NESN

A STUDY OF NEW ENGLAND SEISMICITY

Quarterly Earthquake Report

October - December, 1999

New England
Seismic Network

Weston Observatory

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for

United States Geological Survey

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Notice

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Introduction

The New England Seismic Network (NESN) is operated collaboratively by the Weston Observatory (WES) of Boston College and the Earth Resources Lab (ERL) of the Massachusetts Institute of Technology. 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, 1999. 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 5 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 currently consists of 13 broadband three-component, 4 short-period vertical, and 8 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.

WES operates 12 stations with broadband instruments consisting 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 is continuing to upgrade its recording stations with 2 more broadband instruments scheduled for installation in 2000. WES also maintains 8 SMA-1 strong-motion instruments in New England.

ERL at MIT currently operates 4 short-period stations, all located within 100 km of Boston. The short- period instruments have 1.0 Hz L4C vertical seismometers. Data recorded by these seismometers is transmitted continuously in analog mode to ERL and digitized (12-bit) into a PC at 50 sps. A data acquisition program on the PC triggers on events detected in the short-period data streams and saves them to a disk for manual analysis. Station WFM also has a new three-component, high dynamic range instrument. The instrument has a CMG-40T sensor and transmits 3-channel, 24-bit data at 100 sps continuously to a central processor (Pentium PC) at ERL. Waveform windows of suspected events are extracted from the data stream, analyzed and archived with the short-period data. WES and ERL record some stations in analog format on helicorders to provide additional data for analysis.

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Seismicity

There were 5 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 via FTP at: SEISMOEAGLE.BC.EDU. Waveform data are saved in Nanometrics, ASCII, and SEED formats and are available via SEISMOEAGLE.BC.EDU or through personal contact. Earthquake lists can be fingered at QUAKE@SEISMOEAGLE.BC.EDU. Weston Observatory maintains two web pages with information about local earthquakes: "http://www.bc.edu:80/bc_org/avp/cas/wesobs/" and "http://seismoeagle.bc.edu/". The latter page is still under contruction. Currently available on the seismoeagle web page is the full catalog of northeastern U.S. earthquake activity to 1992. This will be updated as new Northeastern U.S. Seismic Network Bulletins are produced.

MIT/ERL provides two internet utilities, the MIT/ERL web-site ("www-erl.mit.edu/NESN/homepage.html") and an anonymous FTP directory, to distribute seismic data. SESAME (Seismic Event Server at MIT/ERL) is the web data server that distributes catalogs, reports, earthquake bulletins, and epicenter and station maps (including an archive of recent seismic events). The FTP site, named "sunda.mit.edu", is the current facility available to download waveform data recorded by the MIT NESN. The client machine IP number must be forwarded to us for the client to gain access to the anonymous FTP directory. After logging on, the user changes directories to "pub/seismic". Waveforms of individual events for the period April 1995 through the present are accessed as Unix-compressed SAC files, through the anonymous FTP directory. A "readme" file offers further explanation about the data. Older waveform data in SAC format (1981 - March 1995) will be made available on the FTP site upon request.

For more information on matters discussed in this report or general earthquake information (reports, maps, catalogs, etc.) consult our web-sites www-erl.mit.edu/NESN and www.bc.edu:80/bc_org/avp/cas/wesobs/ or contact:

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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. Mag = event magnitude
7. Int = event epicentral intensity
8. Location = event geographic location

Table 4: Earthquake detailed hypocenter and phase data list

Table Header: detailed hypocenter data

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 = Nuttli Lg phase magnitude with amplitude divided by period
8. 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)

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 millimicrons, 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. XMAG = Nuttli 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

Name	Network Position	voice phone	email address
John E. Ebel	Principal Investigator	617-552-8319	ebel@bc.edu
Alan Kafka	Research Seismologist	617-552-8300	kafka@bcvms.bc.edu
Susan O'Connor	Seismic Analyst	617-552-8337	dannolfo@bc.edu
Edward Johnson	Project Engineer	617-552-8332	johnson@bcvms.bc.edu
Patricia Tassia	Administrative Secretary	617-552-8311	tassia@bcvms.bc.edu
W. Richard Ott, S.J.	Assistant to the Director	617-552-8335	ottwi@mail1.bc.edu
		617-552-8300	
Weston Observatory		617-552-8388 (FAX)	

MIT/ERL PERSONNEL

Name	Network Position	voice phone	email address
M. Nafi Toksöz	Principal Investigator	617-253-7852	toksoz@mit.edu
Charles Doll	Research Seismologist	617-253-7863	doll@erl.mit.edu
Charles Doll	Seismic Analyst	617-253-6290	doll@erl.mit.edu
Heather Hooper	Seismic Analyst	617-253-6290	
Sara Brydges	Administrator	617-253-7797	sara@erl.mit.edu
		617-253-8027	
Earth Resources Lab		617-253-6385 (FAX)	

