NESN

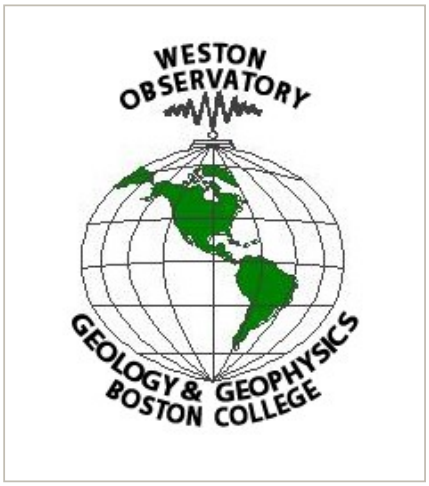
A STUDY OF NEW ENGLAND SEISMICITY

Quarterly Earthquake Report

July-September, 2004

New England

Seismic Network



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NEW ENGLAND SEISMIC NETWORK

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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 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 ofthe 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 July-September, 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 3 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 3 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/eqcatalogs/. 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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Explanation of Tables

Table 1: List of personnel operating the NESN

Table 2: List of Seismic and Strong Motion Stations

1. Code = st ation 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. D ate = 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 se paration, 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 arr ival

   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 arriva l
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 = sign al 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 = neares t 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@bc.edu
Anastasia Macherides Moulis	Seismic Analyst	617-552-8325	macherid@bc.edu
vacant	NESN Operator	617-552-8332	@bc.edu
Dina Smith	Associate Director of Scientific and Technical Operations	617-552-8335	dina.smith.1@bc.edu
Weston Observatory		617-552-8300 617-552-8388 (FAX)	

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TABLE 2

SEISMIC STATIONS OF THE NEW ENGLAND SEISMIC NETWORK

WES43.7050-72.3525Belchertown, MATroy, NYWESUMMWES42.3850WESYLEPQI46.6710

Code	Lat	Long	Elev (m)	Location	Operator
BCX	42.3350	-71.1705	61.0	Chestnut Hill, MA	WES
BRYW	41.9178	-71.5388	380.0	Smithfield, RI	WES
FFD	43.4702	-71.6533	131.0	Franklin Falls Dam, NH	
HNH	-72.2860	180.0	Hanover, NH	WES	
QUA2	42.2789	168.0	WES		
TRY *	42.7311	-73.6669	131.0		
44.7100	-67.4583	35.0	Machias, ME	WES	
VT1	44.3317	-72.7536	410.0	Waterbury, VT	WES
-71.3220	60.0	Weston, MA	WES		
WVL	44.5648	-69.6575	85.0	Waterville, ME	
41.3100	-72.9269	10.0	New Haven, CT	WES	
-68.0168	175.0	Presque Isle, ME	WES		

* = not in operation during this quarter

STRONG MOTION STATIONS OF THE NEW ENGLAND SEISMIC NETWORK

SM2-73.10Newport, RISM4-71.30WESSM742.39-71.54WES

Code	Lat	Long	Location	Operator
SM1	44.90	-67.25	Dennysville, ME	WES
44.49	Essex Junction, VT	WES		
SM3	41.45	-71.33	WES	
42.38	-71.32	Weston, MA	WES	
SM5	42.66	Lowell, MA		
SM6	42.30	-71.34	Natick, MA	WES
Huds on, MA	WES			
SM8	44.48	-69.61	North Vassalboro, ME	

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TABLE 3

EVENTS IN NEW ENGLAND AND ADJACENT REGIONS

Date	Time (UTC)	Lat	Long	Depth	Mag	Int	Location
M/D/Y	Hr:Mn:Sec			(km)			
08/04/2004	23:55:27.02	43.71	-78.24	5.00	3.8*		ON, OFFSHORE, 30KM S OF PORT HOPE
08/28/2004	12:38:37.92	43.16	-71.61	5.00	2.4		NH, 9KM SSW OF CONCORD
09/04/2004	02:05:32.09	44.90	-74.89	0.18	2.9		NY, 3.2KM S OF MASSENA

* indicates Mc rather than Mn.

