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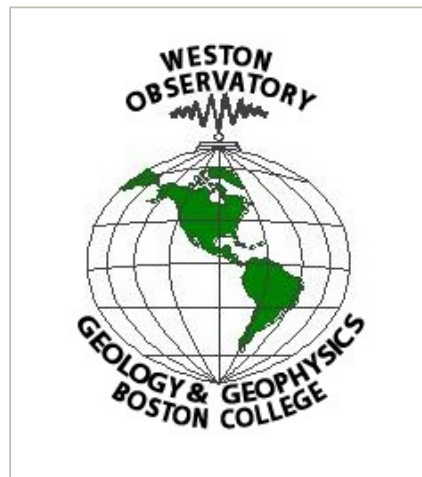
# A STUDY OF NEW ENGLAND SEISMICITY

Quarterly Earthquake Report

October-December, 2004

*NEW ENGLAND*

*SEISMIC NETWORK*



**Weston Observatory**  
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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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## Quarterly Earthquake Report

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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, 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 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 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 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 at [http://aki.bc.edu/cgi-bin/NESN/recent\\_events.pl](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/](http://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](http://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 = 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  
 $WES: 2.23 \text{ Log}(FMP) + 0.12 \text{ Log}(\text{Dist}) - 2.36$  (Rosario, 1979 )  
 $MIT: 2.21 \text{ Log}(FMP) - 1.7$  (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 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 = 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@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
Hudson, 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)		
10/06/2004	16:20:18.25	42.94	-71.96	26.26	2.0	NH, 26.2KM (16.3MI) E OF KEENE
10/08/2004	02:25:45.92	42.51	-71.47	5.00	2.4	MA, 4.25KM (2.64MI) SSE OF LITTLETON COMMON
10/08/2004	03:21:02.12	42.51	-71.47	0.9	-0.2	MA, 4.25KM (2.64MI) SSE OF LITTLETON COMMON
10/08/2004	12:38:13.04	42.51	-71.47	2.01	1.2	MA, 4.25KM (2.64MI) SSE OF LITTLETON COMMON
10/14/2004	09:36:03.58	41.39	-73.99	9.17	2.8	NY, 12.5 KM (7.77 MI) SOUTH OF NEWBURGH

\* indicates Mc rather than Mn.

