STATE OF ALASKA

DEPARTMENT OF NATURAL RESOURCES

DIVISION OF GEOLOGICAL AND GEOPHYSICAL SURVEYS

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May 1986

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Report of Investigations 86-5
SUMMARY OF ALASKA EARTHQUAKES
FOR THE PERIOD
OCTOBER, NOVEMBER, AND DECEMBER 1984

Compiled by
Hans Pulpan and J.N. Davies

STATE OF ALASKA
Department of Natural Resources
DIVISION OF GEOLOGICAL & GEOPHYSICAL SURVEYS

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SUMMARY OF ALASKA EARTHQUAKES FOR THE PERIOD OCTOBER, NOVEMBER, AND DECEMBER 1984

Compiled by
Hans Pulpan[1] and J.N. Davies,[2] editors

INTRODUCTION

This report lists the parameters of earthquakes that occur in and near areas encompassed by the network of seismograph stations operated or recorded by the University of Alaska Geophysical Institute (UAGI) (fig. 1; table 1). The goal of this report is to provide a convenient reference source for earthquake activity in the seismic-network area and quantitative information that researchers, administrators, planners, and other interested people can use. Therefore, this report contains hypocentral parameters and information about the quality of data and precision of the parameters. Because of the substantial quantity of data, this report is based on routine data processing. However, earthquakes are located as accurately and with as many useful data as possible. Additional data and more sophisticated methods of analysis might lead to more accurate locations.

DATA COLLECTION

The data used in this report are derived from two principal sources: seismic stations operated by UAGI and seismic stations operated by other agencies whose data are continuously recorded by UAGI under data-sharing or data-exchange agreements. For earthquakes of local magnitude (M_L) ≥3, we receive records of earthquake arrival times at several stations of the Alaska Tsunami Warning System that is operated by the National Oceanic and Atmospheric Administration (NOAA).

Signals from various stations are transmitted by UAGI-operated VHF-radio links and leased commercial-telephone circuits to one of two recording centers in Homer and Fairbanks that are operated by the University of Alaska. Remote stations are serviced and calibrated annually; stations easily accessible by road are serviced more frequently if necessary. Difficult access to many stations can result in lengthy data losses if instruments have malfunctioned. Significant data losses result in lower detection thresholds and poorer solution qualities for earthquakes in the affected regions. To discern such conditions, a station-use record is provided in figure 2.

Data are recorded on 16-mm film on several Teledyne Geotech Develocorders that have a 20-channel capacity. Satellite-linked clocks provide time marks that are superimposed on the records. Figure 3 shows the typical response of the seismic-network system from transducer to recorder.

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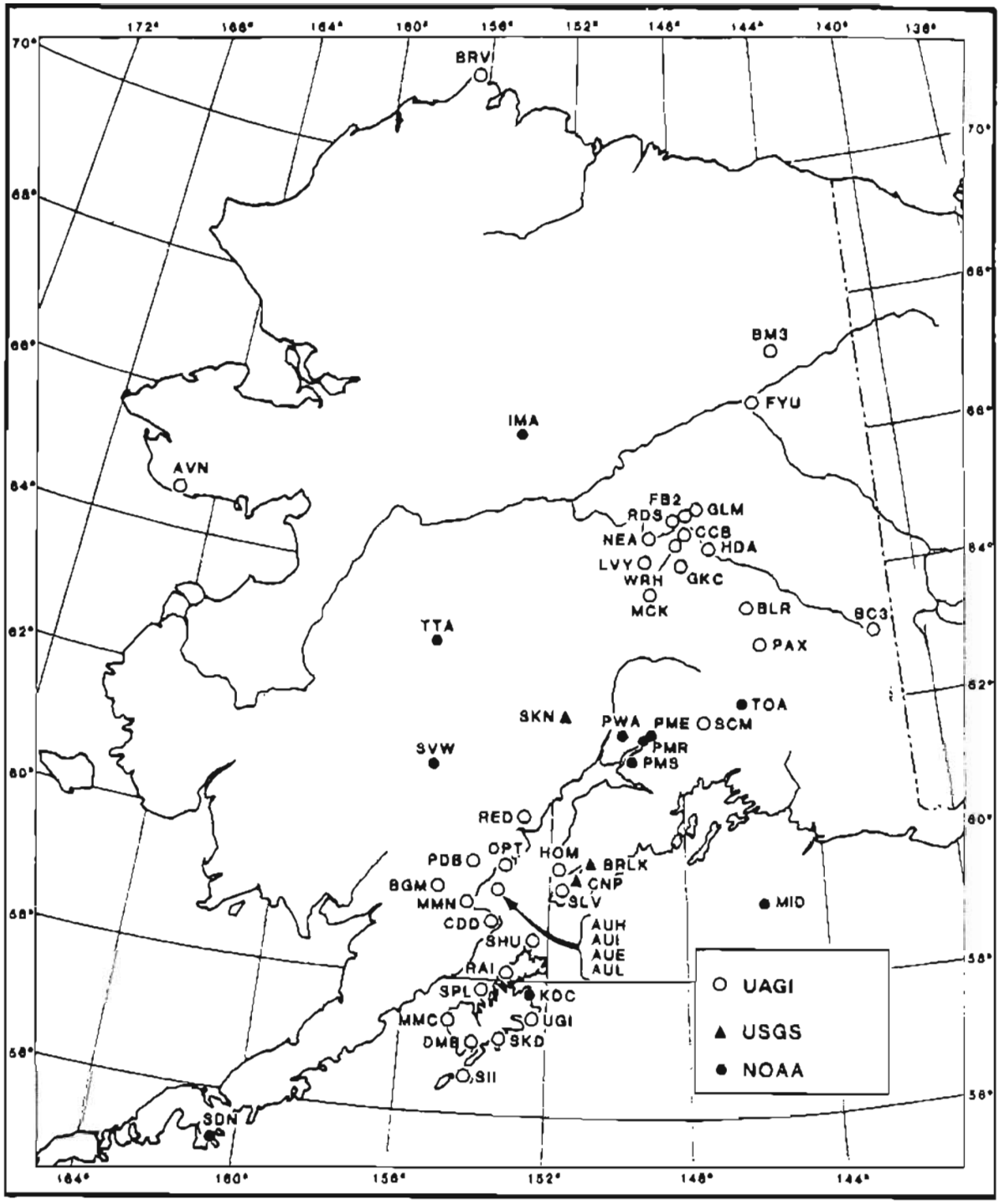