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TABLE 2

SEISMIC STATIONS OF THE NEW ENGLAND SEISMIC NETWORK

Code	Lat	Long	Elev (m)	Location	Operator
BCX	42.3350	-71.1705	61.0	Chestnut Hill, MA	WES
BRY	41.9178	-71.5388	380.0	Smithfield, RI	WES
DNH	43.1225	-70.8948	24.0	Durham, NH	MIT
DXB	42.0610	-70.6992	8.0	Duxbury, MA	MIT
GLO	42.6403	-70.7272	15.2	Gloucester, MA	MIT
HNH	43.7050	-72.2860	180.0	Hanover, NH	WES
MIM	45.2436	-69.0403	140.0	Milo, ME	WES
NH1	43.5473	-71.5743	402.0	Sanbornton, NH	WES
QUA2	42.2789	-72.3525	168.0	Belchertown, MA	WES
TRY	42.7311	-73.6669	131.0	Troy, NY	WES
VT1	44.3317	-72.7536	410.0	Waterbury, VT	WES
WES	42.3850	-71.3220	60.0	Weston, MA	WES
WFM	42.6106	-71.4906	87.5	Westford, MA	MIT
WVL	44.5648	-69.6575	85.0	Waterville, ME	WES

YLE	41.3100	-72.9269	914.0	New Haven, CT	WES
PQI	46.6710	-68.0168	175.0	Presque Isle, ME	WES

STRONG MOTION STATIONS OF THE NEW ENGLAND SEISMIC NETWORK

Code	Lat	Long	Location	Operator
SM1	44.90	-67.25	Dennysville, ME	WES
SM2	44.49	-73.10	Essex Junction, VT	WES
SM3	41.45	-71.33	Newport, RI	WES
SM4	42.38	-71.32	Weston, MA	WES
SM5	42.66	-71.30	Lowell, MA	WES
SM6	42.30	-71.34	Natick, MA	WES
SM7	42.39	-71.54	Hudson, MA	WES
SM8	44.48	-69.61	North Vassalboro, ME	WES

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TABLE 3

EARTHQUAKE HYPOCENTER LIST

NEW ENGLAND AND ADJACENT REGIONS

October - December, 1999

Date	Time	Lat	Long	Depth	Mag	Int	Location
Yr/Mo/Dy	Hr:Mn:Sec			(km)			
1999/10/13	10:08:59.67	42.5245	-71.5042	2.00	2.6		MA, BOXBORO
1999/10/31	20:14:10.19	45.9678	-74.3337	0.14	3.6		PQ, N OF LACHUTE
1999/11/26	22:33:01.65	43.7647	-78.9032	0.27	3.5		ON, 24 KM SW OF OSHAWA
1999/12/10	01:08:51.75	43.2430	-71.6647	8.84	2.1		NH, 8 KM W OF CONCORD
1999/12/25	00:21:41.31	44.9448	-69.3680	5.00	3.0		ME, 10 KM NNE OF HARTLAND