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TABLE 4

EARTHQUAKE PHASE DATA LIST FOR EVENTS IN NEW ENGLAND AND ADJACENT REGIONS

```
SOUTHEAST MAINE CRUSTAL MODEL
NH, 9KM (5.6MI) SSW OF CONCORD
  DATE     ORIGIN     LAT N     LONG W    DEPTH    MN  MC   ML GAP    RMS  ERH   ERZ Q
  40828 1238 37.92 43- 9.41   71-36.75    5.00    .0 2.4      170    .39  3.0   4.5 C
  STN   DIST AZM   RMK HRMN    SEC    TOBS    TCAL    RES    WT AMX PRX XMAG FMP FMAG
  FFD   35.0 355   EP 9 1238 43.99    6.07    5.81   -.34   .91
                   ES 2 1238 48.19    4.20   10.33   -.34 ****
  HRV   72.4 176   EP 0 1238 49.86   11.95   11.75    .17 1.68                  84   2.3
                   ES 3 1238 57.64   19.72   20.91 -1.24   .12
  HNH   81.8 318   EP 3 1238 50.59   12.68   13.23   -.58   .39
  WES   89.0 165   EP 1 1238 52.63   14.71   14.38    .32 1.19                105   2.5
                   ES 0 1238 63.26   25.34   25.60   -.27 1.62
 QUA2 114.9 212    IPD4 1238 58.94   21.02   18.48   2.51   .00                  99   2.5
                   ES 1 1238 71.13   33.21   32.90    .26 1.14
  BRY 137.8 177    EP 1 1239   .48   22.56   22.12    .38 1.05
                   ES 1 1239 16.68   38.76   39.38   -.72   .97
  NCB 229.4 293    EPDO 1239 12.49   34.57   34.09    .39 1.09
                   ES 1 1239 38.46   60.54   60.67   -.31   .84
SE OF NEW YORK, HUGHES & LUETGERT
NY, 3.2KM (2MI) S OF MASSENA
 DATE     ORIGIN     LAT N     LONG W    DEPTH    MN  MC   ML GAP    RMS  ERH   ERZ Q
 40904 2 5 32.09   44-53.90   74-53.42     .18    .0       .0 141    .21   .7   2.4 B
 STN   DIST AZM   RMK HRMN    SEC    TOBS    TCAL    RES    WT AMX PRX XMAG FMP FMAG
MSNY   11.3  11  EP 1  2 5 33.89    1.80    1.83   -.03 1.40
                 S 0  2 5 35.36    3.27    3.25    .01 1.87
 WBO   32.4 290  EP 4  2 5 40.80    8.71    5.04   3.66   .00
                 S 4  2 5 44.70   12.61    8.98   3.62   .00
 PTN   36.9 191  EP 2  2 5 37.91    5.82    5.73    .06   .89
                 S 3  2 5 42.33   10.24   10.21   -.02   .45
 LOZ   39.4 142  EP 2  2 5 38.10    6.01    6.11   -.16   .88
                 S 1  2 5 43.04   10.95   10.87   -.04 1.33
 BGR   41.5 101  EP 1  2 5 38.50    6.41    6.43   -.07 1.33
                 S 1  2 5 43.30   11.21   11.45   -.32 1.28
 GAC  100.7 333  EP 1  2 5 47.66   15.57   15.46    .10 1.17
                 S 2  2 5 59.41   27.32   27.52   -.21   .77
 NCB  115.9 153  EP 2  2 5 49.87   17.78   17.79   -.11   .75
                 S 1  2 5 63.90   31.81   31.67   -.04 1.13
 MNT  120.1  56  EP 1  2 5 50.94   18.85   18.43    .40 1.07
                 S 1  2 5 65.08   32.99   32.81    .15 1.12
 MIV  141.7 130  EP 2  2 5 53.65   21.56   21.73   -.22   .70
                 S 0  2 5 71.11   39.02   38.69    .25 1.40
ACCN  194.7 150  EP 2  2 6  1.70   29.61   29.81   -.26   .60
                 S 1  2 6 25.21   53.12   53.07   -.05   .93
CRLO  232.2 303  EP 4  2 6  5.01   32.92   35.32 -2.43   .00
                 S 4  2 6 31.73   59.64   62.88 -3.29   .00
 HNH  246.5 123  EP 1  2 6  9.79   37.70   37.10    .57   .69
                 S 3  2 6 39.71   67.62   66.04   1.53   .00
BINY  313.4 196  EP 3  2 6 19.07   46.98   45.35   1.56   .00
                 S 4  2 6 55.89   83.80   80.72   2.94   .00
QUA2  356.0 145  EP 4  2 6 26.76   54.67   50.61   4.04   .00
                 S 4  2 6 70.94   98.85   90.08   8.72   .00
