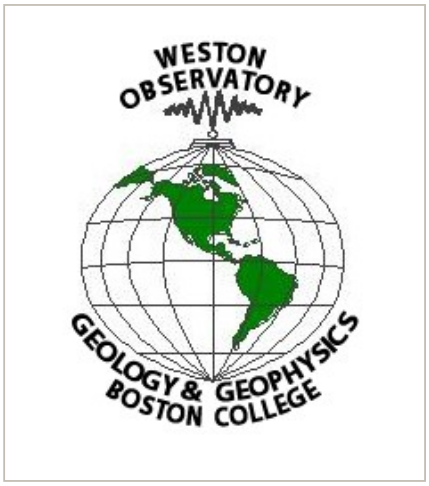
A STUDY OF NEW ENGLAND SEISMICITY

Quarterly Earthquake Report
April-June, 2004
New England
Seismic Network



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NEW ENGLAND SEISMIC NETWORK

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for

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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 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/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

- Code = station name
- Lat = station latitude, degrees north
- Long = station longitude, degrees west
- Elev = station elevation in meters
- Location = geographic location

- Operator = network operator

Table 3: Earthquake Hypocenter List

- D ate = 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

- Geographic 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 se paration, 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 arr ival

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 arriva l
- SEC = second of phase arrival
- TCAL = 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 millimicrons, 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 = sign al 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 = neares t station recording event
- 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
Edward Johnson	Project Engineer	617-552-8332	johnson@bc.edu
Dina Smith	Assistant to the Director	617-552-8335	dina.smith.1@bc.edu
		617-552-8300	
Weston Observatory		617-552-8388 (FAX)	

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TABLE 2

SEISMIC STATIONS OF THE NEW ENGLAND SEISMIC NETWORK

WES 43.7050 -72.3525 Belchertown, MATroy, NY WES UMM WES 42.3850 WES YLE PQI 46.6710

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, RI SM4 -71.30 WES SM7 42.39 -71.54 WES

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

NEW ENGLAND AND ADJACENT REGIONS

April-June, 2004

Date	Time (UTC)	Lat	Long	Depth	Mag	Int	Location
M/D/Y	Hr:Mn:Sec			(km)			
05/24/2004	08:58:28.88	43.5055	-70.9663	2.80	1.9		NH-ME BORDER, 15KM NE OF FARMINGTON, NH
06/22/2004	10:17:52.95	45.175	-69.1236	9.47	2.0		ME, 9.65KM (6MI) NE OF DOVER-FOXCROFT

* indicates Mc rather than Mn.