Figure 1. All seismic-network stations operated by the University of Alaska and by other organizations whose data were used in this report. Stations BGM, PDB, and SLV were installed and operated by the U.S. Geological Survey and are currently operated by the University of Alaska. See table 1 for station names.

Table 1. Names and parameters of seismic-network stations used to prepare this report.

Code	Station	Latitude (N.)	Longitude (W.)	Elevation (m)	Velocity model[a]	Operator
ANV	Anvil Mountain	64° 33.90'	165° 22.28'	323	1	UAGI[b]
AUE	Augustine East	59° 21.54'	153° 22.33'	172	2	UAGI
AUH	Augustine Hill	59° 21.83'	153° 26.61'	900	2	UAGI
AUI	Augustine Island	59° 20.11'	153° 25.66'	293	2	UAGI
AUL	Augustine Lava Flow	59° 22.93'	153° 26.07'	360	2	UAGI
BC3	Beaver Creek	63° 4.00'	141° 45.50'	762	1	UAGI
BGM	Big Mountain	59° 23.56'	155° 13.76'	625	2	UA/USGS[c]
BLM	Blue Mountain	58° 2.70'	156° 20.70'	539	3	UAGI
BLR	Black Rapids	63° 30.10'	145° 50.70'	810	1	UAGI
BM3	Burnt Mountain	67° 17.18'	144° 25.17'	305	1	UAGI
BRLK	Bradley Lake	59° 45.85'	150° 53.13'	631	2	USGS
BRV	Barrow	71° 16.43'	156° 47.08'	13	1	UAGI
CCB	Clear Creek Butte	64° 38.80'	147° 48.33'	219	1	UAGI
CDD	Cape Douglas	58° 55.79'	153° 38.58'	622	2	UAGI
CNP	China Poot	59° 31.55'	151° 14.16'	564	2	USGS
CTG	Chinitna Glacier	60° 57.90'	141° 20.00'	1554	5	USGS
DMB	Deadman Bay	57° 5.23'	153° 57.63'	300	3	UAGI
FB2	Fairbanks	64° 54.00'	147° 47.60'	320	1	UAGI
FLP	Featherly Pass	57° 42.40'	156° 16.10'	486	3	UAGI
FYU	Fort Yukon	66° 33.96'	145° 13.90'	137	1	UAGI
GKC	Gold King Creek	64° 10.72'	147° 56.08'	490	1	UAGI
GLM	Gilmore Dome	64° 59.24'	147° 23.34'	820	1	UAGI
HDA	Harding Lake	64° 24.35'	146° 57.23'	450	1	UAGI
HOM	Homer	59° 39.50'	151° 38.60'	198	2	UAGI
IMA	Indian Mountain	66° 4.10'	153° 40.72'	1380	1	NOAA[d]
KDC	Kodiak	57° 44.87'	152° 29.50'	13	3	NOAA
KSM	King Salmon Mountain	58° 51.80'	156° 10.50'	560	3	UAGI
LVY	Levy	64° 13.00'	149° 15.20'	230	1	UAGI
MCK	McKinley Park	64° 43.94'	148° 56.10'	618	1	UAGI
MID	Middleton Island	59° 25.67'	146° 20.33'	37	4	NOAA
MMC	Middle Cape	57° 20.00'	154° 38.10'	340	3	UAGI
MMN	McNeil River	59° 11.11'	154° 20.20'	442	2	UAGI
MSP	Moose Pass	60° 29.35'	149° 21.64'	150	2	USGS
NEA	Nenana	64° 34.63'	149° 4.63'	364	1	UAGI
NKI	Nikolski	52° 56.56'	168° 51.44'	8	2	NOAA
OPT	Oil Point	59° 39.16'	153° 13.78'	450	2	UAGI
PAX	Paxson	62° 58.25'	145° 28.12'	1130	1	UAGI
PDB	Pedro Bay	59° 47.27'	154° 11.55'	305	2	UA/USGS
PME	Palmer East	61° 37.70'	149° 1.90'	232	2	NOAA
PMR	Palmer Observatory	61° 35.53'	149° 7.85'	100	2	NOAA
PMS	Palmer - Arctic Valley	61° 14.68'	149° 33.63'	716	2	NOAA
PUB	Puale Bay	57° 46.40'	155° 31.00'	280	3	UAGI

[a] See tables 2, 3, and 4.
[b] University of Alaska Geophysical Institute.
[c] U.S. Geological Survey.
[d] National Oceanic and Atmospheric Administration.

Table 1. (con.)

