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Introduction

Since 1967 the U.S. Geological Survey has operated the Northern California Seismic Network (NCSN) to provide earthquake data for a wide range of research topics and hazard-reduction activities. In addition to regional earthquake monitoring, the network has played a role in advancing studies of earthquake forecasting, fault mechanics, tectonics, volcano hazards, earth structure, and geothermal phenomena. A review of the research derived from data recorded by the NCSN and a complete bibliography can be found in *Oppenheimer et al.* (1992). This bulletin documents the status of the network for 1992 and reviews highlights of the year's seismicity.

Network Operations

The Northern California Seismic Network is designed to detect all local earthquakes having signal strength above the background level of microseisms. The network configuration was motivated by the need to monitor active faults and volcanoes with a station density sufficient to determine the focal depth of shallow (0-15 km) crustal earthquakes. Depending on the concentration of stations in a region, the magnitude (*M*) level at which earthquake detection is complete varies from approximately 1.4 in parts of the central Coast Ranges to 2.6 in the Klamath Mountain range. However, earthquakes with $M<1.0$ are routinely detected throughout the network. The network in 1992 operated 359 stations, and recorded an additional 56 stations operated by other networks (Tables 1 and 2; Figure 1). During 1992 eight new stations were installed, and four were removed (Table 3).

Earthquake detection and location occurs on two independent data acquisition systems, the Real-Time-Picker (RTP) and CalTech-USGS-Seismic-Processing (CUSP) system. The RTP is a parallel microprocessor system developed by the NCSN (*Allen*, 1978, 1982) which measures station arrival times and coda-durations from all of the stations in the network. This information is then associated to calculate earthquake origin times, locations, and duration magnitudes. The RTP locations form the basis of the NCSN earthquake notification system that automatically alerts seismologists within minutes of the occurrence of any significant seismicity. Unlike the CUSP system, no seismograms are retained.

The same data are processed through the CUSP system, a complete earthquake detection, location, and data management system originally developed by Carl Johnson of the California Institute of Technology and subsequently enhanced by scientists from the Southern California Seismic Network (SCSN) and NCSN. The CUSP system digitizes 512 channels of input at 100 samples/sec with 12 bit A/D resolution, detects earthquakes, demultiplexes the digital data stream, and tags each "trigger" with a unique identification number for data management. The system then automatically computes the *P*-arrival times and coda durations, locates the earthquake, and "posts" the earthquake for review by seismic analysts. The analysts examine the digital seismograms on computer screens and revise the parameters as necessary to properly locate the earthquake. Subsequently the digital seismograms and earthquake locations are stored on magnetic and optical media for later research. In addition, a continuous digital recording of the entire network provides a backup. The combined power of the CUSP, RTP, and backup tape systems ensures complete recording of ongoing earthquake sequences.

Because of monitoring responsibilities, the NCSN has taken considerable efforts to operate their earthquake detection system with a high degree of reliability. Electricity for the computers and portions of the microwave telemetry system is supplied through an uninterruptable power supply with standby emergency power backup, critical hardware is seismically braced, and earthquake acquisition and monitoring functions occur simultaneously on backup computers. The NCSN also operates software that automatically notifies the seismologist on duty if seismicity exceeds pre-established criteria or if the computers malfunction.

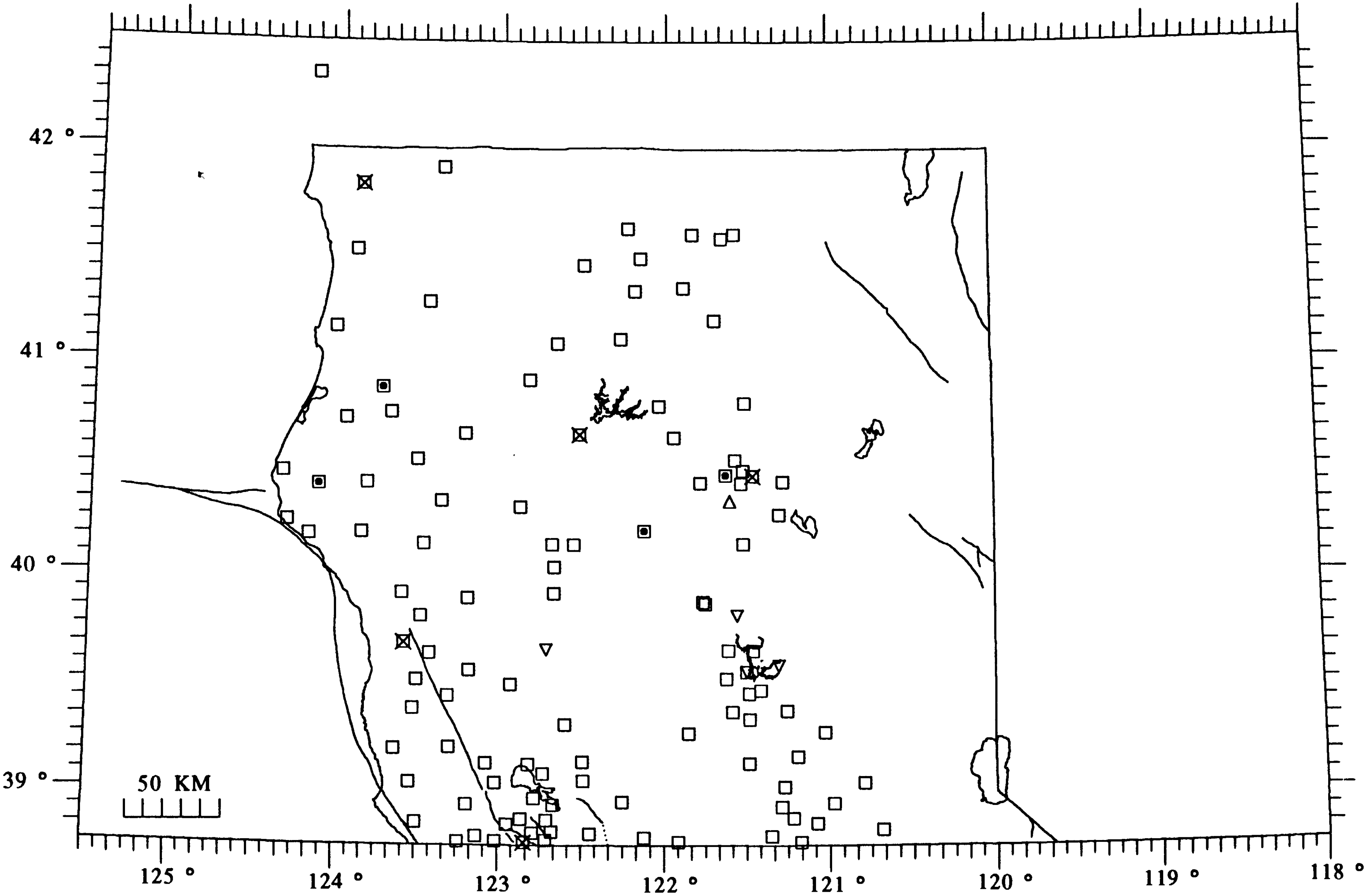

Figure 1. Seismic stations recorded by the NCSN during 1992. Solid lines depict faults with displacement during the Quarternary.

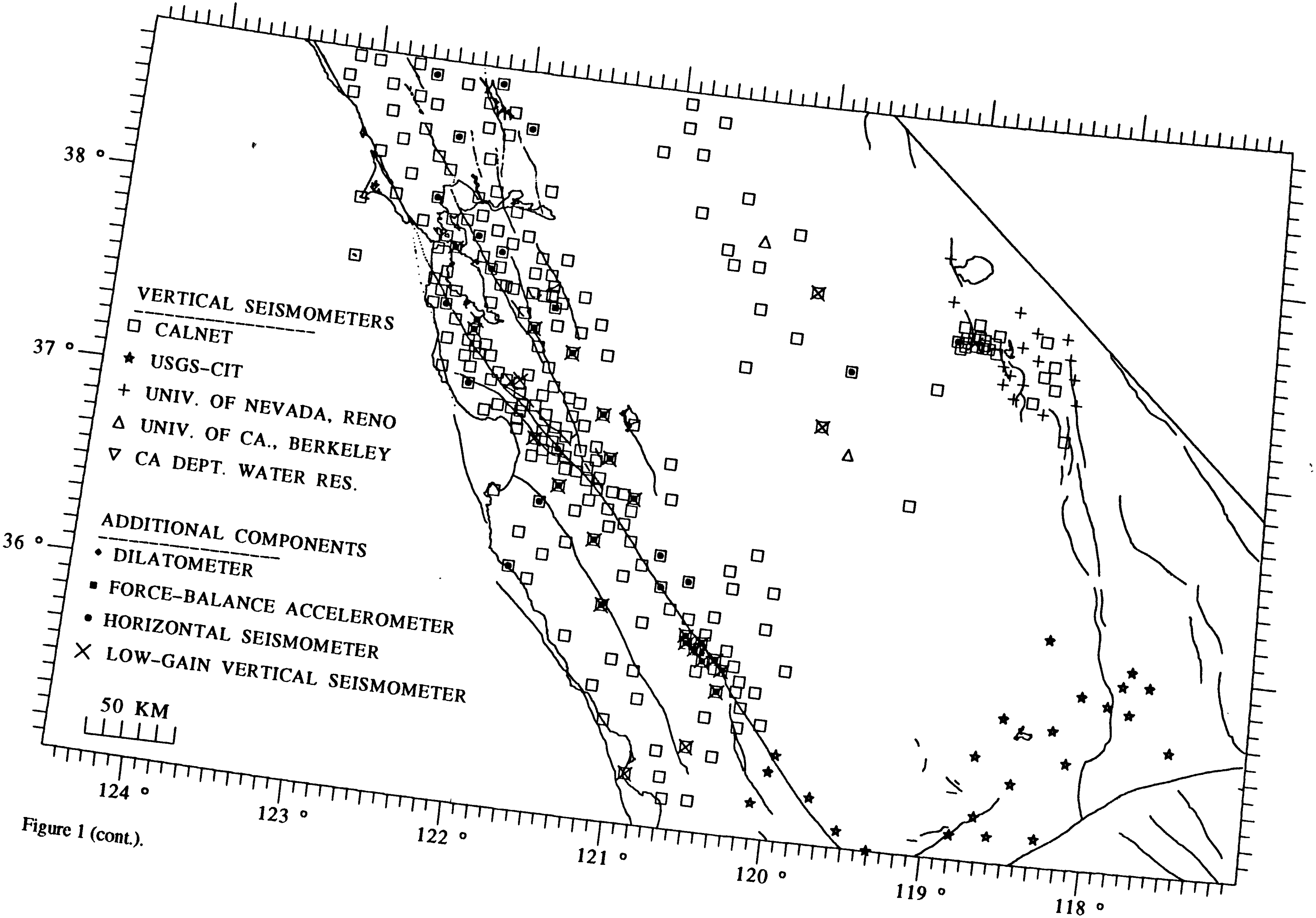

Figure 1 (cont.).

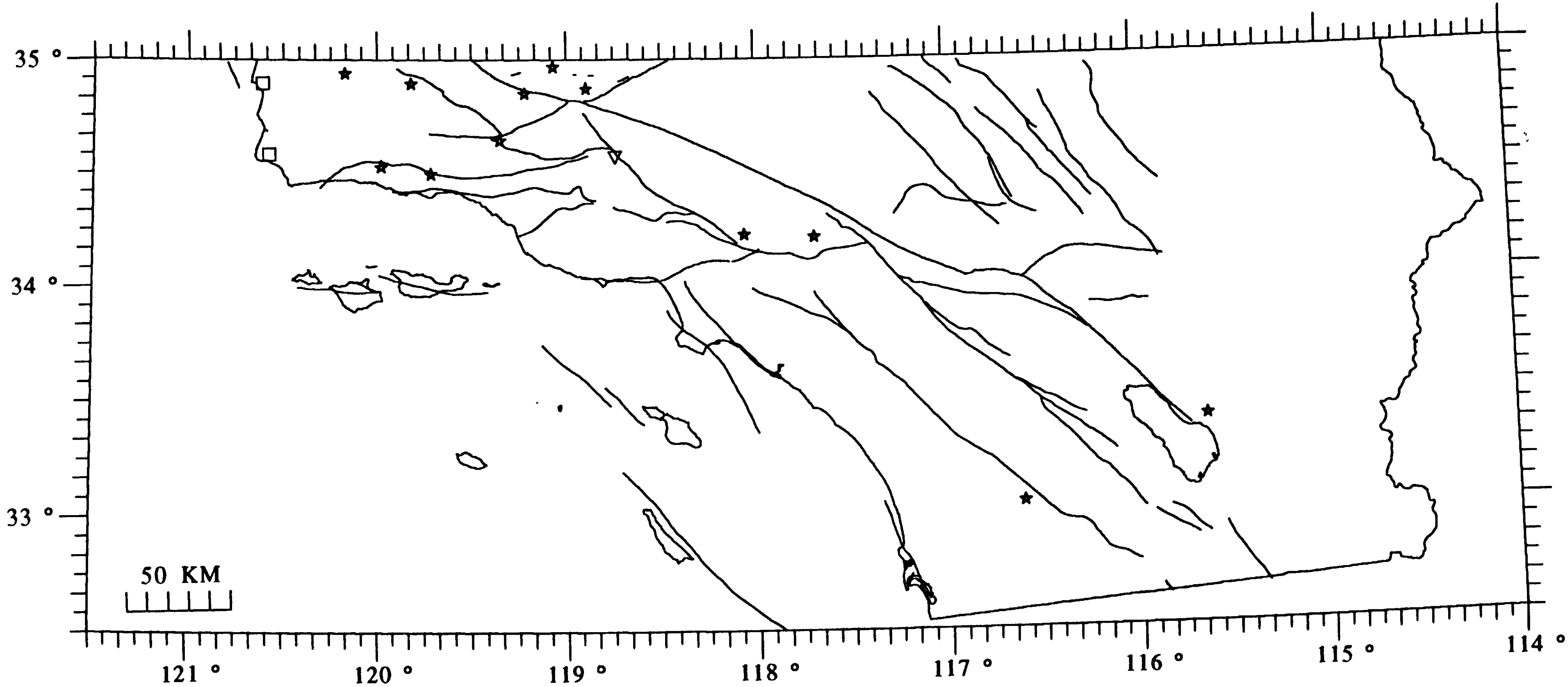

Figure 1 (cont.).

Table 1. Station Locations, Attenuations, Components, and Magnitude Correction Factors

Name	IRIS¶ Code	Latitude (deg min)		Longitude (deg min)		Comp* Code	Attn† (dB)	$\Delta M^{\ddagger}_{coda}$	$\Delta M^{\ddagger}_{amp}$
AAR	NC	39	16.57	121	1.53	VHZ	24	-0.06	-0.18
AAS	NC	38	25.80	121	6.51	VHZ	18	0.14	0.28
ABJ	NC	39	9.92	12'	11.47	VHZ	18	0.28	0.13
ABR	NC	39	8.11	121	29.21	VHZ	24	-0.18	-0.10
ADW	NC	38	26.35	120	50.89	VHZ	12	0.19	0.18
AFD	NC	38	56.88	120	58.34	VHZ	6	0.37	0.30
AFH	NC	39	2.51	120	47.48	VHZ	24	-0.09	-0.17
AFR	NC	38	47.54	121	20.91	VHZ	24	-0.26	-0.15
AHR	NC	38	51.26	121	4.23	VHZ	6	0.29	0.29
ALA	NC	38	34.00	120	57.37	VHZ	12	0.36	0.27
ALN	NC	38	55.78	121	17.27	VHZ	24	-0.02	-0.04
AOD	NC	38	36.89	120	43.71	VHZ	12	0.24	0.19
AOH	NC	39	22.52	121	15.36	VHZ	18	0.17	0.01
APR	NC	38	52.62	121	13.03	VHZ	6	0.29	0.40
ARJ	NC	38	41.19	120	57.38	VHZ	12	0.28	0.23
ARR	NC	38	45.92	121	10.31	VHZ	12	0.52	0.45
ASM	NC	38	49.40	120	41.00	VHZ	18	0.10	-0.05
AVR	NC	39	1.47	121	16.25	VHZ	6	0.39	0.34
BAP	NC	36	10.55	121	38.56	VHZ	18	0.00	-0.17
BAV	NC	36	38.75	121	1.79	VHZ	12	0.22	0.27
						VLZ	48	0.16	0.16
						VLN	42	0.27	0.11
						VLE	42	0.30	0.17
BBG	NC	36	34.70	121	2.31	VHZ	18	-0.39	-0.21
BBN	NC	36	30.57	121	4.57	VHZ	6	-0.30	-0.04
BCG	NC	36	42.55	121	20.60	VHZ	18	0.01	0.07
BCW	NC	36	18.40	121	33.96	VHZ	18	0.17	-0.05
BEH	NC	36	39.88	121	10.45	VHZ	18	-0.19	-0.14
BEM	NC	36	39.68	121	5.76	VHZ	12	0.01	-0.05
BHR	NC	36	43.67	121	15.83	VHZ	18	-0.30	-0.13
BJC	NC	36	32.82	121	23.56	VHZ	6	0.28	0.20
BJO	NC	36	36.65	121	18.81	VHZ	12	0.21	0.14
BLR	NC	36	39.96	121	16.36	VHZ	12	-0.33	-0.07
BMS	NC	36	39.78	120	47.51	VHZ	12	0.00	-0.05
BPC	NC	36	34.32	121	37.56	VHZ	12	-0.20	-0.16
BPC	NC	36	34.32	121	37.56	VLN	42	-0.17	-0.15
BPI	NC	36	29.40	121	10.11	VHZ	6	0.30	0.22
BPO	NC	36	13.72	121	46.00	VHZ	12		
BPO	NC	36	13.72	121	46.00	VLN	42		
BPR	NC	36	24.42	121	43.77	VHZ	18	0.03	-0.13
BRM	NC	36	50.70	120	49.40	VHZ	18	-0.26	-0.21
BRV	NC	36	25.49	121	1.10	VHZ	18	-0.15	0.02
BSG	NC	36	24.83	121	15.22	VHZ	18	0.14	0.06
						VLZ	48	0.02	0.07
						VLN	42	0.14	0.09
						VLE	42	0.14	0.09
BSL	NC	36	46.53	121	20.96	VHZ	24	-0.57	-0.38
BSM	NC	36	23.00	121	25.67	VHZ	18	0.04	-0.10
BSR	NC	36	39.99	121	31.12	VHZ	12	0.09	0.04
						VLZ	48	-0.14	-0.07
						VLN	42	-0.04	0.02
						VLE	42	-0.08	-0.10
BVL	NC	36	34.51	121	11.34	VHZ	6	-0.06	0.08
BVY	NC	36	44.96	121	24.80	VHZ	6	0.20	0.38
CAD	NC	37	9.83	121	37.55	VHZ	18	0.11	0.00
CAI	NC	37	51.68	122	25.77	VHZ	18	0.11	-0.05
CAL	NC	37	27.07	121	47.95	VHZ	12	0.25	0.33
						VLZ	48	0.18	0.22
						VLN	42	0.25	0.21
						VLE	42	0.25	0.24
CAO	NC	37	20.96	121	31.96	VHZ	12	0.19	0.27
						VLZ	48	0.18	0.21
						VLN	42	0.29	0.19
						VLE	42	0.34	0.20
CBR	NC	37	48.97	122	3.72	VHZ	18	0.09	0.07
						VLN	42	0.23	0.15
CBS	NC	37	49.06	121	38.43	VHZ	18	-0.35	-0.17
CBW	NC	37	55.45	122	6.40	VHZ	18	-0.17	-0.07
CCO	NC	37	15.46	121	40.35	VHZ	12	0.05	0.08
CCY	NC	37	33.10	122	5.45	VHZ	18	0.32	0.24
CDA	NC	37	43.80	121	43.70	VHZ	18		
CDO	NC	37	43.80	121	50.12	VHZ	24	-0.38	-0.31
CDU	NC	38	1.78	122	0.05	VHZ	24	-0.72	-0.47
CDV	NC	37	33.98	121	40.81	VHZ	12	0.40	0.40
						VLZ	42	0.11	0.11
CGP	NC	37	38.72	122	0.62	VHZ	18		
CLC	NC	37	44.28	122	3.83	VHZ	18	-0.13	-0.20
CMC	NC	37	46.88	122	10.55	VHZ	24	-0.22	-0.15
CMH	NC	37	21.57	121	45.38	VHZ	18	0.08	0.08
CMJ	NC	37	31.25	121	52.23	VHZ	12	0.15	0.12
CML	NC	37	28.64	121	39.09	VHZ	18	0.33	0.24
CMM	NC	37	27.34	121	29.62	VHZ	12	0.33	0.29
CMN	NC	37	37.65	121	42.50	VHZ	12		
CMO	NC	37	48.68	121	48.15	VHZ	12	-0.09	-0.02
CMP	NC	37	21.46	121	18.51	VHZ	18	0.19	0.11
CMR	NC	37	35.68	121	38.22	VHZ	12	0.15	0.13
COS	NC	37	30.51	121	22.44	VHZ	18	0.25	0.12
CPI	NC	37	59.33	122	12.88	VHZ	18		
CPL	NC	37	38.25	121	57.64	VHZ	18	0.28	0.09
CPM	NC	37	56.94	122	24.46	VHZ	24		
CRP	NC	37	54.75	121	54.33	VHZ	24	-0.29	-0.29
CSA	NC	37	40.42	121	42.25	VHZ	24		
CSL	NC	37	43.46	122	7.10	VHZ	24		
						VLN	42		
						VLE	42		
CSP	NC	37	57.45	122	18.65	VHZ	24	-0.26	-0.31
CST	NC	37	38.35	121	29.89	VHZ	12		
CSV	NC	37	51.88	122	0.16	VHZ	24	-0.34	-0.24
CVA	NC	37	37.10	121	45.49	VHZ	18		
CVL	NC	37	37.58	121	50.14	VHZ	12		
CVP	NC	37	53.04	122	13.32	VHZ	18		
						VLN	42		
						VLE	42		
CYB	NC	37	48.68	122	21.65	VHZ	24		
						VLZ	48		
						VLN	42		
						VLE	42		
GAC	NC	38	52.37	122	51.73	VHZ	12	0.42	0.46
GAR	NC	38	57.31	122	15.13	VHZ	12	-0.30	-0.02
GAX	NC	38	42.65	122	45.30	VHZ	12	0.48	0.28
GBD	NC	39	26.52	123	18.55	VHZ	18	0.01	0.06
GBG	NC	38	48.84	122	40.76	VHZ	18	0.09	0.14
GBM	NC	39	8.51	122	29.64	VHZ	18	0.24	0.34
GCB	NC	39	23.03	123	31.28	VHZ	12	0.17	0.23
GCR	NC	38	46.39	122	42.92	VHZ	12	0.46	0.44
GCV	NC	38	46.18	123	0.83	VHZ	12	0.24	0.20
GCW	NC	39	7.85	123	4.55	VHZ	12	0.27	0.28
GDC	NC	38	46.03	123	14.31	VHZ	12	0.17	0.07
GDX	NC	38	48.46	122	47.63	VHZ	12	0.55	0.57
GGP	NC	38	45.88	122	50.65	VHZ	18	0.22	0.25
						VLZ	48	0.20	0.18
GGU	NC	38	51.39	123	29.87	VHZ	18	0.30	0.16
GHC	NC	38	36.36	123	11.81	VHZ	12	0.31	0.21
GHG	NC	39	7.70	122	49.47	VHZ	12	0.46	0.51
GHL	NC	39	2.43	123	1.12	VHZ	6	0.47	0.48
GHM	NC	39	29.74	122	55.80	VHZ	12	0.31	0.43
GHO	NC	39	2.67	123	32.41	VHZ	12		
GHV	NC	39	5.10	122	44.06	VHZ	18	0.32	0.28
GMC	NC	38	47.56	123	7.80	VHZ	12	0.42	0.30
GMK	NC	38	58.17	122	47.22	VHZ	12	0.01	0.10
GMO	NC	38	42.61	123	8.59	VHZ	6	0.44	0.42
GNA	NC	39	11.85	123	37.85	VHZ	18	-0.08	-0.12
GPM	NC	38	50.85	122	56.78	VHZ	18	0.27	0.14
GRO	NC	39	55.04	122	40.23	VHZ	12		
GRT	NC	38	56.32	122	40.18	VHZ	12	0.14	0.16
GSG	NC	38	52.03	122	42.58	VHZ	12	-0.07	-0.12
GSN	NC	38	56.43	123	11.50	VHZ	12	0.24	0.13
GSS	NC	38	42.12	123	0.81	VHZ	12	0.30	0.16
GTS	NC	39	18.70	122	36.15	VHZ	12	0.29	0.36
GWK	NC	39	3.12	122	29.46	VHZ	12	0.12	0.32
GWR	NC	39	12.43	123	17.99	VHZ	18	0.18	0.21