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TABLE 4

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

```
B4524A.XX
 SOUTHEAST MAINE CRUSTAL MODEL
 04MAY24 NH-ME BORDER, 15KM (24.14MI) NE OF FARMINGTON, NH
  DATE     ORIGIN     LAT N     LONG W   DEPTH    MN  MC  ML GAP    RMS  ERH  ERZ Q
  40524  858 28.88 43-30.33  70-57.98    2.80  1.9  .0     145    .24  1.2  1.9 B
  STN   DIST AZM   RMK HRMN    SEC    TOBS    TCAL    RES    WT AMX PRX XMAG FMP FMAG
  HNH 108.8 282 EP 0   858 46.64   17.76   17.61    .12 1.33
                ES 0   858 60.12   31.24   31.35   -.16 1.32
  HRV 121.0 204 EP 1   858 48.85   19.97   19.55    .39  .87
                ES 0   858 63.54   34.66   34.80   -.20 1.28
  WES 127.9 193 EP 1   858 49.74   20.86   20.63    .22  .93
                ES 1   858 65.42   36.54   36.73   -.21  .94
  BCX 131.1 187 EP 1   858 50.36   21.48   21.15    .30  .91  18 .14  1.7
                ES 1   858 66.12   37.24   37.64   -.46  .80
  WVL 154.4  42 EP 1   858 53.48   24.60   24.84   -.25  .87  25 .14  2.0
                ES 4   858 71.25   42.37   44.22 -1.86  .00
 QUA2 177.2 220 EP 1   858 57.02   28.14   27.88    .23  .82
                ES 0   858 78.45   49.57   49.62   -.10 1.12
  BRY 182.5 195 ES 1   858 80.01   51.13   50.79    .23  .81
  UMM 311.2  65 EP 4   859 18.09   49.21   44.42   4.78  .00   4 .12  2.0
                ES 4   859 53.35   84.47   79.06   5.39  .00
 B4622A.XX
 SOUTHEAST MAINE CRUSTAL MODEL
ME, 9.65 KM (6 MI) NE OF DOVER-FOXCROFT
  DATE     ORIGIN     LAT N     LONG W   DEPTH    MN  MC  ML GAP    RMS  ERH  ERZ Q
  40622 1017 52.95 45-13.05  69- 7.42    9.47  2.0  .0      96    .73  4.3  7.4 D
  STN   DIST AZM   RMK HRMN    SEC    TOBS    TCAL    RES    WT AMX PRX XMAG FMP FMAG
  WVL  87.6 209 EP 0 1018   6.17   13.22   14.19   -.98 3.00  52 .17  1.9
                ES 2 1018  18.38   25.43   25.25    .16 1.57