 HRV  377.9 135  EP 4  2 6 27.87   55.78   53.31   2.44   .00
                 S 4  2 6 75.59  103.50   94.90   8.55   .00
 WES  401.3 134  EP 2  2 6 27.74   55.65   56.20   -.56   .21
                 S 4  2 6 81.00  108.91  100.04   8.85   .00
SE OF NEW YORK, HUGHES & LUETGERT
04AUG04 CANADA, ONTARIO, OFFSHORE 30 KM (18.6 MI) SOUTH OF PORT HOPE
 DATE     ORIGIN     LAT N     LONG W    DEPTH    MN  MC   ML GAP    RMS  ERH   ERZ Q
 40804 2355 27.02 43-42.51   78-14.48    5.00    .0  .0       151    .58  2.6   4.6 D
 STN   DIST AZM   RMK HRMN    SEC    TOBS    TCAL    RES    WT AMX PRX XMAG FMP FMAG
BINY  249.4 132  EP 2 2356   4.62   37.60   37.01    .51 1.30
                 ES 3 2356 33.95   66.93   65.87    .92   .62
BRCO  262.2 283  EP 1 2356   6.10   39.08   38.59    .44 1.86
                 ES 3 2356 33.82   66.80   68.69 -1.98   .18
CRLO  267.6  15  EP 0 2356   6.20   39.18   39.26   -.11 2.46
                 ES 3 2356 38.68   71.66   69.88   1.73   .30
 OTT  274.4  47  EP 1 2356   7.54   40.52   40.09    .42 1.78
                 ES 1 2356 38.74   71.72   71.36    .34 1.80
 WBO  276.5  59  EP 1 2356   7.05   40.03   40.35   -.33 1.79
                 ES 4 2356 37.64   70.62   71.83 -1.23   .00
 PTN  278.0  70  EP 2 2356   8.13   41.11   40.54    .54 1.17
                 ES 2 2356 38.56   71.54   72.16   -.68 1.16
MSNY  305.0  62  EP 2 2356 10.17   43.15   43.87   -.73 1.03
                 ES 3 2356 43.32   76.30   78.09 -1.81   .23
 GAC  311.6  45  EP 1 2356 11.14   44.12   44.69   -.58 1.54
                 ES 4 2356 44.42   77.40   79.55 -2.17   .00
```

```
 NCB 324.7  85 IP 2 2356 12.61  45.59  46.30  -.81  .95
              S 4 2356 55.06  88.04  82.41  5.45  .00
 EEO 332.4 349 EP 3 2356 16.25  49.23  47.25  1.90  .17
              ES 4 2356 54.07  87.05  84.11  2.81  .00
 BGR 332.8  68 EP 4 2356 10.68  43.66  47.30 -3.69  .00
              ES 0 2356 51.31  84.29  84.19   .01 1.89
 GRQ 372.5  30 EP 0 2356 19.17  52.15  52.20  -.11 1.55
              ES 3 2356 61.12  94.10  92.92  1.09  .35
 TRQ 403.1  46 EP 1 2356 23.27  56.25  55.98   .26  .96
              ES 0 2356 66.85  99.83  99.65   .18 1.28
 MNT 417.4  61 EP 1 2356 24.17  57.15  57.75  -.62  .85
              ES 4 2356 67.82 100.80 102.79 -2.03  .00
 VT1 445.6  81 EP 4 2356 36.01  68.99  61.23  7.74  .00
              S 4 2356 86.11 119.09 108.98 10.07  .00
VLDQ 493.3   7 EP 3 2356 35.12  68.10  67.12   .96  .11
              ES 3 2356 85.15 118.13 119.47 -1.38  .10
 MOQ 508.5  69 EP 1 2356 35.85  68.83  68.99  -.30  .27
              ES 1 2356 89.77 122.75 122.80  -.30  .27
 HRV 560.2 104 EP 4 2356 49.83  82.81  75.38  7.40  .00
 BRY 583.3 110 EP 4 2356 56.23  89.21  78.23 10.92  .00
              S 4 2356 61.51  94.49 139.25-44.87  .00
 QCQ 644.8  58 EP 4 2356 49.50  82.48  85.82 -3.36  .00
 DAQ 721.0  49 EP 3 2357  1.38  94.36  95.23 -1.03  .00
              ES 4 2357 74.23 167.21 169.51 -2.59  .00
 LMQ 750.7  55 EP 3 2357  4.82  97.80  98.89 -1.17  .00
              ES 3 2357 82.12 175.10 176.03 -1.06  .00
 CNQ 998.0  51 EP 4 2357 33.61 126.59 129.42 -2.86  .00
 GSQ1034.5  56 EP 4 2357 37.41 130.39 133.94 -3.56  .00
 MNQ1045.1  43 EP 4 2357 40.32 133.30 135.24 -2.03  .00
 ICQ1060.3  52 EP 4 2357 41.92 134.90 137.12 -2.23  .00
 LMN1089.4  77 EP 3 2357 46.77 139.75 140.72 -1.03  .00
 SMQ1137.8  50 EP 3 2357 51.89 144.87 146.69 -1.88  .00
```