Name	IRIS¶ Code	Latitude (deg min)	Longitude (deg min)	Comp* Code	Attn† (dB)	$\Delta M^{\ddagger}_{coda}$	$\Delta M^{\ddagger}_{amp}$
HAZ	NC	36 53.08	121 35.45	VHZ	18	0.18	0.29
HBT	NC	36 51.01	121 33.04	VHZ	24	0.04	0.26
				VLN	42	-0.06	0.16
HCA	NC	37 1.52	121 29.02	VHZ	12	0.04	0.06
HCB	NC	36 55.88	12. 39.63	VHZ	18	-0.24	-0.14
HCO	NC	36 53.25	121 42.49	VHZ	18	-0.53	-0.31
				VLZ	48	-0.53	-0.25
HCR	NC	36 57.46	121 35.01	VHZ	12	0.28	0.28
HDL	NC	36 50.12	121 38.64	VHZ	12	0.22	0.18
HER	NC	36 47.90	121 42.64	VHZ	24	-0.54	-0.14
HFE	NC	36 59.00	121 24.09	VHZ	18	0.07	0.04
HFP	NC	36 45.22	121 29.43	VHZ	6	0.39	0.49
HGS	NC	37 5.75	121 26.83	VHZ	12	0.25	0.18
HGW	NC	37 1.02	121 39.20	VHZ	12	0.27	0.23
HJG	NC	36 47.88	121 34.43	VHZ	12	0.30	0.44
HJS	NC	36 48.99	121 17.92	VHZ	12	0.08	0.16
HLT	NC	36 53.07	121 18.49	VHZ	12	0.19	0.37
HMO	NC	36 36.03	121 55.06	VHZ	18	0.24	0.01
HOR	NC	36 55.03	121 30.46	VHZ	18	-0.54	-0.11
HPH	NC	36 51.38	121 24.37	VHZ	36	-0.80	-0.60
HPL	NC	37 3.13	121 17.40	VHZ	18	0.31	0.23
				VLZ	48	0.30	0.26
				VLN	42	0.43	0.27
				VLE	42	0.30	0.23
HQR	NC	36 50.02	121 12.76	VHZ	18	0.17	0.15
				VLZ	48	0.03	0.07
				VLN	42	0.11	0.00
				VLE	42	0.11	0.05
HSF	NC	36 49.03	121 29.81	VHZ	18	-0.18	-0.02
HSL	NC	37 1.16	121 5.13	VHZ	18	-0.19	-0.23
HSP	NC	37 6.91	121 30.94	VHZ	12	-0.03	0.01
JAL	NC	37 9.50	121 50.82	VHZ	18	0.06	0.02
JBC	NC	37 9.62	122 1.57	VHZ	18	0.14	0.27
JBG	NC	37 20.52	122 20.34	VHZ	24	-0.30	-0.15
JBL	NC	37 7.69	122 10.08	VHZ	18	0.14	0.12
				VLN	42	0.21	0.20
				VLE	42	0.23	0.22
JBM	NC	37 19.09	122 9.16	VHZ	12	0.06	0.22
JBZ	NC	37 1.07	121 49.15	VHZ	18	-0.63	-0.44
JCB	NC	37 6.71	121 41.33	VHZ	12	0.00	-0.10
JCH	NC	37 31.02	122 22.56	VHZ	18		
				VLN	42		
				VLE	42		
JCP	NC	37 35.29	122 19.33	VHZ	24		
JEC	NC	37 3.04	121 48.56	VHZ	12	0.05	0.16
JEG	NC	37 30.84	122 27.74	VHZ	24	-0.14	-0.28
JEL	NC	36 55.64	121 49.61	VHZ	24	-0.69	-0.33
JHL	NC	37 6.54	121 49.99	VHZ	18	0.29	0.49
JHP	NC	37 26.65	122 18.09	VHZ	18	-0.16	-0.10
JJR	NC	37 20.68	122 12.09	VHZ	18		
JLX	NC	37 12.11	121 59.17	VHZ	18	0.11	0.06
JMG	NC	37 38.22	122 28.43	VHZ	18	0.12	0.13
JMP	NC	37 27.33	122 9.93	VFZ	72	-0.34	-0.05
				VFN	72	-0.46	-0.33
				VFE	72	-0.52	-0.32
JNA	NC	37 10.62	121 50.68	VLZ	36	-0.08	-0.01
				VFZ	72	-0.38	-0.21
JPL	NC	36 58.62	121 49.93	VHZ	18	-0.69	-0.37
JPP	NC	37 15.81	122 12.78	VHZ	12	-0.24	0.00
JPR	NC	37 47.70	122 28.43	VHZ	24	-0.25	-0.35
JPS	NC	37 11.94	122 20.90	VHZ	18	-0.19	-0.14
JRG	NC	37 2.22	121 57.87	VHZ	18	-0.36	-0.24
JRR	NC	37 3.27	121 43.61	VHZ	12	0.22	0.17
JSA	NC	37 34.95	122 25.03	VHZ	18	0.18	-0.02
JSB	NC	37 40.74	122 23.80	VHZ	24		
JSC	NC	37 17.07	122 7.42	VHZ	18	0.04	0.06
JSF	NC	37 24.31	122 10.55	VHZ	24	-0.21	-0.16
				VLZ	48	-0.25	-0.08
				VLN	42	-0.10	-0.07
				VLE	42	0.09	0.17
JSG	NC	37 16.96	122 3.00	VHZ	18	-0.23	-0.08
JSJ	NC	37 20.03	122 5.48	VHZ	24	-0.53	-0.44
JSM	NC	37 12.74	122 10.06	VHZ	18	-0.06	-0.08
JSS	NC	37 10.17	121 55.84	VHZ	18	0.09	0.07
JST	NC	37 12.41	121 47.84	VHZ	12	0.02	0.04
JTG	NC	37 1.71	121 52.58	VHZ	18	-0.41	-0.24
JUC	NC	37 0.07	122 2.91	VHZ	12	0.08	0.04
JUM	NC	37 9.65	121 53.86	VLZ	36	0.10	0.07
				VFZ	72	-0.10	-0.17
KBB	NC	40 11.82	123 51.00	VHZ	12	0.02	0.06
KBN	NC	39 53.56	123 11.64	VHZ	12	0.34	0.33
KBR	NC	40 43.79	123 57.34	VHZ	12	0.36	0.25
KBS	NC	39 55.07	123 35.68	VHZ	12	0.11	0.14
KCP	NC	39 41.23	123 34.84	VHZ	18	-0.03	0.01
				VLZ	48		-0.10
KCR	NC	40 25.58	123 49.11	VHZ	12	0.27	0.23
KCS	NC	40 32.26	123 30.76	VHZ	12		
KCT	NC	40 28.55	124 20.18	VHZ	18	0.01	0.00
KFP	NC	39 38.35	123 25.44	VHZ	12	0.30	0.31
KGM	NC	40 45.53	123 40.46	VHZ	18	0.28	0.18
KHB	NC	40 39.61	123 13.11	VHZ	24		
KHM	NC	40 52.48	123 43.89	VHZ	18		
				VLN	42		
				VLE	42		
KIP	NC	39 48.52	123 28.83	VHZ	6	0.31	0.41
KIJ	NC	40 14.86	124 18.41	VHZ	18		
KKP	NC	40 8.75	123 28.10	VHZ	12	0.25	0.27
KMP	NC	40 25.04	124 7.21	VHZ	18	0.08	0.04
				VLN	42	-0.11	-0.36
				VLE	42	-0.08	-0.30
KOM	NC	41 16.73	123 27.13	VHZ	6	0.43	0.42
KPP	NC	40 20.76	123 21.73	VHZ	12	0.30	0.35
KRK	NC	39 33.77	123 10.93	VHZ	12	0.25	0.41
KRM	NC	41 31.31	123 54.31	VHZ	18	0.28	0.24
KRP	NC	41 9.49	124 1.38	VHZ	12	0.23	0.46
KSC	NC	42 20.64	124 9.88	VLZ	18		
KSM	NC	40 11.15	124 10.48	VHZ	12	0.06	0.21
KSP	NC	39 31.04	123 30.09	VHZ	12	0.22	0.37
KSX	NC	41 49.85	123 52.55	VHZ	12	0.44	0.33
				VLZ	48	0.17	0.04
KTR	NC	41 54.52	123 22.59	VHZ	12		
LAS	NC	41 35.96	121 34.60	VHZ	18	0.36	0.12
LBF	NC	41 20.82	121 53.42	VHZ	12	0.06	-0.05
LBK	NC	41 5.05	122 39.91	VHZ	6	0.32	0.27
LBP	NC	40 19.10	122 52.88	VHZ	12	0.62	0.55
LCF	NC	40 29.18	121 31.44	VHZ	18	-0.14	-0.24
LCM	NC	40 8.79	121 31.26	VHZ	18	-0.20	-0.22
LDB	NC	40 25.90	121 47.08	VHZ	18	-0.16	-0.21
LGB	NC	41 20.00	122 11.20	VHZ	12	-0.23	-0.17
LGM	NC	41 35.98	121 50.11	VHZ	12	0.00	-0.06
LGP	NC	40 54.75	122 49.72	VHZ	6	0.35	0.29
LHC	NC	40 48.30	121 30.84	VHZ	24	-0.11	-0.28
LHE	NC	41 37.71	122 13.83	VHZ	18	0.09	-0.05
LHK	NC	40 26.12	121 16.67	VHZ	12	-0.12	-0.17
LME	NC	40 32.27	121 34.21	VHZ	24	-0.11	-0.58
LMH	NC	41 34.74	121 39.44	VHZ	24	-0.16	-0.41
LMP	NC	41 29.25	122 9.28	VHZ	12	-0.34	-0.26
LPD	NC	41 11.72	121 41.76	VHZ	18	-0.08	-0.10
LPG	NC	40 8.72	122 41.20	VHZ	12		
LPK	NC	41 27.34	122 30.05	VHZ	6		
LRB	NC	40 8.60	122 33.40	VHZ	12		
LRD	NC	40 27.78	121 27.85	VHZ	12	-0.28	-0.33
				VLZ	48		
LRR	NC	40 27.98	121 37.78	VHZ	18	-0.21	-0.33
				VLE	30		-0.07
LSF	NC	40 39.49	122 31.36	VHZ	18	0.28	0.09
				VLZ	48		
LSH	NC	40 47.59	122 2.29	VHZ	6	0.42	0.31
LSL	NC	40 25.64	121 32.05	VHZ	12	0.20	0.07
LSM	NC	40 17.00	121 18.09	VHZ	18	-0.09	-0.21
LSR	NC	41 6.43	122 16.16	VHZ	12		

Name	IRIS¶ Code	Latitude (deg min)	Longitude (deg min)	Comp* Code	Attn† (dB)	$\Delta M^{\ddagger}_{coda}$	$\Delta M^{\ddagger}_{amp}$
LTC	NC	40 12.50	122 7.45	VHZ	18	-0.22	-0.11
				VLN	42	-0.23	-0.12
LVR	NC	40 2.35	122 40.25	VHZ	12		
LWH	NC	40 38.66	121 56.70	VHZ	6	0.25	0.28
MBE	NC	36 45.75	119 16.90	VLZ	42		
MBO	NC	37 41.35	120 21.86	VHZ	12	0.43	0.29
MBU	NC	37 33.58	120 7.00	VHZ	12		
MCD	NC	37 32.89	118 26.50	VHZ	18	-0.83	-0.56
MCL	NC	37 35.41	118 49.45	VHZ	18		
MCM	NC	37 36.59	118 52.40	VHZ	18	-0.25	-0.55
MCS	NC	37 39.30	118 54.27	VHZ	18	-0.25	-0.42
MCU	NC	37 58.36	120 37.02	VHZ	6	0.30	0.24
MDC	NC	37 42.60	119 2.50	VHZ	12	0.24	-0.11
MDP	NC	37 37.94	119 4.74	VHZ	24	-0.03	-0.30
				VLN	42		
MDR	NC	37 38.32	118 50.13	VHZ	18		
MEM	NC	37 39.98	118 56.35	VHZ	18	-0.33	-0.57
MFB	NC	37 25.77	118 25.70	VHZ	24	-0.89	-0.59
MGP	NC	37 37.59	118 54.08	VHZ	18	-0.58	-0.60
MHD	NC	37 7.36	119 53.60	VHZ	12	0.22	0.09
				VLZ	48		0.00
MLC	NC	37 36.63	118 54.95	VHZ	24	-0.09	-0.39
MLH	NC	37 40.78	118 48.75	VHZ	18		
MLM	NC	37 43.73	118 56.79	VHZ	18	-0.46	-0.53
MLR	NC	38 5.44	120 9.84	VHZ	6	0.27	0.17
MMI	NC	37 25.20	119 44.56	VHZ	6	0.26	0.02
				VLN	42	0.12	0.04
MML	NC	37 39.36	118 58.68	VHZ	24	-0.56	-0.73
MMP	NC	37 36.60	119 1.68	VHZ	18	0.03	-0.27
MMS	NC	37 37.83	119 1.84	VHZ	24		
MMT	NC	37 22.55	119 10.68	VHZ	24	0.09	-0.26
MNH	NC	38 8.75	120 48.82	VHZ	6	0.25	0.24
MOG	NC	37 29.50	118 30.19	VHZ	24	-0.74	-0.56
MOY	NC	37 54.00	120 34.04	VHZ	18	0.25	0.18
MPR	NC	37 48.26	120 0.80	VHZ	12		
				VLZ	48		
MRC	NC	37 40.30	118 30.38	VHZ	24	-0.03	-0.35
MRD	NC	37 35.88	119 3.40	VHZ	18		
MRF	NC	38 14.72	120 31.24	VHZ	18	0.29	0.14
MSK	NC	37 39.18	119 1.44	VHZ	30	-0.27	-0.43
MSL	NC	37 37.00	118 57.30	VHZ	24	0.06	-0.19
MST	NC	37 54.27	120 24.29	VHZ	12	0.33	0.25
MTC	NC	37 37.90	118 57.90	VLZ	42	-0.27	-0.33
MTU	NC	37 21.20	118 33.81	VHZ	18	0.07	-0.21
MWB	NC	37 10.13	118 20.19	VHZ	12	-0.20	-0.28
MYL	NC	37 23.02	120 25.16	VHZ	18	-0.29	-0.16
NAD	NC	38 27.60	121 58.18	VHZ	18	-0.32	-0.09
NAD	NC	38 27.60	121 58.18	VLN	42	-0.14	-0.08
NAP	NC	38 26.34	122 14.99	VHZ	18	-0.31	-0.13
NBP	NC	38 40.07	122 11.60	VHZ	12	-0.15	0.07
				VLN	42	0.03	0.07
NBR	NC	38 15.65	122 32.99	VHZ	24	-0.16	-0.15
NCF	NC	38 19.28	122 47.73	VHZ	18	0.02	0.03
NCP	NC	38 47.17	122 7.33	VHZ	18	-0.19	0.00
NDH	NC	38 45.93	121 54.75	VHZ	12	-0.43	-0.02
NFI	NC	37 41.90	123 0.00	VHZ	24	0.26	0.07
NFR	NC	38 31.36	123 9.66	VHZ	12	0.13	0.02
NGV	NC	38 16.84	122 12.89	VHZ	18	-0.01	0.05
NHF	NC	38 2.98	122 31.34	VHZ	18		
				VLN	42		
				VLE	42		
NHM	NC	38 9.28	121 48.02	VHZ	18	-0.45	-0.08
NIM	NC	38 33.69	122 15.86	VHZ	12	0.11	0.17
NLH	NC	38 7.19	122 8.87	VHZ	18	-0.07	-0.01
NLN	NC	38 9.15	122 42.75	VHZ	18	0.13	0.03
NMC	NC	38 35.46	122 54.74	VHZ	12	0.28	0.21
NMH	NC	38 40.17	122 37.93	VHZ	12	0.24	0.21
				VLN	42	0.14	0.14
NMI	NC	38 4.69	122 15.44	VHZ	24		
NMT	NC	38 48.34	122 26.76	VHZ	6	0.14	0.37
NMW	NC	38 33.03	122 43.37	VHZ	18	-0.10	-0.03
NOL	NC	38 2.50	122 47.64	VHZ	18	-0.20	-0.51
NPR	NC	37 59.79	123 0.98	VHZ	30	0.11	-0.07
NPV	NC	38 38.55	122 25.55	VHZ	18	0.15	0.21
NRR	NC	38 31.82	122 5.73	VHZ	12	-0.07	0.11
NSH	NC	38 31.20	122 36.43	VHZ	12	0.05	0.09
NSP	NC	38 12.02	122 27.82	VHZ	12	-0.01	0.03
NTA	NC	37 55.43	122 35.70	VHZ	18	0.37	0.32
NTB	NC	38 14.87	122 55.86	VHZ	18	0.07	-0.09
NTY	NC	38 23.37	122 39.70	VHZ	18	-0.14	-0.07
NVA	NC	38 24.92	122 6.88	VHZ	18	-0.05	0.06
NVE	NC	38 22.36	122 26.17	VHZ	24	-0.03	-0.01
				VLN	42	-0.04	-0.02
NWR	NC	38 27.42	122 53.26	VHZ	24	-0.04	-0.04
OBH	NC	39 39.22	121 27.64	VHZ	18	0.07	-0.07
OCH	NC	39 52.55	121 45.93	VHZ	12	-0.27	-0.05
OCM	NC	39 31.43	121 37.40	VHZ	18	-0.23	-0.14
OCR	NC	39 52.09	121 45.04	VHZ	12		
OGO	NC	39 39.22	121 36.72	VHZ	12	-0.07	-0.03
OHC	NC	39 20.18	121 29.05	VHZ	12	0.38	0.25
ORA	NC	39 28.13	121 24.80	VHZ	12	0.33	0.14
ORD	NC	39 33.33	121 30.00	VHZ	18	0.33	0.12
OST	NC	39 22.22	121 35.11	VHZ	18	-0.19	-0.06
OSU	NC	39 16.23	121 51.10	VHZ	12	-0.36	0.04
OWY	NC	39 27.19	121 29.20	VHZ	18	0.31	0.19
PAB	NC	35 9.41	120 38.17	VHZ	24	-0.14	-0.25
PAD	NC	35 38.36	120 51.86	VHZ	18	-0.25	-0.27
PAG	NC	35 43.92	120 14.96	VHZ	24	-0.05	-0.08
PAN	NC	35 46.78	120 54.44	VHZ	24	-0.27	-0.33
PAP	NC	35 54.77	121 21.70	VHZ	12	0.26	0.10
PAR	NC	36 14.95	120 20.52	VHZ	18	-0.26	-0.16
PBI	NC	35 9.68	120 28.42	VHZ	24	-0.31	-0.41
PBM	NC	35 23.68	120 21.16	VHZ	24	0.29	0.02
PBP	NC	35 34.73	120 4.58	VHZ	24	-0.02	-0.16
PBW	NC	36 18.90	120 55.75	VHZ	24	-0.17	0.02
PCA	NC	35 55.90	120 20.22	VHZ	24	-0.04	-0.11
PCB	NC	35 31.11	121 3.56	VHZ	18	0.30	0.07
PCR	NC	36 5.65	120 26.08	VHZ	24	0.04	0.00
PDR	NC	36 20.14	120 22.12	VHZ	18	-0.29	-0.14
PGH	NC	35 49.86	120 21.17	VHZ	24	0.32	0.28
				VLZ	48	0.60	0.31
PHA	NC	35 50.16	120 23.91	VHZ	24	-0.28	-0.07
PHB	NC	36 14.93	120 4.96	VHZ	24	-0.57	-0.31
PHC	NC	35 40.93	121 9.15	VHZ	24	0.07	-0.11
PHF	NC	35 52.91	120 24.03	VHZ	24	0.12	0.05
				VLZ	48	0.14	0.14
				VLN	42	0.17	0.12
				VLE	42	0.16	0.12
PHO	NC	35 52.12	120 28.88	VHZ	24	-0.40	-0.30
				VLZ	48	-0.34	-0.23
				VLN	42	-0.30	-0.21
				VLE	42	-0.35	-0.29
PHP	NC	35 59.13	120 36.12	VHZ	24	-0.18	-0.25
				VLZ	48	-0.22	-0.22
				VLN	42	-0.31	-0.38
				VLE	42	-0.33	-0.41
PHR	NC	36 22.38	120 49.10	VHZ	12	-0.26	-0.33
				VLN	42	0.04	0.13
PHS	NC	35 49.45	121 3.17	VHZ	24	-0.16	-0.18
PIR	NC	35 33.28	120 13.06	VHZ	24	-0.27	-0.22
PJL	NC	36 5.39	121 9.33	VHZ	18	-0.08	-0.12
				VLZ	48	-0.09	-0.03
				VLN	42	-0.01	0.04
				VLE	42	-0.03	-0.03
PKE	NC	36 3.69	120 6.54	VHZ	24	-0.30	-0.23
PKY	NC	35 15.83	120 39.94	VHZ	24	-0.19	-0.34
PLO	NC	36 14.79	121 2.55	VHZ	18	-0.34	-0.34
PMC	NC	35 43.48	120 22.23	VHZ	24	-0.39	-0.21
				VLZ	48	-0.26	-0.11
				VLN	42	0.02	0.02
				VLE	42	-0.19	-0.03

Name	IRIS[¶] Code	Latitude (deg min)	Longitude (deg min)	Comp* Code	Attn[†] (dB)	$\Delta M^{\ddagger}_{coda}$	$\Delta M^{\ddagger}_{amp}$
PMG	NC	35 25.79	120 31.22	VHZ	24	0.28	-0.01
				VLZ	48	0.20	-0.03
PML	NC	34 53.70	120 36.51	VHZ	24	-0.15	-0.27
PMM	NC	35 57.39	120 29.84	VHZ	24	-0.02	-0.03
				VLZ	48	-0.05	0.04
				VLN	42	-0.10	-0.08
				VLE	42	-0.08	-0.07
PMP	NC	36 12.91	120 47.69	VHZ	24	-0.10	0.02
PMP	NC	36 12.91	120 47.69	VLN	42	-0.09	0.09
PMR	NC	35 47.09	120 14.14	VHZ	24	0.01	-0.02
POP	NC	35 44.29	120 7.95	VHZ	24	-0.02	-0.05
PPB	NC	35 15.63	120 53.07	VHZ	24	-0.04	-0.18
				VLZ	48	0.09	-0.13
PPC	NC	35 56.98	120 35.66	VHZ	24	-0.03	-0.06
				VLZ	48	-0.16	-0.03
				VLN	42	-0.01	-0.04
				VLE	42	0.11	0.07
PPG	NC	35 51.78	119 57.35	VHZ	24	-0.48	-0.21
PPT	NC	36 6.50	120 43.27	VHZ	24	-0.34	-0.27
PRC	NC	36 15.37	120 37.20	VHZ	24	-0.03	0.07
				VLN	42	-0.15	-0.03
PRP	NC	36 0.05	120 28.60	VHZ	24		
PSA	NC	36 1.52	120 53.30	VHZ	24	-0.61	-0.34
PSC	NC	35 35.30	120 25.58	VHZ	24	-0.32	-0.08
PSM	NC	36 4.18	120 35.68	VHZ	24	-0.26	-0.31
PSR	NC	35 51.47	120 16.81	VHZ	24	0.06	0.01
PST	NC	35 55.73	120 30.50	VHZ	24	0.09	0.02
PTA	NC	35 23.56	120 42.40	VHZ	18	0.18	0.05
PTQ	NC	34 34.88	120 34.29	VHZ	24	0.17	0.03
PTR	NC	35 39.28	120 12.67	VHZ	24	-0.12	-0.13
PVC	NC	35 55.32	120 32.06	VHZ	24	-0.24	-0.30
				VLZ	48	-0.33	-0.28
				VLN	42	-0.29	-0.32
				VLE	42	-0.34	-0.32
PWK	NC	35 48.87	120 30.67	VHZ	24	-0.31	-0.02
PWM	NC	36 25.97	120 12.66	VHZ	24	-0.48	-0.14
FRI	BK	36 59.50	119 42.50	VHZ	24		
MIN	BK	40 20.70	121 36.30	VHZ	30		
ABL	CI	34 51.05	119 13.25	VHZ	6	0.29	0.10
ARV	CI	35 7.63	118 49.76	VHZ	12	0.30	0.03
BCH	CI	35 11.10	120 5.05	VHZ	12	0.10	0.12
BMT	CI	35 8.15	118 35.81	VHZ	6	0.36	0.15
CRG	CI	35 14.53	119 43.40	VHZ	12	-0.17	-0.14
FRK	CI	33 24.05	115 38.21	VHZ	18		
FTC	CI	34 52.25	118 53.51	VHZ	18	0.58	0.41
JUL	CI	33 2.90	116 36.77	VHZ	12		
MAR	CI	35 0.15	119 20.36	VHZ	12	-0.05	-0.02
MWC	CI	34 13.40	118 3.50	VHZ	1.5		
PKM	CI	34 53.75	119 49.13	VHZ	12	0.13	0.08
PLE	CI	34 58.11	119 4.08	VHZ	24	-0.16	-0.31
RYS	CI	34 38.60	119 21.10	VHZ	12	-0.12	-0.23
SCC	CI	34 56.48	120 10.32	VHZ	18	-0.07	-0.15
SIM	CI	35 21.02	119 59.74	VHZ	24	-0.39	-0.16
SLC	CI	34 29.79	119 42.81	VHZ	12	-0.03	0.04
SND	CI	35 8.58	118 18.13	VHZ	12		
SUN	CI	34 12.64	117 41.58	VHZ	24		
SYP	CI	34 31.63	119 58.67	VHZ	26		
TEJ	CI	35 13.79	118 41.37	VHZ	18		
TMB	CI	35 5.24	119 32.08	VHZ	30	-0.58	-0.64
TOW	CI	35 48.50	117 45.90	VHZ	12	-0.67	-0.37
WAS	CI	35 44.29	118 33.42	VHZ	12	0.24	0.12
WBS	CI	35 32.22	118 8.37	VHZ	12	0.12	-0.14
WCH	CI	35 52.98	118 4.48	VHZ	12	0.26	0.15
WJP	CI	35 24.65	118 28.84	VHZ	12	0.21	-0.01
WLH	CI	36 9.14	118 18.70	VHZ	12	0.03	-0.04
WNM	CI	35 50.57	117 54.29	VHZ	12		
WOF	CI	35 32.14	118 42.75	VHZ	6	0.40	0.20
WOR	CI	35 41.79	118 14.52	VHZ	12	0.37	0.06
WRC	CI	35 57.04	117 38.89	VHZ	6	-0.01	0.14
WSH	CI	35 37.96	117 29.50	VHZ	6	0.13	0.14
WVP	CI	35 56.98	117 49.02	VHZ	6	0.48	0.28
YEG	CI	35 26.18	119 57.56	VHZ	12	0.08	0.17
BCK	NN	37 41.85	118 22.32	VHZ	12		
BEN	NN	37 42.93	118 34.40	VHZ	6		
BHP	NN	37 17.97	118 29.24	VHZ	12		
CAS	NN	37 34.49	118 33.09	VHZ	12		
CWC	NN	37 29.69	118 18.38	VHZ	12		
HTC	NN	37 31.79	118 46.26	VHZ	12		
LUL	NN	38 3.14	119 10.82	VHZ	18		
MGN	NN	37 48.80	118 41.73	VHZ	12		
MLN	NN	37 35.63	118 20.56	VHZ	12		
ORC	NN	37 38.12	118 39.36	VHZ	36		
POC	NN	37 21.74	118 16.75	VHZ	12		
RCC	NN	37 29.26	118 43.30	VHZ	12		
SCH	NN	37 21.95	118 41.22	VHZ	12		
SLK	NN	37 50.04	119 7.72	VHZ	12		
STR	NN	37 26.20	118 45.60	VHZ	12		
WMD	NN	37 26.61	118 38.22	VHZ	12		
GAS	WR	39 39.29	122 42.91	VHZ	24		
KPK	WR	39 35.01	121 18.32	VHZ	24		
MGL	WR	39 48.71	121 33.42	VHZ	0		
ORV	WR	39 33.23	121 30.02	VHZ	12		

Notes to Table 1.