  UMM 142.9 113 EP 0 1018  16.64   23.69   22.96    .72 2.70  29 .16  2.0
                ES 2 1018  34.40   41.45   40.86    .57 1.36
  GGN 181.2  94  P 4 1018  20.90   27.95   27.69    .25  .00
                 S 4 1018  42.58   49.63   49.28    .33  .00
  PQI 183.0  28 EP 0 1018  20.43   27.48   27.91   -.46 2.49  26 .15  2.1
                ES 2 1018  41.23   48.28   49.67 -1.45 1.05
  A11 239.9 340  P 1 1018  28.45   35.50   34.93    .56 1.56
                 S 1 1018  55.38   62.43   62.18    .24 1.58
  MOQ 245.8 272  P 3 1018  30.60   37.65   35.66   1.85  .32
                 S 3 1018  56.51   63.56   63.47   -.16  .52
  A54 268.0 338  P 3 1018  31.68   38.73   38.41    .26  .48
                 S 3 1018  61.03   68.08   68.36   -.39  .48
  A21 279.7 351  P 3 1018  33.59   40.64   39.85    .78  .44
                 S 3 1018  63.88   70.93   70.94   -.03  .46
  A64 296.0 349  P 3 1018  35.61   42.66   41.86    .78  .42
                 S 3 1018  67.57   74.62   74.52    .07  .43
