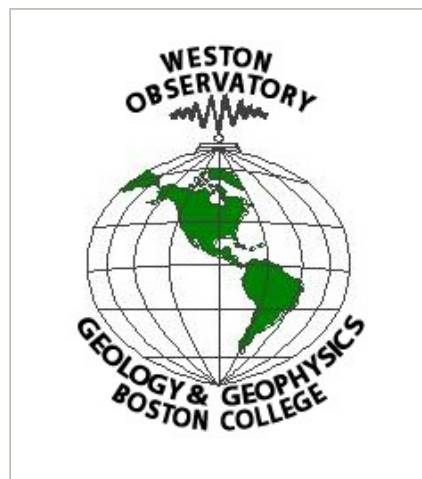


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## A STUDY OF NEW ENGLAND SEISMICITY

Quarterly Earthquake Report  
April-June, 2004  
*NEW ENGLAND  
SEISMIC NETWORK*



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**381 Concord Road**  
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for

United States Geological Survey

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**Notice**

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## Quarterly Earthquake Report

April-June, 2004

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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 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](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

- 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

- Date = 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:  $2.23 \text{ Log(FMP)} + 0.12 \text{ Log(Dist)} - 2.36$  (Rosario, 1979 )  
 MIT:  $2.21 \text{ Log(FMP)} - 1.7$  (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 separation, 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 arrival
    - 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 arrival
    - 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 = signal 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 = nearest 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
Weston Observatory		617-552-8300	
		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	Sta	Arrival Time
Yr/Mo/Dy		Hr:Mn:Sec
None recorded this period.		