[¶] IRIS codes for network operator:
NC = USGS-Menlo Park
BK = Univ. CA Berkeley
CI = USGS/Caltech-Pasadena
NN = Univ. Nev. Reno
WR = CA Div. Water Res.

[*] Component Code Definition in use by NCSN and SCSN
Sensor type (first letter of 3-letter code
V=short period seismometer
Gain (second letter)
H=high gain (0-24 dB attenuation)
L=low gain (36-48 dB attenuation)
F=very low gain (54-72 dB attenuation)
Orientation (third letter)
Z=vertical
E=east-west
N=north-south

[†] Attenuation down from 90dB gain, except staton GASW which is down from 120 dB. Please see non-NC operators for appropriate system responses.

[‡] Magnitude correction in magnitude units. Blank value indicates no correction available.

Table 2. Summary of Seismic Stations Recorded by the NCSN

OPERATOR	SITES	COMPONENTS
NCSN (NC)		
High-gain vertical	359	359
Low-gain vertical	33	35
Horizontal	42	65
Dilatometer	4	7
Force-balance accelerometer	1	2
USGS-CIT† (CI)	34	34
Univ. of Nevada, Reno† (NN)	16	16
U.C. Berkeley † (BK)	2	2
Ca Dept. Water Res.† (WR)	4	4
Total	425	528‡

†High-gain vertical only

‡Number of components exceeds digitizer channels due to network changes throughout year

Table 3. Network Changes in 1992

NEW STATIONS

CODE†	LAT	LONG	ELEV (M)	SITE NAME	SENSOR.	DATE INSTALLED
CGP VHZ	37° 38.72′	122° 00.62′	366	Garin Park (Surface)	L4	92/02/05
CYB VLE	37° 48.68′	122° 21.65′	24	Yerba Buena Island	L4	92/06/04
CYB VLN					L4	
CYB VHZ					L4	
CYB VLZ					L4	
HSF VHZ	36° 49.03′	121° 29.81′	183	St. Francis Retreat	L4	92/11/04
KCS VHZ	40° 32.26′	123° 30.76′	1640	Cold Springs	L4	92/08/13
KTR VHZ	41° 54.52′	123° 22.59′	1378	Thompson Ridge	L4	92/08/05
MBE VHZ	36° 45.75′	119° 16.90′	1023	Bear Mountain	L4	92/09/17
MBU VHZ	37° 33.58′	120° 07.00′	1265	Mt. Bullion	L4	92/09/16
OCR VHZ	39° 52.09′	121° 45.04′	564	Cohasset Ridge	L4	92/01/22

DISCONTINUED STATIONS

CODE†	LAT	LONG	SITE NAME	DATE REMOVED	REASON
HQR VLE	36° 50.02′	121°12.76′	Quien Sabe Ranch	92/10/19	Lost lease
HQR VLN					
HQR VHZ					
HQR VLZ					
HSF VHZ	36° 48.98′	121°29.88′	St Francis Retreat	92/11/04	Slight move (see Table 1)
OCH VHZ	39° 52.55′	121°45.93′	Cohasset Ridge	92/01/22	Moved to OCR (see Table 1)
PRP VHZ	36° 0.05′	120°28.60′	Reason Peak	92/09/15	Large rent increase

†CODE convention: Last 3 letters describe instrument as follows:

Letter 1 - Instrument	Letter 2 - Attenuation	Letter 3 - Orientation
V- short-period	H - high (0-24 db)	Z - vertical
	L - low (36-42 db)	N - north-south
		E - east-west

Earthquake Catalog

The NCSN maintains a catalog of earthquake locations for the area spanned by the seismograph net (Figure 1). All earthquakes have a minimum of 4 P and S arrival time readings from at least 3 independent stations. During 1992 the NCSN located 21,365 earthquakes (Figure 2), bringing the total number of earthquakes in the catalog to about 324,000 events since 1968. Because the CUSP and RTP systems detect and locate earthquakes independently, their data are merged together to generate a comprehensive catalog. CUSP data takes precedence over RTP data for events which have data from both sources.

The merged arrival time data are relocated using the program Hypoinverse (*Klein*, 1989). The location program uses one of thirty-four crustal velocity models, whose velocity varies only with depth (Table 4; Figure 3), and associated station traveltime corrections (Table 5). Multiple crustal models partly account for lateral velocity variations within the crust and consequently improve the accuracy of earthquake locations. The velocity model used depends on the current epicentral coordinates during the earthquake location iteration process; thus the model can change from that used for the trial hypocenter to the model appropriate for the final location. For some models the travel-time delays are assumed from an adjacent model if there is insufficient earthquake data to determine a value. Please note that the models given in Tables 4 and 5 reflect the location procedures at the time this report was written. The catalog periodically undergoes revision to reflect improved velocity models and location procedures.

All models have layers in which the velocity increases linearly with depth (gradient models) that have been adapted from homogenous layered velocity models referenced in Table 4. Events falling between regions are located with an interpolation between the closest two or three models. Two of the regions along the San Andreas fault, Loma Prieta and the Bear Valley, have different models for either side of the San Andreas Fault. An event in either of these regions uses separate models for stations on different sides of the fault regardless of which side of the fault the epicenter is on. The Loma Prieta region uses model LOM for stations on the west (Pacific) side and model LON for stations on the east (North American) side. The geographic region code LOM (see Table 7) labels all events that use these two models. The Bear Valley region uses model GAB for stations on the Gabilan (west) side and model DIA for stations on the Diablo (east) side. The three Parkfield areas use identical models but slightly different sets of station delays.

Duration and amplitude magnitudes are calculated using the equations of *Eaton* (1992) which produce magnitudes that are in close agreement with the M_L scale applied by U.C. Berkeley. The magnitude calculations utilize station corrections (Table 1), a distance and depth term, and the time dependent gain history of the seismic station.

Data Access and Archival

With the advent of large capacity storage devices and computer networks, data access and exchange is improving. Because the number of earthquakes in the NCSN catalog exceeds 320,000, it is neither practical nor desirable to distribute the catalog through printed media. Instead, most users prefer to have the data in a computer-readable format. Therefore, we provide 24-hour access to the earthquake database for scientists anywhere in the world who are connected to the Internet computer network. The NCSN phase, location, and focal mechanism data is stored on a 330 Gbyte optical data storage system operated by U.C. Berkeley. This storage device provides random access to all files within seconds, and the optical storage media are purported to have a life on the order of 100 years. During 1992 the NCSN began transcribing the 230 Gbytes of digital waveform data acquired by the CUSP system since 1984 from 9-track tape to the optical storage device. The UCB - USGS data center also provides access to the broadband waveform data collected by UCB and historical phase and location data. Data requests by individuals without Internet access are routinely obliged through the distribution of computer tapes, floppy disks, customized maps, and paper records. Appendix A provides instructions for obtaining an account at the UCB - USGS data center. The Appendix also provides a list of commands for obtaining documentation on the programs at the data center that retrieve the seismic data.

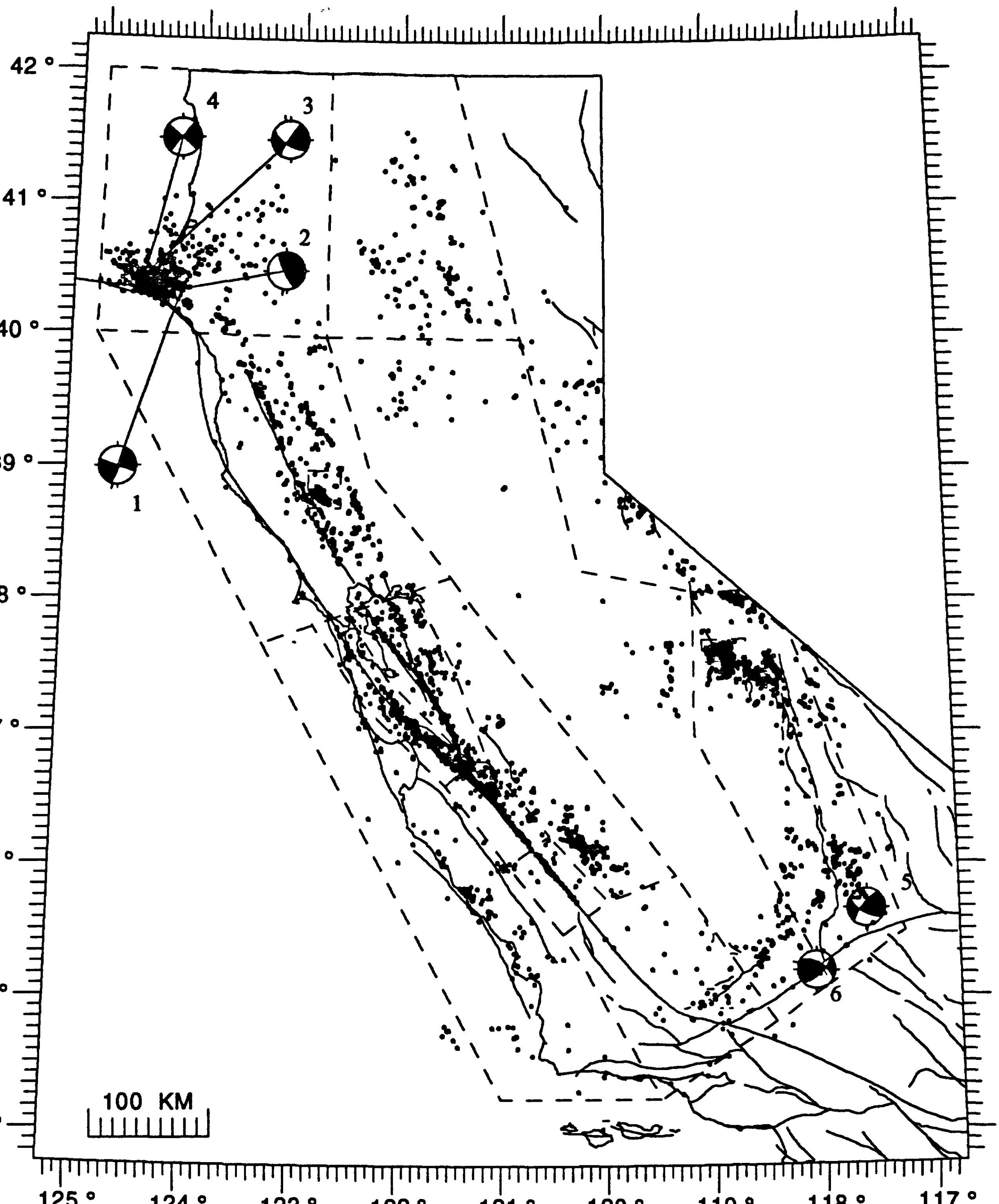

Figure 2. Seismicity recorded by the NCSN during 1992 (small circles) and focal mechanisms for $M \geq 4.5$ earthquakes. Symbol size is independent of magnitude. All plotted earthquakes have at least 8 P readings and horizontal and vertical location uncertainties less than 2.5 and 5.0 km, respectively. Focal mechanisms are lower-hemisphere, equal-area projections; the compressional quadrant is shaded solid. Numbers adjacent to focal mechanisms are referenced in text. The seismicity in each dashed polygonal region (see Figure 4) is discussed in text. The region enclosed by the dashed lines corresponds to the limits of reliable network coverage.

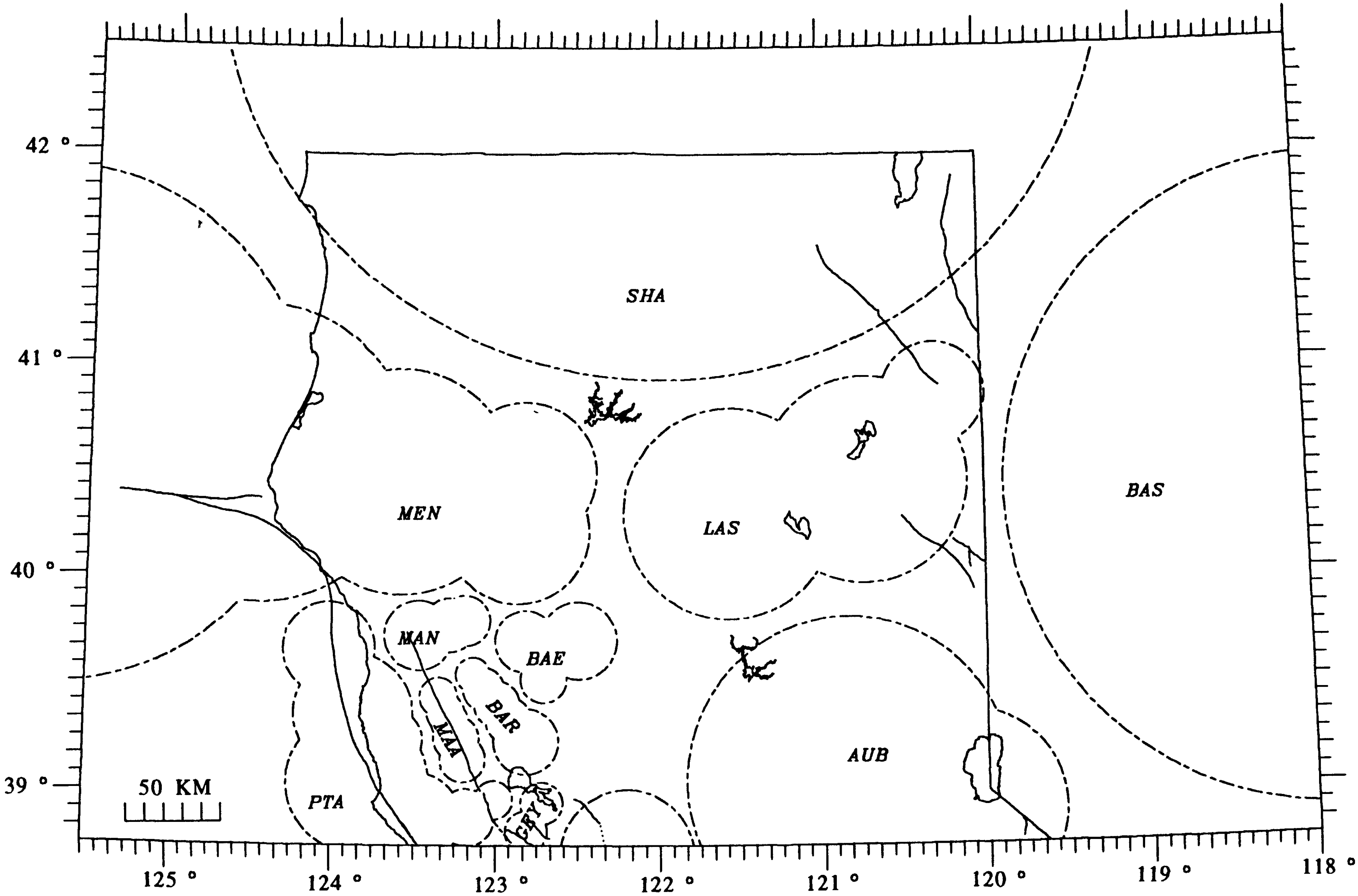

Figure 3. Boundaries of local velocity regions used by HYPOINVERSE (*Klein*, 1989)to locate earthquakes. The velocity-depth distribution for each region is given in Table 4. Earthquakes occurring between models have locations based on a combination of up to 3 adjacent models. The default Coast Range model (NCG, Table 4) is used to locate earthquakes in areas without a local model, such as the Great Valley and the Pacific Ocean.

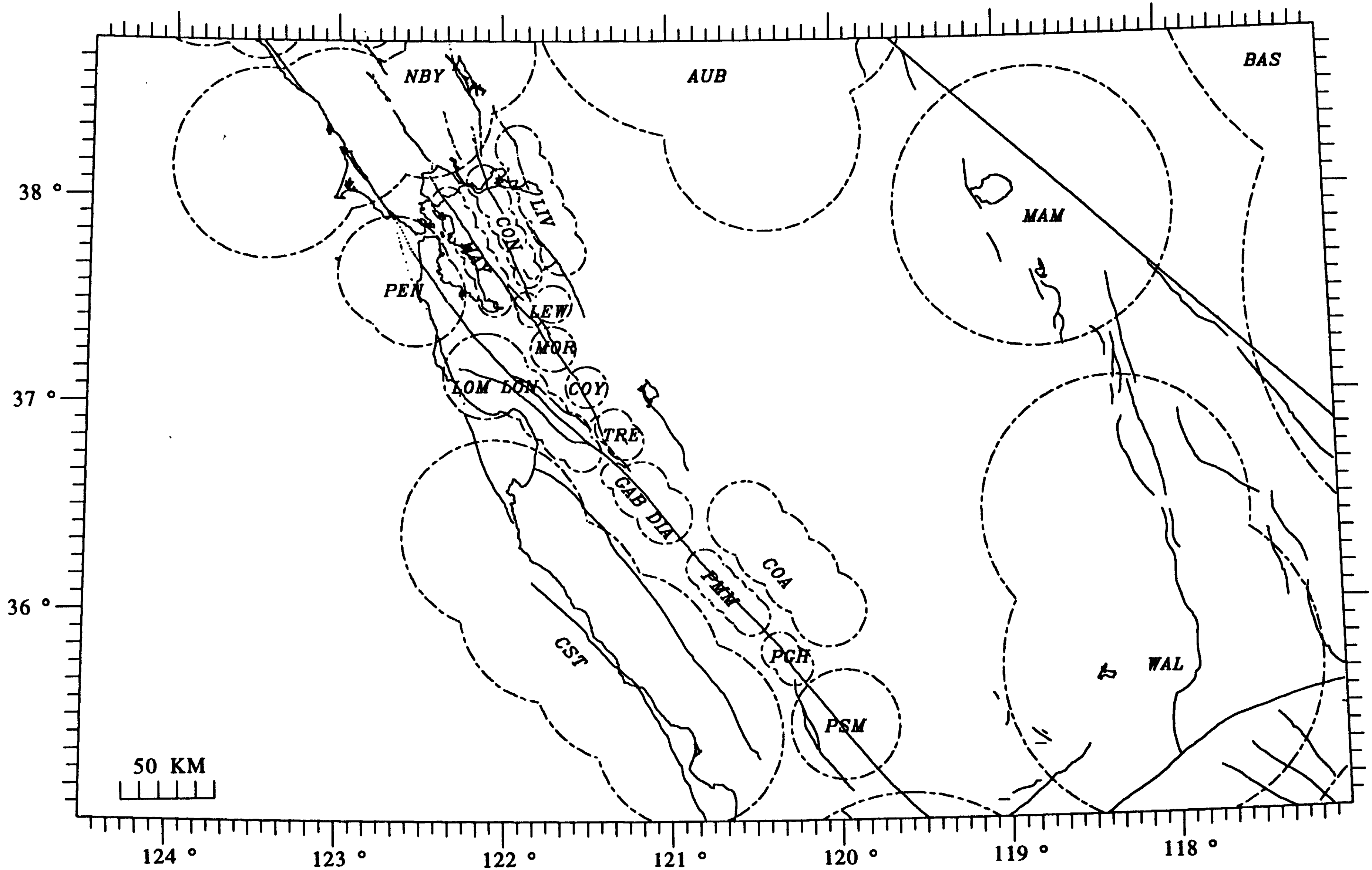

Figure 3 (cont.).

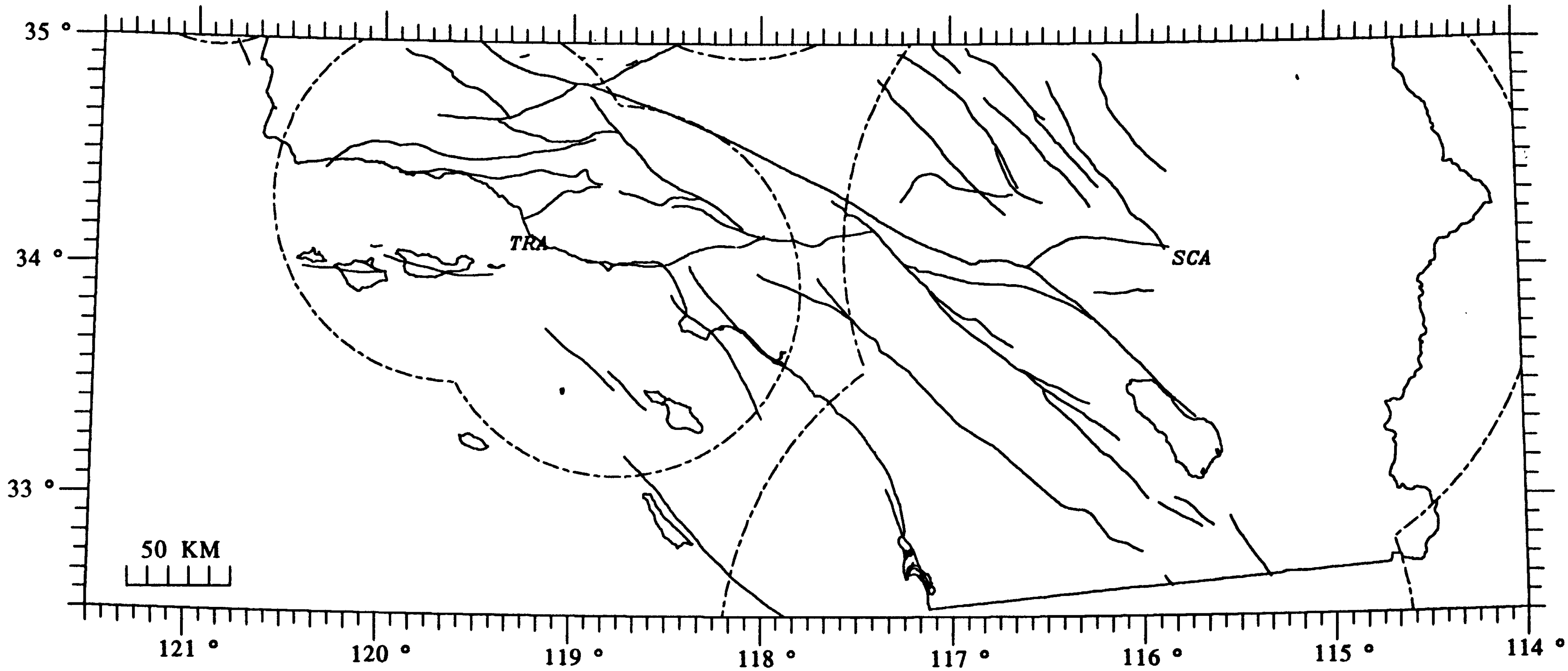

Figure 3 (cont.).

Table 4: Gradient P-Velocity Models[¶]

Auburn - Sierra Foothills (AUB)[2]

Eaton & Simirenko (1980)[‡]

Z (km)	0.00	1.00	34.00	36.00
V (km/s)	4.80	6.20	6.85	8.00

Bartlett Springs Fault - East (BAE)[2]

Castillo and Ellsworth (1993)*

Z (km)	0.00	4.50	18.60	28.50
V (km/s)	4.20	5.80	6.05	7.80

Bartlett Springs Fault (BAR)[2]

Castillo and Ellsworth (1993)*

Z (km)	0.00	2.00	19.00	21.00	29.00	31.00
V (km/s)	4.00	5.46	6.08	6.60	6.80	7.80

Basin & Range (BAS)[0]

Prodehl (1979)[†]

Z (km)	0.00	7.10	28.60	32.60
V (km/s)	4.00	5.95	6.60	7.85

Coalinga (COA)[2]

Eaton (1985)[‡]

Z (km)	0.00	2.20	14.00	26.00	30.00
V (km/s)	2.00	4.30	6.25	6.80	7.95

Concord-Calaveras Faults(CON)[2]

F. Klein pers. comm. (1991)*

Z (km)	0.00	2.00	12.00	24.00	26.00
V (km/s)	2.50	4.70	5.77	6.12	7.95

Coyote Lake (COY)[2]

Reasenberg & Ellsworth (1982)*

Z (km)	0.00	1.40	5.80	10.60	24.00	26.00
V (km/s)	3.80	5.30	6.12	6.37	6.59	8.00

Central Coast Ranges (CST)[2]

K. Poley and J. Eaton (pers. comm.)[‡]

Z (km)	0.00	2.50	8.00	23.80	26.80
V (km/s)	2.95	5.13	6.20	6.65	8.12

Bear Valley - Diablo Range side (DIA)[2]

L. Dietz (pers. comm.)*; *Walter & Mooney* (1982)[†]

Z (km)	0.00	1.50	5.80	14.40	15.60	29.00	31.00
V (km/s)	2.45	4.62	5.80	6.05	6.85	7.15	7.95

Bear Valley - Gabilan Range side (GAB)[2]

L. Dietz (pers. comm.)*; *Walter & Mooney* (1982)[†]

Z (km)	0.00	4.00	22.50	25.50
V (km/s)	3.73	6.07	6.47	7.95

The Geysers (GEY)[2]

Eberhart-Phillips & Oppenheimer (1984)*

Z (km)	0.00	3.00	8.00	20.00	22.00
V (km/s)	4.10	5.47	5.75	6.02	7.90

Hayward Fault (HAY)[2]

F. Klein pers. comm. (1991)*

Z (km)	0.00	3.00	9.00	24.00	26.00
V (km/s)	3.70	5.17	5.90	6.38	7.98

Lassen (LAS)[2]

S. Walter (pers. comm.)*

Z (km)	0.00	4.50	9.00	29.00	31.00
V (km/s)	4.00	6.00	6.28	6.55	8.05

Mount Lewis (LEW)[2]

F. Klein pers. comm. (1991)*

Z (km)	0.00	2.00	6.30	24.00	26.00
V (km/s)	3.18	5.23	5.89	6.40	7.95

Livermore-Antioch (LIV)[2]

F. Klein pers. comm. (1991)*

Z (km)	0.00	6.80	14.00	24.00	26.00
V (km/s)	2.27	5.85	6.10	6.44	7.95

Loma Prieta - Pacific side (LOM)[2]

Dietz & Ellsworth (1990)*

Z (km)	0.00	2.00	6.70	24.00	26.00
V (km/s)	3.00	4.95	5.94	6.64	8.00

Loma Prieta-North American side (LON)[2]

Dietz & Ellsworth (1990)*

Z (km)	0.00	2.50	8.90	24.00	26.00
V (km/s)	2.53	5.44	6.29	6.69	7.98

Maacama Fault (MAA)[2]

Castillo and Ellsworth (1993)*

Z (km)	0.00	3.60	16.60	24.00	26.00
V (km/s)	3.93	5.55	5.96	6.80	7.80

Mammoth Lakes - Long Valley (MAM)[2]

Kissling (1987)[†]; *Cockerham & Kissling* (pers. comm.)*

Z (km)	0.00	1.30	2.80	7.00	29.00	31.00	49.00	51.00
V (km/s)	3.52	3.67	5.53	6.03	6.28	6.51	6.85	8.00

North Maacama/Bartlett Springs Faults - (MAN)[2]

Castillo and Ellsworth (1993)*

Z (km)	0.00	2.10	14.00	24.00	26.00
V (km/s)	4.00	5.43	5.93	6.78	7.80

Cape Mendocino (MEN)[2]

M. Magee (pers. comm., 1992)*

Z (km)	0.00	4.20	22.00	24.00
V (km/s)	3.50	5.05	6.90	7.90

Morgan Hill (MOR)[2]

Cockerham & Eaton (1987)*

Z (km)	0.00	1.00	4.20	10.00	24.00	26.00
V (km/s)	3.60	4.75	5.48	6.05	6.33	7.60

North Bay - Coast Ranges (NBY)[2]

Eberhart-Phillips & Oppenheimer (1984)*

Z (km)	0.00	3.00	8.00	20.00	22.00
V (km/s)	4.10	5.47	5.75	6.02	7.90

Default Northern California (NCG)[1]

J. Eaton (pers. comm.)[‡]

Z (km)	0.00	3.50	23.00	27.00
V (km/s)	2.70	5.70	6.80	8.05

San Francisco Peninsula (PEN)[2]

Olson (1986)*

Z (km)	0.00	3.00	9.00	24.00	26.00
V (km/s)	2.20	5.37	6.10	6.62	7.75

Parkfield - Gold Hill (PGH)[2]

K. Poley and J. Eaton (pers. comm.)‡

Z (km)	0.00	2.60	9.40	23.30	27.00
V (km/s)	2.25	5.30	6.10	6.70	8.00

Parkfield - Middle Mountain (PMM)[2]

K. Poley and J. Eaton (pers. comm.)‡

Z (km)	0.00	2.60	9.40	23.30	27.00
V (km/s)	2.25	5.30	6.10	6.70	8.00

Parkfield - Simmler (PSM)[2]

K. Poley and J. Eaton (pers. comm.)‡

Z (km)	0.00	2.60	9.40	23.30	27.00
V (km/s)	2.25	5.30	6.10	6.70	8.00

Point Arena - Fort Bragg (PTA)[2]

Castillo and Ellsworth (1993)*

Z (km)	0.00	2.50	19.80	26.60
V (km/s)	4.00	5.40	6.40	7.80

Southern California (SCA)[0]

L. Jones (pers. comm.)‡

Z (km)	0.00	5.50	16.60	31.00	33.00
V (km/s)	4.80	6.17	6.60	6.85	7.80

Shasta (SHA)[0]

Zucca et al. (1986)†

Z (km)	0.00	5.00	38.10	42.50
V (km/s)	3.10	6.20	6.80	7.95

Transverse Ranges (TRA)[0]

Prodehl (1979)†

Z (km)	0.00	7.00	32.30	36.80
V (km/s)	3.10	6.10	6.73	8.10

Tres Piños (TRE)[1]

L. Dietz (pers. comm.)*; *Walter & Mooney* (1982)†

Z (km)	0.00	2.00	5.60	14.40	16.00	28.40	30.00
V (km/s)	2.70	5.33	5.75	6.00	6.83	7.07	7.95

Walker Pass (WAL)[1]

Jones and Dollar (1986)‡

Z (km)	0.00	1.20	36.40	38.00
V (km/s)	2.80	5.70	7.20	7.90

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[0] No station delays at present.