  HNH 302.4 236 EP 4 1018  45.73   52.78   42.65 10.10  .00
                ES 4 1018  81.33   88.38   75.92 12.40  .00
  DPQ 326.9 300  P 3 1018  39.47   46.52   45.67    .85  .37
                 S 3 1018  74.97   82.02   81.29    .73  .37
  LMN 344.8  78  P 3 1018  40.47   47.52   47.88   -.42  .35
                 S 3 1018  75.97   83.02   85.23  -2.32  .08
  WES 361.1 209 EP 4 1018  35.93   42.98   49.89  -6.92  .00
                ES 4 1018  87.17   94.22   88.81   5.39  .00
  GSQ 438.5  20  P 4 1018  52.55   59.60   59.45    .14  .00
                 S 4 1018  95.56  102.61  105.82  -3.23  .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

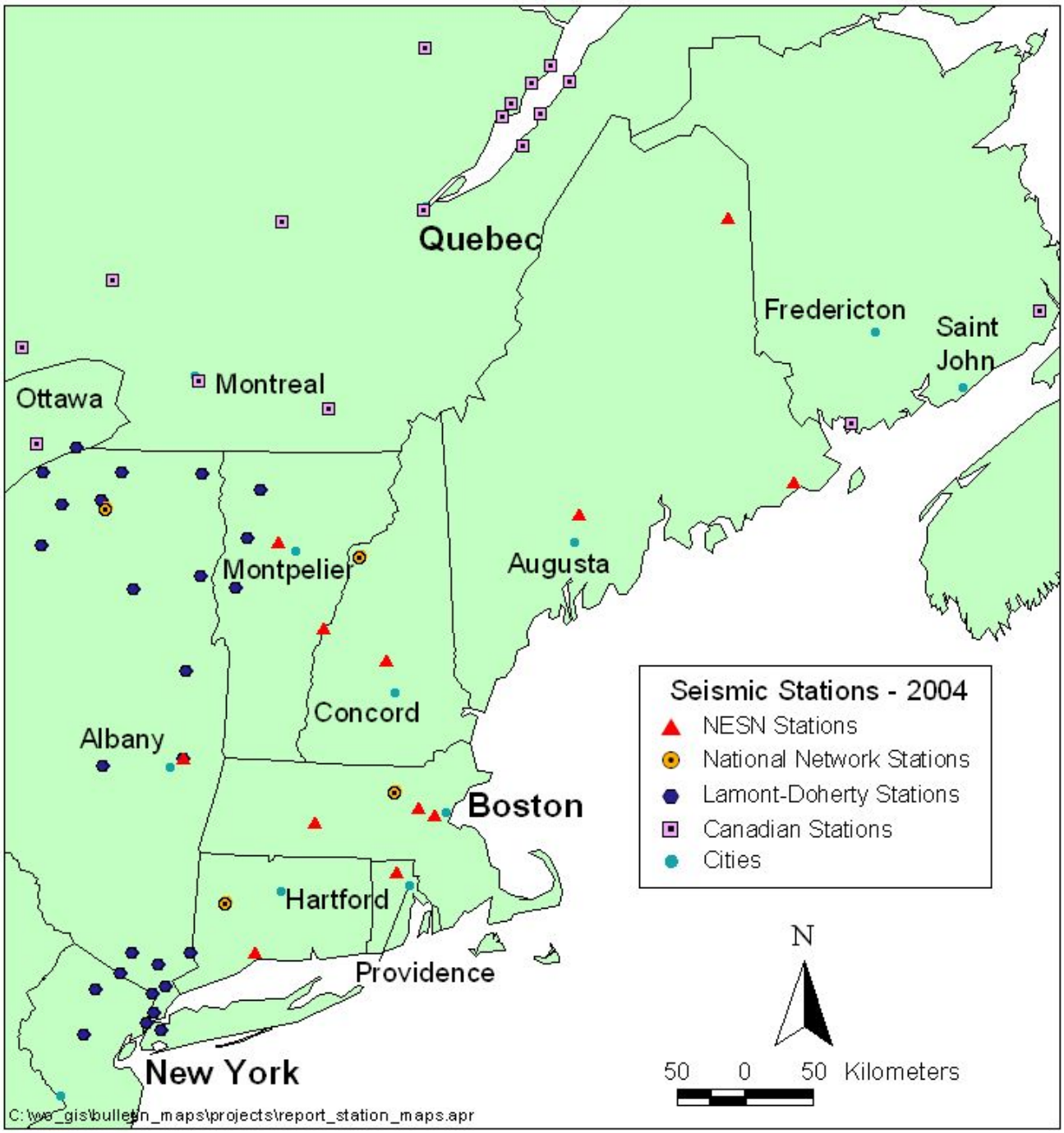

Figure 1: Map of stations of the New England Seismic Network (NESN) in operation during the period of this report. Also included are other Northeast U.S. and Canadian seismic stations in operation during this period.