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TABLE 4

EARTHQUAKE PHASE DATA LIST
NEW ENGLAND AND ADJACENT REGIONS
October - December, 1999

```
SOUTH & COASTAL NEW ENGLAND, CHIBURIS, 1979
99OCT13 MA, BOXBORO

 DATE      ORIGIN    LAT N    LONG W   DEPTH   MN  MC  ML GAP   RMS  ERH  ERZ Q
991013 10 8 59.67 42-31.47  71-30.25   2.00  2.6 2.5      85  0.53  1.4  3.2 D

 STN  DIST AZM  RMK HRMN   SEC   TOBS   TCAL   RES   WT AMX PRX XMAG FMP FMAG
 WFM   9.6   7 IPC0 10 9  1.30   1.63   1.68 -0.06 2.09                38  1.3
             ES 0 10 9  3.00   3.33   2.99  0.32 2.09
 WES  21.6 136 IPC1 10 9  3.63   3.96   3.65  0.30 1.53 997 .19  2.5 150  2.7
             IS 1 10 9  6.12   6.45   6.49 -0.06 1.53
 BCX  34.6 127 IPC3 10 9  7.02   7.35   5.80  1.55 0.21 420 .21  2.4 152  2.7
              S 3 10 9 10.68  11.01  10.32  0.69 0.48
 GLO  65.1  79 EPD1 10 9 10.18  10.51  10.81 -0.31 1.40               105  2.5
             ES 3 10 9 17.60  17.93  19.25 -1.32 0.32
 BRY  67.5 182 EP 4 10 9  8.16   8.49  11.21 -2.72 0.00 879 .15  3.0 144  2.7
             ES 4 10 9 15.67  16.00  19.96 -3.96 0.00
QUA2  75.0 249 IPD2 10 9 12.46  12.79  12.45  0.30 0.92 384 .09  2.8 166  2.9
             ES 1 10 9 21.22  21.55  22.17 -0.68 1.33
 DNH  83.0  37 EPC0 10 9 13.42  13.75  13.78 -0.04 1.80                97  2.4
             ES 3 10 9 22.80  23.13  24.54 -1.41 0.25
 DXB  84.0 128 EPC3 10 9 14.42  14.75  13.94  0.80 0.43                73  2.2
             ES 1 10 9 23.84  24.17  24.82 -0.65 1.31
 NH1 113.8 357 EP 1 10 9 19.21  19.54  18.85  0.68 1.22 146 .16  2.5 167  3.0
```

```
                ES 3 10 9 32.40  32.73  33.56 -0.83 0.39
 HNH 145.8 334  EP 3 10 9 24.86  25.19  23.73  1.43 0.22 173 .33  2.6 132  2.8
                 S 2 10 9 41.55  41.88  42.24 -0.42 0.77
 YLE 179.3 221  EP 4 10 9 30.43  30.76  28.60  2.15 0.00 162 .18  2.8
                 S 2 10 9 51.06  51.39  50.92  0.47 0.71
 WVL 267.8  34  EP 4 10 9 23.81  24.14  39.54-15.41 0.00   7 .06  2.4
                 S 4 10 9 75.18  75.51  70.38  5.11 0.00

NORTHWEST MAINE CRUSTAL STRUCTURE
99OCT31 PQ, N OF LACHUTE

 DATE     ORIGIN    LAT N    LONG W   DEPTH   MN  MC  ML GAP   RMS  ERH  ERZ Q
991031 2014 10.19 45-58.07  74-20.02   0.14  3.6         137  0.49  2.5 10.1 C

 STN  DIST AZM  RMK HRMN   SEC   TOBS   TCAL   RES   WT AMX PRX XMAG FMP FMAG
 MOQ 177.9 114   P 0 2014 37.74  27.55  28.83 -1.42 0.76
 VT1 220.3 146  EP 0 2014 45.26  35.07  34.21  0.84 1.14
                 S 4 2014 68.79  58.60  60.90 -2.34 0.00
 QCQ 251.6  69   P 0 2014 48.44  38.25  38.08  0.17 1.21
                 S 4 2014 80.14  69.95  67.78  2.17 0.00
 HNH 299.1 147  EP 0 2014 53.89  43.70  43.95 -0.28 1.12 312 .23  3.5
                 S 4 2014 89.91  79.72  78.23  1.44 0.00
 A54 342.5  61   P 0 2014 59.67  49.48  49.31  0.12 1.03
 NH1 346.5 141  EP 0 2014 59.77  49.58  49.79 -0.21 1.02 347 .22  3.7
 A11 347.2  66   P 0 2015  0.66  50.47  49.88  0.59 0.99
                 S 4 2015 43.80  93.61  88.78  4.82 0.00
 LMQ 352.8  60   P 0 2015  0.93  50.74  50.57  0.10 1.01
                 S 4 2015 40.30  90.11  90.01 -0.03 0.00
 A16 370.4  63   P 0 2015  2.51  52.32  52.74 -0.42 0.96
 EEO 372.8 282   P 0 2015  3.02  52.83  53.04 -0.21 0.97
 A61 376.4  59   P 0 2015  3.85  53.66  53.49  0.16 0.96
                 S 4 2015 44.12  93.93  95.22 -1.30 0.00
 A64 396.6  59   P 0 2015  6.17  55.98  55.99 -0.02 0.92
                 S 4 2015 48.38  98.19  99.65 -1.50 0.00
 WVL 400.0 114  EP 4 2015 10.00  59.81  56.40  3.40 0.00 183 .24  3.5
                 S 4 2015 58.99 108.80 100.39  8.39 0.00