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TABLE 4

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

```

D4A06A.XX
SOUTHEAST MAINE CRUSTAL MODEL
04OCT06 NH, 26.2KM (16.3MI) E OF KEENE
DATE ORIGIN LAT N LONG W DEPTH MN MC ML GAP RMS ERH ERZ Q
41006 1620 18.25 42-56.34 71-57.80 26.26 1.6 2.0 157 .43 3.2 7.5 C
STN DIST AZM RMK HRMN SEC TOBS TCAL RES WT AMX PRX XMAG FMP FMAG
HRV 58.4 145 EP 1 1620 27.85 9.60 10.24 -.67 1.22
ES 1 1620 36.56 18.31 18.22 .04 1.24
QUA2 80.0 204 EP 0 1620 32.08 13.83 13.32 .48 1.55 13 .10 1.3 61 2.0
ES 3 1620 40.70 22.45 23.70 -1.31 .30
WES 81.0 140 EP 0 1620 31.76 13.51 13.45 .05 1.58 34 .08 1.8 59 2.0
ES 1 1620 42.50 24.25 23.95 .28 1.17
HNH 89.1 343 EP 0 1620 32.98 14.73 14.61 .09 1.55
ES 3 1620 42.04 23.79 26.01 -2.27 .02
BRY 118.7 163 ES 3 1620 50.67 32.42 32.58 -.26 .36
D4A08A.XX
SOUTH & COASTAL NEW ENGLAND, CHIBURIS, 1979
04OCT08 MA, 4.25KM (2.64MI) SSE OF LITTLETON COMMON
DATE ORIGIN LAT N LONG W DEPTH MN MC ML GAP RMS ERH ERZ Q
41008 225 45.92 42-30.67 71-28.08 2.00 .0 2.0 148 .50 2.2 5.0 D
STN DIST AZM RMK HRMN SEC TOBS TCAL RES WT AMX PRX XMAG FMP FMAG
HRV 7.4 266 EP 1 225 47.11 1.19 1.33 -.17 1.43
ES 1 225 48.04 2.12 2.36 -.29 1.42
WES 18.5 139 IPDO 225 49.26 3.34 3.14 .19 1.87 68 1.9
ES 1 225 51.15 5.23 5.59 -.38 1.39
QUA2 77.3 250 EP 3 226 1.62 15.70 12.83 2.84 .02 56 2.0
ES 3 226 10.90 24.98 22.83 2.09 .21
FFD 107.6 352 EP 3 226 4.95 19.03 17.84 1.17 .37
ES 0 226 17.45 31.53 31.75 -.25 1.56
HNH 148.4 333 EP 3 226 11.24 25.32 24.13 1.16 .33
ES 0 226 28.87 42.95 42.95 -.06 1.41
D4A08B.XX
SOUTH & COASTAL NEW ENGLAND, CHIBURIS, 1979
04OCT08 MA, 4.25KM (2.64MI) SSE OF LITTLETON COMMON
DATE ORIGIN LAT N LONG W DEPTH MN MC ML GAP RMS ERH ERZ Q
41008 321 2.12 42-28.64 71-29.96 .90 .0 -.2 181 .14 .0 .0 A
STN DIST AZM RMK HRMN SEC TOBS TCAL RES WT AMX PRX XMAG FMP FMAG
HRV 5.8 304 EP 0 321 3.09 .97 1.04 -.10 1.04 4 -.7
S 0 321 4.06 1.94 1.85 .03 1.05
WES 17.9 125 EP 0 321 5.39 3.27 3.03 .23 .92 10 .3
S 0 321 7.39 5.27 5.39 -.14 .99
D4A08C.XX
SOUTH & COASTAL NEW ENGLAND, CHIBURIS, 1979
04OCT08 MA, 4.25KM (2.64MI) SSE OF LITTLETON COMMON
DATE ORIGIN LAT N LONG W DEPTH MN MC ML GAP RMS ERH ERZ Q
41008 1238 13.04 42-17.55 71-48.84 2.01 .0 1.2 192 1.78 5.9 **** D
STN DIST AZM RMK HRMN SEC TOBS TCAL RES WT AMX PRX XMAG FMP FMAG
HRV 31.7 42 EP 0 1238 20.00 6.96 5.32 1.61 1.02 16 .9
ES 0 1238 20.83 7.79 9.47 -1.73 1.01
WES 41.8 76 EP 0 1238 22.77 9.73 6.99 2.73 .94 33 1.5
ES 0 1238 24.05 11.01 12.45 -1.45 1.01
QUA2 44.4 268 ES 0 1238 25.31 12.27 13.21 -.98 1.01
D4A14A.XX
SE OF NEW YORK, HUGHES & LUETGERT
04OCT14 NY, 12.5 KM (7.77 MI) SOUTH OF NEWBURGH
DATE ORIGIN LAT N LONG W DEPTH MN MC ML GAP RMS ERH ERZ Q
41014 936 3.58 41-23.33 73-59.41 9.17 .0 2.8 77 .40 1.5 2.7 C
STN DIST AZM RMK HRMN SEC TOBS TCAL RES WT AMX PRX XMAG FMP FMAG
MANY 21.1 151 EP 3 936 6.57 2.99 3.54 -.57 .48
ES 1 936 9.74 6.16 6.30 -.18 1.47
TBR 33.6 215 EP 1 936 8.56 4.98 5.35 -.41 1.42
ES 0 936 13.19 9.61 9.53 .01 1.91
PAL 43.3 171 EP 0 936 10.38 6.80 6.78 -.01 1.88
ES 0 936 15.79 12.21 12.08 .10 1.88
GPD 57.1 224 EP 0 936 12.35 8.77 8.86 -.15 1.83
ES 0 936 19.61 16.03 15.78 .15 1.83
CPNY 66.4 178 EP 0 936 13.82 10.24 10.28 -.04 1.79
ES 0 936 22.00 18.42 18.29 .13 1.79
BRNJ 92.2 212 EP 1 936 18.31 14.73 14.18 .53 1.26
ES 3 936 29.63 26.05 25.25 .78 .41
QUA2 168.2 54 EP 3 936 32.50 28.92 25.77 3.12 .00 147 2.9
ES 3 936 51.30 47.72 45.87 1.79 .18
BINY 188.3 298 EP 0 936 32.49 28.91 28.74 .09 1.34
    
```