Code	Station	Latitude (N.)	Longitude (W.)	Elevation (m)	Velocity model	Operator
PWA	Palmer West - Houston	61° 39.05'	149° 52.72'	137	2	UAGI
RAI	Raspberry Island	58° 3.63'	153° 9.55'	520	3	UAGI
RDT	Redoubt	60° 34.43'	152° 24.37'	930	2	USGS
RDS	Richard D. Siegrist	64° 49.59'	148° 8.68'	930	1	UAGI
RED	Redoubt Volcano	60° 25.14'	152° 46.32'	1087	2	UAGI
SCM	Sheep Mountain	61° 50.00'	147° 19.66'	1020	4	UAGI
SDN	Sand Point	55° 20.40'	160° 29.83'	19	6	NOAA
SHU	Shuyak Island	58° 37.68'	152° 20.93'	10	3	UAGI
SII	Sitkinak Island	56° 33.60'	154° 10.92'	500	3	UAGI
SKD	Sitkalidak Island	57° 9.85'	153° 4.82'	135	3	UAGI
SKN	Skwentna	61° 58.86'	151° 31.78'	564	2	USGS
SLV	Seldovia	59° 28.28'	151° 34.83'	91	2	UA/USGS
SPL	Spiridon Lake	57° 45.55'	153° 46.28'	600	3	UAGI
SPU	Mount Spurr	61° 10.90'	152° 3.26'	800	2	USGS
SSN	Susitna Mountain	61° 27.83'	150° 44.60'	1297	1	USGS
SVW	Sparrevohn	61° 6.49'	155° 37.30'	762	2	NOAA
TOA	Tolsona	62° 6.29'	146° 10.34'	909	4	NOAA
TTA	Tatalina	62° 55.80'	156° 1.32'	914	2	NOAA
UGI	Ugak Island	57° 23.67'	152° 16.90'	213	3	UAGI
WRH	Wood River Hill	64° 28.28'	148° 5.39'	314	4	UAGI
WWW	Wonder Why Ridge	58° 20.90'	156° 19.90'	414	3	UAGI

DATA PROCESSING

Arrival times of body waves are read from the 16-mm film with Geotech filmviewers that provide a time resolution of 0.1 s/mm. Thus, the impulsive arrivals can be read to 0.05 s.

Earthquake locations are based on arrival times of P and S waves. As many S arrivals as possible are used to help determine hypocentral depth. Most S readings are obtained from vertical components because few three-component systems are recorded. When large earthquakes occur, traces overlap on multichannel-film recorders; consequently, S arrivals are difficult to identify.

After earthquakes are identified and arrival times are determined, phase data are processed with the HYPOELLIPSE computer program (Lahr, 1980) to obtain earthquake parameters. Each solution is checked for the root-mean-square (RMS) error of travel-time residuals and the spatial distribution of stations used. Solutions that have residuals 0.5 s or greater are reread. If the stations used are poorly distributed, additional data are sought from stations not recorded by UAGI. Events recorded by fewer than six stations receive less attention. Data for earthquakes of $M_L \geq 3.5$ are processed more carefully, sometimes by changing control parameters in the computer program.