 A21 403.6  61   P 0 2015  7.16  56.97  56.85  0.12 0.91
                 S 4 2015 56.12 105.93 101.19  4.74 0.00
 DNH 418.1 139  ES 4 2015 60.68 110.49 104.37  6.13 0.00
 WFM 436.6 149  ES 4 2015 66.63 116.44 108.44  7.98 0.00
QUA2 439.5 159  EP 4 2015 12.50  62.31  61.28  1.00 0.00 336 .40  3.6
                 S 4 2015 66.17 115.98 109.08  6.85 0.00
 WES 465.3 149  EP 4 2015 15.66  65.47  64.46  1.00 0.00 162 .30  3.5
                 S 4 2015 76.22 126.03 114.73 11.28 0.00
 GLO 468.5 142  ES 4 2015 76.46 126.27 115.45 10.82 0.00
 BCX 476.3 148  EP 4 2015 22.26  72.07  65.82  6.25 0.00 162 .34  3.5
                 S 4 2015 76.72 126.53 117.16  9.37 0.00
 PQI 492.9  81   S 4 2015 87.67 137.48 120.81 16.62 0.00 285 .27  3.8
 EFO 508.9 231   P 4 2015 17.12  66.93  69.84 -2.91 0.00
CRNY 521.2 173   P 4 2015 19.88  69.69  71.36 -1.67 0.00
 YLE 529.9 168   S 4 2015 90.68 140.49 128.93 11.56 0.00 160 .36  3.5
 CNQ 599.2  52   P 4 2015 30.32  80.13  80.99 -0.89 0.00
                 S 4 2015 89.41 139.22 144.17 -5.00 0.00
 GSQ 636.1  59   P 4 2015 35.84  85.65  85.54  0.10 0.00
 MNQ 654.5  39   P 4 2015 37.70  87.51  87.82 -0.31 0.00
 ICQ 661.2  53   P 4 2015 37.42  87.23  88.64 -1.42 0.00
 SMQ 739.5  50   P 4 2015 47.67  97.48  98.32 -0.89 0.00
 LMN 739.5  91   P 4 2015 46.60  96.41  98.32 -1.91 0.00

NORTHWEST MAINE CRUSTAL STRUCTURE
99NOV26 ON, 24 KM SW OF OSHAWA

 DATE     ORIGIN    LAT N    LONG W   DEPTH   MN  MC  ML GAP   RMS  ERH  ERZ Q
991126 2233  1.65 43-45.88  78-54.19   0.27  3.5 0.0      231  0.13  4.0  3.3 C

 STN  DIST AZM  RMK HRMN   SEC   TOBS   TCAL   RES   WT AMX PRX XMAG FMP FMAG
BINY 295.1 126   P 0 2233 45.10  43.45  43.44 -0.07 1.72
                 S 0 2233 79.24  77.59  77.32  0.12 1.71
 EEO 320.0 358   P 3 2233 48.77  47.12  46.50  0.62 0.06
 WBO 320.0  65   P 3 2233 47.72  46.07  46.51 -0.44 0.22
 PTN 326.0  74   P 0 2233 48.97  47.32  47.25  0.03 1.52
 GRQ 396.1  37   P 0 2233 57.61  55.96  55.91  0.05 1.04
 TRQ 438.3  51   P 0 2233 62.60  60.95  61.11 -0.17 0.74
 VT1 497.3  83  EP 4 2234 80.20 138.55  68.39 70.14 0.001312 .31  4.5
LSCT 519.9 116   P 4 2233 72.70  71.05  71.18 -0.18 0.00
 HNH 533.5  91  EP 4 2234 15.60  73.95  72.87  1.05 0.00 204 .43  3.6
                 S 4 2234 82.91 141.26 129.70 11.50 0.00
QUA2 559.1 107  EP 4 2234 20.79  79.14  76.02  3.08 0.00 250 .38  3.8
                 S 4 2234 91.95 150.30 135.32 14.92 0.00
 YLE 561.9 119  EP 4 2234 46.26 104.61  76.37 28.24 0.00  99 .50  3.3
 DPQ 580.2  56   P 0 2234 20.21  78.56  78.64 -0.08 0.00
                 S 0 2234 81.20 139.55 139.97 -0.42 0.00
 NH1 591.3  92  EP 4 2234 21.84  80.19  80.00  0.19 0.00  85 .20  3.7
                 S 4 2234 96.44 154.79 142.40 12.38 0.00
 WFM 616.0 102  ES 4 2235 49.54 167.89 147.83 20.04 0.00
 WES 636.0 104  EP 4 2234 43.83 102.18  85.51 16.65 0.00  51 .34  3.3
 BRY 636.5 109  EP 4 2234 41.33  99.68  85.57 14.10 0.00  54 .43  3.2
 BCX 650.3 104                                            37 .34  3.2
 DNH 652.7  96  ES 4 2235 51.30 169.65 155.89 13.76 0.00
 GLO 676.2 101  ES 4 2235 64.40 182.75 161.05 21.69 0.00
 WVL 744.5  83                                            60 .40  3.4

  HUGHES AND LUETGERT NH
99DEC10 NH, 8 KM W OF CONCORD

 DATE     ORIGIN    LAT N    LONG W   DEPTH   MN  MC  ML GAP   RMS  ERH  ERZ Q
991210  1 8 51.75 43-14.58  71-39.88   8.84  2.1 2.3      116  0.48  1.7  3.4 C

 STN  DIST AZM  RMK HRMN   SEC   TOBS   TCAL   RES   WT AMX PRX XMAG FMP FMAG
 NH1  34.6  12 IPD0  1 8 57.32   5.57   5.99 -0.41 1.73  92 .06  1.8 120  2.5
                ES 3  1 8 60.72   8.97  10.65 -1.68 0.11
 DNH  64.0 102  EP 1  1 9  2.96  11.21  10.74  0.47 1.21                61  2.0