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TABLE 5

MICROEARTHQUAKES AND OTHER NON-LOCATABLE EVENTS

Date Yr/Mo/Dy	Sta	Arrival Time Hr:Mn:Sec
None recorded this period.		

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<

NESN Station Map

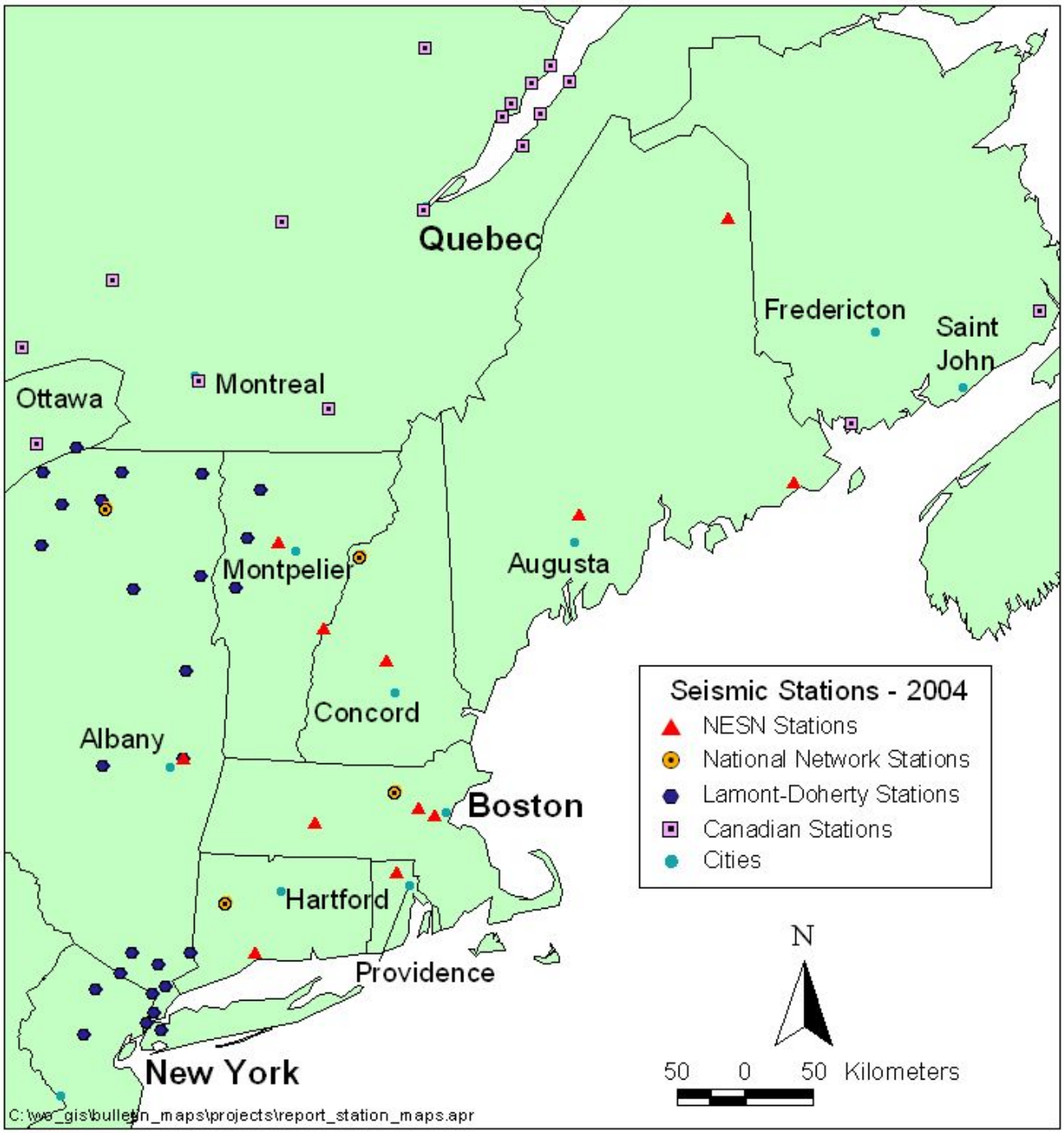

Figure 1: Map of stations of the New England Seismic Network (NESN) in operation during