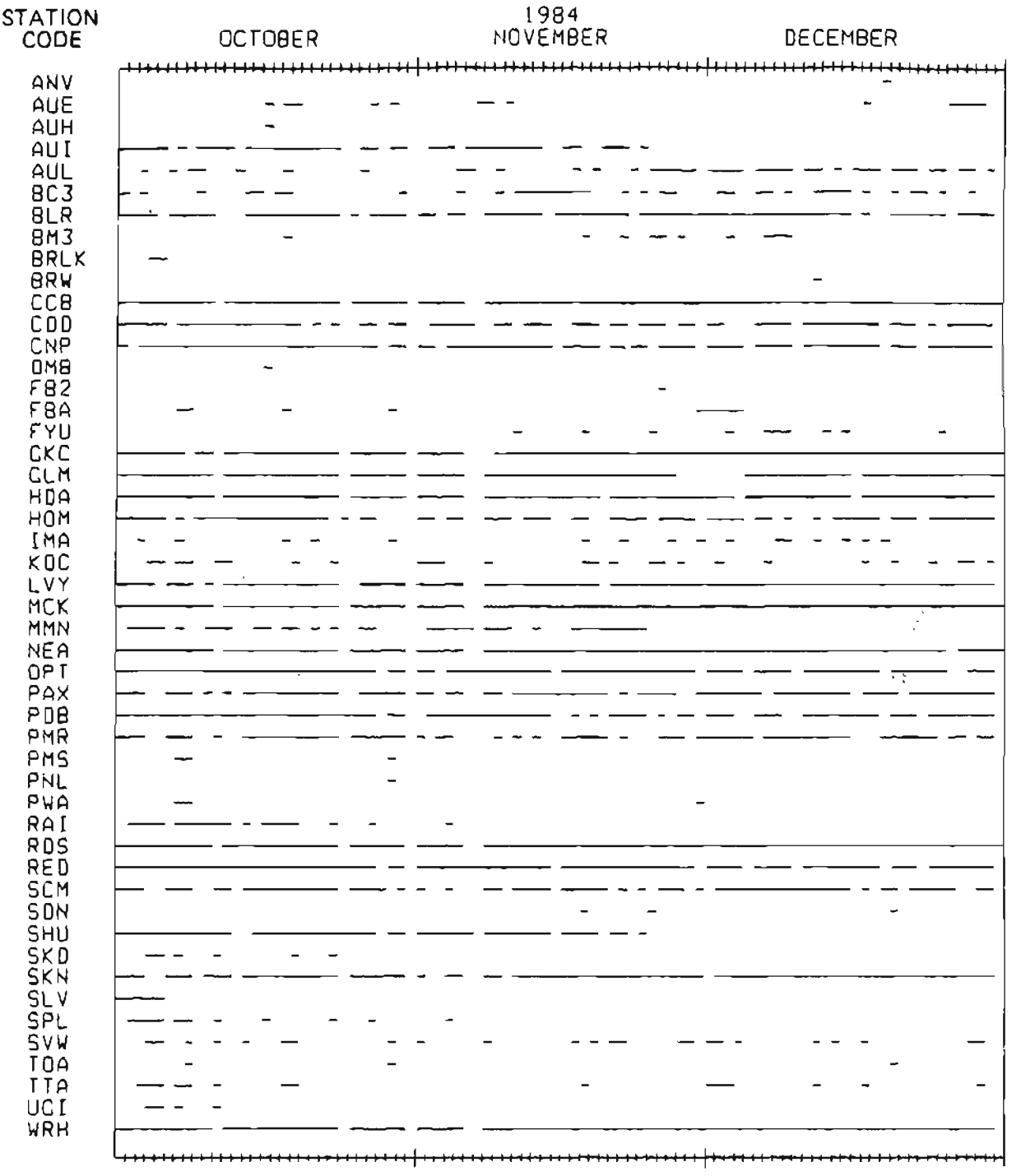

Figure 2. Station-use record. Lines indicate that at least one arrival-time was read from a specific station operating on a specific day. Nonuse does not imply that a station was malfunctioning, but rather that no data were required to locate earthquakes. See table 1 for station names.

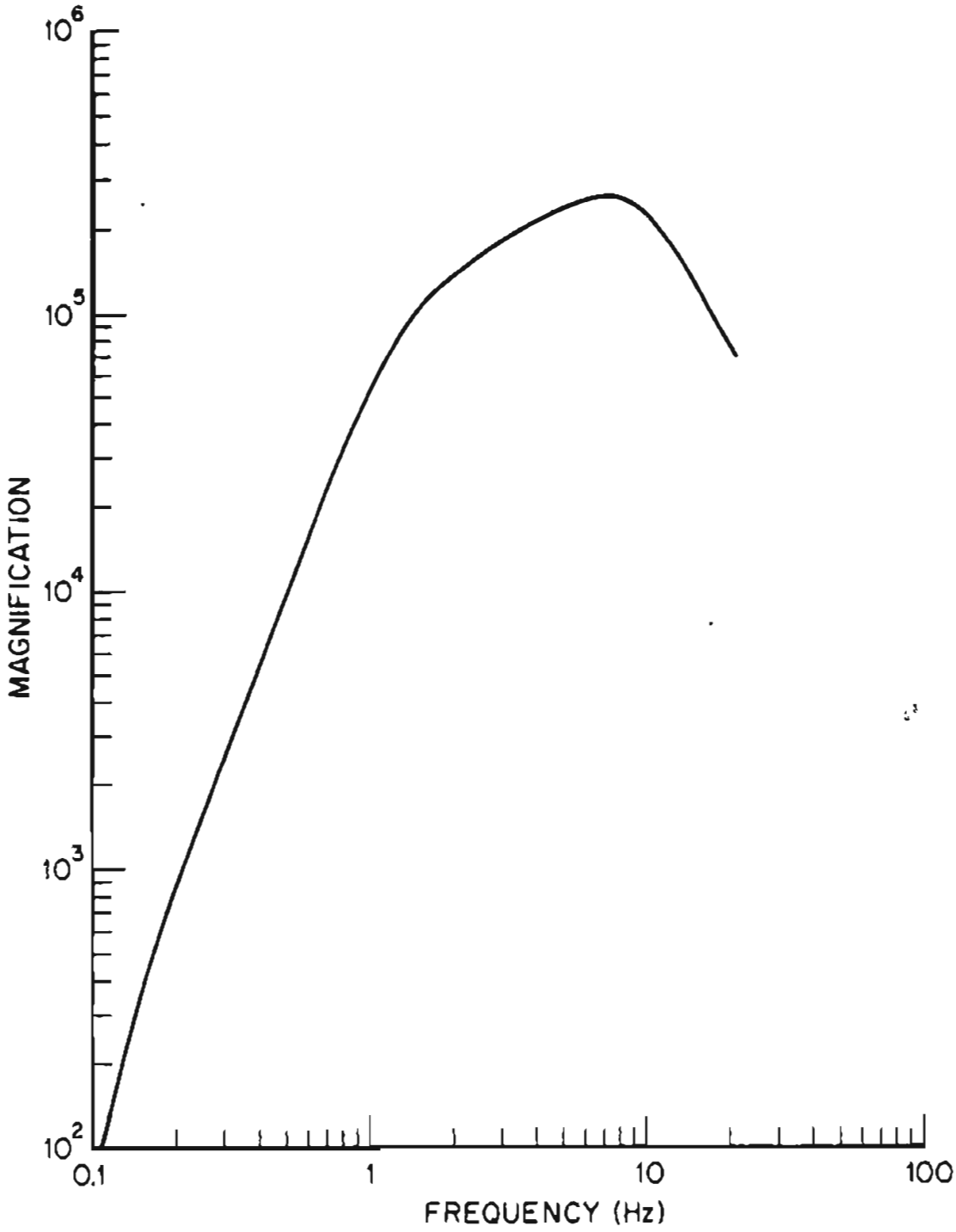

Figure 3. Typical response of a seismic-network station operated by the University of Alaska Geophysical Institute. Magnification is the ratio of the amplitude measured on the filmviewer to that of the actual ground motion recorded. Actual values vary with station.