		ES 0	936	54.44	50.86	51.16	-.44	1.33		
BRY	212.4	74	EP 1	936	35.41	31.83	32.06	-.29	.94	
			ES 2	936	60.19	56.61	57.06	-.56	.61	
ACCN	223.2	7	EP 2	936	36.54	32.96	33.39	-.50	.60	
			ES 3	936	61.99	58.41	59.44	-1.14	.26	
HRV	236.9	58	EP 2	936	39.80	36.22	35.09	1.10	.53	131 2.9
			ES 1	936	65.90	62.32	62.46	-.20	.87	
WES	247.5	63	EP 3	936	37.37	33.79	36.40	-2.62	.00	92 2.6
			ES 0	936	68.75	65.17	64.79	.36	1.12	
HNH	293.0	29	EP 3	936	48.30	44.72	42.02	2.67	.00	97 2.7
			ES 3	936	80.99	77.41	74.79	2.56	.01	
MDV	297.5	13	EP 0	936	46.51	42.93	42.56	.34	.94	
			ES 2	936	79.02	75.44	75.77	-.36	.46	
MIV	300.7	7	EP 3	936	45.83	42.25	42.96	-.77	.22	
			ES 3	936	79.65	76.07	76.47	-.50	.23	
FFD	300.8	40	EP 2	936	47.70	44.12	42.97	1.13	.41	
			ES 4	936	84.20	80.62	76.49	4.09	.00	

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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