the period of this report. Also included are other Northeast U.S. and Canadian seismic stations in operation during this period.

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NESN Strong-Motion Station Map

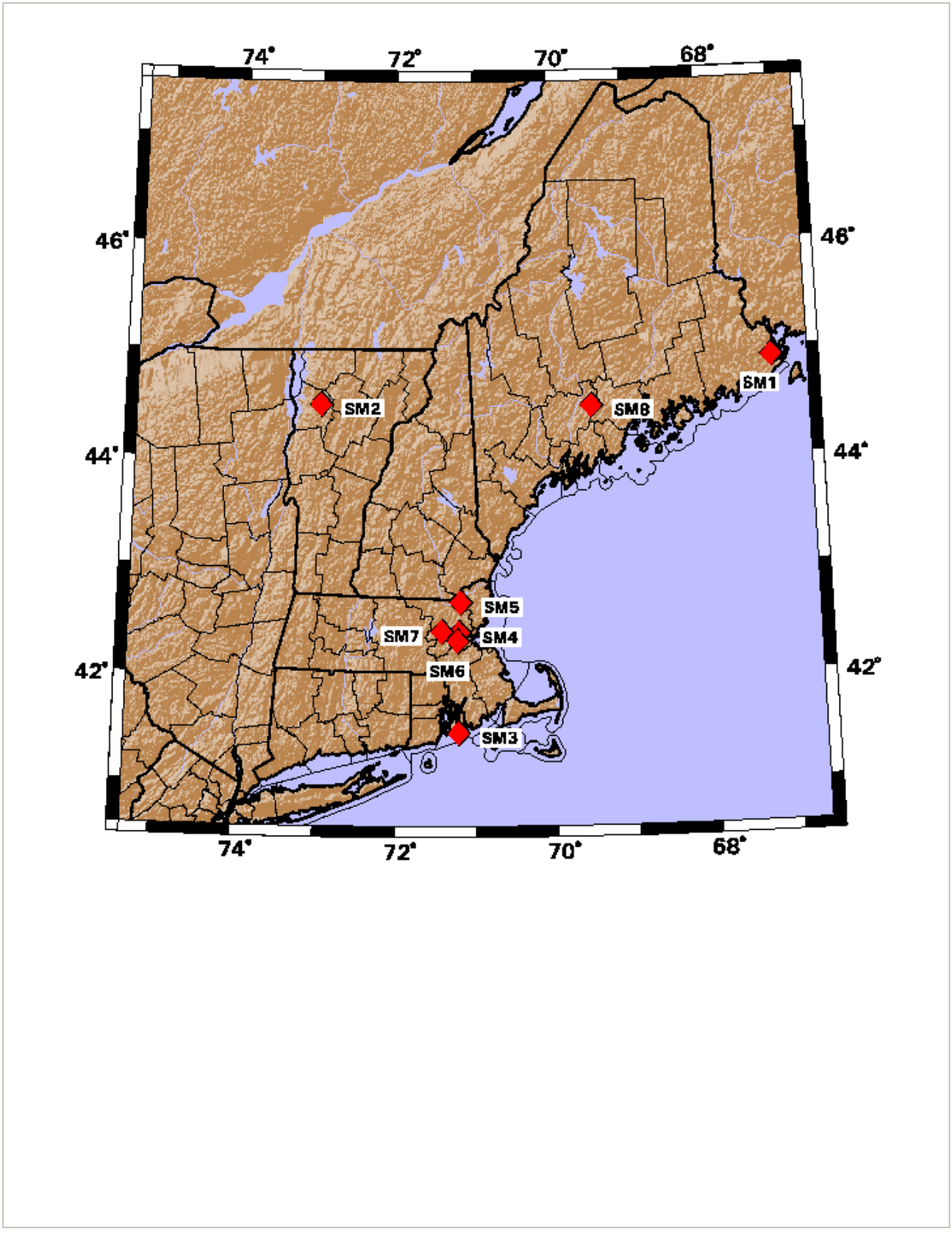

Figure 2: Map of strong-motion stations of the New England Seismic Network (NESN) in operation during the period of this report.