                 S 0  1 9 10.64  18.89  19.12 -0.23 1.64
 WFM  71.7 169  EP 2  1 9  4.60  12.85  11.99  0.85 0.72                69  2.1
```

```
                 S 0  1 9 13.18  21.43  21.35   0.06 1.62
 HNH  71.8 316 EP 4  1 8 59.99   8.24  12.02 -3.80 0.00
               ES 4  1 8 64.92  13.17  21.39 -8.27 0.00
 WES  99.4 164 EP 2  1 9  8.90  17.15  16.44  0.70 0.72  11 .05  1.6
               ES 0  1 9 20.75  29.00  29.27 -0.29 1.52
 GLO 101.7 131 EP 3  1 9  9.52  17.77  16.80  0.97 0.32               94  2.4
                 S 0  1 9 21.52  29.77  29.91 -0.14 1.52
QUA2 121.0 208 EP 1  1 9 11.85  20.10  19.79  0.28 1.08  21 .13  1.8
               ES 3  1 9 25.54  33.79  35.23 -1.49 0.16
 BRY 147.6 176  S 2  1 8 93.54  41.79  42.57 -0.78 0.64   8 .12  1.5
 VT1 149.4 324  S 1  1 8 95.10  43.35  43.06  0.25 1.02 517 .16  3.2
 YLE 238.6 206  S 4  1 8 85.84  34.09  63.69-29.60 0.00  34 .11  2.6

NORTHWEST MAINE CRUSTAL STRUCTURE
99DEC25 ME, 10 KM NNE OF HARTLAND

 DATE      ORIGIN     LAT N     LONG W   DEPTH    MN  MC  ML GAP   RMS  ERH  ERZ Q
991225  021 41.31 44-56.69  69-22.08   5.00  3.0 3.1     178  0.57  3.2  2.8 D

 STN  DIST AZM  RMK HRMN    SEC    TOBS    TCAL    RES    WT AMX PRX XMAG FMP FMAG
 WVL  51.8 207 IPD1  021 49.59   8.28   8.56 -0.29 2.40 457 .08  2.7
               ES 2  021 55.93  14.62  15.23 -0.63 1.55
 PQI 218.7  29 EP 3  022 16.17  34.86  33.47  1.36 0.39 170 .25  2.9
               ES 0  022 40.97  59.66  59.57  0.03 2.13
 MOQ 230.8 280  P 2  022 17.03  35.72  34.96  0.62 1.00
 NH1 235.0 229 EP 1  022 17.24  35.93  35.47  0.45 1.50  89 .09  3.1
               ES 1  022 44.72  63.41  63.14  0.26 1.52
 DNH 236.6 211 EP 3  022 18.60  37.29  35.68  1.61 0.25              167  3.1
               ES 3  022 43.90  62.59  63.50 -0.92 0.46
 A11 263.3 346  P 2  022 21.05  39.74  38.97  0.75 0.88
                S 4  022 46.46  65.15  69.37 -4.24 0.00
 HNH 270.5 239 EP 2  022 21.86  40.55  39.86  0.66 0.87 168 .29  3.0
               ES 4  022 57.99  76.68  70.95  5.67 0.00
 VT1 277.3 256 EP 4  022 31.36  50.05  40.70  9.33 0.00
               ES 4  022 60.98  79.67  72.44  7.19 0.00
 A54 290.6 344  P 1  022 23.95  42.64  42.34  0.23 1.25
 LMQ 298.7 346  P 0  022 24.87  43.56  43.34  0.15 1.61
                S 2  022 57.90  76.59  77.14 -0.68 0.78
 A21 307.6 355  P 1  022 26.13  44.82  44.44  0.37 1.15
                S 3  022 58.96  77.65  79.11 -1.46 0.24
 A61 310.6 350  P 0  022 25.93  44.62  44.80 -0.20 1.54
                S 3  022 59.73  78.42  79.75 -1.35 0.26
 WFM 310.6 213 EP 3  022 27.80  46.49  44.80  1.67 0.17              163  3.1
               ES 4  022 63.78  82.47  79.75  2.70 0.00
 A64 322.9 353  P 1  022 27.18  45.87  46.32 -0.48 1.08
 BCX 324.5 207 EP 3  022 29.00  47.69  46.52  1.17 0.30  56 .15  3.0
                S 4  022 69.81  88.50  82.80  5.69 0.00
 WES 325.2 209 EP 1  022 27.31  46.00  46.61 -0.62 1.05  86 .34  2.9
               ES 1  022 64.07  82.76  82.96 -0.22 1.08
 MNT 340.0 281  P 4  022 27.24  45.93  48.44 -2.52 0.00
 DAQ 365.2 337  P 2  022 32.15  50.84  51.54 -0.87 0.55
 LMN 371.1  74  P 4  022 31.42  50.11  52.28 -2.18 0.00
                S 4  022 68.77  87.46  93.06 -5.61 0.00
 BRY 379.5 208 EP 4  022 77.88  96.57  53.31 43.25 0.00  87 .27  3.1
                S 4  022 88.46 107.15  94.90 12.25 0.00
QUA2 381.9 219 EP 4  022 37.34  56.03  53.61  2.39 0.00  94 .29  3.1
                S 4  022 87.25 105.94  95.42 10.46 0.00
 TRQ 428.9 289  P 4  022 35.19  53.88  59.42 -5.54 0.00
 YLE 497.0 216  S 4  023 59.72 138.41 120.72 17.69 0.00  94 .33  3.3
```