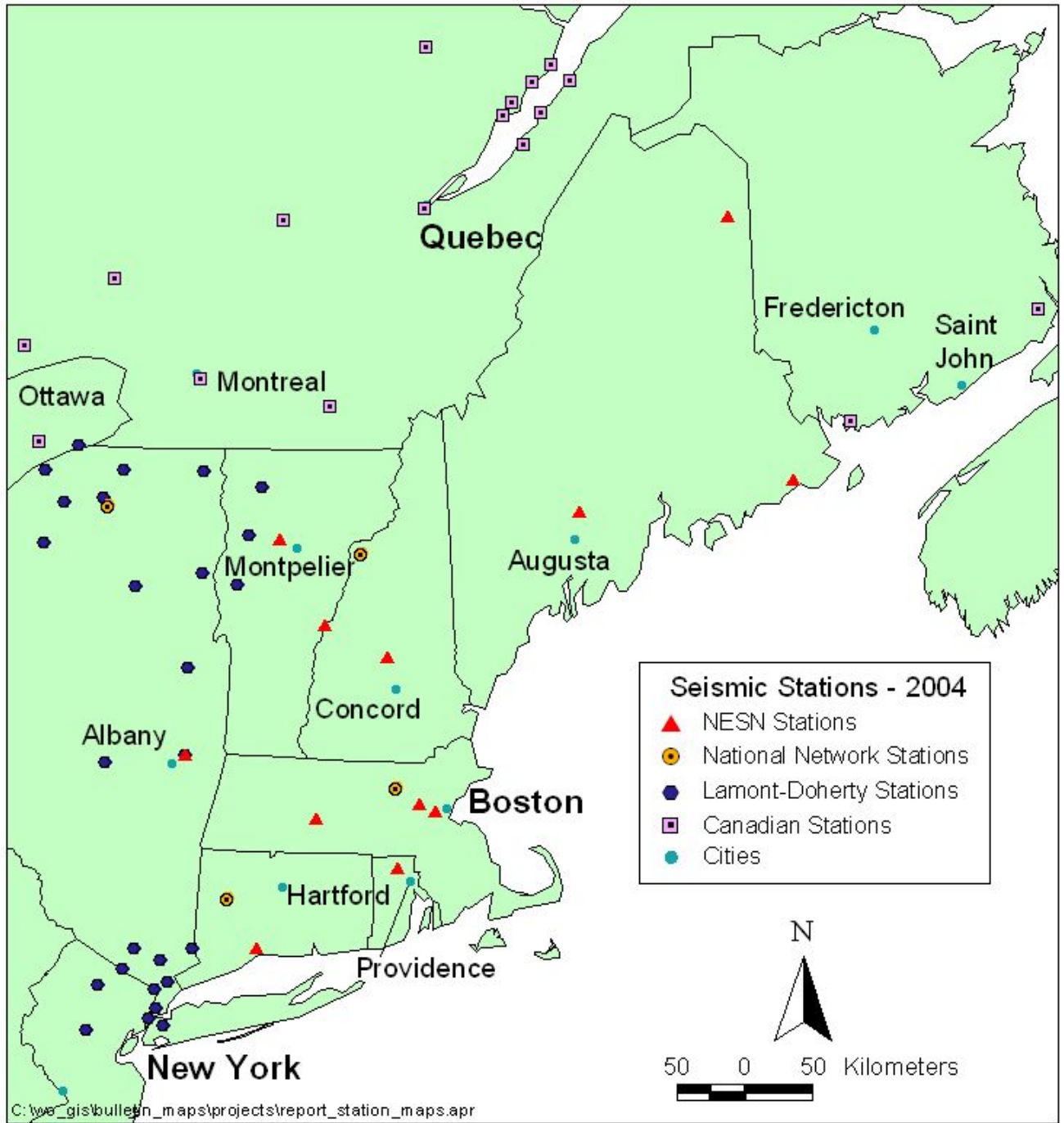


Figure 1: Map of stations of the New England Seismic Network (NESN) in operation during the period of this report. Also included are other Northeast U.S. and Canadian seismic stations in operation during this period.

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NESN Strong-Motion Station Map