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NESN Quarterly Seismicity Map

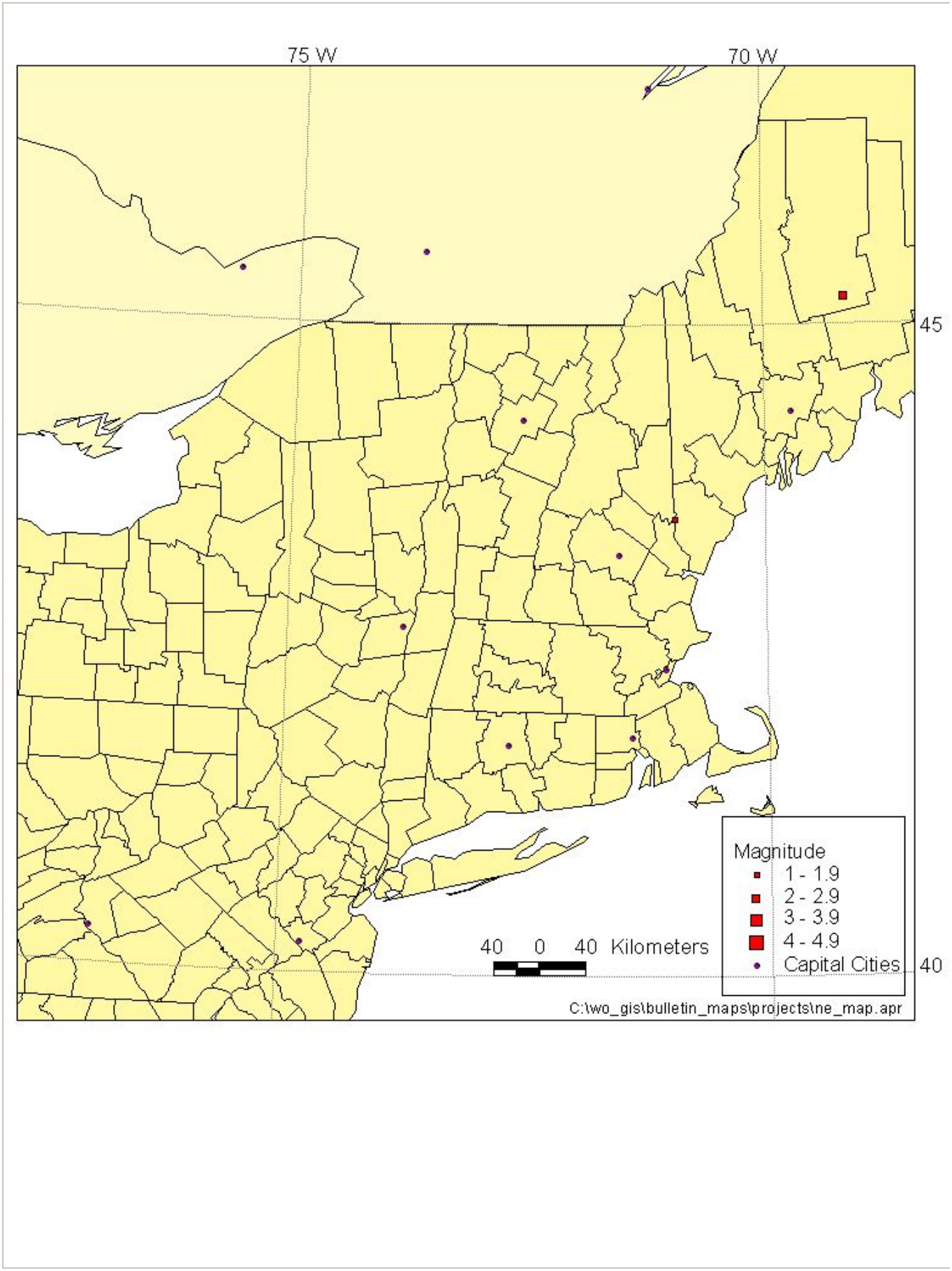

Figure 3: Earthquake epicenters located by the NESN during the period of this report.