[1] Delays are from original investigator for layer model.

[2] Delays revised for gradient model adaptation.

*Derived from joint hypocenter-velocity determination

‡Derived from test/modify procedure

†Derived from seismic refraction study

¶$V_P/V_S = 1.78$

Table 5. Seismic Station Traveltime Corrections

Name	IRIS	Delays (sec) by Velocity Model‡																															
	CODE	AUB	BAE	BAR	BAS	COA	CON	COY	CST	DIA	GAB	GEY	HAY	LAS	LEW	LIV	LOM	LON	MAA	MAM	MAN	MEN	MOR	NBY	NCG	PEN	PGH	PMM	PSM	PTA	SCA	SHA	TRA	TRE	WAL
AAR	NC	0.08					-0.08			-0.12	-0.12	-0.12	0.22	0.01			1.27	1.27				-0.12		-0.12	0.05									-0.12	
AAS	NC						-1.15						-0.33			-0.82	0.19	0.19																	
ABJ	NC	-0.09					-0.26			-0.22	-0.22	-0.22	-0.49	-0.25			0.90	0.90						-0.22	-0.09									-0.22	
ABR	NC	0.24								-0.09	-0.09	-0.09												-0.09	-0.12									-0.09	
ADW	NC	0.13					-0.83			-0.01	-0.01	-0.01	-0.40		-0.51	0.17	0.64	0.64		-1.02				-0.01	-0.03									-0.01	
AFD	NC	0.06					-0.46			-0.13	-0.13	-0.13	0.27	-0.04			0.93	0.93						-0.13	0.03									-0.13	
AFH	NC	0.09					0.16			-0.22	-0.22	-0.22	1.17				1.30	1.30						-0.22	-0.22									-0.22	
AFR	NC	0.31					-0.67			0.32	0.32	0.32	-0.43			-0.32	0.85	0.85						0.32	0.32									0.32	
AHR	NC	-0.07					-0.53			-0.15	-0.15	-0.15	-0.35				0.51	0.51						-0.15	0.14									-0.15	
ALA	NC	-0.10					-1.14			-0.08	-0.08	-0.08	-0.60		-1.00		0.47	0.47		-1.07				-0.08	-0.12									-0.08	
ALN	NC	-0.02					0.27			0.23	0.23	0.23	-0.73				0.66	0.66						0.23	0.19									0.23	
AOD	NC	0.02					-0.50			-0.18	-0.18	-0.18	0.48				1.01	1.01		-1.06				-0.18	-0.18									-0.18	
AOH	NC	-0.06					0.22			-0.05	-0.05	-0.05	-0.08	-0.16			0.95	0.95				-0.05		-0.05	-0.08									-0.05	
APR	NC	-0.01					-0.35			0.17	0.17	0.17	-0.52			-0.37	0.47	0.47						0.17	0.19									0.17	
ARJ	NC	0.01					-0.74			-0.22	-0.22	-0.22	-0.17				0.75	0.75		-1.06				-0.22	0.14									-0.22	
ARR	NC	0.09								0.13	0.13	0.13	-0.65			-0.38	0.37	0.37						0.13	0.14									0.13	
ASM	NC	0.02															1.30	1.30																	
AVR	NC	-0.11					-0.28			-0.24	-0.24	-0.24	-0.66	-0.54			0.54	0.54						-0.24	-0.04									-0.24	
BAP	NC						-0.25		0.03	-0.06	-0.06		-0.36				0.03	0.03							-0.29		-0.36	-0.36	-0.36						
BAV	NC					-0.51	0.03	-0.19	0.50	0.29	0.29	0.04	0.58		-0.38		0.21	0.21				-2.16	-0.30	0.04	-0.10		0.02	0.02	0.02					-0.09	
BBG	NC					-0.09	0.62		0.69	0.61	0.61	0.12	1.09				0.50	0.50						0.12	0.13		0.12	0.12	0.12					0.20	
BBN	NC					-0.18	0.14		0.26	0.24	0.24	0.26	0.53				0.53	0.53						0.26	0.33		0.30	0.30	0.30					0.46	
BCG	NC					-0.01	0.10	0.33	-0.13	0.06	0.06	0.16	0.65		-0.03		-0.09	-0.09					0.44	0.16	0.15		0.16	0.16	0.16					0.41	
BCW	NC					-0.19	0.16		-0.03	-0.02	-0.02		0.63		-0.33		-0.10	-0.10							-0.26		-0.24	-0.24	-0.24						
BEH	NC					-0.19	0.31	-0.07	0.58	0.48	0.48	0.19	0.13		-0.29		0.49	0.49						0.19	-0.03		0.19	0.19	0.19					0.07	
BEM	NC					-0.36	0.07	-0.08	0.44	0.35	0.35	0.03	0.28		-0.40		0.27	0.27					-0.18	0.03	-0.10		0.03	0.03	0.03					-0.06	
BHR	NC					-0.20	0.88	-0.10	0.50	0.44	0.44		0.34		-0.09		0.57	0.57					0.12		-0.06									0.10	
BJC	NC					-0.54	0.07	-0.10	-0.15	-0.29	-0.29	-0.25	-0.51		-0.86		-0.72	-0.72					-0.34	-0.25	-0.43		-0.03	-0.03	-0.03					-0.19	
BJO	NC					-0.47	0.37		-0.08	-0.10	-0.10	-0.19	-0.46		-0.54		-0.65	-0.65					-0.05	-0.19	-0.11		-0.19	-0.19	-0.19					0.10	
BLR	NC					0.04	0.21	0.47	-0.09	0.22	0.22	0.26	0.72		0.04		0.19	0.19					0.53	0.26	0.45		0.26	0.26	0.26					0.63	
BMS	NC					-0.18	0.56			0.62	0.62	0.08	0.65		0.32		0.85	0.85		-0.35				0.08	0.17		0.08	0.08	0.08					0.07	
BPC	NC					-0.25	0.17	0.10	-0.07	0.07	0.07	-0.11	-0.02		-0.27		-0.08	-0.08					-0.02	-0.11	-0.17		-0.03	-0.03	-0.03					0.04	
BPI	NC					-0.73	0.10	-0.10	-0.26	-0.12	-0.12	-0.16	-0.46		-0.62		-0.69	-0.69					-0.61	-0.16	-0.17		-0.57	-0.57	-0.57					-0.05	
BPO	NC																																		
BPR	NC						-0.02	-0.02	-0.15	-0.06	-0.06		-0.20		0.12		-0.16	-0.16					-0.27		-0.35		-0.28	-0.28	-0.28					-0.03	
BRM	NC					-0.05		0.57		1.09	1.09	0.21	0.78		0.54		0.77	0.77		-0.29				0.21	0.54		0.21	0.21	0.21					0.52	
BRV	NC					-0.29	0.64		0.20	0.46	0.46	0.31	0.01				0.19	0.19						0.31	0.23		0.14	0.14	0.14					0.30	
BSG	NC					-0.58	0.28		-0.27	-0.32	-0.32	-0.24	-0.42		-0.66		-0.61	-0.61						-0.24	-0.46		-0.54	-0.54	-0.54					-0.29	
BSL	NC						0.34	0.16	0.54	0.51	0.51	0.24	0.66		0.18		0.82	0.82					0.35	0.24	-0.02		0.24	0.24	0.24					0.28	
BSM	NC					-0.29	0.38	0.13	-0.11	0.01	0.01		0.07				-0.07	-0.07					-0.25		-0.19		-0.29	-0.29	-0.29					-0.09	
BSR	NC					-0.40	-0.58	-0.03	-0.11	-0.20	-0.20	-0.20	-0.56		-0.57		-0.56	-0.56				-2.09	-0.13	-0.20	-0.30		-0.20	-0.20	-0.20					-0.03	
BVL	NC					-0.38	0.17	0.26	-0.05	0.17	0.17	0.03	-0.16		-0.33		-0.44	-0.44					-0.01	0.03	0.24		0.03	0.03	0.03					0.35	
BVY	NC					-0.29	0.29	0.39	-0.22			-0.06	0.12		0.23		-0.45	-0.45					0.58	-0.06	0.17		-0.06	-0.06	-0.06					0.45	
CAD	NC						-0.04	-0.11		0.09	0.09	-0.09	-0.05		0.26	0.30	0.20	0.20					0.40	-0.09	-0.08	-0.30	-0.09	-0.09	-0.09					-0.20	
CAI	NC						-0.51			-0.13	-0.13	-0.13	-0.34		-0.45	-0.71	-0.17	-0.17					-0.42	-0.29	-0.13	-0.15	-0.13	-0.13	-0.13					-0.13	

Delays (sec) By Velocity Model‡

Name	IRIS CODE	AUB	BAE	BAR	BAS	COA	CON	COY	CST	DIA	GAB	GEY	HAY	LAS	LEW	LIV	LOM	LON	MAA	MAM	MAN	MEN	MOR	NBY	NCG	PEN	PGH	PMM	PSM	PTA	SCA	SHA	TRA	TRE	WAL
CAL	NC						-0.14	-0.08		0.07	0.07	-0.01	-0.19		-0.14	-0.12	0.62	0.62				-1.54	0.01	-0.01	-0.04	-0.03	-0.01	-0.01	-0.01						
CAO	NC					-0.17	-0.31	-0.26		0.40	0.40	-0.01	-0.39		-0.12	-0.07	0.48	0.48				-1.63	-0.07	-0.01	-0.02	-0.12	-0.01	-0.01	-0.01					-0.11	
CBR	NC						-0.17			0.04	0.04	0.04	0.10		0.45	-0.15	0.77	0.77					0.35	0.04	0.04	0.13	0.04	0.04	0.04					0.04	
CBS	NC						0.56						0.95		0.74	0.30	1.07	1.07					0.66												
CBW	NC						0.15			0.07	0.07	0.07	0.41		0.47	-0.19	0.92	0.92					0.27	0.08	0.07	0.22	0.07	0.07	0.07					0.07	
CCO	NC						0.15	0.24		0.82	0.82	0.31	0.15		0.15	0.31	0.82	0.82					0.38	0.31	0.31	0.33	0.31	0.31	0.31					0.61	
CCY	NC						-0.41			-0.24	-0.24	-0.24	-0.40		-0.33	-0.47	0.15	0.15					-0.41	-0.24	-0.34	-0.34								-0.24	
CDA	NC						0.35			-0.20	-0.20	-0.20	0.63		0.65	0.03	1.26	1.26					0.40	-0.20	-0.20									-0.20	
CDO	NC						0.37			0.20	0.20	0.20	0.74		0.79	-0.01	1.29	1.29					0.79	0.20	0.20	0.61								0.20	
CDU	NC						0.55			0.21	0.21	0.21	1.05		0.49	0.21	1.21	1.21					0.19	0.19	0.21									0.21	
CDV	NC						0.13	-0.01					0.11		0.09	-0.12	0.82	0.82				0.40	0.04		-0.14	0.06									
CGP	NC																																		
CLC	NC						-0.06	0.53		0.02	0.02	0.02			0.24	-0.13	0.71	0.71					0.09	0.02	0.12	-0.03	0.02	0.02	0.02					0.02	
CMC	NC						-0.20			-0.05	-0.05	-0.05	-0.05		-0.10	-0.32	0.49	0.49					-0.05	-0.05	-0.05	-0.13	-0.05	-0.05	-0.05					-0.05	
CMH	NC						-0.05	0.24		0.69	0.69	0.16	0.01		-0.01	0.08	0.76	0.76					0.28	0.16	0.09	0.14	0.16	0.16	0.16						
CMJ	NC						-0.02	0.23		-0.01	-0.01	-0.01	-0.12		-0.01		0.57	0.57					0.04	-0.01	0.06	-0.06	-0.01	-0.01	-0.01					-0.01	
CML	NC						0.17	0.04					0.17		0.12	-0.03	0.80	0.80					0.12		0.11	0.09									
CMM	NC						-0.10	-0.04		0.46	0.46		-0.05		0.09	-0.12	0.76	0.76																	
CMN	NC						0.50			-0.10	-0.10	-0.10	0.49		0.20	0.11	1.02	1.02					0.15	-0.10	-0.06	0.44								-0.10	
CMO	NC						0.19			0.06	0.06	0.06	0.55		0.80	-0.06	0.92	0.92					0.91	0.06	0.06	0.55	0.06	0.06	0.06					0.06	
CMP	NC					-0.44	-0.50	-0.21		0.96	0.96		-0.23		-0.19	-0.29	0.59	0.59					-0.27		0.02										
CMR	NC						0.16	0.04		-0.06	-0.06	-0.06	0.22		0.06	-0.11	0.73	0.73					-0.03	-0.06	-0.07	0.09	-0.06	-0.06	-0.06					-0.06	
COS	NC						-0.25	-0.01					0.19		0.23	-0.35	0.91	0.91					0.01		0.14										
CPI	NC																																		
CPL	NC						-0.03	0.25		-0.03	-0.03	-0.03	-0.06			-0.12	0.60	0.60					-0.05	-0.03	0.15	-0.10								-0.03	
CPM	NC																																		
CRP	NC						-0.24			-0.29	-0.29	-0.29	0.14		0.47	-0.60	0.66	0.66					0.21	-0.29	-0.29	0.15	-0.29	-0.29	-0.29					-0.29	
CSA	NC						0.72			0.10	0.10	0.10	0.97		0.35	0.25	1.25	1.25					0.28	0.10	0.10		0.10	0.10	0.10					0.10	
CSL	NC																																		
CSP	NC						0.04						0.17		-0.03	-0.17	0.51	0.51					0.11	0.17											
CST	NC						0.20	0.40					0.53		0.49	0.17	1.04	1.04					0.40		0.40										
CSV	NC												0.69																						
CVA	NC						0.42						0.44		0.15	0.22	0.89	0.89					0.16		0.22	0.26									
CVL	NC						0.49			0.20	0.20	0.20	0.55		0.31	0.19	1.06	1.06					0.32	0.20	0.28	0.43								0.20	
CVP	NC																																		
CYB	NC																																		
GAC	NC						0.92					-0.09	0.73				0.92	0.92						0.01											
GAR	NC		1.56	1.17			0.63						0.90			0.28	1.30	1.30	1.21		0.14			0.14	0.12					0.69					
GAX	NC		-0.06	-0.15			-0.48			-0.30	-0.30	-0.32	-0.30			-0.71	-0.32	-0.32	-0.44		-0.06			-0.23	-0.19					-0.41				-0.30	
GBD	NC		0.03	-0.20						-0.06	-0.06	-0.06							-0.10		-0.25	-0.46		-0.04	-0.06					-0.18				-0.06	
GBG	NC		1.54	0.11			0.10					0.03	0.15			-0.02	0.17	0.17	-0.05		0.20			0.13	0.03					-0.15					
GBM	NC		-0.16	-0.43															-0.23		-0.09			-0.03						0.30					
GCB	NC		0.12	-0.21													0.20	0.20	-0.07		-0.14	-0.49		-0.05						-0.09					
GCR	NC						-0.37			-0.25	-0.25	-0.26	-0.30			-0.53	-0.30	-0.30						-0.23										-0.25	
GCV	NC		0.30	0.34			-0.31					0.06	-0.04				0.15	0.15	0.03		0.30	-0.33		0.06	0.05		0.05	0.05	0.05	-0.05					
GCW	NC		0.05	-0.12						-0.25	-0.25	-0.26					0.38	0.38	-0.12		-0.26	-0.40		-0.09	-0.07					-0.32				-0.25	
GDC	NC		0.15	0.40			-0.11			0.05	0.05	0.07	0.11				0.23	0.23	0.12		0.15	-0.65		0.14	0.09					0.09				0.05	
GDX	NC						-0.09			-0.20	-0.20	-0.19	-0.29				0.01	0.01						-0.21	0.03									-0.20	

Name	IRIS	Delays (sec) By Velocity Model‡																																	
	CODE	AUB	BAE	BAR	BAS	COA	CON	COY	CST	DIA	GAB	GEY	HAY	LAS	LEW	LIV	LOM	LON	MAA	MAM	MAN	MEN	MOR	NBY	NCG	PEN	PGH	PMM	PSM	PTA	SCA	SHA	TRA	TRE	WAL
GGP	NC						0.16			-0.09	-0.09	-0.12	-0.15				0.10	0.10				-0.43		0.03	0.07									-0.09	
GGU	NC		0.09	0.13			-0.40					-0.08	-0.30						0.20		0.04	-0.72		0.02						0.11					
GHC	NC						-0.56			-0.07	-0.07	-0.03	0.42				-0.39	-0.39				-0.27		0.06	-0.04									-0.07	
GHG	NC		0.01	-0.22						-0.05	-0.05	-0.12							-0.12		-0.13	-0.12		-0.13	-0.05					-0.18				-0.05	
GHL	NC		0.02	-0.18			-0.53			-0.18	-0.18	-0.19	-0.32				0.10	0.10	-0.17		-0.11	-0.37		-0.02	-0.04		-0.04	-0.04	-0.04	-0.16				-0.18	
GHM	NC		-0.29	-0.06						0.17	0.17	0.17							0.21			-0.19		0.15	0.17					0.15				0.17	
GHO	NC		-0.10	0.03			-0.80					0.03					-0.21	-0.21	0.21		-0.01	-0.57		0.16						0.11					
GHV	NC		-0.02	-0.21			-0.50					0.06					0.22	0.22	-0.03		-0.03	0.03		0.04						-0.01					
GMC	NC		-0.13	-0.13			0.03			-0.18	-0.18	-0.13	0.23				-0.25	-0.25	-0.08		-0.13	-0.82		-0.04	-0.02					-0.06				-0.18	
GMK	NC		0.30	0.06						0.25	0.25	0.26	0.46				0.55	0.55	0.11		0.28	0.12		0.12	-0.04					0.17				0.25	
GMO	NC						0.36			-0.13	-0.13	-0.08	-0.23				-0.33	-0.33				-0.68		-0.03	-0.13		-0.13	-0.13	-0.13					-0.13	
GNA	NC		-0.12	-0.08			-0.02										0.08	0.08	0.08		0.18	-0.62		-0.08						-0.06					
GPM	NC		0.22	0.07			-0.37			-0.06	-0.06	-0.08	-0.03				0.25	0.25	-0.02		0.05	-0.03		0.08	0.02					-0.03				-0.06	
GRO	NC																					0.41													
GRT	NC		0.07	-0.34			0.43			-0.26	-0.26	-0.19	0.42				0.19	0.19	-0.26		-0.14			-0.24	-0.13					-0.30				-0.26	
GSG	NC		0.18	0.02			0.91			0.28	0.28	0.26	1.13						-0.03		0.26			0.29	0.37					0.12				0.28	
GSN	NC		0.16	0.02			-0.31			0.03	0.03	0.05	-0.17				-0.07	-0.07	0.06		0.44	-0.36		0.09	0.19					0.01				0.03	
GSS	NC						0.27			-0.02	-0.02	-0.02	0.17				-0.18	-0.18							-0.13									-0.02	
GTS	NC		-0.25	-0.25													0.70	0.70	0.05		-0.33	0.01		0.16						0.19					
GWK	NC		0.14	-0.12			0.14			0.19	0.19	0.05							0.03		0.01			-0.11	0.15					0.01				0.19	
GWR	NC		0.18	-0.03						0.05	0.05	-0.24							0.04		-0.02	-0.43		-0.11	0.05					-0.20				0.05	
HAZ	NC						0.67	0.19	-0.24	0.28	0.28	-0.22	-0.23		0.21	0.06	-0.44	-0.44					0.34	-0.22	0.26	-0.56	-0.22	-0.22	-0.22					0.37	
HBT	NC						0.63	0.42	-0.01	0.43	0.43	-0.16	0.10		0.39		-0.44	-0.44					0.48	-0.16	0.31		-0.16	-0.16	-0.16					0.58	
HCA	NC						0.35	-0.33	0.19	0.33	0.33	0.03	0.37		-0.09		0.26	0.26					0.06	0.03	-0.07	-0.24	0.03	0.03	0.03					0.07	
HCB	NC						0.86	0.01	0.01	0.21	0.21	-0.17	0.11		0.18	0.13	0.13	0.13					0.24	-0.17	0.07	-0.19	-0.17	-0.17	-0.17					0.40	
HCO	NC						0.23	0.13	-0.09	0.26	0.26	-0.15	-0.30		0.22		0.05	0.05					0.37	-0.15	0.07	-0.32	-0.15	-0.15	-0.15					0.31	
HCR	NC						0.17	-0.38	0.07	0.04	0.04	-0.18	-0.44		-0.13		0.02	0.02					-0.02	-0.18	-0.37	-0.20	-0.18	-0.18	-0.18					-0.20	
HDL	NC						0.38	0.01	-0.19	-0.04	-0.04	-0.28	-0.58		0.02		-0.24	-0.24					0.15	-0.28		-0.52	-0.28	-0.28	-0.28					0.20	
HER	NC																-0.03	-0.03																	
HFE	NC					-0.09	0.06	-0.41		0.29	0.29	-0.05	0.06		-0.21	0.01	0.23	0.23					-0.16	-0.05	-0.11		-0.05	-0.05	-0.05						
HFP	NC					-0.48	-0.36	0.16	-0.20	-0.22	-0.22	-0.27	-0.62				-0.62	-0.62					0.28	-0.27	-0.11	-0.88	-0.27	-0.27	-0.27					0.17	
HGS	NC					0.01	-0.33	-0.43		0.27	0.27	-0.07	-0.35		-0.19	-0.07	0.33	0.33					-0.15	-0.07	-0.08	-0.15	-0.07	-0.07	-0.07					-0.09	
HGW	NC						0.06	-0.30	-0.11	-0.14	-0.14	-0.24	-0.50		-0.11	-0.07	-0.12	-0.12					0.02	-0.24	-0.47	-0.41	-0.24	-0.24	-0.24					-0.33	
HJG	NC					-0.36	0.10	0.11	-0.20	-0.20	-0.20	-0.34	-0.63		0.05		-0.51	-0.51					0.19	-0.34	-0.09	-0.64	-0.34	-0.34	-0.34					0.11	
HJS	NC					-0.12	-0.09	-0.19	0.43	0.38	0.38	-0.02	0.49		-0.18		0.38	0.38					0.02	-0.02	-0.12		-0.02	-0.02	-0.02						
HLT	NC					-0.14	0.51	-0.36	0.46	0.29	0.29	0.06	0.29		-0.26		0.31	0.31					-0.23	0.06	-0.06		0.06	0.06	0.06					-0.04	
HMO	NC					-0.42	0.04	-0.06	-0.19	-0.01	-0.01	-0.18	-0.06		-0.32		-0.25	-0.25					-0.24	-0.18	-0.24		-0.18	-0.18	-0.18					-0.25	
HOR	NC						0.77	-0.21		0.41	0.41	-0.10	0.05		-0.02	0.13	0.13	0.13					0.03	-0.10	-0.02	-0.32	-0.10	-0.10	-0.10					0.17	
HPH	NC							0.35		0.70	0.70	0.26	0.74		0.53		0.91	0.91					0.63	0.26	0.15	0.22	0.26	0.26	0.26					0.43	
HPL	NC					-0.16	0.05	-0.47		0.29	0.29	0.01	-0.08		-0.35	0.03	0.40	0.40				-2.50	-0.25	0.01	-0.01		0.01	0.01	0.01					-0.12	
HQR	NC					-0.05	-0.09	-0.20	0.47	0.45	0.45	0.07	0.03		-0.30		0.32	0.32					-0.20	0.07	0.01		0.07	0.07	0.07					-0.03	
HSF	NC						0.49	0.49	0.06	0.29	0.29	0.09	0.51		0.68		0.06	0.06					0.78	0.09	0.27	-0.14	0.09	0.09	0.09					0.55	
HSL	NC					-0.44	0.65	-0.07		0.72	0.72	-0.16	0.74		0.09		0.87	0.87		-0.45			0.06	-0.16	0.22		-0.16	-0.16	-0.16					0.16	
HSP	NC					-0.34	-0.11	-0.28	0.39	0.35	0.35		-0.13		-0.03	0.06	0.36	0.36					0.05		-0.06	-0.10								-0.03	
JAL	NC						-0.40	-0.21		-0.47	-0.47	-0.11	-0.32		-0.01	-0.21	-0.11	-0.11				-2.30	0.20	-0.11	-0.38	-0.49	-0.11	-0.11	-0.11					-0.18	
JBC	NC						-0.30	0.01		0.33	0.33	0.01	-0.09		0.02	-0.05	0.03	0.03					0.24	0.01	-0.10	-0.25	0.01	0.01	0.01					0.21	
JBG	NC						-0.20			0.07	0.07	0.07	0.14		0.05	0.09	0.03	0.03					0.09	0.07	0.07	-0.04	0.07	0.07	0.07					0.07	
JBL	NC						-0.56	-0.26	-0.42	-0.47	-0.47	-0.18	-0.41		-0.33	-0.27	-0.33	-0.33				-2.89	-0.14	-0.18	-0.61	-0.41	-0.18	-0.18	-0.18					-0.16	