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NESN Strong-Motion Station Map

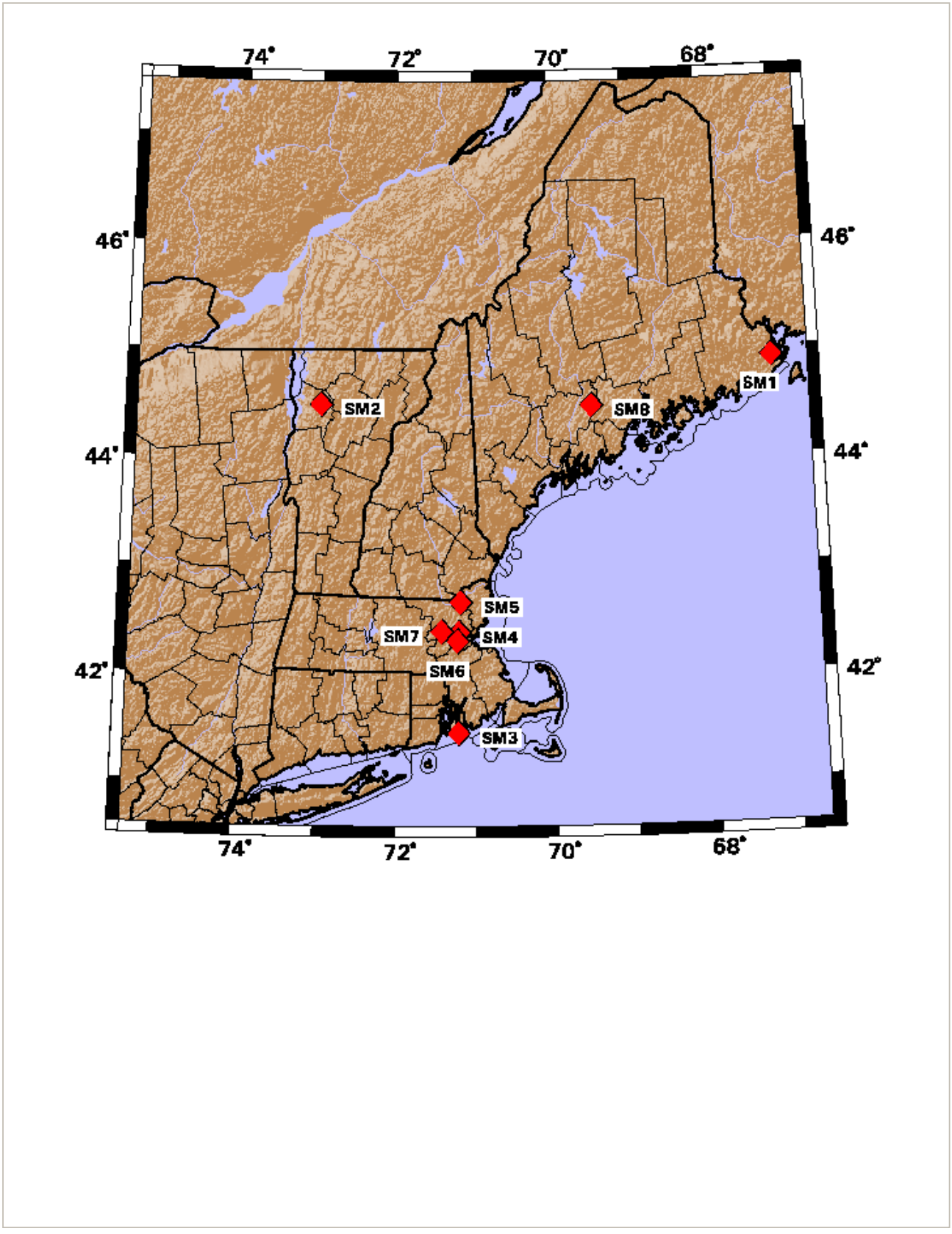

Figure 2: Map of strong-motion stations of the New England Seismic Network (NESN) in operation during the period of this report.

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NESN Quarterly Seismicity Map

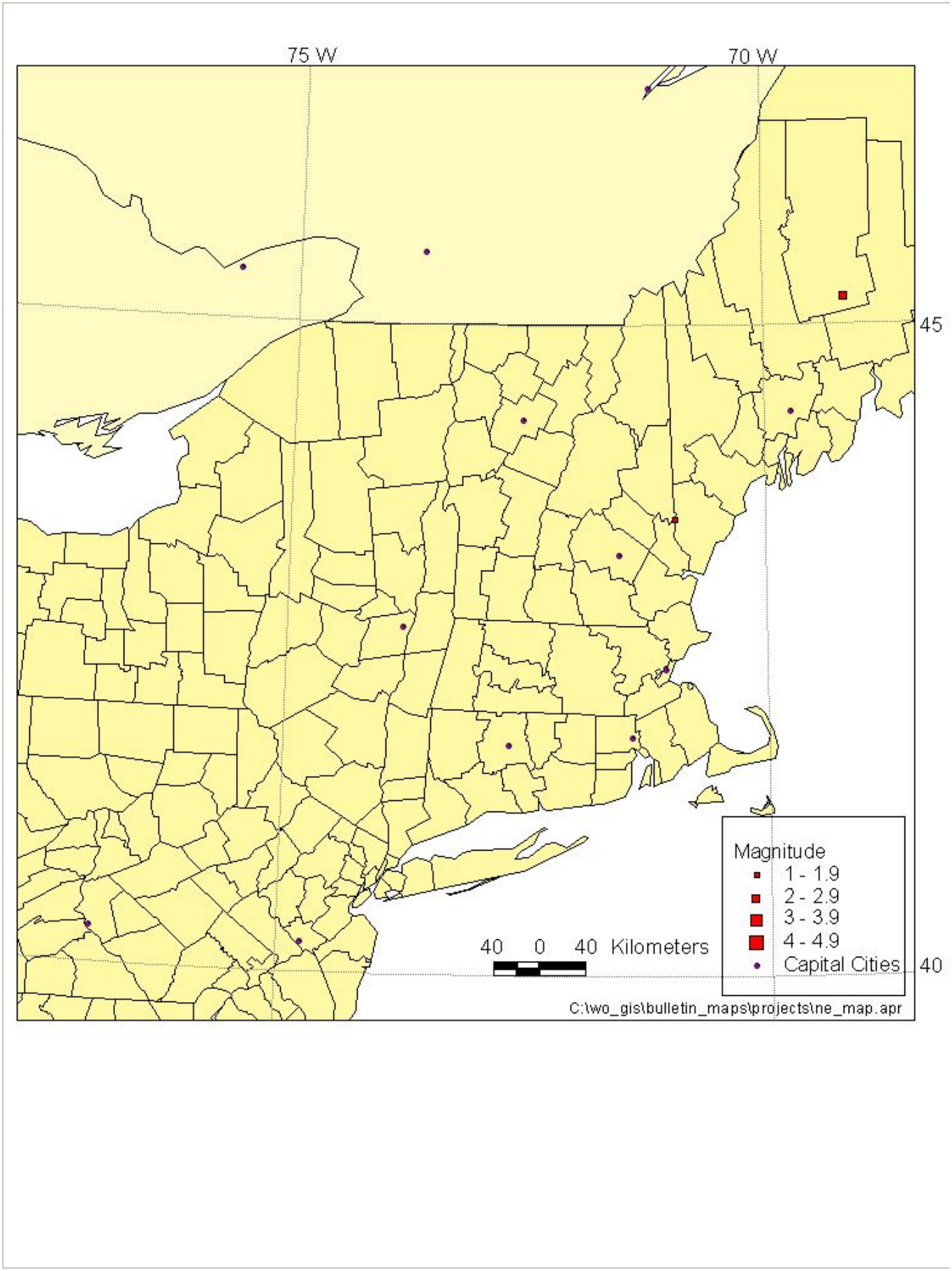

Figure 3: Earthquake epicenters located by the NESN during the period of this report.

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NESN Cumulative Seismicity Map

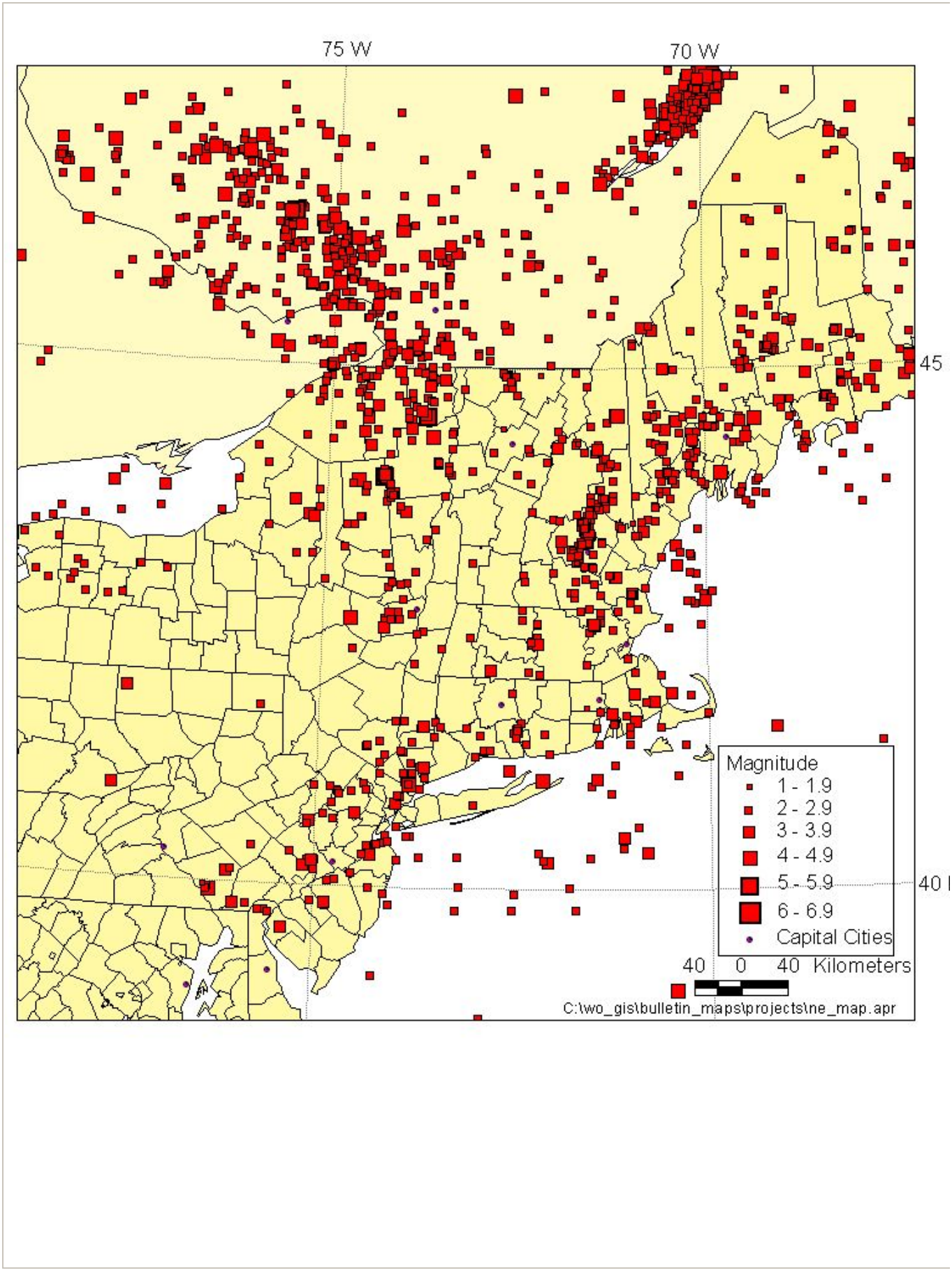

Figure 4: Seismicity for period October, 1975 - June, 2004.

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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.

References

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

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

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

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