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NESN Station Map

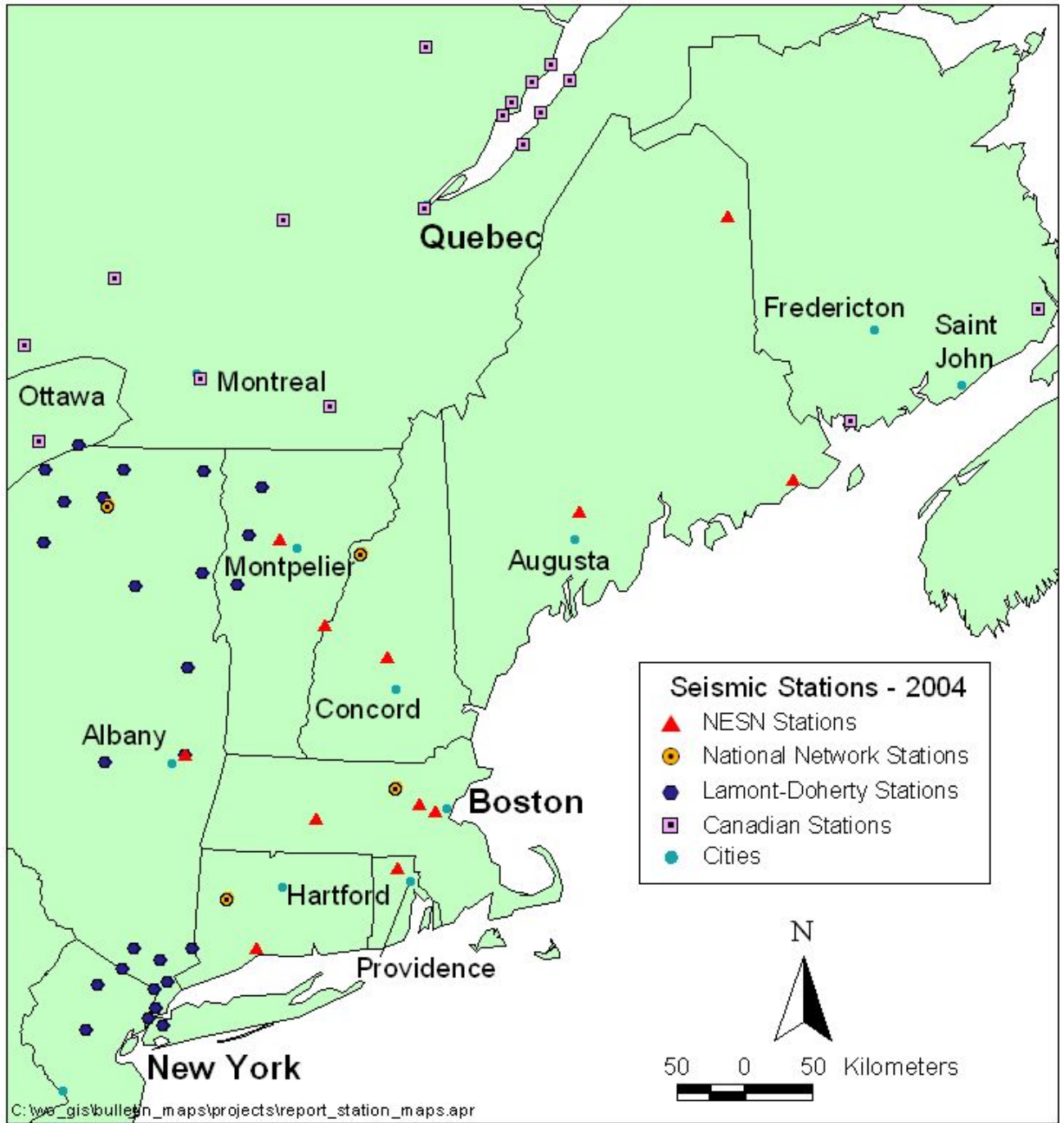


Figure 1: Map of stations of the New England Seismic Network (NESN) in operation during the period of this report. Also included are other Northeast U.S. and Canadian seismic stations in operation during this period.

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NESN Strong-Motion Station Map