Name	IRIS	Delays (sec) By Velocity Model‡																																	
	CODE	AUB	BAE	BAR	BAS	COA	CON	COY	CST	DIA	GAB	GEY	HAY	LAS	LEW	LIV	LOM	LON	MAA	MAM	MAN	MEN	MOR	NBY	NCG	PEN	PGH	PMM	PSM	PTA	SCA	SHA	TRA	TRE	WAL
JBM	NC						-0.40	-0.16		-0.08	-0.08	-0.08	-0.17		-0.02	-0.11	-0.05	-0.05					0.05	-0.08	-0.25	-0.31	-0.08	-0.08	-0.08					-0.08	
JBZ	NC						0.44	0.23		0.36	0.36	0.19	0.11		0.31	0.56	0.21	0.21					0.44	0.19	0.15	0.01	0.19	0.19	0.19					0.26	
JCB	NC						-0.28	-0.32	-0.04	-0.04	-0.04	-0.07	-0.44		0.01	-0.02	0.11	0.11					0.17	-0.07	-0.37	-0.34	-0.07	-0.07	-0.07					-0.33	
JCH	NC																																		
JCP	NC																																		
JEC	NC						-0.06	-0.13	0.17	0.48	0.48	-0.04	-0.19		0.04	0.10	-0.05	-0.05					0.20	-0.04	-0.25	-0.22	-0.04	-0.04	-0.04					-0.21	
JEG	NC						-0.77			-0.14	-0.14	-0.14	-0.47		-0.52	-0.62	-0.49	-0.49					-0.34	-0.14	-0.14	-0.38	-0.14	-0.14	-0.14					-0.14	
JEL	NC																0.11	0.11																	
JHL	NC						-0.35	-0.23	-0.09	-0.22	-0.22	-0.15	-0.24		-0.04	-0.08	-0.02	-0.02					0.18	-0.15	-0.39	-0.45	-0.15	-0.15	-0.15					-0.28	
JHP	NC						-0.39	0.03					-0.14		-0.19	-0.15	-0.13	-0.13					-0.18			-0.16									
JJR	NC																																		
JLX	NC						-0.39	-0.28		-0.40	-0.40	-0.07	-0.27		-0.17	-0.18	-0.03	-0.03					0.03	-0.07	-0.56	-0.44	-0.07	-0.07	-0.07					-0.07	
JMG	NC						-0.68			-0.10	-0.10	-0.10	-0.43		-0.51	-0.65	-0.32	-0.32					-0.29	0.04	-0.10	-0.35								-0.10	
JMP	NC																																		
JNA	NC																																		
JPL	NC						0.55	0.33	0.02	0.26	0.26	0.06	0.23		0.37	0.73	0.08	0.08					0.50	0.06	0.11	-0.24	0.06	0.06	0.06					0.31	
JPP	NC						-0.32	-0.05		0.06	0.06	-0.05	-0.04		0.07		-0.07	-0.07					0.18	-0.05	-0.29	-0.16	-0.05	-0.05	-0.05					-0.05	
JPR	NC						-0.46			-0.11	-0.11	-0.11	-0.21		-0.42	-0.57	-0.06	-0.06					-0.38	0.04	-0.11	-0.05								-0.11	
JPS	NC						-0.51	-0.11		0.49	0.49	-0.03	-0.07		-0.11	-0.21	-0.23	-0.23					-0.02	-0.03	-0.03	-0.09	-0.03	-0.03	-0.03					0.24	
JRG	NC						-0.22	0.02		-0.15	-0.15	-0.15	-0.12		0.02	0.16	-0.17	-0.17					0.23	-0.15	-0.43	-0.40	-0.15	-0.15	-0.15						
JRR	NC						-0.18	-0.31	-0.14	-0.20	-0.20	-0.20	-0.27		-0.06	0.04							0.07	-0.20	-0.49	-0.46	-0.20	-0.20	-0.20					-0.43	
JSA	NC						-0.59			-0.08	-0.08	-0.08	-0.30		-0.37	-0.50	-0.26	-0.26					-0.39	0.13	-0.08	-0.32								-0.08	
JSB	NC																																		
JSC	NC						-0.46	-0.18		-0.10	-0.10	-0.10	-0.19		-0.08	-0.09	-0.26	-0.26					0.01	-0.10	-0.10	-0.34	-0.10	-0.10	-0.10					-0.10	
JSF	NC						-0.32	0.10		0.09	0.09	0.09			-0.13	-0.15	0.22	0.22				-1.03	-0.06	0.09	0.09	-0.02	0.09	0.09	0.09					0.09	
JSG	NC						0.05	0.14		0.15	0.15	0.15	0.23		0.38	0.33	0.26	0.26					0.53	0.15	0.02	-0.17	0.15	0.15	0.15					0.15	
JSJ	NC						-0.08	0.41		0.16	0.16	0.16	0.19		0.24	0.25	0.42	0.42					0.40	0.16	0.19	-0.06	0.16	0.16	0.16					0.16	
JSM	NC						-0.25	-0.03		0.07	0.07	0.07	0.07		0.15	0.08	-0.13	-0.13					0.21	0.07	-0.10	-0.08	0.07	0.07	0.07					0.07	
JSS	NC						-0.35	-0.26		-0.44	-0.44	-0.09	-0.25		-0.09	-0.21	-0.03	-0.03					0.13	-0.09	-0.51	-0.39	-0.09	-0.09	-0.09					-0.30	
JST	NC						-0.31	-0.26	0.03	-0.05	-0.05	-0.10	-0.45		0.05	-0.08	0.15	0.15					0.26	-0.10	-0.37	-0.25	-0.10	-0.10	-0.10					-0.43	
JTG	NC						0.46	0.23	0.01	0.07	0.07	0.11	0.38		0.27	0.02	0.05	0.05					0.44	0.11	0.01	-0.17	0.11	0.11	0.11					0.13	
JUC	NC						-0.53	-0.17	-0.42	-0.29	-0.29	-0.16	-0.16		-0.28	-0.11	-0.33	-0.33					-0.01	-0.16	-0.62	-0.60	-0.16	-0.16	-0.16					0.05	
JUM	NC																																		
KBB	NC		0.06	0.06													0.82	0.82	0.44		0.26	0.16			0.18					0.34					
KBN	NC		-0.21	-0.07															0.33		0.23	0.50								0.35					
KBR	NC		-0.27	-0.27															-0.27		-0.27	-0.22								-0.27					
KBS	NC		0.49	-0.01															0.06		-0.13	0.06			0.16					-0.09					
KCP	NC		0.45	-0.03													0.59	0.59	0.07		-0.08	-0.05								-0.08					
KCR	NC		-0.12	-0.12															0.27		0.46	0.04			0.02					0.69					
KCS	NC																					0.25													
KCT	NC		0.09	0.09													0.25	0.25	0.19		0.09	0.15								-0.95					
KFP	NC		0.11	-0.30													0.69	0.69	-0.17		-0.21	-0.21								-0.01					
KGM	NC		0.13	0.13															0.13		0.13	0.15								0.13					
KHB	NC																					-0.04													
KHM	NC																					-0.02													
KIP	NC		0.10	-0.26													0.87	0.87	-0.13		-0.25	0.15													
KJJ	NC																					-0.02													
KKP	NC		0.22	0.22															0.40		0.22	0.55								0.26					

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KMP	NC		-0.31	-0.31		-0.20													-0.17		-0.31	-0.12			-0.12					0.50					
KOM	NC																					-0.14													
KPP	NC		0.10	0.10															0.42		0.24	0.42			0.20					0.38					
KRK	NC		-0.12	-0.20															0.09		0.03	-0.05								0.13					
KRM	NC																					-0.34													
KRP	NC																					-0.35													
KSC	NC																																		
KSM	NC		-0.40	-0.40													-0.63	-0.63	0.25		0.19	-0.17								-0.88					
KSP	NC		0.22	-0.14													0.56	0.56	-0.02		0.02	-0.36								-0.19					
KSX	NC																					-0.39													
KTR	NC																					-0.09													
LAS	NC																																		
LBF	NC													0.34								1.05													
LBK	NC													-0.24								0.14													
LBP	NC																					0.01													
LCF	NC													0.13								0.48													
LCM	NC													0.02								0.27													
LDB	NC													-0.09																					
LGB	NC													-0.09								1.10													
LGM	NC																																		
LGP	NC													-0.31								0.04													
LHC	NC													0.36																					
LHE	NC																					1.28													
LHK	NC													0.28								0.76													
LME	NC													0.20								0.54													
LMH	NC																					0.92													
LMP	NC																					1.65													
LPD	NC													0.13								0.54													
LPG	NC																					0.31													
LPK	NC																					0.16													
LRB	NC																					0.63													
LRD	NC													0.13								0.47													
LRR	NC																																		
LSF	NC																					0.13													
LSH	NC													-0.43								0.47			0.12										
LSL	NC													-0.04								0.25													
LSM	NC													0.03																					
LSR	NC																					0.67													
LTC	NC					-0.20								0.02								0.35													
LVR	NC																					0.52													
LWH	NC													-0.51								0.16			-0.05										
MBE	NC																																		
MBO	NC					-0.13	-0.23						0.02		-0.25		0.23	0.23		-0.68				-0.14	0.07										
MBU	NC																																		
MCD	NC																			0.13					0.27										
MCL	NC					1.58														-0.08					-0.03										
MCM	NC																			-0.16					-0.08										
MCS	NC																			0.04					0.20										

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MCU	NC						-0.54			0.17	0.17	0.17	-0.15		-0.63		0.45	0.45		-0.94			-0.55	0.17	0.02									0.17	
MDC	NC																			-0.16					-0.01										
MDP	NC																			-0.22					-0.05										
MDR	NC					1.96														0.07					0.11										
MEM	NC					1.86														0.06					0.17										
MFB	NC																			0.07					0.09										
MGP	NC																			0.01					0.09										
MHD	NC					-1.35	0.55			0.65	0.65				0.35		0.72	0.72		-0.41					0.14										
MLC	NC					1.52														-0.16					-0.05										
MLH	NC																			0.45					0.46										
MLM	NC					2.16														0.26					0.29										
MLR	NC						0.51						0.96				1.28	1.28		-0.77															
MMI	NC						0.89										1.27	1.27																	
MML	NC					1.83														0.14					0.25										
MMP	NC																			-0.23					-0.06										
MMS	NC																																		
MMT	NC																																		
MNH	NC						-1.01			-0.03	-0.03	-0.03	-0.63			-0.04	0.33	0.33		-1.00				-0.03	-0.03									-0.03	
MOG	NC																			-0.02					-0.26										
MOY	NC						-0.46			0.11	0.11	0.11	-0.26		-0.60		0.38	0.38		-0.96			-0.45	0.11	-0.01		0.11	0.11	0.11					0.11	
MPR	NC																																		
MRC	NC																			-0.07					0.04										
MRD	NC																																		
MRF	NC						0.06			-0.10	-0.10	-0.10	0.43		0.13		1.08	1.08		-1.07				-0.10	-0.03									-0.10	
MSK	NC																			0.04					0.07										
MSL	NC					1.50														-0.12					0.02										
MST	NC						0.06						0.16		0.12		0.64	0.64		-1.04					0.04										
MTC	NC					1.67																			0.20										
MTU	NC																			-0.17					-0.02										
MWB	NC																			-0.14															
MYL	NC					-0.50				0.61	0.61		-0.03		-0.24		0.41	0.41		-0.49			-0.49		-0.13										
NAD	NC						0.43						0.98			0.40	1.22	1.22																	
NAP	NC						-0.37						0.18			-0.60	0.52	0.52																	
NBP	NC						-0.03			0.49	0.49	0.46	0.77		-0.07	-0.09	1.01	1.01						0.35	0.21		0.21	0.21	0.21					0.49	
NBR	NC						-0.57			-0.10	-0.10	-0.41	-0.04		-0.69	-0.79	0.35	0.35						0.11	-0.10	0.03	-0.10	-0.10	-0.10					-0.10	
NCF	NC						-0.94			-0.16	-0.16	-0.08	-0.32		-0.37	-0.74	-0.04	-0.04						-0.02	-0.17	-0.11	-0.17	-0.17	-0.17					-0.16	
NCP	NC						0.37									0.31	1.34	1.34																	
NDH	NC						0.54			0.18	0.18	0.18	0.44			-0.07	1.33	1.33						0.45	0.18		0.18	0.18	0.18					0.18	
NFI	NC						-0.77			-0.09	-0.09	-0.09	-0.56				-0.31	-0.31						-0.09	-0.09		-0.09	-0.09	-0.09					-0.09	
NFR	NC						-0.45			0.04	0.04	0.08	0.25				0.08	0.08				0.07		0.10	-0.04									0.04	
NGV	NC						-0.08			-0.13	-0.13	-0.50	0.34		-0.41	-0.51	0.39	0.39						-0.20	-0.13	0.24	-0.13	-0.13	-0.13					-0.13	
NHF	NC																																		
NHM	NC						0.54			0.51	0.51	0.51	0.93		1.06	0.91	1.01	1.01						0.36	0.51		0.51	0.51	0.51					0.51	
NIM	NC						-0.31						0.18			-0.74	0.43	0.43																	
NLH	NC						0.28					-0.01	0.52		0.02	-0.15	0.50	0.50						-0.12		0.50									
NLN	NC						-0.98			-0.11	-0.11	-0.13	-0.52		-0.58	-0.73	-0.77	-0.77						-0.15	-0.11	-0.19	-0.11	-0.11	-0.11					-0.11	
NMC	NC						-0.16						-0.25				-0.66	-0.66																	
NMH	NC					-0.20	-0.11			-0.39	-0.39	-0.39	0.09			-0.39	-0.01	-0.01						-0.05	-0.20									-0.39	

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NMI	NC																																		
NMT	NC			-0.08			0.45			-0.19	-0.19	-0.12	-0.02			-0.41	0.16	0.16	-0.13		-0.12			-0.18	-0.18					0.10				-0.19	
NMW	NC						-0.11			-0.12	-0.12	-0.12	0.14			-0.30	0.02	0.02				-0.17		0.02	-0.17		-0.17	-0.17	-0.17					-0.12	
NOL	NC						-0.94			-0.10	-0.10	-0.11	-0.60		-0.50	-0.58	0.42	0.42						-0.07	-0.10	-0.16								-0.10	
NPR	NC						-0.80						-0.63				-0.20	-0.20						-0.06		-0.19									
NPV	NC						-0.31						-0.09			-0.85	0.22	0.22																	
NRR	NC						-0.21						0.98			-0.30	0.76	0.76																	
NSH	NC						-0.70			-0.27	-0.27	-0.27	-0.26			-0.82	-0.11	-0.11				-0.27		-0.07	-0.23		-0.23	-0.23	-0.23					-0.27	
NSP	NC						-0.42			-0.10	-0.10	-0.79	0.06		-0.70	-0.74	-0.19	-0.19						-0.24	-0.10	0.31								-0.10	
NTA	NC						-0.82						-0.56		-0.81	-0.77	-0.01	-0.01					-0.62	-0.19		-0.18									
NTB	NC						-0.75					0.03	-0.55			-0.32	-0.50	-0.50				-0.68		0.07		-0.23									
NTY	NC						-0.95			0.18	0.18	-0.12	-0.03		-0.32	-0.66	0.54	0.54				-0.30		0.02	-0.10		-0.10	-0.10	-0.10					0.18	
NVA	NC						0.14					-0.06	0.95		-0.36	-0.04	0.91	0.91						0.05											
NVE	NC						-0.40			-0.53	-0.53	-0.44	0.36			-0.89	-0.01	-0.01						-0.03										-0.53	
NWR	NC						-0.38			-0.04	-0.04		-0.30			-0.69	0.44	0.44				-0.40		0.01	-0.18									-0.04	
OBH	NC	0.06					0.36			0.02	0.02	0.02		-0.18			1.06	1.06				-0.04		0.02	0.14									0.02	
OCH	NC	0.06					-0.21			-0.14	-0.14	-0.14		0.13			0.01	0.01				-0.38		-0.14	-0.12									-0.14	
OCM	NC	0.20												-0.16			0.35	0.35							0.03										
OCR	NC																																		
OGO	NC	0.05					-0.07			-0.11	-0.11	-0.11		-0.07			0.57	0.57				-0.11		-0.11	0.04									-0.11	
OHC	NC	-0.08					-0.39			-0.14	-0.14	-0.14	-0.70	-0.27			0.60	0.60				-0.14		-0.14	-0.15									-0.14	
ORA	NC	-0.04								-0.06	-0.06	-0.06	-0.71	-0.16			0.81	0.81				-0.06		-0.06	-0.05									-0.06	
ORD	NC	-0.01												-0.31			0.65	0.65						-0.15	-0.15										
OST	NC	0.38					0.18			-0.08	-0.08	-0.08		-0.05			0.23	0.23				-0.08		-0.08	-0.10									-0.08	
OSU	NC	0.69								-0.24	-0.24	-0.24	-0.81	0.03			0.14	0.14				-0.24		-0.43	0.09									-0.24	
OWY	NC	0.01								0.09	0.09	0.09	-0.90	-0.10			0.47	0.47				0.09		0.09	0.09									0.09	
PAB	NC																0.44	0.44											0.20						
PAD	NC					-0.49			-0.01	0.23	0.23						0.56	0.56							0.13		-0.23	-0.23	-0.16					0.13	
PAG	NC					-0.58			-0.02			-0.03					1.00	1.00						-0.03	0.04		0.01	0.15	0.08					-0.03	
PAN	NC					-0.44			-0.03	0.20	0.20	-0.07					0.44	0.44						-0.07	0.26		-0.24	-0.24	-0.09					0.29	
PAP	NC					-0.63	0.39		-0.01	0.20	0.20						0.53	0.53							0.29		-0.54	-0.54	-0.54					0.23	
PAR	NC					0.16				0.88	0.88	0.25					1.25	1.25		-0.50				0.25	0.20		1.29	1.29	1.29					0.68	
PBI	NC					-0.08			0.11								0.66	0.66							0.16		0.51	0.51	0.22						
PBM	NC																0.28	0.28																	
PBP	NC																0.94	0.94																	
PBW	NC					-0.34	0.61		-0.01	0.28	0.28						0.41	0.41							0.14		-0.15	-0.15	-0.15					0.63	
PCA	NC					-0.22			0.51	0.83	0.83	0.29												0.29	0.34		0.47	0.66	0.35					0.83	
PCB	NC																-0.05	-0.05																	
PCR	NC					-0.49			0.42	0.30	0.30	0.03					1.15	1.15		-0.80				0.03	0.08		0.48	0.60	0.48					0.02	
PDR	NC					0.18	0.61			0.81	0.81						1.16	1.16		-0.47					0.24		1.40	1.40	1.40						
PFR	NC																																		
PG1	NC																																		
PGH	NC					-0.53			-0.12	-0.33	-0.33	-0.17					0.68	0.68						-0.17	-0.27		-0.08	-0.19	-0.16					-0.33	
PHA	NC					-0.21			-0.04	0.34	0.34						0.92	0.92							-0.03		0.04	0.07	-0.13					0.34	
PHB	NC					0.60											1.29	1.29		-0.29					0.07		1.90	1.90	1.90						
PHC	NC					-0.35			0.08	0.20	0.20	-0.10					0.56	0.56						-0.10	-0.10		-0.26	-0.26	-0.26					0.38	
PHF	NC																0.55	0.55																	
PHO	NC					-0.16			0.05	0.59	0.59	-0.05					0.54	0.54						-0.05	-0.07		0.04	0.13	-0.12					0.32	

Name	IRIS	Delays (sec) By Velocity Model‡																																	
	CODE	AUB	BAE	BAR	BAS	COA	CON	COY	CST	DIA	GAB	GEY	HAY	LAS	LEW	LIV	LOM	LON	MAA	MAM	MAN	MEN	MOR	NBY	NCG	PEN	PGH	PMM	PSM	PTA	SCA	SHA	TRA	TRE	WAL
PHP	NC					-0.10	0.79		-0.20	0.06	0.06						0.36	0.36							-0.10		-0.31	-0.19	-0.31						
PHR	NC					-0.45	0.33		0.19	0.09	0.09	0.16					0.59	0.59						0.16	0.05		0.26	0.26	0.26					0.17	
PHS	NC					-0.38	0.52		-0.02	0.10	0.10						0.59	0.59									-0.16	-0.16	0.01					0.04	
PIR	NC																0.83	0.83																	
PJL	NC					-0.52	-0.33		0.02	0.18	0.18	-0.01					0.18	0.18				-2.93		-0.01	0.09		-0.20	-0.20	-0.20					0.21	
PKE	NC					-0.01																					1.56	1.56	1.56						
PKY	NC					-0.17			-0.09								0.37	0.37											-0.22						
PLO	NC					-0.62	0.28		-0.10	-0.09	-0.09	-0.23					0.24	0.24						-0.23	-0.06		-0.35	-0.35	-0.35					-0.07	
PMC	NC					-0.36			0.24	0.08	0.08	0.08					0.84	0.84						0.08	0.25		0.13	0.17	0.09					0.08	
PMG	NC					-0.88			-0.27			-0.13					0.28	0.28						-0.13	-0.22		-0.61	-0.61	-0.49					-0.13	
PML	NC																0.20	0.20									0.64	0.64	0.65						
PMM	NC					0.13			0.12	0.71	0.71						0.77	0.77							0.16		0.28	0.28	0.16						
PMP	NC					-0.15			0.09	0.39	0.39	0.11					0.48	0.48						0.11	0.24		-0.09	0.02	-0.09					0.33	
PMR	NC					-0.40			-0.03								1.06	1.06							0.12		0.07	0.13	0.18						
POP	NC																0.95	0.95																	
PPB	NC								0.12								0.01	0.01																	
PPC	NC					-0.29			-0.13	0.09	0.09						0.35	0.35							-0.14		-0.35	-0.27	-0.35						
PPG	NC																1.42	1.42																	
PPT	NC					-0.28	0.88		0.03	0.27	0.27	-0.01					0.47	0.47						-0.01	0.13		-0.01	-0.08	0.09					0.22	
PRC	NC					-0.33			0.37	0.28	0.28	0.13					0.98	0.98						0.13	0.01		0.70	0.66	0.70					0.23	
PRP	NC																																		
PSA	NC					-0.58	0.46		-0.02	0.09	0.09	0.02					0.42	0.42						0.02	0.01		-0.03	-0.29	-0.09					0.06	
PSC	NC					-0.45			-0.03								0.56	0.56							0.13		-0.03	-0.14	0.09						
PSM	NC					0.12			0.24	0.34	0.34	0.25					0.97	0.97						0.25	0.32		0.28	0.41	0.41					0.11	
PSR	NC					-0.19			-0.10								0.94	0.94							0.01		0.01	0.21	-0.13						
PST	NC					-0.11			-0.21	0.26	0.26						0.62	0.62							-0.12		-0.11	-0.15	-0.23					0.49	
PTA	NC																0.76	0.76																	
PTQ	NC																-0.13	-0.13																	
PTR	NC					-0.46			-0.10								0.65	0.65							0.07		-0.11	-0.11	-0.06						
PVC	NC					-0.16			-0.07	0.28	0.28						0.58	0.58							-0.08		-0.16	-0.08	-0.25						
PWK	NC					-0.21			0.23	0.60	0.60	0.11					0.83	0.83						0.11	-0.01		0.16	0.16	0.02					0.44	
PWM	NC					0.62											1.38	1.38		-0.25					0.13		1.76	1.76	1.76						
FRI	BK					-1.26				-0.03	-0.03	-0.03					0.81	0.81		-0.50				-0.03	-0.02		-0.03	-0.03	-0.03					-0.03	-0.35
MIN	BK						0.74							-0.23								-0.13			-0.09										
ABL	CI																0.52	0.52							-0.31										-0.30
ARV	CI																1.15	1.15																	0.17
BCH	CI					-1.16			-0.29								0.36	0.36							-0.13		-0.08	-0.08	-0.23						
BMT	CI																0.86	0.86							-0.02										
CRG	CI					-0.87			0.21								0.90	0.90							0.07				0.08						
FRK	CI																														0.30				
FTC	CI																0.69	0.69																	
JUL	CI																																		
MAR	CI																0.98	0.98																	
MWC	CI																																		
PKM	CI																0.71	0.71							-0.04				-0.26						
PLE	CI																1.19	1.19																	
RYS	CI																1.09	1.09																	
SCC	CI					-0.15			-0.01								0.48	0.48							0.17				-0.27						

Name	IRIS	Delays (sec) By Velocity Model‡																																	
	CODE	AUB	BAE	BAR	BAS	COA	CON	COY	CST	DIA	GAB	GEY	HAY	LAS	LEW	LIV	LOM	LON	MAA	MAM	MAN	MEN	MOR	NBY	NCG	PEN	PGH	PMM	PSM	PTA	SCA	SHA	TRA	TRE	WAL
SIM	CI																0.87	0.87																	
SLC	CI																0.86	0.86																	
SND	CI																																		0.05
SUN	CI																																		
SYP	CI																0.75	0.75																	
TEJ	CI																																		-0.13
TMB	CI					-0.67											1.19	1.19							0.20										
TOW	CI																														0.40				0.40
WAS	CI					-0.29											1.34	1.34		-0.70															0.10
WBS	CI																			0.17											-0.30				-0.03
WCH	CI																			-0.61											-0.30				0.04
WJP	CI																1.26	1.26																	-0.15
WLH	CI					-0.07														-0.55											-0.30				
WNM	CI																			-0.60											-0.30				-0.09
WOF	CI					-1.29											0.85	0.85		-0.62															0.02
WOR	CI																			-0.80											-0.30				-0.04
WRC	CI																			-0.34															0.11
WSH	CI																			-0.59															0.22
WVP	CI																			-1.00															-0.05
YEG	CI					-0.67			0.11								0.84	0.84							-0.07		0.12	0.12	0.12						
BCK	NN																			-0.02					-0.04										
BEN	NN																			-0.20					-0.13										
BHP	NN																			-0.11					-0.02										
CAS	NN																			-0.01					0.10										
CWC	NN																			-0.08					-0.15										
HTC	NN																			0.08					0.04										
LUL	NN																2.73	2.73		-0.10															
MGN	NN					2.37														0.07					0.06										
MLN	NN																			-0.01					0.04										
ORC	NN					2.02														-0.12					-0.05										
POC	NN																			-0.33					-0.05										
RCC	NN																			-0.14					-0.10										
SCH	NN					1.49														-0.17					-0.17										
SLK	NN																			-0.21					0.13										
STR	NN																			-0.02					0.02										
WMD	NN																			-0.19					-0.16		-0.23	-0.23	-0.23						
GAS	WR		0.02	-0.02															0.30		0.08	0.27		0.14	0.11					0.24					
KPK	WR	-0.01												0.03											0.22									0.06	
MGL	WR	-0.03					0.83			0.07	0.07			-0.18			1.25	1.25																0.07	
ORV	WR												-0.60	-0.23											-0.05									-0.15	

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‡Blank delay field denotes a value of zero or no delay available.