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TABLE 5

MICROEARTHQUAKES AND OTHER NON-LOCATABLE EVENTS

Date	Sta	Arrival Time
Yr/Mo/Dy		Hr:Mn:Sec

NONE RECORDED THIS PERIOD.

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NESN Station Map

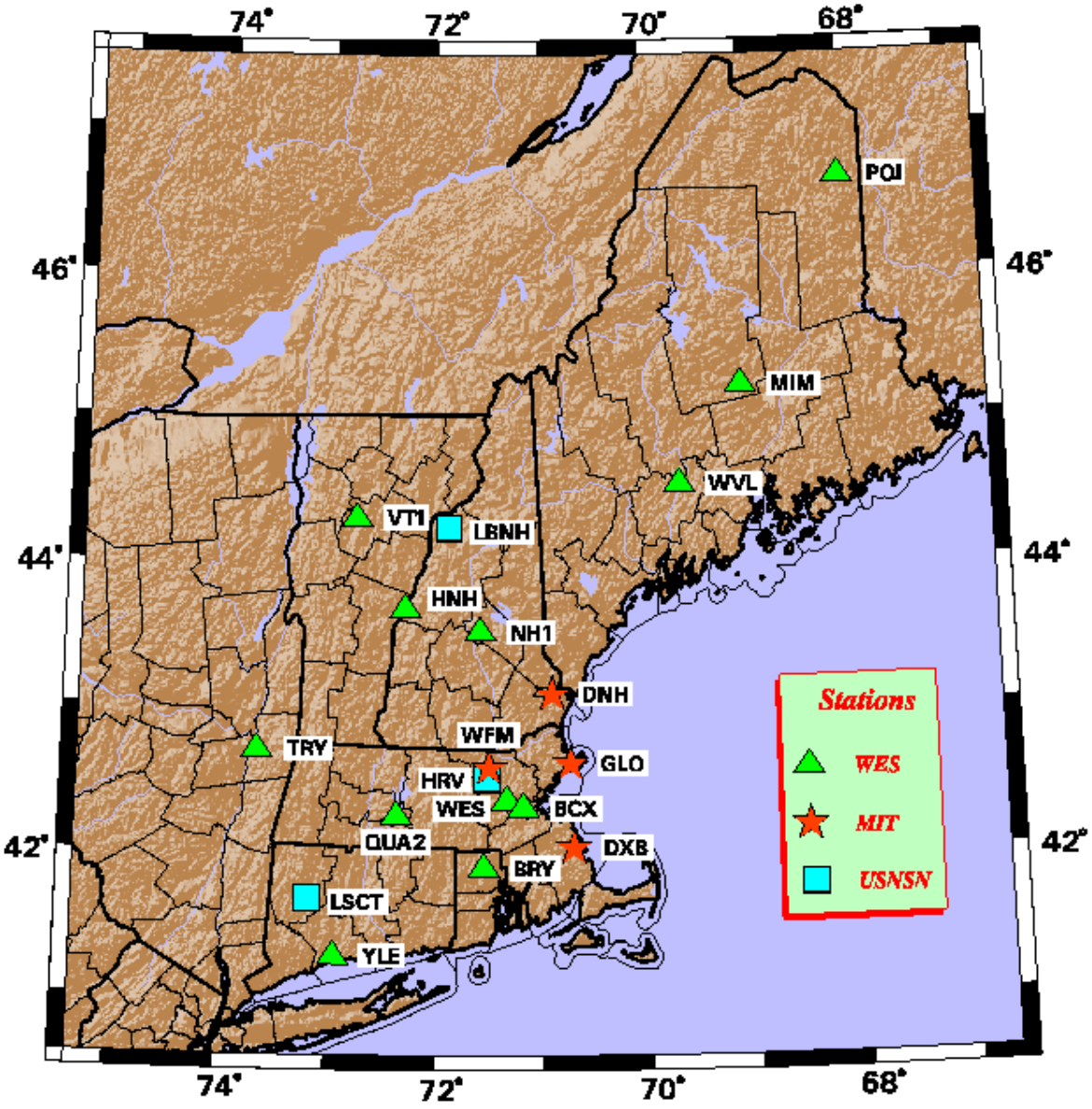

Figure 1: Map of stations of the New England Seismic Network (NESN) in operation during period October - December, 1999. Also included are the US National Seismic Network stations operating in New England during this period.

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NESN Strong-Motion Station Map

