarterly Seismicity Map
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 - December, 2007.

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

References