VELOCITY MODELS

The tectonic regime and geologic setting vary greatly throughout the area covered by the UAGI seismic network. Although our knowledge of the seismic-velocity structure is limited, significant variations exist. To account for these variations, each UAGI station is associated with one of three velocity models (see tables 1 through 4), depending on the station's location. The models vary only with depth; lateral variation of velocity is not considered. For stations outside the UAGI seismic network, we generally use models adopted by the station's operators (table 1). For all models, S velocity = $\frac{\text{P velocity}}{\sqrt{3}}$.

Table 2. Velocity model 1.

Layer	Depth (km)	P velocity (km/sec)
1	0-24	5.9
2	24-40	7.4
3	40-76	7.9
4	76-300	8.3
5	301-545	10.4
6	>545	12.6

Model 1 is used primarily in central and northern Alaska (figs. 4 and 5) and is based on unpublished data by Biswas (oral commun., 1978). The upper mantle structure is based on travel-time studies by Biswas and Bhattacharya (1974).

Table 3. Velocity model 2.

Layer	Depth (km)	P velocity (km/sec)
1	0-2	2.75
2	2-4	5.3
3	4-10	5.6
4	10-15	6.2
5	15-20	6.9
6	20-25	7.4
7	25-33	7.7
8	33-47	7.9
9	47-65	8.1
10	>65	8.3

Model 2 is associated with stations located in the Cook Inlet - Kenai Peninsula area (figs. 6 and 7) and is used by the USGS for locating earthquakes in the same area. It is a modified version of the model determined by Matumoto and Page (1969) from travel-time studies of aftershocks of the 1964 Great Alaska earthquake.

Table 4. Velocity model 3.

Layer	Depth (km)	P velocity (km/sec)
1	0-1.6	4.2
2	1.6-12	5.5
3	12-42	6.6
4	42-60	8.06
5	60-80	8.09
6	80-100	8.11
7	100-150	8.14
8	150-200	8.27
9	200-250	8.41
10	250-300	8.50
11	300-350	8.74
12	>350	9.02

Model 3 is used on Kodiak Island and the Alaska Peninsula. The depth and velocity of the first three layers are based on refraction experiments in the central Aleutian Islands (Engdahl and Tarr, 1970). The remaining layers are based on work by Herrin and others (1968).

EARTHQUAKE MAGNITUDE

Earthquake magnitudes are determined from the maximum amplitude of the body-wave trace. Because regional body-wave phases are used, we determine local magnitudes (M_L). The relationship we use was derived by Richter (1958) using earthquake data recorded on standard horizontal Wood-Anderson seismographs in California. Corrections were made for differences in response and magnification between the standard instrument used by Richter and the instruments we used. However, no corrections were made for differences in attenuation properties between California and Alaska. Additionally, no corrections were made for measuring vertical ground motion rather than horizontal ground motion.

The magnitude of each earthquake is usually calculated at several seismic-network stations and then averaged. When large earthquakes occur, the instrument response saturates the maximum trace amplitude of the recorder at most of our stations. Therefore, we frequently list local magnitude determined by NOAA's Palmer Observatory. Felt reports and intensity observations based on the Modified Mercalli Intensity Scale (table 5; Richter, 1958) are also listed. The intensity levels are defined in the explanation at the end of table 5.

RECORDED EARTHQUAKES

Appendix A lists hypocenter, magnitude, and quality parameters for each earthquake of $M_L \geq 3.0$ that was located during the fourth quarter of 1984 (see also figs. 5, 7, and 8). Appendix B lists the same parameters for all earthquakes that were located during the same period (see also figs. 4 and 6). Detection threshold and solution quality vary throughout the areas shown in figures 4, 6, and 8. Appendix A is probably complete for $M_L > 3$. As shown