Network Response

Most of the stations in the NCSN have identical instrumentation but operate at different gains. The amplified output of each velocity transducer (seismometer) is frequency modulated, multiplexed, and transmitted to Menlo Park, California via a combination of radio, telephone, and microwave communications, so that all stations are digitized in common with the same time base. Most of the network is designed to record ground motion between 0.2 and 20 Hz with 40-50 db of dynamic range, but the passband and dynamic range is greater for special instrument clusters along the Hayward fault and at Parkfield. To provide on-scale recordings for larger earthquakes, the NCSN records 34 stations located throughout the network that have low-gain vertical seismometers (Figure 1, Table 1).

Healy and O'Neill (1977) showed how the response of the network can be modelled as a series of response functions, or filters, for each of the instrument components. These response functions are solutions of first and second order ordinary differential equations that describe the movement of a damped mass-and-spring system (*e.g.*, a seismometer) and the currents and voltages in an L-R-C electrical circuit. *Stewart and O'Neill* (1980) applied the method of *Healy and O'Neill* to determine the responses of the individual components used in the USGS short-period seismic networks. A discussion of the network and its response spectra previously and currently used by the NCSN is given by *Eaton* (1993). Table 6 provides the instrument response in terms of the complex poles and zeroes of the spectral elements, following the convention of *Stewart and O'Neill* (1980). The total response of the system at different attenuator settings is shown in Figure 4.

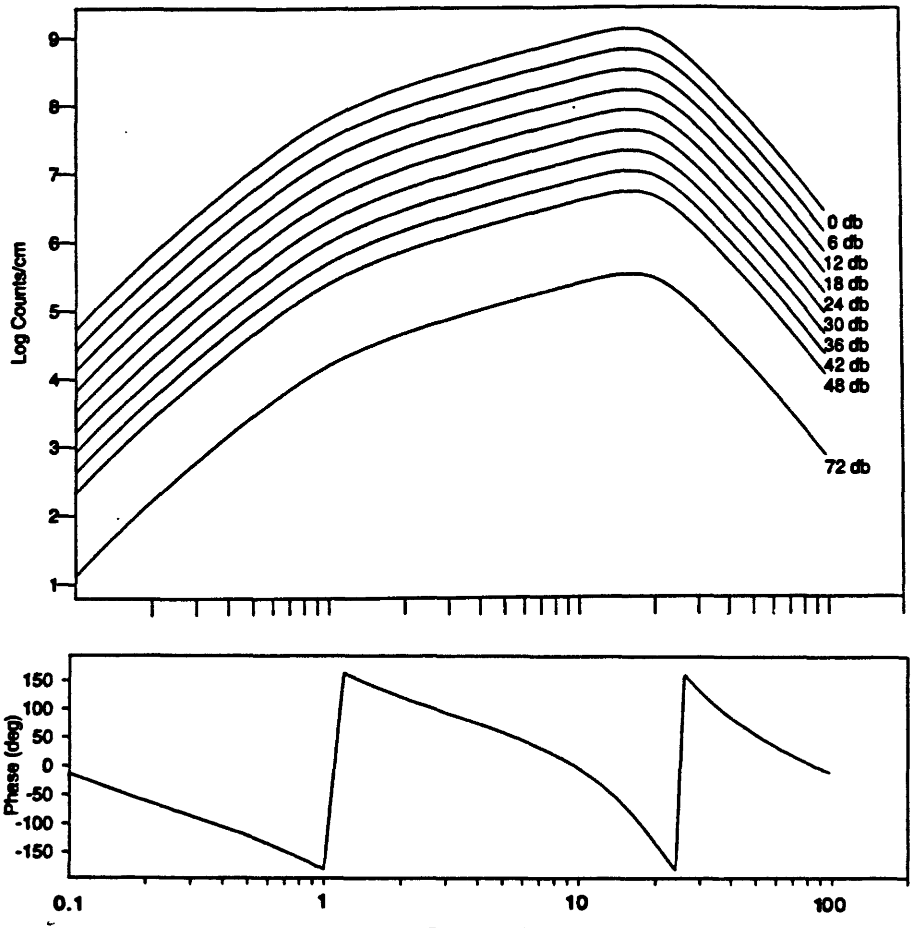

Figure 4. Amplitude and phase response of NCSN corresponding to parameters given in Table 6. Amplitude response is given as a function of attenuator settings.

Table 6. USGS Instrument Response Parameters

Instrument/ Amplitude function	f_0 (hz)	Damping	Poles[1] (rad/s)	Zeroes	Amplitude constant
Mark Products L4-C Seismometer $\frac{i\omega^3}{(\omega-\alpha_j)(\omega-\alpha_k)}$	1.0	0.8	$\alpha_j = +3.7699 + 5.0265i$ $\alpha_k = -3.7699 + 5.0265i$	$0.0 + 0.0i$ $0.0 + 0.0i$ $0.0 + 0.0i$	1.0

Sensitivity: A_S = 1.00 v/cm/sec

J512 Preamp/Voltage control oscillator

Hi-pass filter $\frac{\omega^2}{(\omega-\alpha_j)(\omega-\alpha_k)}$	0.095	1.0	$\alpha_j = 0.0 + 0.5969i$ $\alpha_k = 0.0 + 0.5969i$	$0.0 + 0.0i$ $0.0 + 0.0i$	1.0 1.0
Lo-pass filter $\frac{-1}{(\omega-\alpha_j)(\omega-\alpha_k)}$	44.0	1.0	$\alpha_j = 0.0 + 276.460i$ $\alpha_k = 0.0 + 276.460i$	none	276.46 276.46

Sensitivity: A_A= amplifier gain = $10^{(92.6\text{-attn})/20}$
A_M = modulator gain = 105/4.05 = 25.926 hz/v
A_{VCO} = VCO gain = 25.926 × $10^{(92.6\text{ - attn})/20}$ = 25.926 × $10^{2.3/20}$ × $10^{(90.3\text{ - attn})/20}$ hz/v

121 Discriminator

Lo-pass # 1 $\frac{-1}{(\omega-\alpha_j)(\omega-\alpha_k)}$	20.0	.3827	$\alpha_j = +116.0973 + 48.0915i$ $\alpha_k = -116.0973 + 48.0915i$	none	125.664 125.664
Lo-pass #2 $\frac{-1}{(\omega-\alpha_j)(\omega-\alpha_k)}$	20.0	.9239	$\alpha_j = +48.0832 + 116.1007i$ $\alpha_j = -48.0832 + 116.1007i$	none	125.664 125.664

Sensitivity: A_D = discriminator gain = 2.2 v/125 hz = 0.0176 v/hz

12-bit Tustin digitizer

Sensitivity: Ar = digitizer gain = 2047 counts/2.5 v = 818.8 counts/v.

System sensitivity

The response of the system as a whole is obtained by combining the spectral elements and sensitivity factors of its constituent parts. The overall system sensitivity A = $A_S \times A_{VCO} \times A_D \times A_R$ = 486.4 × $10^{(90.3\text{-attn})/20}$ counts/cm/sec.

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[1] The poles can be expressed in the SEED convention (*IRIS*, 1990) by multiplying by (0.0 + *i*).

Synopsis of Seismicity

In general, 1992 was notable for the absence of any significant earthquake sequences in the center of the network. However, two $M > 7$ earthquakes occurred at the edge of the net. The first event occurred in April at Cape Mendocino, but its aftershocks occurred primarily in the Pacific ocean, where the network's ability to locate earthquakes is degraded. Then on 28 June the Landers earthquake occurred within the Southern California Seismic Network. Only the northernmost Landers aftershocks that occurred within the NCSN are discussed in this report. A total of 21,365 earthquakes and blasts were detected by the NCSN during 1992. Of this total, 170 events had a coda magnitude (M_c) ≥ 3.5 and 5 events were $M \geq 5$ (Table 7, Figure 2). The following sections summarize the seismicity that occurred within the sub-regions shown in Figure 5. All origin times are UTC.

Cape Mendocino
Sub-region A

Two significant earthquake sequences occurred near the Mendocino Triple Junction, where the Pacific, North America, and southernmost Juan de Fuca (Gorda) plates meet. On 8 March at 03:43 a M 5.3 earthquake occurred at a depth of 11.2 km (Table 7) and caused minor damage near the town of Honeydew. This strike-slip earthquake (#1, Figure 2) had only 11 aftershocks within 20 km of the mainshock epicenter in the following 30 days, of which the largest event was approximately M 3.0. While this earthquake did not produce a large aftershock sequence, it should be noted that the magnitude of uniform detection for this region is approximately 1.9 due to the sparse network and the occurrence of earthquakes offshore. The aftershock distribution did not indicate which plane was the slip plane, but the prevailing geologic structure of the region would favor right-lateral slip on the vertical plane striking N60°W.

[*The following summary is an excerpt from Oppenheimer et al. (1993) which provides a review of geophysical observations of the Cape Mendocino earthquake sequence and implications for the hazards of the region.*] On 25 April, 1992 at 18:06 a surface wave magnitude (M_s) 7.1 earthquake occurred near the town of Petrolia, California (#2, Figures 2 and 6). The mainshock was followed the next day by two M_s 6.6 aftershocks at 07:41 (#3) and 11:41 (#4) located offshore approximately 25 km west-northwest of Petrolia. These three earthquakes generated more than 2000 recorded aftershocks in the triple junction region. The occurrence of a M 7 earthquake is not unusual at the triple junction; over 60 earthquakes of Modified Mercalli intensity (1) *(MMI)* ≥ VI or $M \geq 5.5$ have occurred there since 1853 (*Dengler et al.*, 1992). Damage estimates ranged from $48 to $66 million dollars, and the sequence caused 356 reported injuries, destroyed 202 buildings, and caused damage to an additional 906 structures primarily in the towns of Petrolia, Ferndale, Rio Dell, Scotia and Fortuna. It also triggered numerous landslides and rock falls and caused widespread liquefaction in local river valleys. The peak Modified Mercalli intensity was IX in the Petrolia region and decreased in approximately a radial pattern around the epicenter. The strong ground motions of the mainshock and two aftershocks were recorded on 14 instruments at epicentral distances from 5 to 130 km, and the peak accelerations were some of the highest ever recorded (*Shakal et al.*, 1992).

The hypocenter of the 25 April 1992 mainshock was 4 km east of Petrolia at a depth of 10.6 km (Figure 6). A focal mechanism determined by inverting teleseismic mantle Rayleigh waves and aftershock locations indicate nearly pure thrust motion on a N10°W-striking fault plane dipping 13° to the east-northeast (Figures 2 and 6). The location of the hypocenter at the southeast end of the aftershock zone suggests that the fault ruptured unilaterally to the west. Most aftershocks less than 12 km deep occurred within 10 km of the coast in a region bounded on the east by the main shock epicenter, on the south by the Mendocino fault, and on the north by a west-northwest trend of earthquakes. The location, depth, and orientation of the rupture plane are consistent with the absence of surface faulting onshore.

The two M_s 6.6 aftershocks locate 30 km west of the mainshock at depths near 20 km, and their mechanisms indicate right-lateral, strike-slip motion on planes striking to the southeast (Figure 6). The slip plane of the first aftershock is unknown because of the paucity of aftershocks. However, the second aftershock locates within a trend of smaller aftershocks at depths of 14 to 30 km on a southeast-striking plane dipping about 80° to the southwest; this orientation is consistent with the focal mechanism. The depths and mechanisms of the two large aftershocks provide evidence that rupture took place on faults in the Gorda plate and distinct from the mainshock fault. Although no large shocks ruptured the Mendocino fault during this sequence, many aftershocks occurred on the eastward projection of the fault. The aftershock activity was bounded on the south where the distribution of hypocenters is near vertical and extends to a depth of 25 km.

The elastic strain released by the mainshock caused significant horizontal and vertical deformation in the epicentral region. The mainshock elevated about 25 km of the coast from 3 km south of Punta Gorda to Cape Mendocino. Many intertidal organisms inhabiting rocky reefs perished in the three weeks following the mainshock. Maximum uplift was 140 ± 20 cm at Mussel Rock and 40 to 50 cm at the northernmost reef at Cape Mendocino. Modeling of coseismic horizontal and vertical site displacements measured by GPS surveys indicates shallow thrusting on a plane consistent with the teleseismic focal mechanism of the mainshock. The mainshock also generated a small tsunami recorded by sea level gauges along the California, southern Oregon, and Hawaiian coastlines. The largest tsunami amplitudes were recorded at Crescent City where two well-defined packets of wave energy with maximum positive heights of 35 and 53 cm within the first five hours were recorded.

Shasta and Lassen

Sub-region B

The most noteworthy seismicity recorded in this region occurred in response to the June 28 M 7.3 Landers earthquake (Figure 7) (*Hill et al.*, 1993). Significant increases in seismicity were triggered 12 minutes after the earthquake at Lassen (840 km) and 23 hours later at Burney (900 km). Otherwise, no unusual seismicity occurred in this region during 1992 (Figure 2). Of the 214 earthquakes located by the NCSN during this period, only three exceeded M 3.5. The largest event, a M 4.0 occurred on 16 July at a depth of 19 km approximately 18 km north-northeast of Red Bluff (Table 7). No aftershocks occurred within 20 km of the epicenter in the following 30 days.

Coast Ranges north of S.F. Bay

Sub-region C

The NCSN recorded 501 earthquakes primarily along the Rodgers Creek-Healdsburg-Maacama fault system and the Green Valley-Cedar Roughs-Bartlett Springs fault system (Figure 2) (see sub-region D for a discussion of The Geysers-lower Clear Lake region). No unusual earthquake sequences were recorded and no earthquakes above M 3.5 occurred. The San Andreas fault was nearly aseismic except for five $M \leq 2$ earthquakes near Gualala. A localized cluster of fourteen earthquakes ($M \leq 2$) occurred throughout the year 60-65 km west-southwest of Red Bluff at a depth range of 2 to 13 km. Another cluster of $M \leq 2$ events was located at depths of 6 - 8 km in the Montezuma Hills north of Antioch.

The Geysers - Lower Clear Lake

Sub-region D

The Geysers region continued to be one of the most seismogenic regions monitored by the NCSN. Earthquakes in this region are induced by activities associated with production of electricity, such as steam withdrawal, cooling of the reservoir, and fluid injection. We recorded an average of 7 earthquakes per day in 1992 and over 2600 events for the year. Four earthquakes had $M \geq 3.5$; the largest event, a M 4.4, occurred on 19 September at 23:04 at a depth of 3 km beneath the northern region of the geothermal steam field. Two events, a M 3.7 followed by a M 3.5 occurred on 24 March at 14:27 and 14:28 at a depths of 1.7 and 1.5 km near the same location as the M 4.4 event. The Geysers was the only region in the northern San Andreas fault system which exhibited triggered seismicity in response to the Landers earthquake (distance = 740 km) (*Hill et al.*, 1993). A swarm of $M < 1$ triggered seismicity occurred 30 s after the arrival of the main shock S wave.

Central California Coast Range

Sub-region E

There was very little seismicity recorded in sub-region E during 1992. Of the 155 events shown in Figure 2, only one event exceeded M 3.5. This event had a magnitude of 4.1 and occurred on 2 July at 13:59 about 4 km south-southwest of San Simeon at a depth of 3 km.

Loma Prieta - S. F. Peninsula

Sub-region F

Of the 908 earthquakes recorded in this sub-region during 1992, 805 occurred in the aftershock region of the 1989 M 7 Loma Prieta earthquake. The number of aftershocks is 51% the number that occurred in 1991 and 24% of the number that occurred in 1990. The two largest events in this sub-region both were magnitude 3.7 and occurred within 5 minutes of each other on 12 December at 15:53 and 15:58. They ruptured the San Andreas fault 4 km west of San Juan Bautista at a depth of 4.5 km and produced about 24 aftershocks in the following week. The largest event on the San Francisco Peninsula, north of the Loma Prieta region, was a M 3.4 event on 29 April at 01:16 that occurred at a depth of 6.7 km 1 km southeast of Pacifica.

San Francisco East Bay

Sub-region G

Seismicity in the East Bay continued on the same faults that have exhibited seismicity in the previous two decades. Two thirds of the activity (520 earthquakes) occurred on the Calaveras fault south of the Calaveras reservoir, with the remainder occurring primarily on the Hayward, Mission, Greenville, and Concord faults. The largest event to occur in this region during 1992 was a M 3.9 event on 15 February; it occurred 14 km east of Livermore at a depth of 16.6 km near the Tesla fault. A M 3.6 also occurred near San Leandro along the Hayward fault on 20 December at a depth of 5.5 km.

Creeping San Andreas
Sub-region H

The NCSN recorded 997 events in this region, and the largest event was a *M* 3.7 event on 28 February at a depth of 6.3 km on the San Andreas fault 29 km east of King City. This earthquake was followed by a brief swarm of 25 events over the next two days. Scattered seismicity also occurred on the Tres Piños and Quien Sabe faults.

Parkfield
Sub-region I

Two earthquakes in 1992 occurred in the vicinity of the nucleation points of the *M* 6 1934 and 1966 Parkfield earthquakes. On 20 October at 05:28 a *M* 4.5 event ruptured the San Andreas at a depth of 10.0 km near Middle Mountain, followed 6 days later by a M3.7 aftershock at 10.5 km on 26 October at 07:27. The former event triggered the first "A" level alert for the Parkfield experiment since its inception in 1985 (*Bakun et al.*, 1987), whereas the latter event resulted in a "B" level alert. The remaining 261 events located were otherwise typical (*Parkfield Working Group*, 1993).

Western margin of the S. Central Valley
Sub-region J

Six earthquakes above *M* 3.5 occurred in this region. A *M* 4.3 on 16 September occurred at a depth of 10.6 km 20 km east of Avenal. This event was followed by a *M* 4.2 event on 27 September. Three *M* 3.7-3.8 events occurred in the Coalinga region (15 January 04:58; 22 April 16:52; 5 December 02:52). A *M* 3.7 event also occurred 15 km west-northwest of Los Baños. The remaining 300 events were typical of activity of this region.

Central Valley/Western Sierra Nevada
Sub-region K

More than two hundred events occurred in this region. The largest event was a *M* 5.7 event on 11 July at 18:14 20 km north-northeast of Mojave (#6 Figure 2). This event is related to the Landers earthquake sequence and is discussed more fully in the SCSN Bulletin (*Wald et al.*, 1993). Similarly, about half of the events shown in Figure 2 are related to this earthquake. The remaining significant event was a poorly located *M* 3.8 on 25 December 10 km east-northeast of Quincy.

Long Valley Caldera
Sub-region L

This region continued to be very seismically active, recording 13% of all the seismicity in the network. Although there were no earthquakes greater than *M* 3.8 in 1992 (29 June), several noteworthy swarms occurred (Figure 7). In particular, the Long Valley region exhibited one of the most pronounced triggered seismicity responses to the Landers earthquake (*Hill et al.*, 1993). At an epicentral distance of about 415 km from the main shock, the number of earthquakes jumped from 38 in the week preceding the main shock to 340 in the week following the event. Seismicity commenced 9 minutes after the mainshock during the passage of the *S* wave and the Love and Rayleigh surface waves. Seismicity returned to the background level in the second half of July.

Most of the significant swarms occurred in the latter half of the year about 2 km east of Mammoth Lakes with focal depths of 5 to 8 km. The swarm of 27 August included a *M* 2.9 event, and the largest event of the swarm of 23 September was *M* 2.7. On 20 November a swarm of over 80 events occurred which included a *M* 2.7 earthquake.

Central/Southern Sierra Nevada
Sub-region M

The Rose Valley swarm began on February 15 near Coso Junction and was jointly recorded by the NCSN and SCSN networks (see *Wald et al.*, 1993) (Figures 2 and 7). The largest event in this swarm was a *M* 4.1 event on 19 February at a depth of 6.6 km. The activity returned to normal by the end of March. Another *M* 4.0 event occurred in the same vicinity on 4 September. The biggest event to occur in the region was a *M* 4.5 on 30 June that occurred 6 km east of China Lake (#5 Figure 2). About another 12 *M* 3.5-4.0 events occurred in the Coso-Indian Wells region throughout the year, but this activity was typical. Similar magnitude events were recorded in the Round Valley, Mt. Morrison, Chalfant, Silver Peak, and Owens Valley regions.

The Coso-Indian Wells, Mono Basin, Chalfant Valley, and region south of Long Valley caldera also exhibited triggered seismicity in response to the 28 June Landers earthquake (*Hill et al.*, 1993). The Coso region sustained the largest triggered event (*M* 4.4), and was closest to the source region (165-205 km). The seismicity in the Mono Basin region increased from 3 events in the week preceding Landers to 12 events in the week following the earthquake. Most triggered seismicity did not occur until 8 hours after the mainshock.

Carrizo Plain
Sub-region N

No unusual seismicity was recorded except for a *M* 3.6 event 10 km northeast of Taft at a depth of 21 km and a *M* 3.8 event on 3 March 24 km northwest of Tejon Pass at a depth of 25 km.

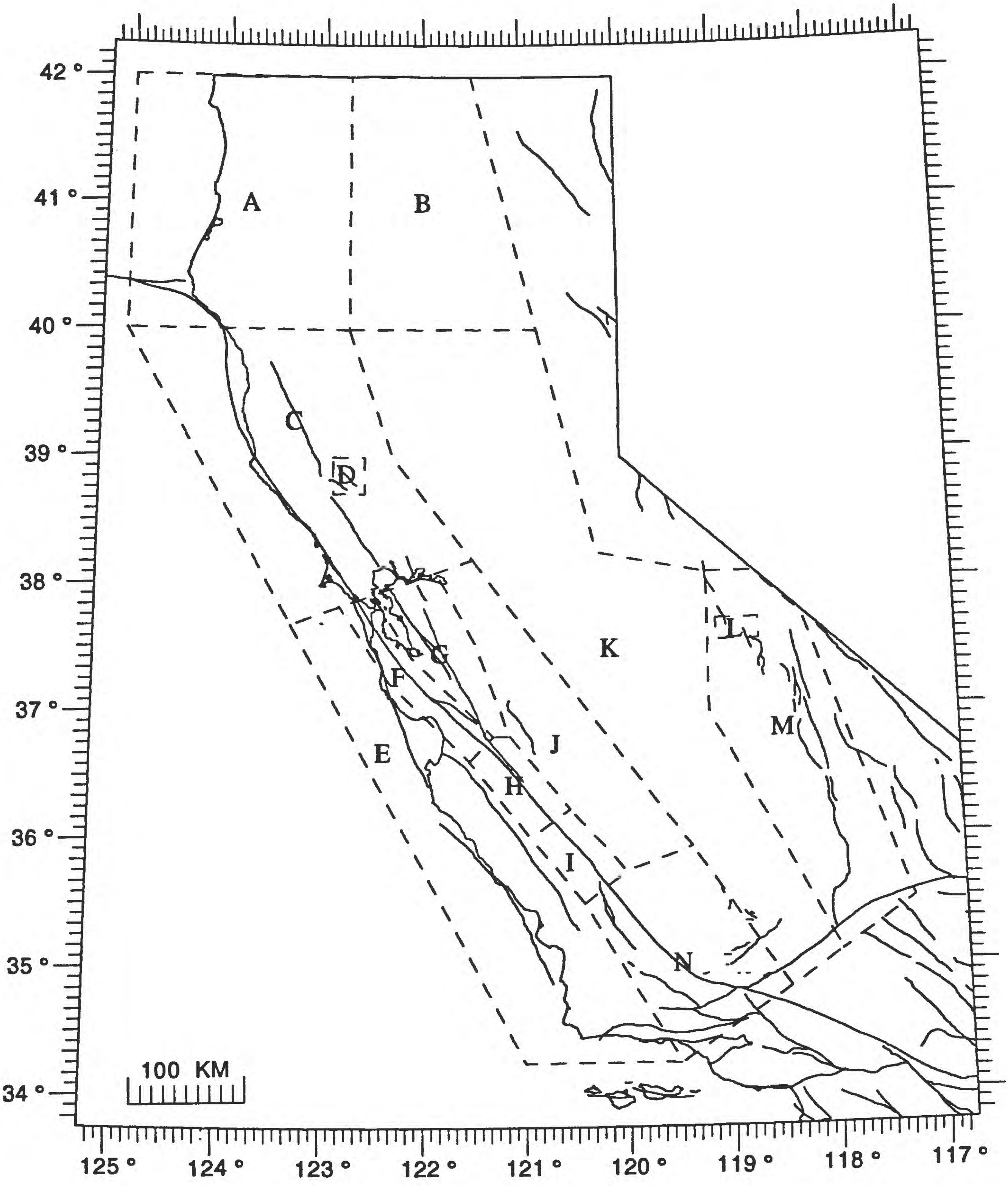

Figure 5. Boundaries of seismicity regions discussed in text.