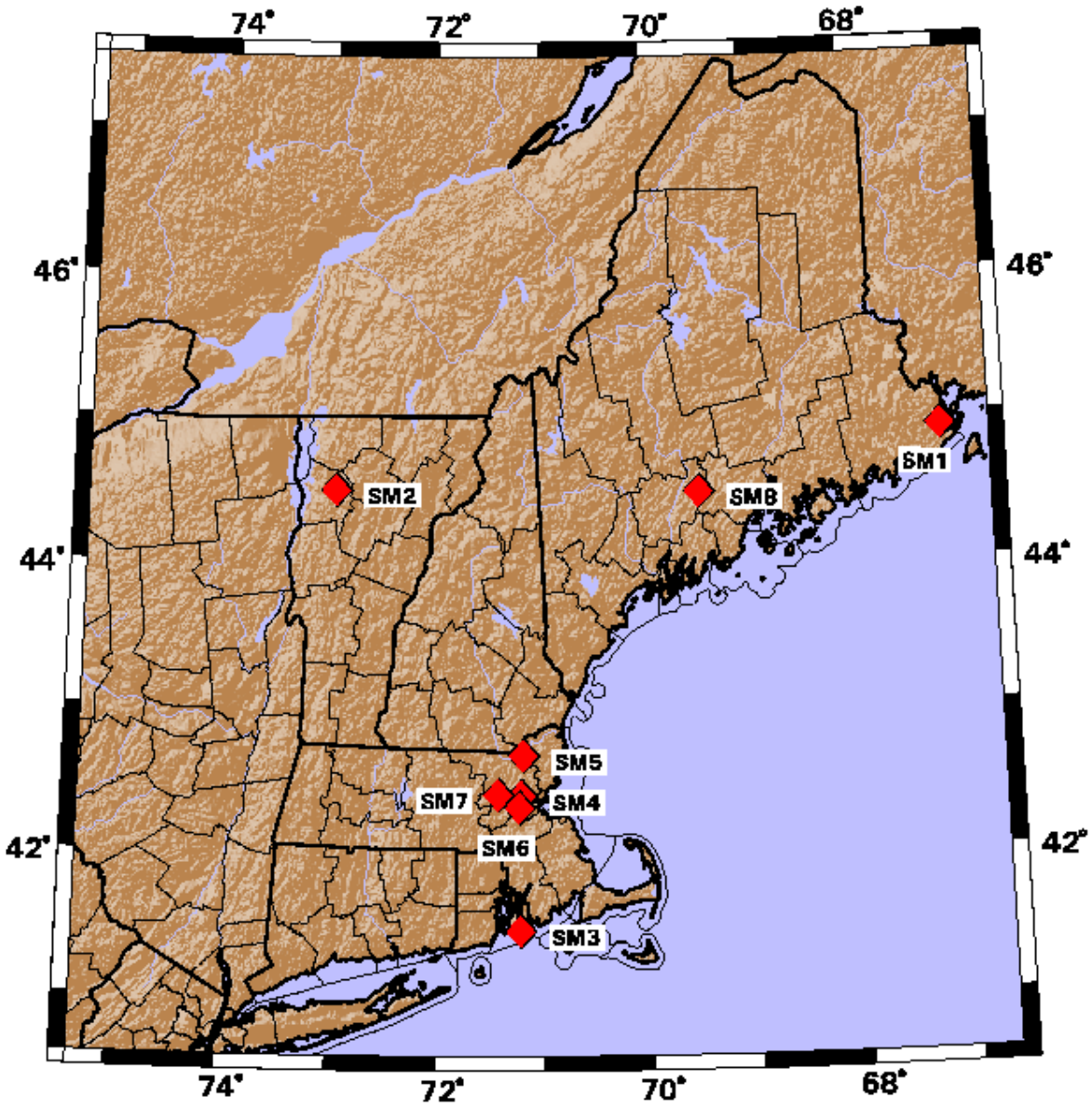

Figure 2: Map of strong-motion stations of the New England Seismic Network (NESN) in operation during period October - December, 1999.

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NESN Quarterly Seismicity Map

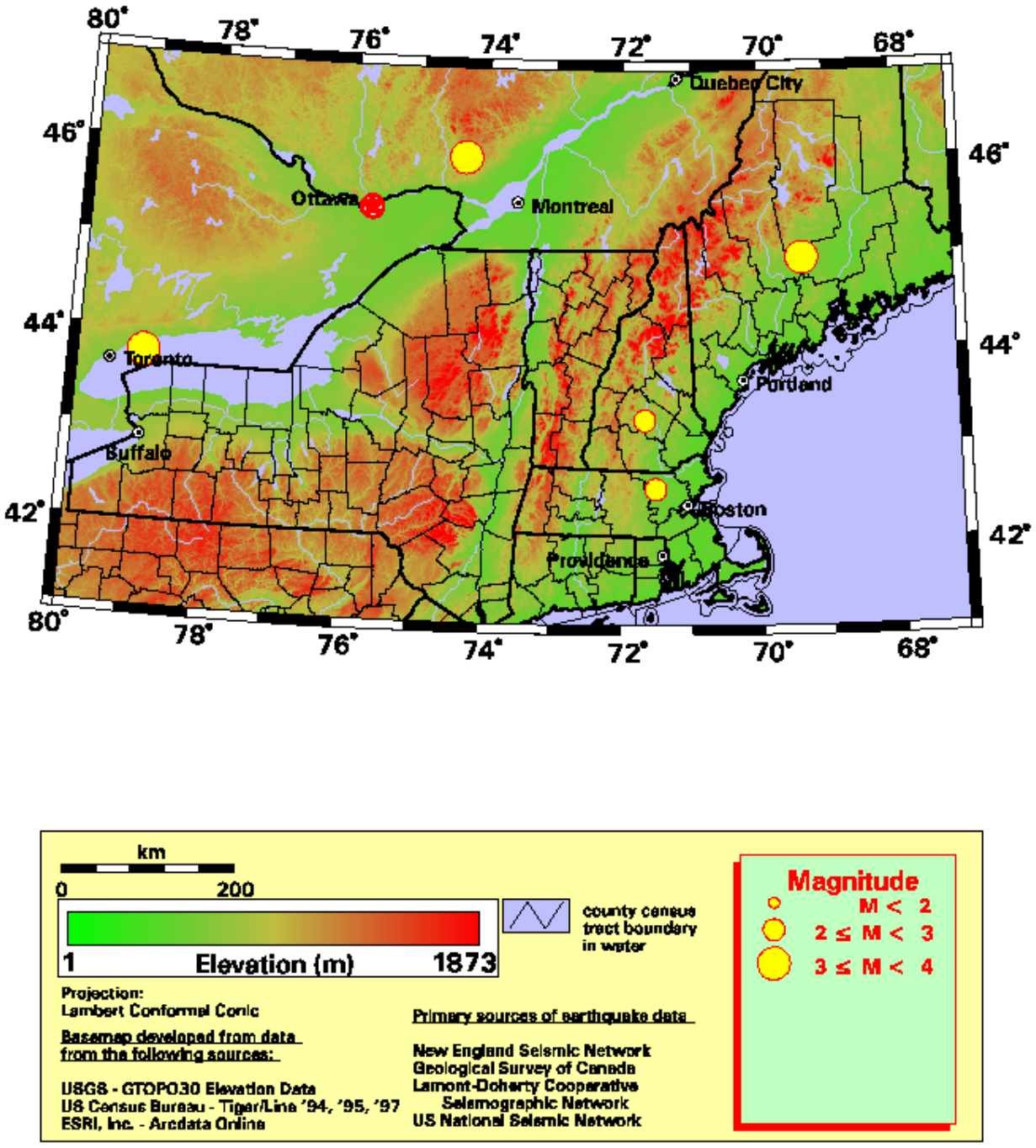

Figure 3: Earthquake epicenters located by the NESN during period October - December, 1999.