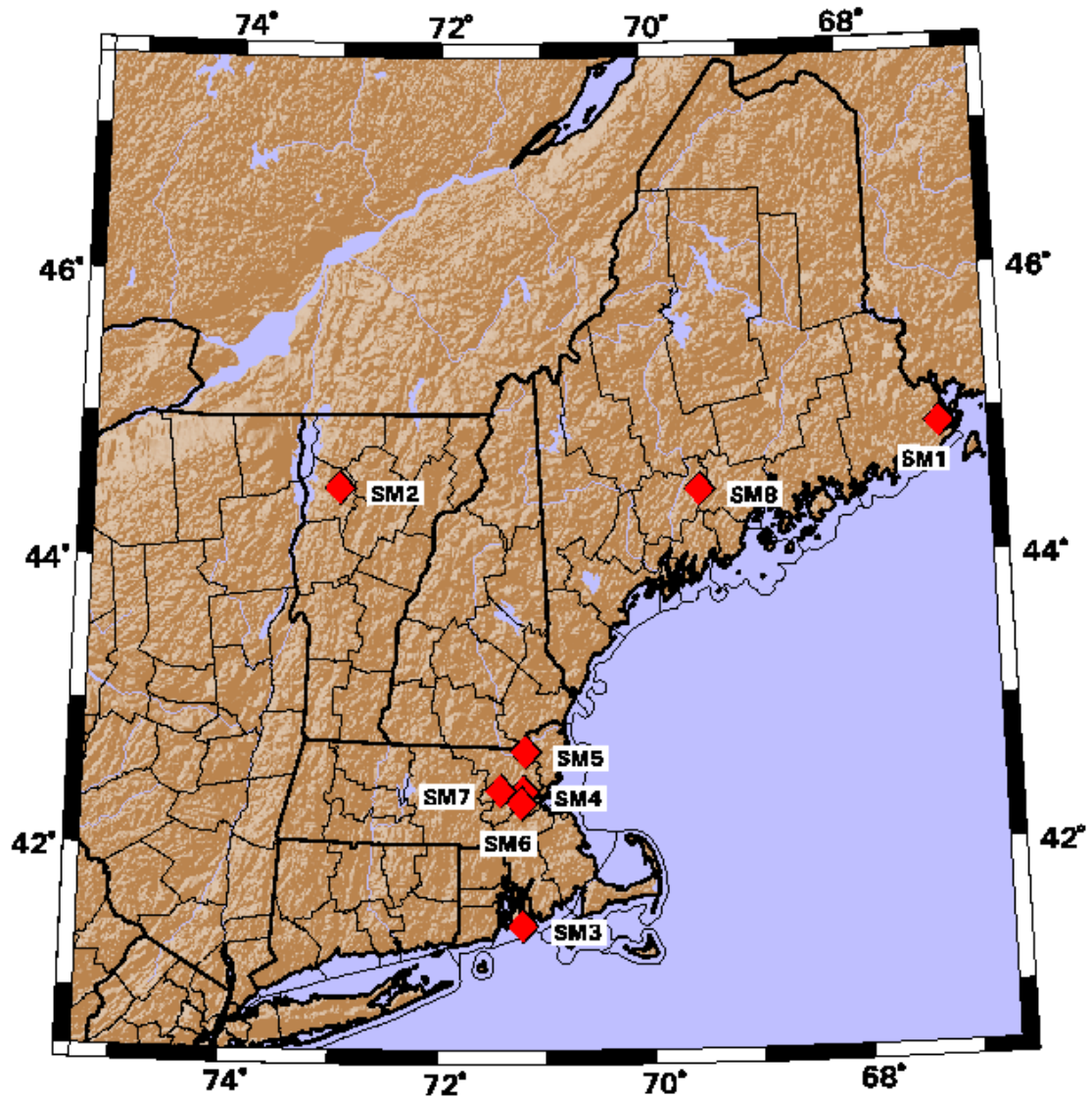


Figure 2: Map of strong-motion stations of the New England Seismic Network (NESN) in operation during the period of this report.

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### NESN Quarterly Seismicity Map

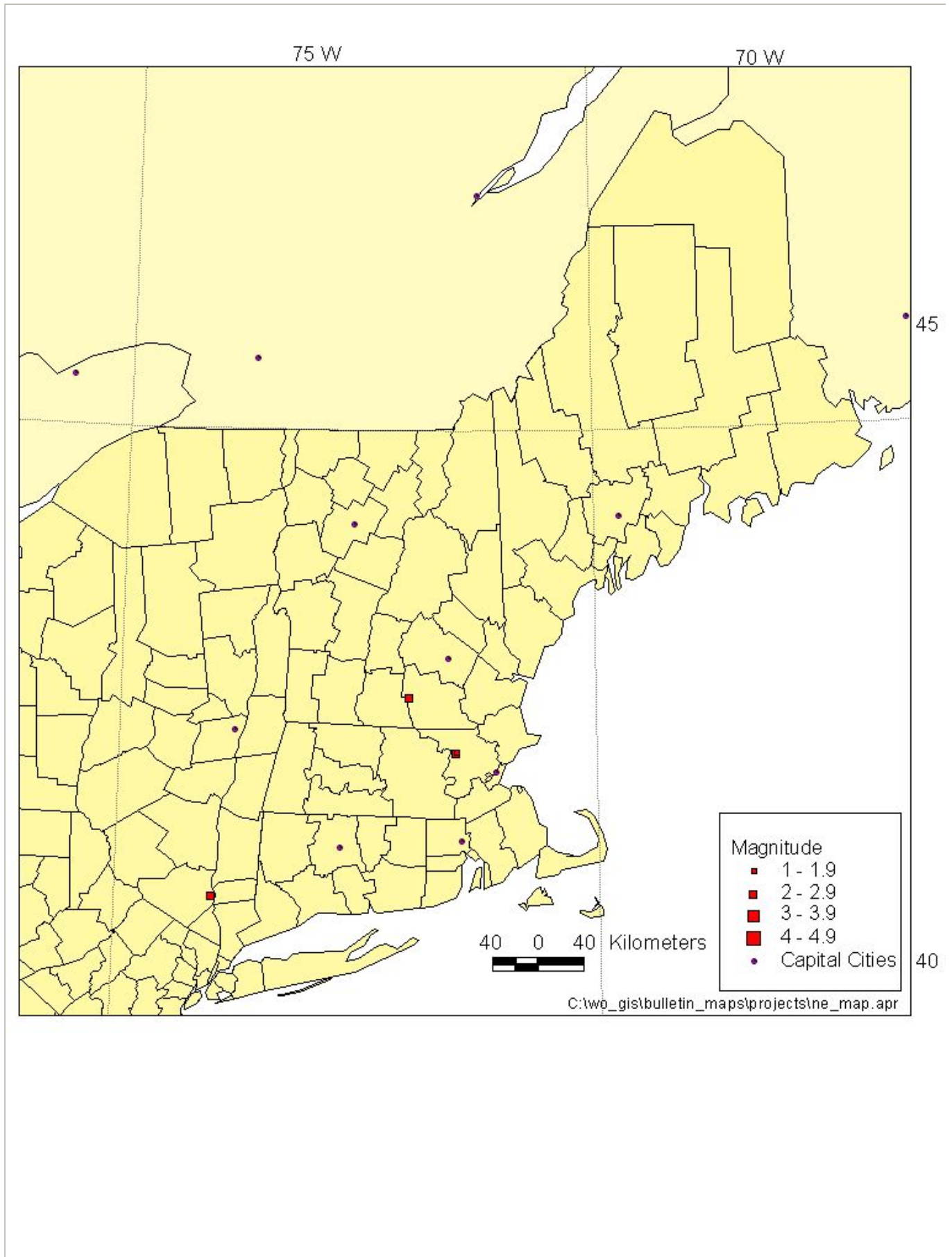


Figure 3: Earthquake epicenters located by the NESN during the period of this report.