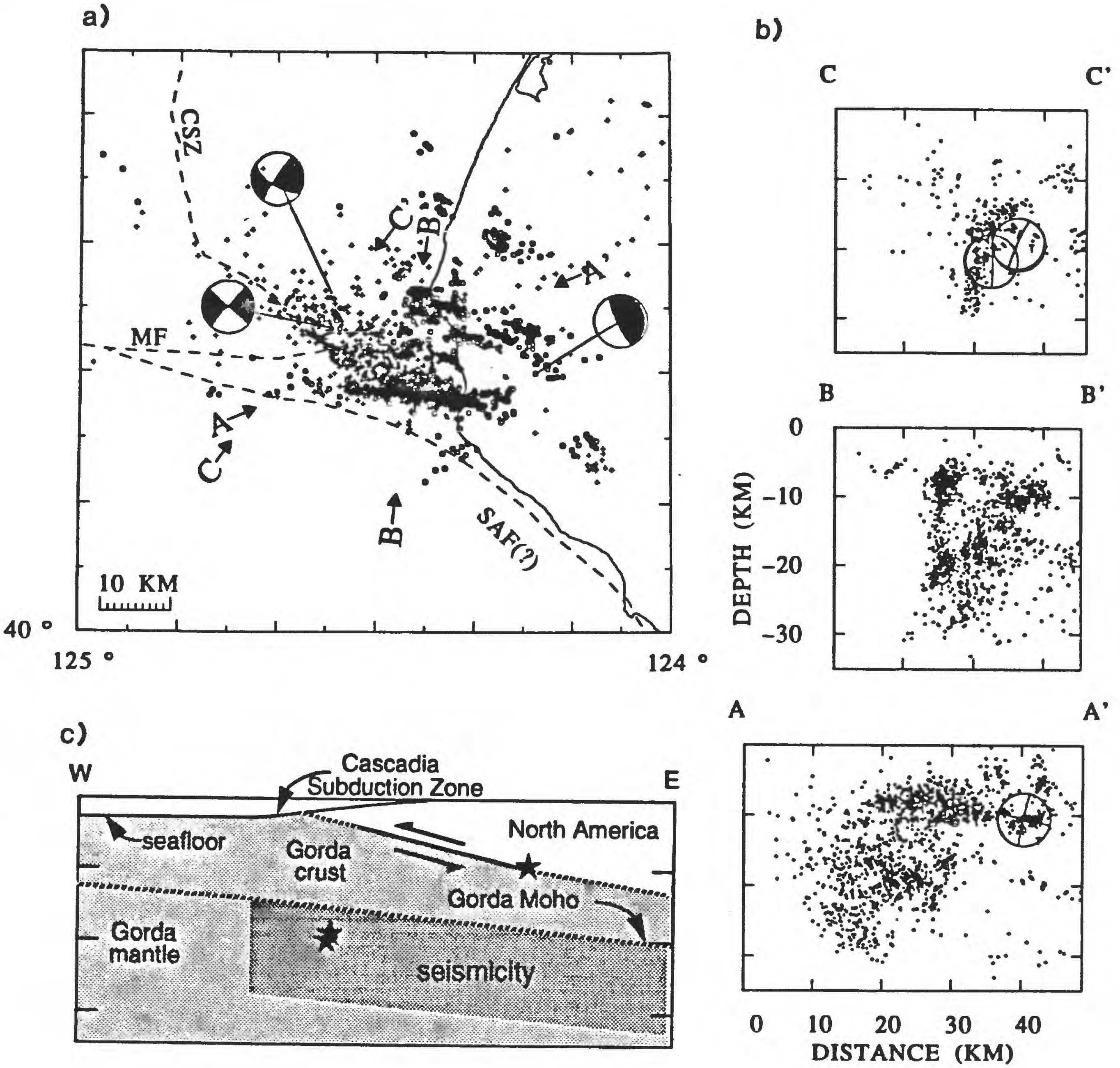

Figure 6. a) Focal mechanisms of the main shock and two large aftershocks at their epicentral locations and location of other aftershocks for 25 April 1992 to 30 September 1992 (open circles for foci < 12 km depp and plus symbols for deeper foci). b) Depth of earthquakes on cross sections aa' (perpendicular to mainshock strike, width ± 20 km), bb' (perpendicular to Mendocino fault, width ± 20 km), and cc' (perpendicular to strike of M_S 6.6 aftershocks, width ±9 km. Compressional quadrant marked by "T". c) East-west cross section depicts location of mainshock rupture plane (solid line), hypocenters (stars), and pre-main-shock seismicity with respect to plausible interpretation of Gorda North American plate geometry (Figure after *Oppenheimer et. al.*, 1993).

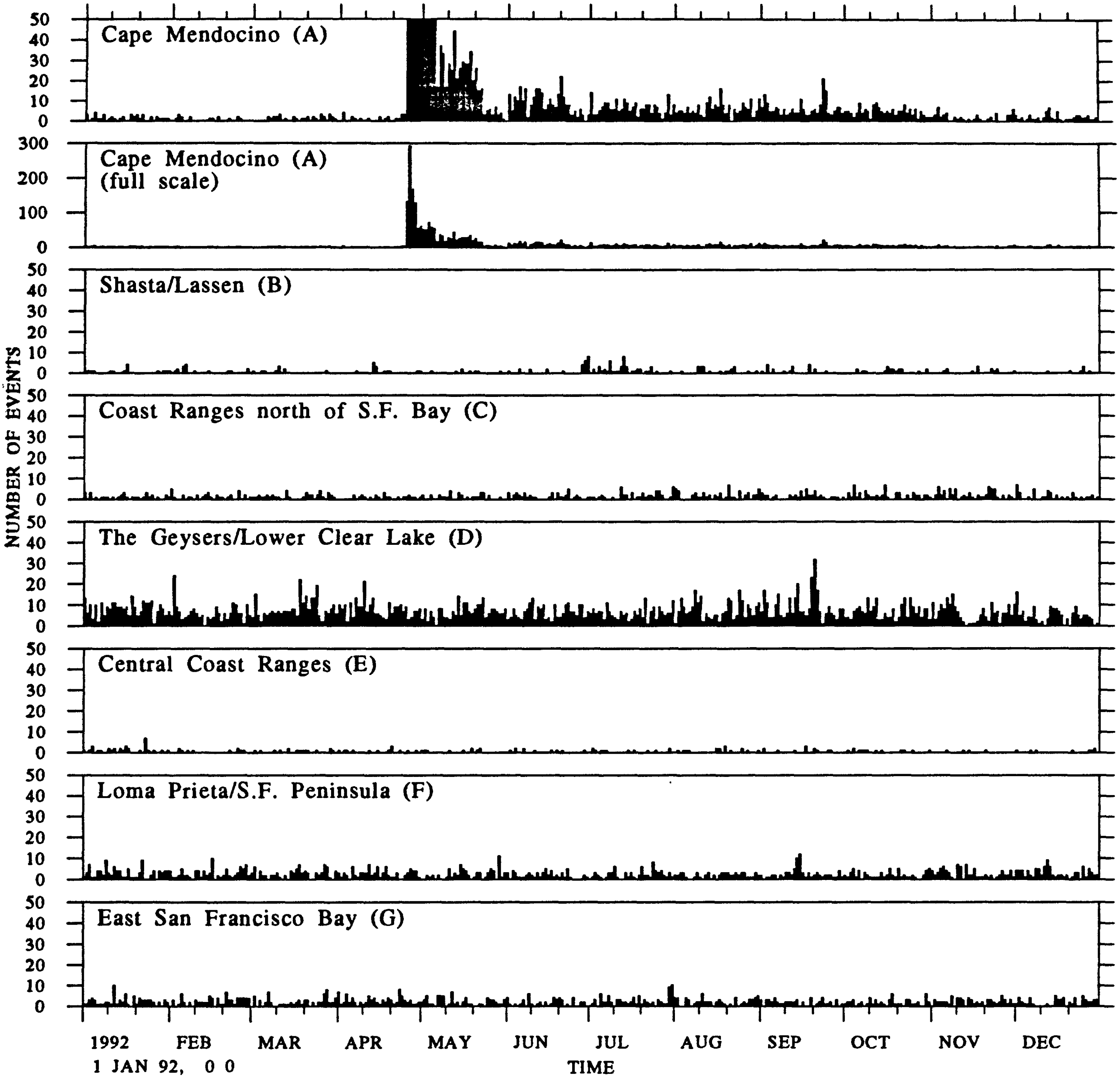

Figure 7. Time-histograms of the seismicity regions shown in Figures 2 and 5.

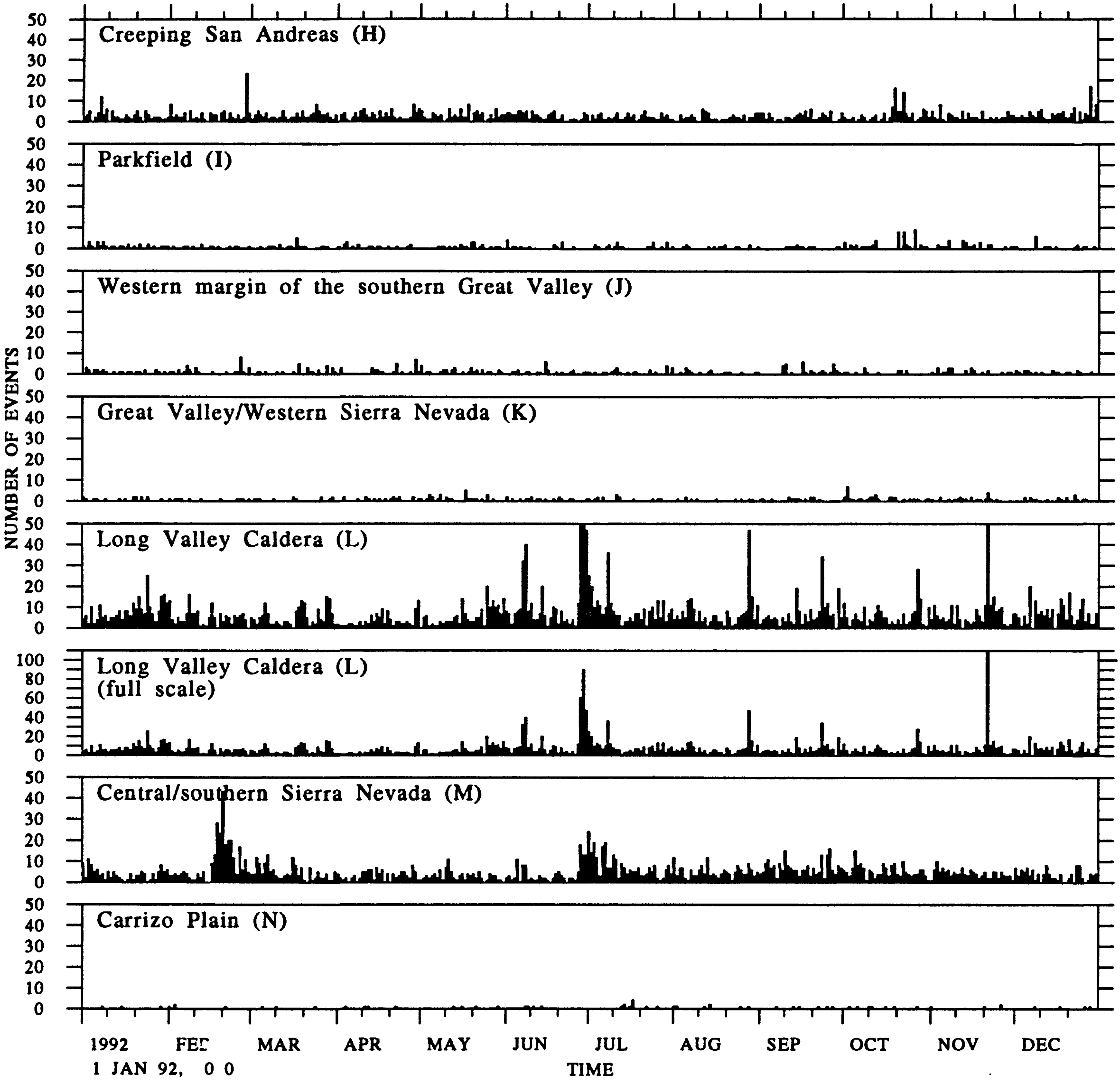

Figure 7 (cont.).

Table 7. M>3.5 Earthquakes Recorded during 1992 by the U.S.G.S. in Menlo Park

DATE	TIME	LATITUDE (NORTH)	LONGITUDE (WEST)	DEPTH (KM)	GEOGRAPHIC LOCATION	M_D	# M_D	MAD M_D	M_X	# M_X	MAD M_X	# P+S	# S	# VR	# FM	RMS (SEC)	ERH (KM)	ERZ (KM)	AZM-GAP (DEG)	DMIN (KM)	VEL MODEL	SOURCE PDX
92 JAN 15	458 50.36	36 18.03	120 27.32	12.63	COA	3.8	99	.11	3.6	13	.15	53	2	110	99	.13	.2	.5	84	9	COA	222
92 JAN 24	2026 55.04	40 17.65	124 28.88	21.04	MEN	3.7	99	.15	3.6	14	.13	25	2	103	99	.09	.9	.3	230	24	MEN	222
92 JAN 26	1820 37.51	35 53.12	117 37.25	58.07	IWV	3.6	14	.31				4	0	13	6	.01	1.8	2.2	221	30	WAL	22
92 FEB 10	1829 41.88	38 50.47	122 52.26	2.86	GEY	3.8	99	.18	3.8	26	.16	47	1	215	99	.08	.1	.6	28	4	GEY	222
92 FEB 15	1436 19.66	37 40.60	121 36.67	16.60	HAM	4.0	99	.12	4.0	15	.22	94	7	294	99	.19	.2	.3	85	9	LIV	222
92 FEB 19	1119 24.73	36 1.41	117 53.24	6.61	COS	4.1	99	.14	4.5	14	.16	11	0	132	99	.05	.5	1.0	179	10	WAL	222
92 FEB 19	1224 39.77	36 1.72	117 53.14	6.84	COS	3.6	99	.13	3.8	22	.27	11	0	110	99	.07	.6	1.3	182	11	WAL	222
92 FEB 21	417 54.63	36 1.03	117 53.33	6.53	COS	3.7	99	.14	3.8	11	.18	11	0	111	99	.05	.5	1.0	176	10	WAL	222
92 FEB 21	1459 44.63	36 1.47	117 53.31	6.97	COS	3.5	99	.14	3.2	6	.31	14	0	82	78	.06	.5	.9	127	11	WAL	222
92 FEB 21	1919 42.08	34 57.38	119 6.42	20.77	WWF	3.6	99	.15	3.4	10	.12	11	0	109	99	.09	.6	.9	111	4	TRA	222
92 FEB 22	332 20.51	36 1.63	117 53.36	6.01	COS	3.7	99	.14	3.8	15	.33	11	0	128	99	.06	.6	1.2	180	11	WAL	222
92 FEB 23	103 12.29	37 31.77	118 25.78	8.73	CHV	3.6	99	.11	3.3	6	.33	34	0	109	99	.05	.3	.6	94	2	MAM	222
92 FEB 27	2203 0.74	36 46.07	121 28.76	8.60	SJB	3.5	99	.13	3.6	23	.16	85	7	211	99	.23	.2	.5	35	2	LOM	222
92 FEB 28	329 20.48	36 13.22	120 47.18	5.83	BIT	3.7	99	.15	3.2	10	.12	48	1	52	49	.31	.5	1.8	65	1	PMM	222
92 MAR 3	807 49.33	35 45.60	118 1.60	7.82	WWF	3.8	99	.15				11	0	121	99	.06	.3	1.2	97	14	WAL	22
92 MAR 5	1824 22.31	35 12.63	119 22.67	25.21	BAK	3.8	99	.15	3.1	15	.10	35	0	123	99	.24	.4	.9	86	20	TRA	222
92 MAR 8	343 4.45	40 15.49	124 13.82	10.74	MEN	5.3	99	.34	5.3	30	.15	15	1	284	99	.15	.7	.4	191	9	MEN	222
92 MAR 9	451 15.82	40 34.39	123 22.42	35.63	KLA	4.4	99	.18	4.1	10	.14	42	3	198	99	.10	.2	.8	50	16	MEN	222
92 MAR 16	1208 6.39	40 19.46	124 36.06	18.56	MEN	3.7	99	.15	3.7	16	.12	48	2	164	99	.10	.6	.5	226	39	MEN	222
92 MAR 16	1920 22.18	36 0.15	117 52.73	5.51	COS	3.6	99	.12	3.5	8	.30	11	0	131	99	.04	.5	1.0	171	8	WAL	222
92 MAR 17	1156 35.71	36 0.26	117 52.58	5.29	COS	3.8	99	.14	4.1	30	.18	11	0	141	99	.05	.5	1.1	173	8	WAL	222
92 MAR 24	1427 6.12	38 50.63	122 47.86	1.71	GEY	3.7	99	.20				38	0	94	94	.07	.2	.7	35	4	GEY	22
92 MAR 24	1428 28.45	38 50.20	122 48.31	1.55	GEY	3.6	99	.27				28	0	41	41	.07	.2	.6	39	3	GEY	22
92 APR 22	1652 54.89	36 9.97	120 14.48	11.01	COA	3.7	99	.10	3.7	28	.12	42	1	167	99	.08	.2	.4	129	13	COA	222
92 APR 25	1501 48.16	40 18.18	124 31.84	21.28	MEN	3.5	99	.13	3.4	17	.14	16	1	97	79	.08	1.0	.4	254	20	MEN	222
92 APR 25	1806 5.18	40 19.96	124 13.77	10.21	MEN	6.5	99	.27	6.1	27	.22	9	0	346	99	.06	.3	.7	116	12	MEN	222
92 APR 25	1820 14.20	40 27.36	124 23.00	6.91	MEN	4.4	9	.49				14	0	15	15	.07	1.1	2.5	237	69	MEN	PP
92 APR 25	1825 18.21	40 25.68	124 31.62	7.46	MEN	3.6	7	.12				11	0	13	13	.08	3.6	2.8	278	59	MEN	PP
92 APR 25	1827 35.32	40 15.93	124 26.23	0.76	MEN	3.6	16	.46				22	0	26	26	.15	1.5	4.9	235	50	MEN	PP
92 APR 25	1828 58.08	40 22.61	124 25.55	12.27	MEN	4.2	15	.21				13	0	15	15	.07	2.9	2.4	284	56	MEN	PP
92 APR 25	1831 51.54	40 18.77	124 31.49	5.96	MEN	4.3	15	.20				17	0	22	22	.07	1.5	2.0	239	36	MEN	PP
92 APR 25	1832 58.06	40 19.36	124 47.20	5.02	MEN	3.9	14	.32				51	0	56	56	.32	3.8	21.6	267	125	MEN	PP
92 APR 25	1842 15.13	40 18.74	124 32.32	5.10	MEN	4.0	26	.28				23	0	84	84	.04	.8	1.7	235	68	MEN	PP
92 APR 25	1845 19.10	40 19.09	124 25.21	8.23	MEN	3.7	61	.27	3.5	6	.13	10	0	50	29	.11	1.8	.7	253	12	MEN	222
92 APR 25	1848 8.76	40 17.20	124 24.32	6.62	MEN	3.6	14	.28	3.1	3	.34	15	1	16	6	.10	1.2	.5	242	9	MEN	222
92 APR 25	1848 47.84	40 19.14	124 30.86	5.31	MEN	3.8	9	.10	3.6	2	.07	14	2	19	13	.08	.7	.4	248	19	MEN	222
92 APR 25	1853 18.01	40 16.76	124 27.57	6.44	MEN	4.0	36	.22	3.2	5	.21	19	0	19	9	.08	1.2	2.3	238	66	MEN	222
92 APR 25	1853 32.20	40 14.75	124 21.04	8.53	MEN	4.1	27	.21	4.0	2	.05	6	2	7	1	.09	1.9	1.0	260	27	MEN	222
92 APR 25	1909 27.43	40 20.07	124 22.54	5.53	MEN	3.7	16	.32				8	0	20	20	.05	.8	.6	223	11	MEN	PP
92 APR 25	1910 2.13	40 17.59	124 21.24	8.88	MEN	3.5	26	.30	3.6	2	.24	18	1	36	31	.10	.5	.3	223	6	MEN	222
92 APR 25	1914 51.74	40 18.81	124 32.62	2.82	MEN	4.7	15	.14				25	0	31	31	.11	1.4	2.4	232	38	MEN	PP
92 APR 25	1915 31.76	40 18.31	124 31.17	6.94	MEN	4.0	99	.28	4.2	10	.12	19	1	80	42	.13	1.3	.7	246	19	MEN	222
92 APR 25	1921 41.38	40 21.52	124 27.75	6.64	MEN	3.5	9	.11				8	0	15	15	.05	1.7	.7	266	17	MEN	PP
92 APR 25	1922 58.99	40 24.19	124 6.99	9.23	MEN	3.5	11	.10				8	0	10	10	.17	2.9	1.3	214	2	MEN	PP
92 APR 25	1930 44.26	40 17.84	124 24.30	8.49	MEN	3.8	17	.19				17	0	25	25	.05	1.2	.7	223	23	MEN	PP