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NESN Cumulative Seismicity Map

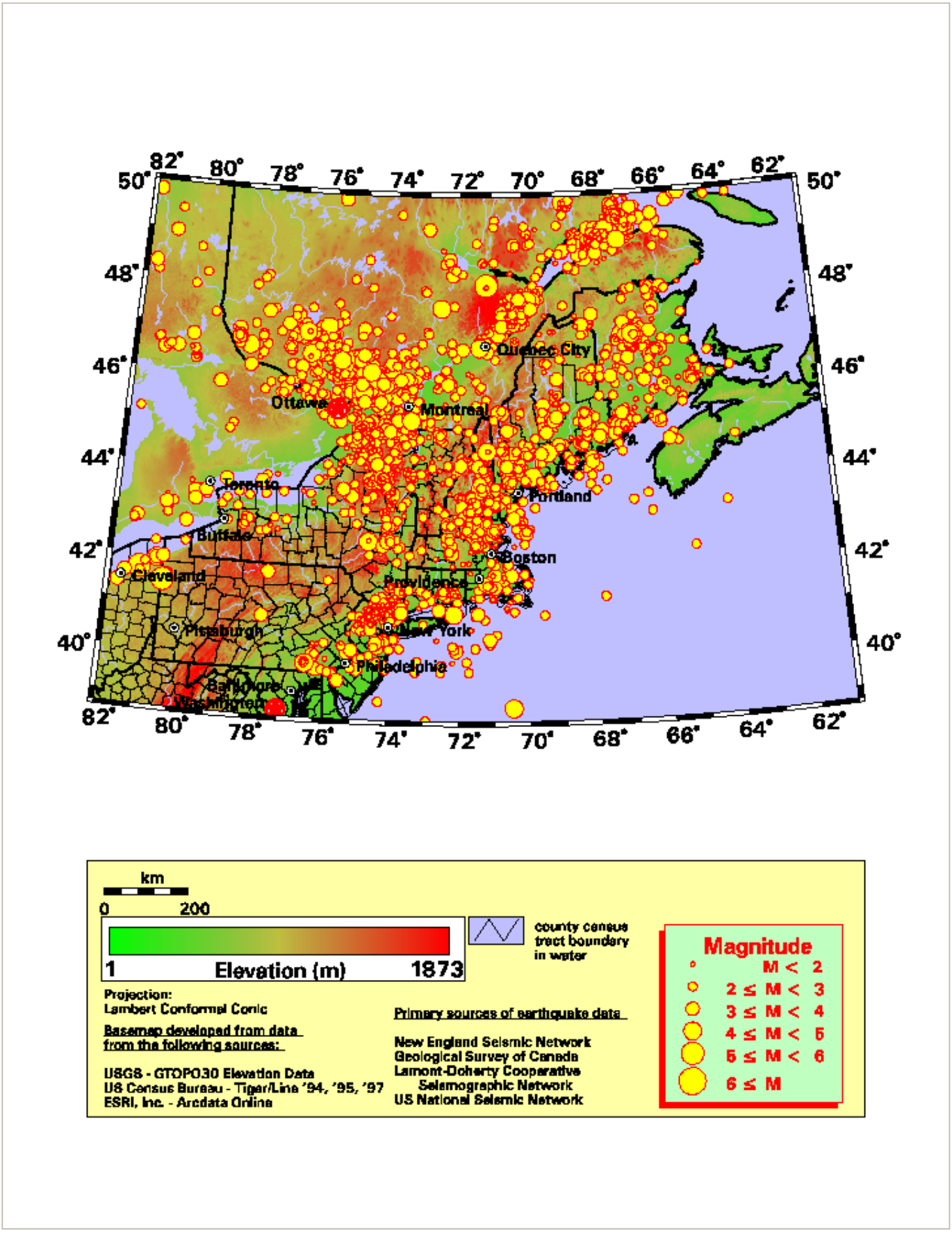

Figure 4: Seismicity for period October, 1975 - December, 1999.

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Acknowledgments

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References

Chaplin, M.P., Taylor, S.R., and Toksöz, M.N. (1980), A coda length magnitude scale for New England, *Earthquake Notes, 51,* 15-22.

Ebel, J.E. (1982), M_L measurements for northeastern United States earthquakes, *Bull. Seism. Soc. Am., 72,* 1367-1378.

Rosario, M. (1979), A coda duration magnitude scale for the New England Seismic Network, *Master's Thesis,* Boston College, 82 pp.

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