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### NESN Cumulative Seismicity Map

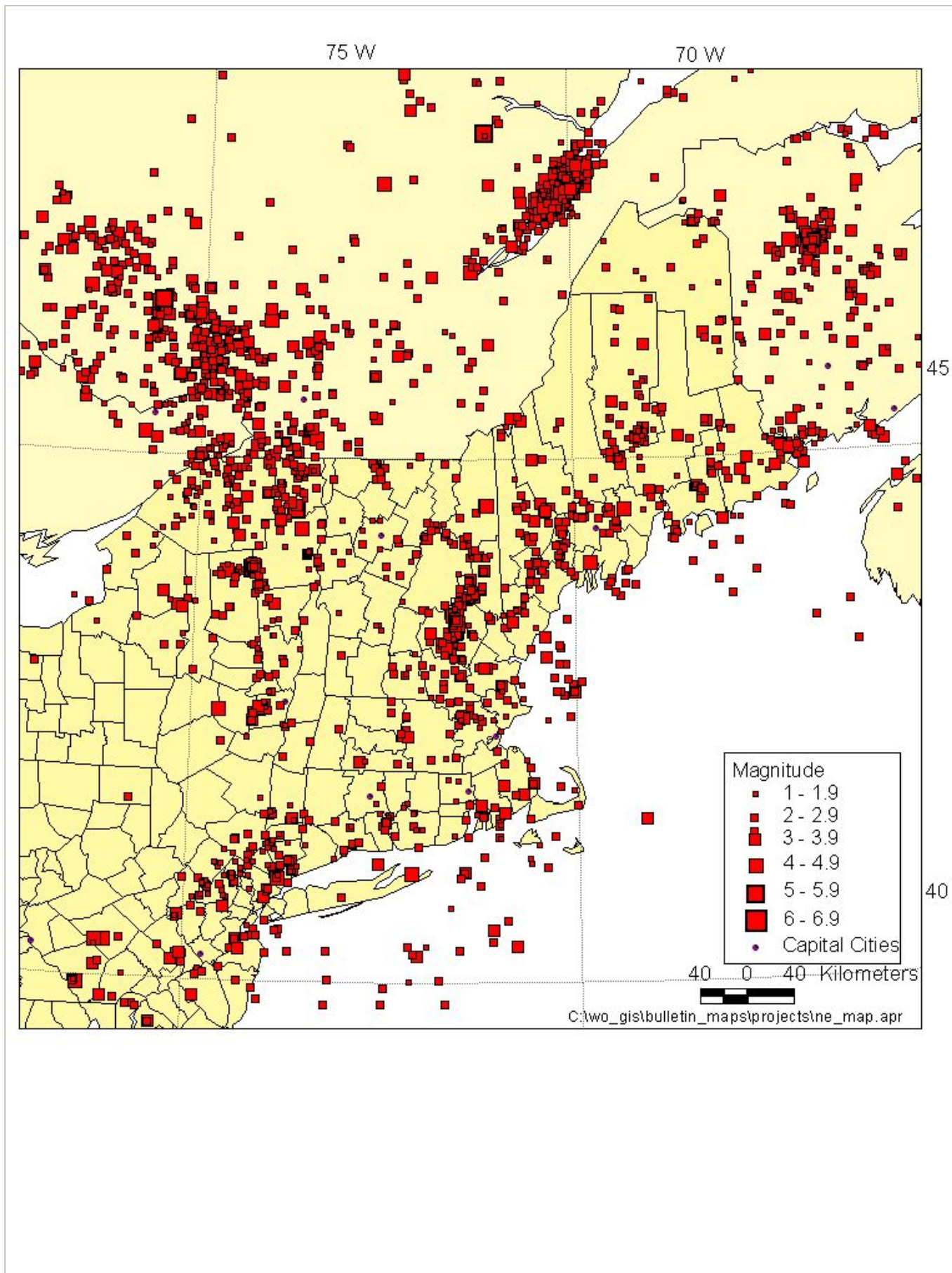


Figure 4: Seismicity for period October, 1975 - December, 2004.

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### 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.

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