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NESN Cumulative Seismicity Map

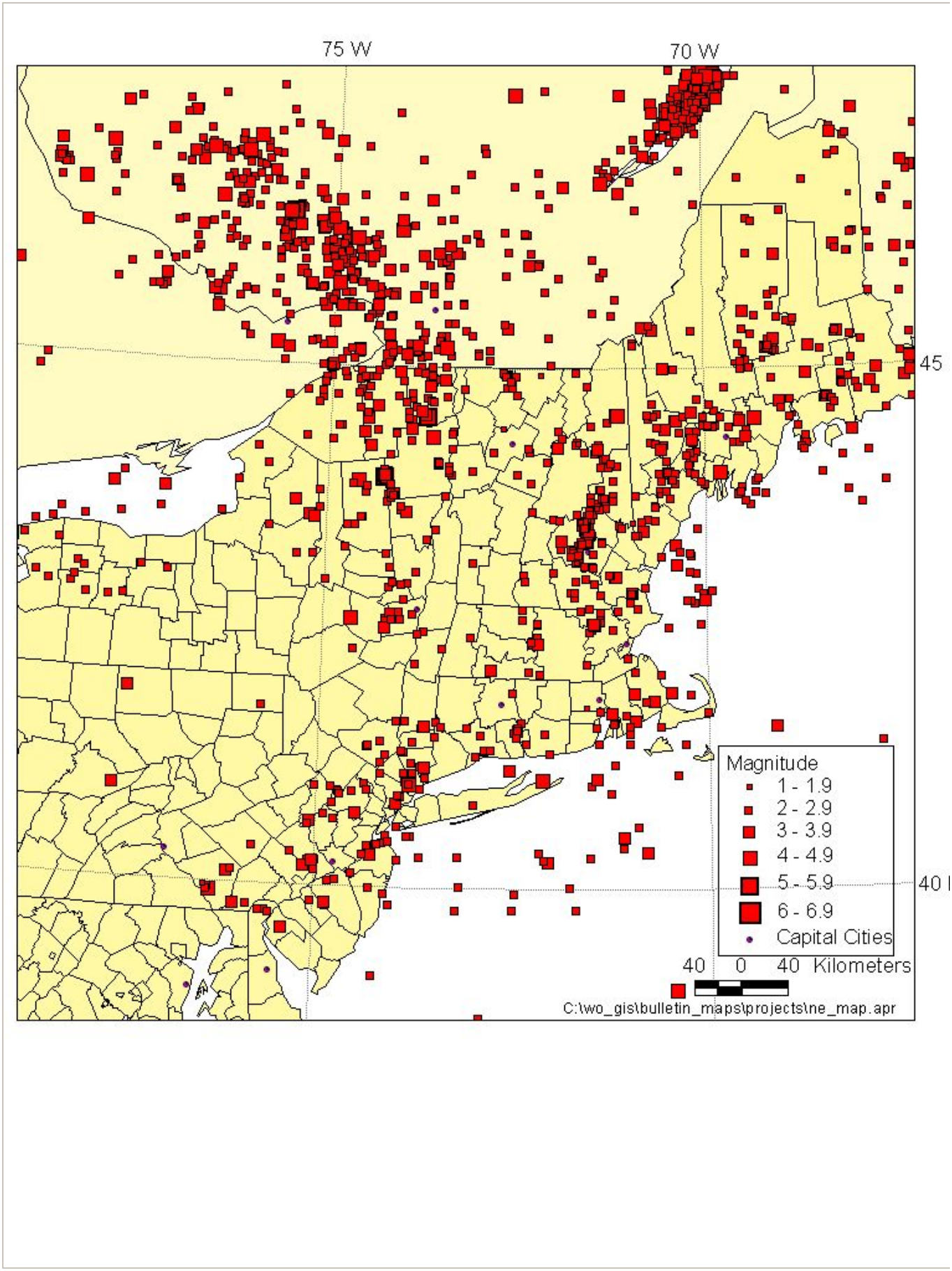

Figure 4: Seismicity for period October, 1975 - June, 2004.

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Acknowledgments

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

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