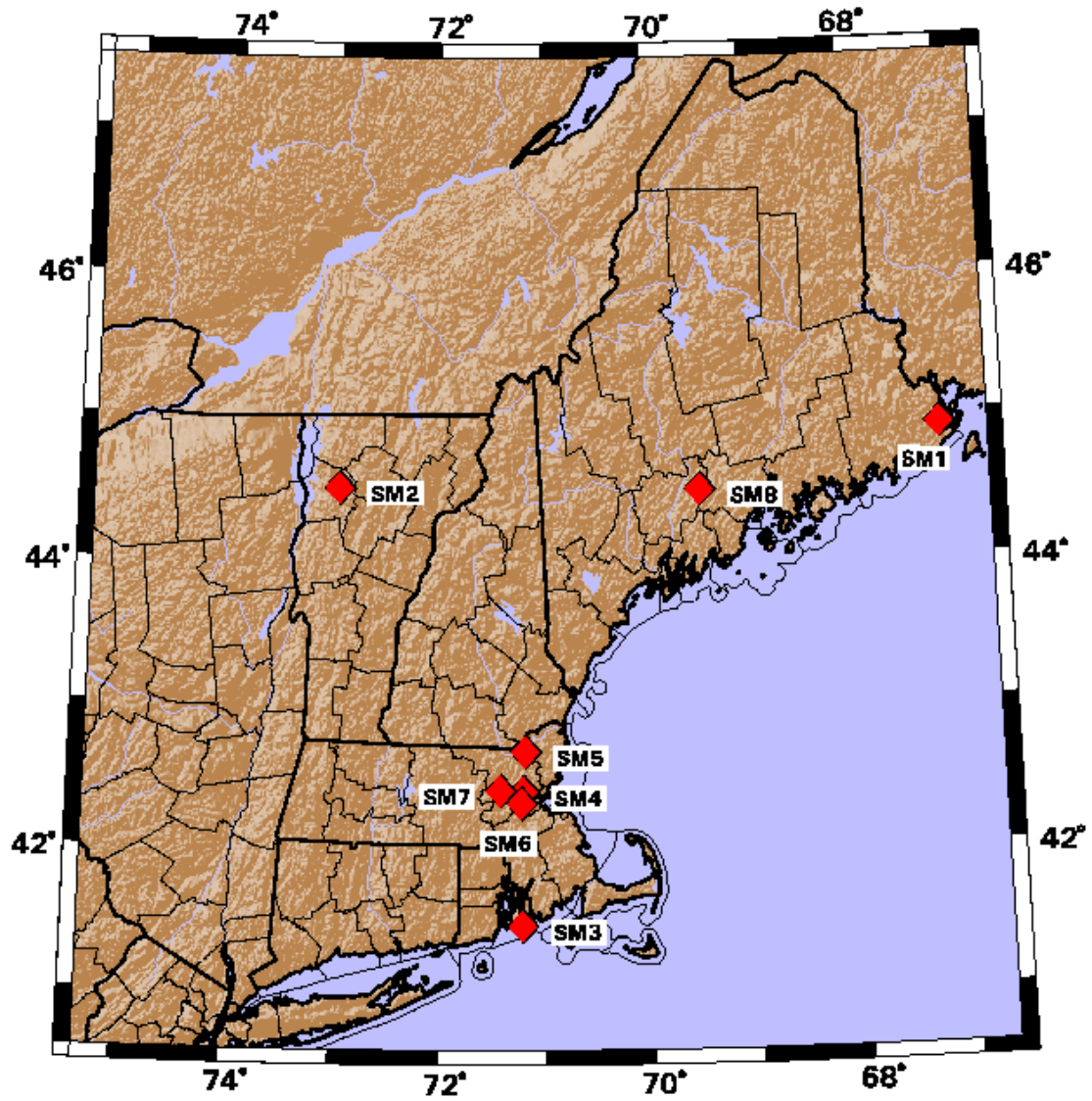


Figure 2: Map of strong-motion stations of the New England Seismic Network (NESN) in operation during the period of this report.

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### NESN Quarterly Seismicity Map



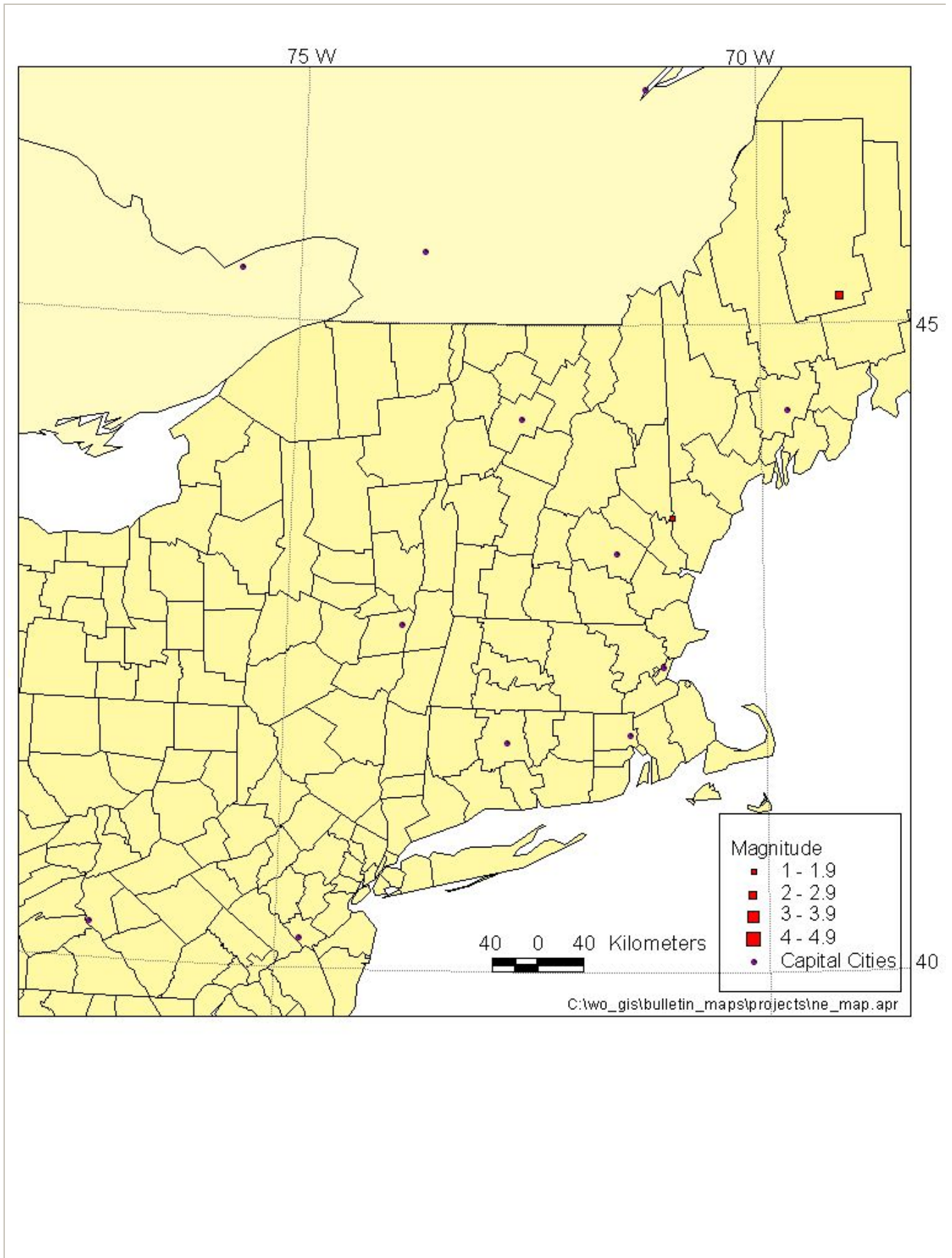


Figure 3: Earthquake epicenters located by the NESN during the period of this report.