DATE	TIME	LATITUDE (NORTH)	LONGITUDE (WEST)	DEPTH (KM)	GEOGRAPHIC LOCATION	M_D	# M_D	MAD M_D	M_X	# M_X	MAD M_X	# P+S	# S	# VR	# FM	RMS (SEC)	ERH (KM)	ERZ (KM)	AZM-GAP (DEG)	DMIN (KM)	VEL MODEL	SOURCE PDX
92 APR 25	1939 30.39	40 24.62	124 21.10	9.64	MEN	3.6	90	.22	3.8	8	.09	17	1	74	61	.09	.5	.3	202	7	MEN	222
92 APR 25	1941 59.31	40 19.93	124 24.90	6.25	MEN	4.0	22	.19				11	0	33	33	.15	2.0	.7	244	13	MEN	PP
92 APR 25	1942 46.83	40 17.73	124 24.63	7.31	MEN	3.8	34	.20	3.8	5	.15	21	2	52	43	.09	.6	.4	239	21	MEN	222
92 APR 25	1950 42.24	40 17.87	124 25.97	7.83	MEN	3.9	99	.18	4.1	14	.16	25	1	134	99	.07	.8	.5	237	25	MEN	222
92 APR 25	1955 6.57	40 25.94	124 24.53	9.86	MEN	3.6	45	.19	3.4	5	.07	21	2	60	58	.06	.5	.2	222	8	MEN	222
92 APR 25	2000 7.65	40 29.44	124 28.04	26.68	EUR	3.6	83	.19	3.7	10	.22	13	2	109	87	.09	1.2	.8	233	11	MEN	222
92 APR 25	2012 35.82	40 25.3[illegible]	124 25.99	9.46	MEN	3.9	99	.33	3.9	12	.14	15	1	76	62	.09	.6	.3	250	10	MEN	222
92 APR 25	2029 17.10	40 24.52	124 22.00	10.36	MEN	3.7	94	.26	3.9	7	.12	18	2	106	88	.07	.6	.2	214	8	MEN	222
92 APR 25	2109 13.64	40 22.90	124 13.18	10.44	MEN	3.5	43	.14				15	0	49	49	.05	.3	.3	110	9	MEN	PP
92 APR 25	2126 9.77	40 22.03	124 33.03	2.25	MEN	3.8	92	.29	3.8	6	.07	17	0	55	41	.13	1.4	1.6	247	22	MEN	222
92 APR 25	2136 49.44	40 20.90	124 26.77	19.41	MEN	3.6	99	.17	3.7	12	.16	13	1	45	30	.06	.9	.2	246	16	MEN	222
92 APR 25	2225 25.87	40 19.80	124 24.69	5.55	MEN	3.9	99	.21	4.2	16	.09	11	1	179	99	.13	1.6	.7	246	13	MEN	222
92 APR 26	40 26.01	40 17.97	124 23.48	8.46	MEN	3.5	95	.18	3.8	10	.11	12	1	65	56	.06	.7	.3	245	9	MEN	222
92 APR 26	49 17.42	40 21.40	124 26.36	7.07	MEN	3.5	73	.14	3.6	11	.15	10	0	53	40	.07	1.0	.5	256	16	MEN	222
92 APR 26	100 57.88	40 21.82	124 30.47	6.33	MEN	3.9	99	.23	4.2	7	.19	16	1	88	75	.11	1.1	.5	251	19	MEN	222
92 APR 26	127 14.56	40 18.50	124 28.16	8.63	MEN	3.6	71	.18	3.6	10	.12	10	0	44	41	.05	1.2	.4	271	15	MEN	222
92 APR 26	132 15.10	40 18.25	124 24.72	19.20	MEN	3.7	99	.19	3.5	9	.21	12	2	78	72	.05	.8	.3	253	11	MEN	222
92 APR 26	133 36.28	40 19.00	124 25.25	17.41	MEN	3.9	99	.23	3.9	8	.14	14	1	62	47	.09	1.1	.3	251	12	MEN	222
92 APR 26	207 6.04	40 18.22	124 24.67	19.07	MEN	3.9	99	.28	3.9	7	.15	12	1	84	81	.05	.9	.3	253	11	MEN	222
92 APR 26	208 9.33	40 17.83	124 24.42	18.62	MEN	4.0	33	.26	3.5	5	.22	14	2	26	13	.09	.8	.3	245	10	MEN	222
92 APR 26	450 17.19	40 25.34	124 22.22	10.14	MEN	3.5	99	.14	3.7	10	.16	12	1	68	61	.09	.8	.3	221	7	MEN	222
92 APR 26	741 39.76	40 25.63	124 35.79	19.42	MEN	6.3	99	.38	6.1	28	.25	17	0	362	99	.15	2.2	.6	253	23	MEN	222
92 APR 26	749 52.12	40 24.48	124 33.98	17.85	MEN	4.0	27	.23	3.5	6	.08	15	2	36	23	.08	.5	.6	257	21	MEN	222
92 APR 26	752 3.44	40 24.94	124 40.18	0.08	MEN	3.8	65	.27	3.9	7	.15	30	0	54	31	.47	2.7	5.9	233	36	MEN	222
92 APR 26	821 9.49	40 23.05	124 33.28	22.66	MEN	3.7	93	.26	3.8	10	.09	16	0	64	60	.15	2.4	.7	250	21	MEN	222
92 APR 26	843 28.57	40 19.89	124 33.99	18.80	MEN	3.5	64	.16	3.4	7	.14	20	1	31	18	.12	1.1	.3	247	24	MEN	222
92 APR 26	924 21.96	40 25.36	124 22.45	9.91	MEN	3.7	99	.19	4.0	9	.10	21	2	110	99	.05	.5	.2	216	7	MEN	222
92 APR 26	941 2.62	40 26.01	124 26.29	9.76	MEN	3.5	54	.31	2.8	2	.17	13	2	41	35	.08	.8	.5	232	10	MEN	222
92 APR 26	941 44.79	40 20.26	124 21.43	11.18	MEN	3.6	37	.16	3.6	6	.07	12	2	49	37	.07	.4	.3	210	11	MEN	222
92 APR 26	1118 25.66	40 22.52	124 35.12	22.63	MEN	5.9	49	.46	6.2	7	.15	12	0	329	99	.07	2.4	.6	263	24	MEN	2O2
92 APR 26	1128 50.85	40 22.95	124 31.47	14.15	MEN	4.1	50	.30	2.2	3	.16	16	1	21	13	.08	1.0	.6	251	24	MEN	222
92 APR 26	1129 7.58	40 26.27	124 35.33	10.78	MEN	4.1	53	.25	4.0	5	.11	24	1	46	26	.12	.8	.8	240	32	MEN	222
92 APR 26	1204 29.98	40 24.44	124 24.52	10.71	MEN	4.1	77	.23	4.1	4	.06	12	0	98	80	.06	.8	.3	227	10	MEN	222
92 APR 26	1428 23.77	40 21.84	124 27.50	18.93	MEN	3.7	38	.10				11	0	32	32	.10	1.7	.3	264	16	MEN	PP
92 APR 26	2040 55.33	40 18.43	124 31.05	16.35	MEN	3.5	69	.19	3.4	8	.15	18	2	56	45	.06	.9	.2	264	19	MEN	222
92 APR 26	2118 4.95	40 23.90	124 35.40	18.50	MEN	4.0	99	.15	4.1	8	.18	33	1	152	99	.12	1.0	.4	240	23	MEN	222
92 APR 26	2208 0.30	40 21.39	124 31.94	18.03	MEN	3.8	99	.15	3.9	5	.17	17	1	102	97	.08	1.1	.3	249	21	MEN	222
92 APR 26	2225 52.97	40 19.29	124 32.84	9.76	MEN	4.2	99	.20	4.2	18	.20	18	0	173	99	.13	1.9	.7	250	22	MEN	222
92 APR 26	2339 15.61	40 19.53	124 37.02	6.02	MEN	4.0	99	.23	4.2	24	.18	30	2	144	99	.09	.8	.6	242	28	MEN	222
92 APR 27	6 23.80	40 19.29	124 37.09	5.53	MEN	3.5	87	.22	3.6	11	.20	24	2	70	63	.08	.9	.7	247	28	MEN	222
92 APR 27	33 34.42	40 20.62	124 28.35	18.53	MEN	3.6	99	.13	3.6	9	.16	15	1	111	99	.07	1.0	.3	248	18	MEN	222
92 APR 27	228 18.40	40 19.21	124 37.19	7.83	MEN	4.0	99	.19	4.2	15	.17	28	0	151	99	.15	1.5	1.0	247	28	MEN	222
92 APR 27	235 36.65	40 19.17	124 29.10	19.77	MEN	3.6	96	.16	3.6	11	.18	14	1	91	87	.05	.7	.2	250	17	MEN	222
92 APR 27	247 21.08	40 19.76	124 38.95	4.12	MEN	4.2	99	.27	4.4	12	.21	31	0	174	99	.10	1.0	1.1	240	30	MEN	222
92 APR 27	631 24.34	40 19.87	124 33.51	22.92	MEN	3.5	99	.12	3.3	12	.19	21	1	101	89	.11	1.5	.6	247	23	MEN	222
92 APR 27	907 10.92	40 22.89	124 35.34	23.36	MEN	3.5	99	.15	3.5	10	.20	22	1	115	99	.11	1.5	.8	248	24	MEN	222
92 APR 27	1537 57.10	40 18.90	124 32.96	8.59	MEN	3.7	99	.22	3.7	6	.16	18	1	57	52	.14	1.3	.7	251	22	MEN	222
92 APR 30	840 20.57	40 22.29	124 34.64	26.14	MEN	3.5	99	.15	3.5	11	.17	25	1	144	99	.10	1.2	1.0	243	23	MEN	222
92 APR 30	953 26.57	40 17.04	124 22.38	22.79	MEN	4.0	99	.19	3.9	11	.15	13	0	178	99	.09	1.4	.6	234	7	MEN	222

DATE	TIME	LATITUDE (NORTH)	LONGITUDE (WEST)	DEPTH (KM)	GEOGRAPHIC LOCATION	M_D	# M_D	MAD M_D	M_X	# M_X	MAD M_X	# P+S	# S	# VR	# FM	RMS (SEC)	ERH (KM)	ERZ (KM)	AZM-GAP (DEG)	DMIN (KM)	VEL MODEL	SOURCE PDX
92 MAY 1	102 28.83	37 6.19	121 0.79	1.07	JQN	3.5	99	.16	3.4	18	.18	73	3	190	99	.16	.4	1.4	184	11	NCG	222
92 MAY 1	1542 56.79	40 21.00	124 31.63	26.19	MEN	3.6	98	.14	3.6	9	.24	21	1	120	99	.12	1.3	.8	249	21	MEN	222
92 MAY 1	2241 52.53	40 19.24	124 34.21	8.57	MEN	3.6	79	.16	3.6	12	.23	25	0	78	69	.13	1.3	.7	235	24	MEN	222
92 MAY 2	1130 31.38	40 17.90	124 27.35	22.04	MEN	3.9	99	.11	3.9	16	.14	13	1	197	99	.08	1.1	.3	267	14	MEN	222
92 MAY 4	13 27.93	40 20.44	124 27.95	20.18	MEN	3.5	84	.20	3.5	10	.12	14	0	67	62	.07	1.5	.2	248	17	MEN	222
92 MAY 4	708 19.14	40 17.59	124 23.39	22.79	MEN	3.7	99	.12	3.6	9	.12	14	1	141	99	.08	1.1	.4	238	9	MEN	222
92 MAY 4	744 42.61	40 17.61	124 23.12	22.61	MEN	3.5	99	.14	3.6	9	.16	13	1	135	99	.09	1.1	.4	237	21	MEN	222
92 MAY 5	1046 17.24	40 17.36	124 19.77	7.55	MEN	4.3	99	.14	4.5	33	.16	13	1	238	99	.10	.7	.4	202	5	MEN	222
92 MAY 10	1758 3.17	40 26.01	124 25.73	10.44	MEN	4.1	99	.19	4.3	14	.12	13	0	107	86	.08	1.0	.5	230	9	MEN	222
92 MAY 11	249 23.65	40 17.71	124 26.63	22.41	MEN	3.5	99	.12	3.4	10	.10	13	1	101	97	.07	.8	.3	264	13	MEN	222
92 MAY 12	1217 20.93	40 18.46	124 27.72	8.07	MEN	3.6	99	.16	3.6	7	.16	12	0	79	66	.05	1.1	.5	269	15	MEN	222
92 MAY 18	742 31.43	40 21.54	124 45.95	13.92	MEN	3.8	99	.25	3.8	14	.23	54	1	162	99	.12	.6	.9	237	39	MEN	222
92 MAY 20	230 50.53	40 18.42	124 22.84	7.14	MEN	3.7	99	.17	3.9	20	.16	12	1	138	99	.08	.9	.4	235	9	MEN	222
92 MAY 21	338 0.88	40 18.75	124 25.39	20.64	MEN	3.9	99	.18	3.9	13	.16	12	1	105	92	.06	.9	.2	256	12	MEN	222
92 MAY 27	1532 38.38	40 17.85	124 20.67	8.41	MEN	3.5	87	.15	3.6	8	.18	12	1	62	57	.07	.4	.3	212	6	MEN	222
92 JUN 5	2146 42.98	40 18.66	124 24.80	20.41	MEN	4.8	99	.17	4.8	16	.21	10	0	201	99	.05	1.2	.3	252	11	MEN	222
92 JUN 16	345 8.44	40 27.99	124 35.70	23.44	MEN	3.5	85	.17	3.8	2	.04	17	1	105	99	.08	.7	.7	251	22	MEN	222
92 JUN 24	725 28.50	40 20.80	124 30.57	23.27	MEN	3.7	99	.15	3.7	10	.16	19	1	180	99	.12	1.4	.6	247	20	MEN	222
92 JUN 28	1210 42.44	40 27.77	121 32.73	4.40	LAS	3.5	28	.59	1.7	1	.00	13	1	13	9	.03	.3	.5	60	3	LAS	FFF
92 JUN 29	537 45.89	37 34.60	118 49.67	12.37	MOR	3.8	99	.21	3.7	2	.29	34	0	72	69	.07	.3	.6	77	2	MAM	222
92 JUN 30	1305 36.04	35 40.61	117 36.52	9.81	IWV	4.5	67	.16				11	0	83	83	.06	.7	1.5	145	12	WAL	RR
92 JUL 1	616 56.39	35 40.62	117 36.71	8.65	IWV	4.4	99	.18	4.5	25	.16	10	0	130	99	.05	.5	1.7	136	12	WAL	222
92 JUL 2	701 10.51	35 37.41	118 3.63	13.54	WWF	3.9	89	.12				17	0	77	77	.22	2.3	.5	285	18	WAL	RR
92 JUL 2	1359 20.49	35 36.31	121 12.58	3.02	SSM	4.1	99	.13	4.4	22	.35	40	0	137	99	.09	.3	.6	183	10	CST	222
92 JUL 3	1322 38.06	35 51.46	117 51.29	11.65	IWV	3.8	99	.14	3.9	13	.13	7	0	72	41	.03	.5	2.9	178	39	WAL	222
92 JUL 6	1949 10.78	36 38.75	118 1.87	0.31	OWV	3.9	99	.13	4.3	13	.10	69	0	74	60	.19	.7	2.9	170	60	WAL	222
92 JUL 11	1814 15.85	35 12.82	118 4.66	16.02	GAR	5.2	99	.22	5.5	48	.20	19	0	319	99	.10	.5	1.1	139	22	WAL	FFF
92 JUL 13	825 38.12	35 58.14	118 21.15	6.86	WWF	3.5	99	.13	3.5	15	.34	60	0	113	99	.15	.4	.7	107	32	WAL	222
92 JUL 13	953 6.13	35 58.75	118 23.19	0.31	WWF	4.1	99	.21	4.2	6	.08	72	0	124	99	.41	.7	4.3	105	31	WAL	O22
92 JUL 13	954 19.56	35 57.92	118 22.82	0.20	WWF	4.0	56	.28	3.4	4	.23	7	0	9	3	.05	2.2	6.7	269	32	WAL	222
92 JUL 14	24 59.59	35 57.42	118 21.12	7.76	WWF	3.6	99	.13	3.7	10	.21	53	0	107	99	.19	.3	.6	105	31	WAL	222
92 JUL 16	1538 0.19	40 19.43	122 9.73	18.86	SHA	4.0	99	.15	3.7	29	.26	19	1	164	94	.11	.4	1.2	125	13	LAS	222
92 JUL 18	658 39.52	37 29.34	118 56.94	2.87	SIL	3.9	99	.12	4.3	37	.18	36	0	308	99	.08	.3	1.4	116	14	MAM	222
92 JUL 27	2210 59.48	36 3.20	117 39.51	0.63	COS	3.9	99	.14	4.2	12	.21	32	0	34	23	.25	1.5	4.7	200	66	WAL	222
92 AUG 13	133 10.72	40 24.39	124 25.67	9.70	MEN	3.5	94	.16	3.6	7	.22	8	0	59	53	.06	1.1	.5	256	11	MEN	222
92 AUG 14	2327 56.62	35 50.40	117 40.27	11.24	IWV	3.7	99	.14	3.8	11	.19	10	0	94	75	.12	.5	1.1	135	9	WAL	222
92 AUG 18	238 29.00	37 20.37	118 22.79	12.26	OWV	3.7	99	.20	3.8	8	.33	28	0	51	43	.05	.4	1.1	148	10	MAM	222
92 AUG 25	1742 18.50	40 17.94	124 26.11	22.31	MEN	3.5	99	.15	3.5	10	.20	14	1	119	99	.08	.8	.3	263	12	MEN	222
92 SEP 4	1502 58.19	36 8.29	117 52.28	7.74	COS	4.0	99	.13	4.1	19	.17	15	0	113	84	.08	.5	1.1	156	22	WAL	222
92 SEP 5	2228 8.56	37 27.47	118 35.77	8.36	RVL	3.5	99	.16	3.7	10	.19	32	0	138	99	.10	.3	.7	81	4	MAM	222
92 SEP 14	1246 53.70	37 34.23	118 52.07	7.57	MOR	3.5	99	.13	3.7	23	.21	31	0	148	99	.07	.3	.5	85	4	MAM	222
92 SEP 16	614 33.28	36 0.00	119 54.66	10.55	COA	4.3	99	.16	4.3	28	.17	41	3	259	99	.17	.5	.7	216	16	COA	222
92 SEP 19	2304 46.84	38 51.59	122 47.61	3.01	GEY	4.3	99	.18	4.4	19	.15	49	0	322	99	.11	.2	.7	32	6	GEY	222
92 SEP 23	904 41.52	40 18.02	124 23.43	8.37	MEN	3.7	99	.15	4.0	13	.09	12	0	109	99	.06	.9	.4	244	9	MEN	222
92 SEP 23	1110 31.09	40 18.06	124 23.49	8.18	MEN	4.0	99	.22	4.2	23	.14	14	0	235	99	.06	.7	.3	244	9	MEN	222
92 SEP 27	1659 13.89	36 0.29	119 55.59	11.72	COA	4.2	99	.13	4.1	23	.17	47	3	198	99	.17	.5	1.0	187	18	COA	222
92 SEP 29	525 43.87	37 34.02	118 52.21	7.39	MOR	3.7	99	.15	3.9	17	.22	32	0	96	88	.07	.3	.5	86	5	MAM	222
92 OCT 5	1140 28.50	37 27.28	118 50.32	7.64	MOR	3.9	99	.11	4.3	15	.14	33	0	181	99	.07	.3	.9	129	7	MAM	222
92 OCT 8	1744 58.83	36 5.26	117 40.78	8.10	COS	3.6	99	.13	3.4	9	.21	11	0	62	47	.08	.9	1.3	243	20	WAL	222

DATE	TIME	LATITUDE (NORTH)	LONGITUDE (WEST)	DEPTH (KM)	GEOGRAPHIC LOCATION	M_D	# M_D	MAD M_D	M_X	# M_X	MAD M_X	# P+S	# S	# VR	# FM	RMS (SEC)	ERH (KM)	ERZ (KM)	AZM-GAP (DEG)	DMIN (KM)	VEL MODEL	SOURCE PDX
92 OCT 9	223 48.67	40 27.33	124 16.74	19.38	MEN	3.7	99	.14	3.7	9	.13	16	1	101	93	.06	.5	.3	109	5	MEN	222
92 OCT 14	2208 47.31	39 43.29	122 5.73	15.75	SAC	3.5	99	.18	3.3	28	.19	104	0	139	99	.38	.3	.7	36	34	NCG	222
92 OCT 20	528 8.91	35 55.72	120 28.35	9.99	MID	4.3	99	.14	4.5	46	.14	56	1	329	99	.10	.2	.3	31	2	PMM	222
92 OCT 26	727 40.47	35 56.66	120 29.40	10.45	MID	3.6	99	.12	3.7	6	.06	52	1	94	89	.09	.2	.3	40	2	PMM	222
92 NOV 21	1511 42.36	35 19.04	118 36.11	9.12	WWF	3.7	99	.13	3.8	20	.12	20	0	78	63	.16	.4	1.0	72	15	WAL	222
92 DEC 5	252 57.11	36 27.20	120 11.83	17.41	JQN	3.7	99	.14	3.5	29	.29	40	1	219	99	.13	.4	.3	207	3	COA	222
92 DEC 12	1553 46.17	36 51.25	121 35.06	4.85	SJB	3.7	99	.12	3.7	23	.20	79	1	152	99	.18	.2	.4	41	3	LOM	222
92 DEC 12	1558 52.47	36 51.18	121 34.83	4.46	SJB	3.7	99	.12	3.6	21	.15	79	0	130	99	.19	.2	.4	39	3	LOM	222
92 DEC 20	2105 20.79	37 44.92	122 8.99	4.23	HAY	3.6	99	.14	3.5	30	.15	75	2	185	99	.14	.2	.4	31	4	HAY	222
92 DEC 25	425 9.32	39 56.67	120 51.43	0.00	WAK	3.8	99	.14	4.0	6	.14	123	0	136	93	.48	.9	1.5	181	53	LAS	222

Notes to Table 7

DATE TIME	Origin Time (Universal Coordinated Time)
GEOGRAPHIC/ LOCATION	Event location remark. (See Figure 4 and table below).
M_D	Coda duration magnitude (Eaton, 1991).
# / M_D	Total of duration magnitude weights (does not exceed 99).
MAD / M_D	Median-absolute-difference of coda magnitudes.
M_X	Primary amplitude magnitude (Eaton, 1991).
# / M_X	Total of amplitude magnitude weights (does not exceed 99).
MAD / M_X	Median-absolute-difference of amplitude magnitudes
# / P+S	Number of P& S times with final weights > than 0.1 (does not exceed 99).
# / S	Number of S readings with weights > 0.1 (does not exceed 99).
# / VR	Number of valid P & S readings with weight > 0 (does not exceed 99).
# / FM	Number of P first motions (does not exceed 99).
RMS / (SEC)	RMS travel time residual.

ERH / (KM)	Horizontal error (km).
ERZ / (KM)	Vertical error (km).
AZM-GAP / (DEG)	Maximum azimuthal Gap
DMIN / (KM)	Distance to nearest station (km).
VEL / MODEL	3-letter code of crust and delay model. (See Table 4).
SOURCE / PDX	Most common P & S (P), M_D (D), and M_X (X) data source codes.

where data source codes are as follows:

R	Main RTP
P	Prototype RTP
O	Motorola RTP
2	CUSP Tustin A/D #2
F	Digitized event from FM tape

Hypoinverse Geographic Locations

ALM	Lake Almanor	CON	Concord Fault	GOL	Gold Hill	LOM	Loma Prieta	NMO	North Moat	RVL	Round Valley	SJB	San Juan Bautista
ALU	Alum Rock	COS	Coso Range	GRN	Greenville Fault	MAA	Maacama Fault	ORE	Oregon	SAC	Sacramento Valley	SLA	Slack Canyon
ANN	Anno Nuevo	CRV	Ciervo Hills	GVL	Green Valley Fault	MAM	Mammoth Mtn.	ORO	Oroville	SAL	Salinas Valley	SMO	South Moat
AUB	Auburn	CYN	Coyote North	HAM	Mt. Hamilton	MAR	Marin	ORT	Ortigaleta Fault	SAR	Sargent Fault	SSM	San Simeon
BAK	Bakersfield	CYS	Coyote South	HAY	Hayward Fault	MCA	Mono Caldera	OWV	Owens Valley	SBA	Santa Barbara	STN	Stone Canyon
BAR	Bartlett Springs Fault	DAN	Danville	HCF	Hilton Crk. Flt.	MEN	Mendocino Escarpment	PAI	Paicines	SCA	Southern Calif.	SUN	Sunol
BIT	Bitterwater Valley	DEL	Del Norte	HOL	Hollister	MID	Middle Mountain	PAN	Panoche Pass	SCV	Santa Clara Valley	SUR	Big Sur
BLM	Black Mountain	DEV	Death Valley	INC	Inyo Craters	MIS	Mission Fault	PAR	Point Arena	SFB	South S.F. Bay	WAK	Walker Lane
BUS	Busch Fault	DOM	Resurgent Dome	IWV	Indian Wells Val.	MOD	Modoc Plateau	PIN	Pinnacles	SFL	San Felipe	WCN	Wheeler Crest No.
BVL	Bear Valley	EMO	East Moat	JQN	San Joaquin Valley	MOL	Mono Lake	PON	Pacific Ocean N	SFP	S.F. Peninsula	WCS	Wheeler Crest So.
CAS	Casa Diablo Mtn.	EUR	Eureka	KAI	Kaiser Peak	MON	Monterey Bay	POS	Pacific Ocean S	SHA	Shasta	WHI	White Mountains
CHA	Chalk Bluffs	GAR	Garlock Fault	KLA	Klamath Mountains	MOR	Mt. Morrison	QUI	Quiensabe	SHE	Sherwin Lakes	WMO	West Moat
CHV	Chalfant Valley	GEY	Geysers	KON	Konocti Bay	NAP	West Napa Fault	ROB	Paso Robles	SIL	Silver Peak	WWF	White Wolf Fault
COA	Coalinga	GLA	Glass Mtn.	LAS	Lassen	NEV	Nevada	ROG	Rogers Creek Fault	SIM	Simmler	YOS	Yosemite

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Appendix A. The UCB/USGS Seismology Data Center

The UCB/USGS Seismology Data Center is accessible via the Internet. As of the date of this publication, the data center is establishing individual accounts for each user accessing the data center. In the future we may migrate to a single publicly-accessible account similar to the IRIS bulletin board system. It is assumed that users are either familiar with or will obtain their own support on the use of the Unix operating system. The data center cannot provide consulting support on questions not directly related to the data center.

- Host Name: brkseis20.berkeley.edu
- Internet address: 128.32.146.106
- Computer: Sun SPARCstation 2
- Operating system: SunOS (Unix)

To request an account at the data center:

1. Use telnet to connect to brkseis20.berkeley.edu. Depending on your local computer configuration, you may have to use the Internet address of the machine instead of the hostname:

   ```
   telnet brkseis20.berkeley.edu
   ```

   or

   ```
   telnet 128.32.146.106
   ```

2. Login to special account "bulletin", which has a password of "board".
3. Select the option to request an account. It is currently the only option available, other than "quit". You will be prompted for information such as your name, address, institutional affiliation, email address, and phone number.
4. You should be contacted within 2 working days with your account information. If you do not hear within this time period, please contact:

   Douglas Neuhauser
   Seismographic Station
   Earth Science Building
   University of California
   Berkeley CA 94720
   510-642-0931

5. This computer account is to be used strictly for accessing and retrieving data explicitly provided by the data center. Any other use constitutes fraud.

Sample session to the UCB/USGS Seismology Data Center

```
telnet brkseis20.berkeley.edu
Trying 128.32.146.106 ...
Connected to brkseis20.berkeley.edu.
Escape character is ‘^]’.

SunOS UNIX (brkseis20.berkeley.edu)

login: bulletin
Password:
Last login: Mon Dec 7 11:14:13 from brkseis10.berkeley.edu

**********************************************************************
UCB/USGS Seismology Data Center
**********************************************************************
Welcome to the UCB/USGS Northern California Seismology Data Center.
Your host is: brkseis20.berkeley.edu

Type “man info” to get more information about available resources.
**********************************************************************
Welcome to the UCB/USGS Seismology Data Center

Enter   ‘a’ to request an account
        ‘n’ to send a note to the data center staff.
        ‘q’ to QUIT

Enter your selection: a

UC Berkeley Seismographic Station / USGS
Seismology Data Center

User ID request form:
Please answer the following questions:
(Terminate each reply with a ‘return’.)
(Type a control-D to abort account request.)

Full Name: Joe Smith
Institution/Organization/Company: Podunk U, Dept of Seismology
Full Address (1 line): 123 Earth Sciences Building, Podunk U, Podunk, NY 14882
Office Phone #: 800-555-1212
Internet/Bitnet address (0=none): joesmith@geo.podunk.edu
preferred user ID name: joesmith

request logged...
You will be contacted at the above address with information about your account. If you have not heard by the end of two
working days, please resubmit your request, and if that does not work, please call 510-642-0931 or 510-642-3977
Thank you.

Enter ‘a’ to request an account
Enter ‘q’ to QUIT

Enter your selection: q
Connection closed by foreign host.
```

Help files at the data center

After you have been notified that your data center account is open, you may obtain more information about NCSN data by typing the following commands:

```
man info                                   ! General information on data available at the data center
more /data/dc1/calnet/parameters/history   ! Documentation on date of significant changes in data at data center
man eqselect                               ! Program documentation for obtaining earthquake location data
man extract                                ! Program documentation for obtaining earthquake phase data

man calnet                                 ! Overview of types of NCSN data available at the data center
man calnet.catalog                         ! Format of NCSN earthquake location files
man calnet.phase                           ! Format of NCSN earthquake phase files
man calnet.mech                            ! Format of NCSN first motion focal mechanism files
man ascii_mem                              ! Format of ASCII representation of CUSP .mem files
man getmem                                 ! Program documentation for obtaining CUSP .mem files
man getseis                                ! Program documentation for obtaining CUSP seismograms
man cusp2ah                                ! Program documentation for converting seismograms to ahxdr format

man ucb                                    ! Overview of type of UCB data available at the data center
man ucb.catalog                            ! Format of UCB earthquake location files
man ucb.phase                              ! Format of UCB earthquake phase files
man qdata                                  ! Program documentation for obtaining UCB waveform data as Steim-1
                                           ! compressed data blocks

man sdata                                  ! Program documentation for obtaining UCB waveform data as SEED
                                           ! volumes
```