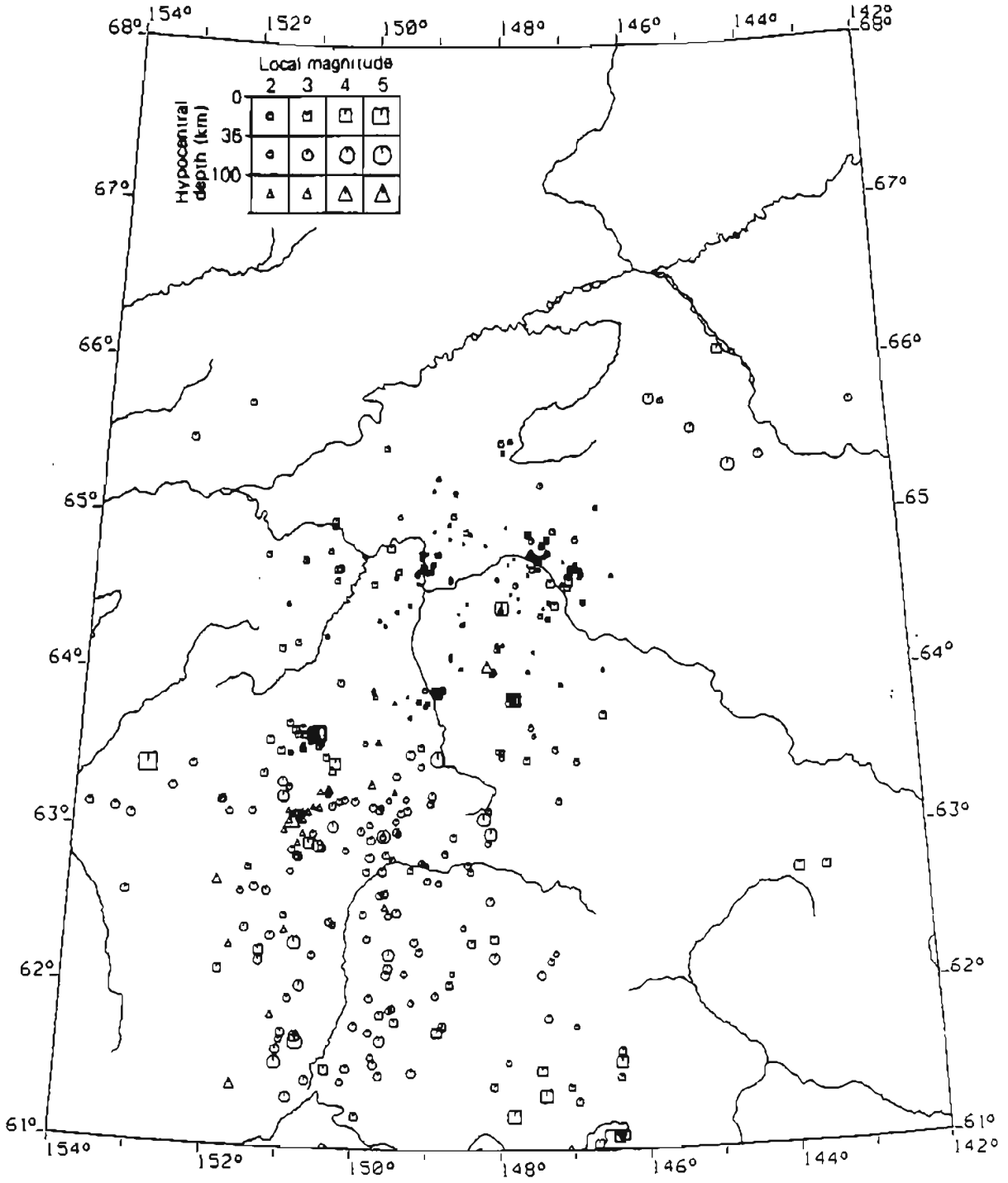

Figure 4. Epicenters of earthquakes that occurred north of lat 61° N. during the fourth quarter of 1984. Symbol sizes are shown for local magnitudes 2 through 5. Symbols larger or smaller than those shown reflect local magnitudes that must be interpolated relative to the symbol sizes shown.