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### NESN Cumulative Seismicity Map

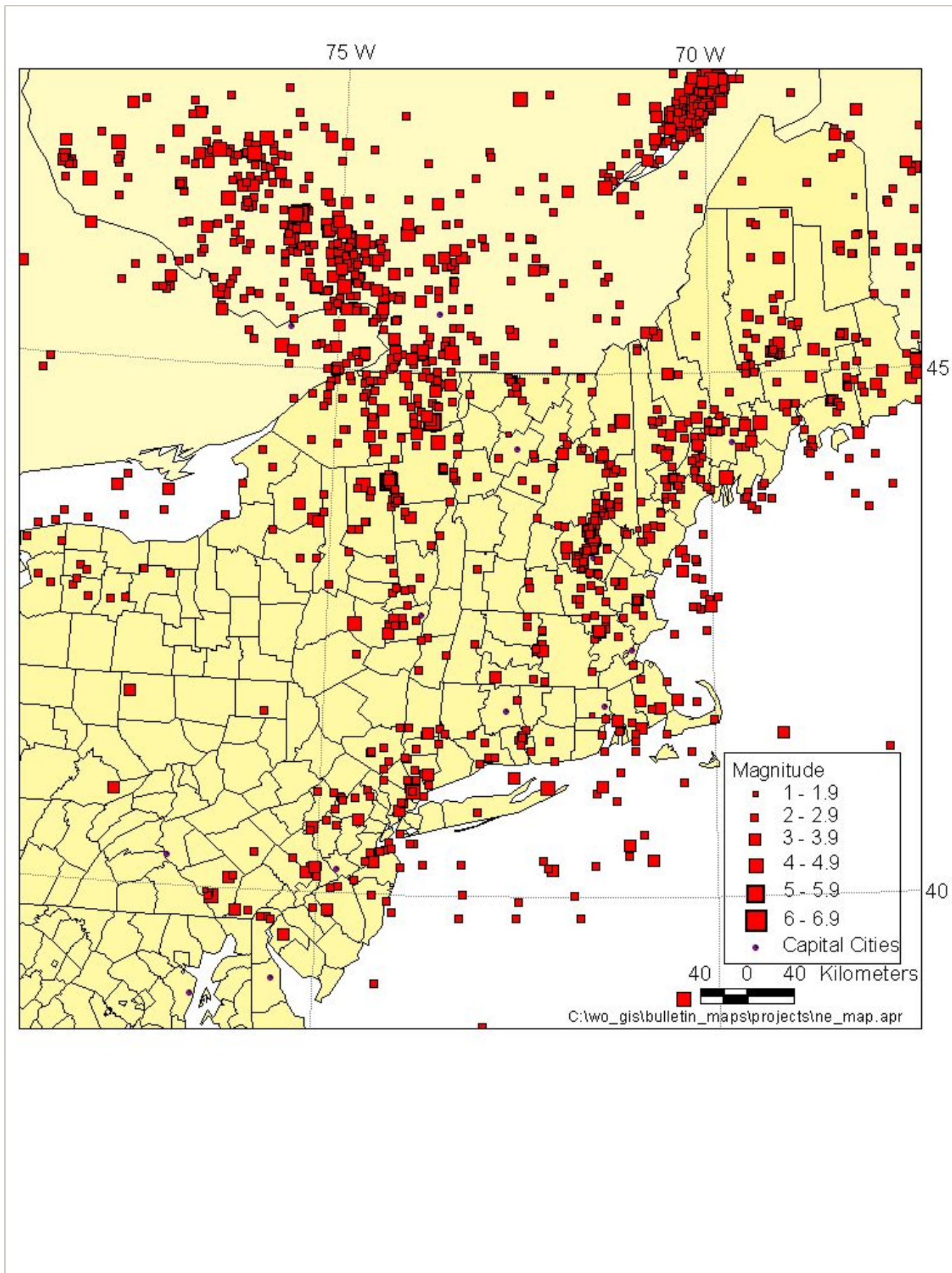


Figure 4: Seismicity for period October, 1975 - June, 2004.

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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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