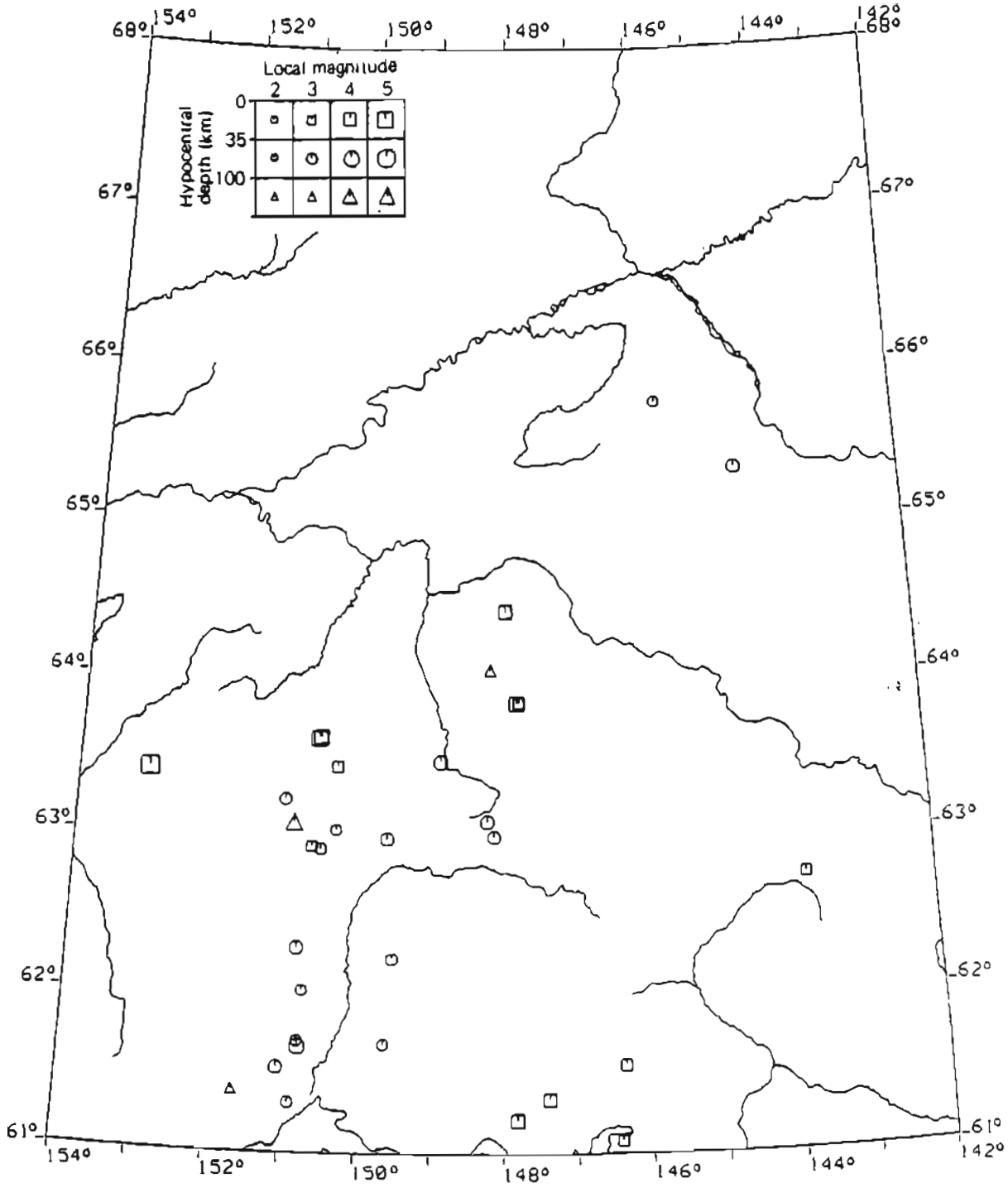

Figure 5. Epicenters of earthquakes with $M_L \geq 3$ that occurred north of lat 61° N. during the fourth quarter of 1984. Symbol sizes are shown for local magnitudes 2 through 5. Symbols larger or smaller than those shown reflect local magnitudes that must be interpolated relative to the symbol sizes shown.

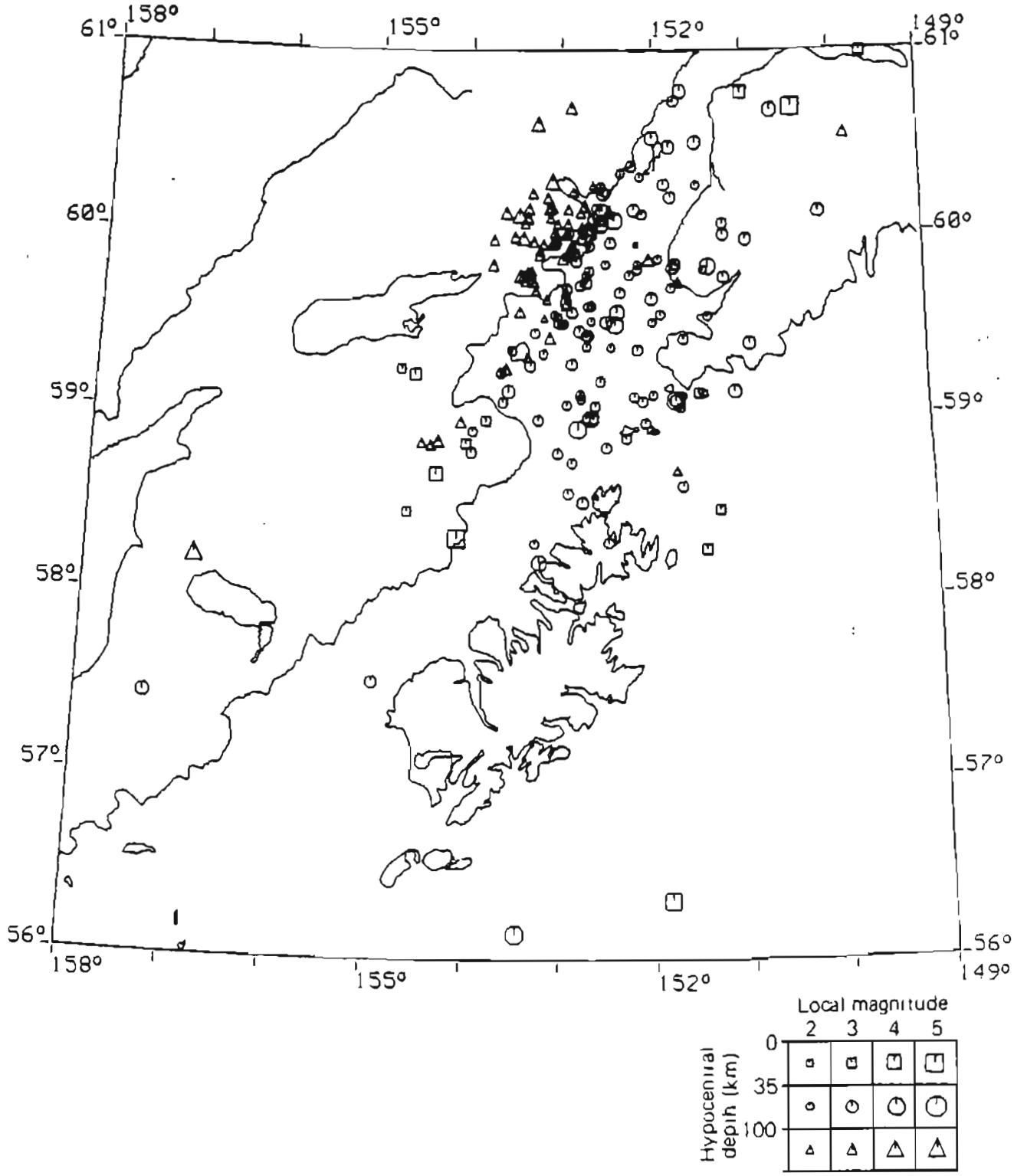

Figure 6. Epicenters of earthquakes that occurred south of lat 61° N. during the fourth quarter of 1984. Symbol sizes are shown for local magnitudes 2 through 5. Symbols larger or smaller than those shown reflect local magnitudes that must be interpolated relative to the symbol sizes shown.

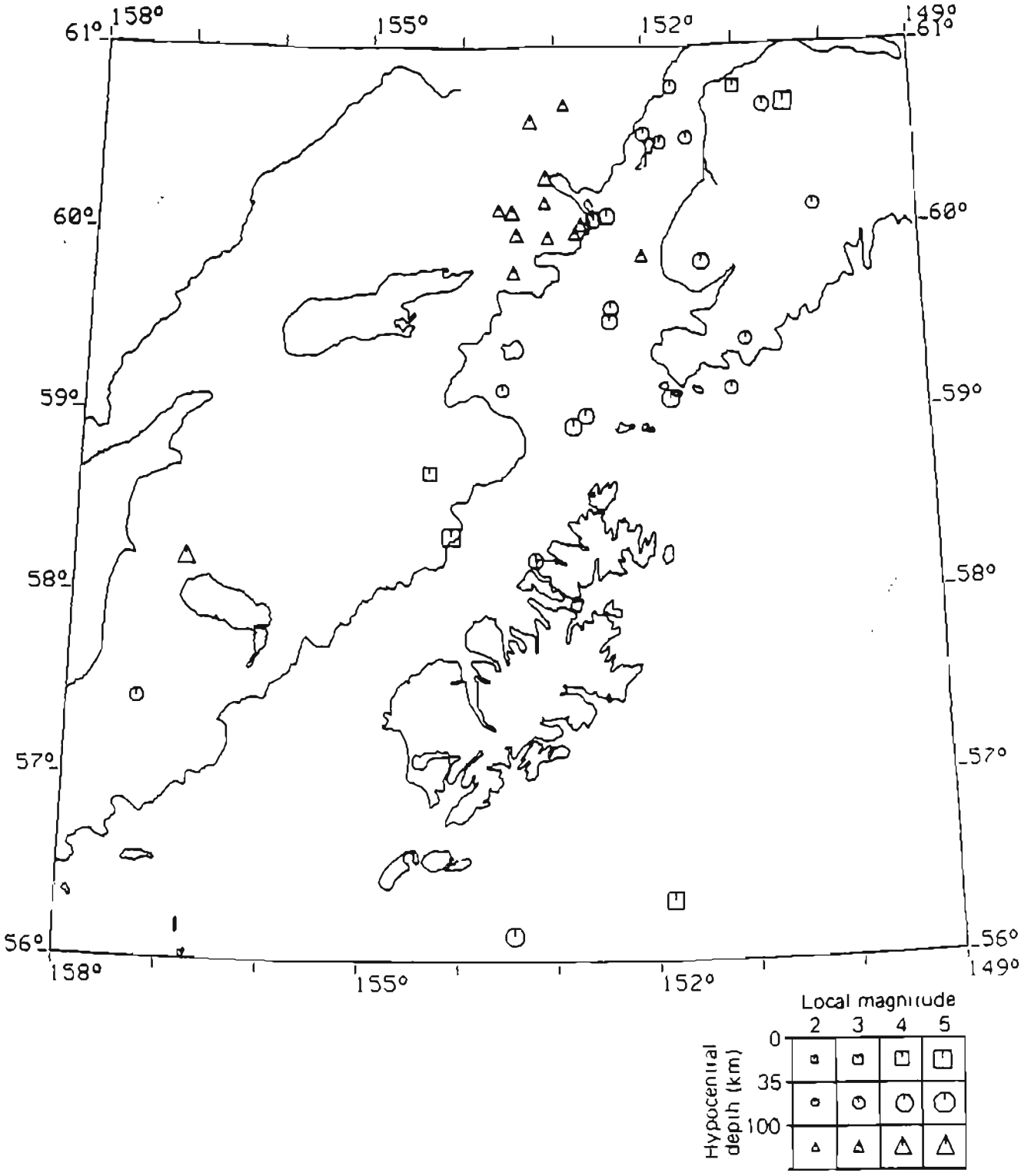

Figure 7. Epicenters of earthquakes with $M_L \geq 3$ that occurred south of lat 61° N. during the fourth quarter of 1984. Symbol sizes are shown for local magnitudes 2 through 5. Symbols larger or smaller than those shown reflect local magnitudes that must be interpolated relative to the symbol sizes shown.

Table 5. Modified Mercalli scale, 1956 version.

I. Not felt. Some very low frequency effects, such as seiching in lakes, may be observed resulting from large, distinct earthquakes.

II. Felt by persons at rest, on upper floors, or favorably placed.

III. Felt indoors. Hanging objects swing. Vibration like passing of light trucks. Duration estimated. May not be recognized as an earthquake.

IV. Hanging objects swing. Vibration like passing of heavy trucks; or sensation of a jolt like a heavy ball striking the walls. Standing motor cars rock. Windows, dishes, doors rattle. Glasses clink. Crockery clashes. In the upper range of IV, wooden walls and frame creak.

V. Felt outdoors; direction estimated. Sleepers wakened. Liquids disturbed, some spilled. Small unstable objects displaced or upset. Doors swing, close, open. Shutters, pictures move. Pendulum clocks stop, start, change rate.

VI. Felt by all. Many frightened and run outdoors. Persons walk unsteadily. Windows, dishes, glassware broken. Knickknacks, books, etc., off shelves. Pictures off walls. Furniture moved or overturned. Weak plaster and masonry D cracked. Small bells ring (church, school). Trees, bushes shaken (visibly, or heard to rustle--CFR[3]).

VII. Difficult to stand. Noticed by drivers of motor cars. Hanging objects quiver. Furniture broken. Damage to masonry D, including cracks. Weak chimneys broken at roof line. Fall of plaster, loose bricks, stones, tiles, cornices (also unbraced parapets and architectural ornaments--CFR). Some cracks in masonry C. Waves on ponds; water turbid with mud. Small slides and caving in along sand or gravel banks. Large bells ring. Concrete irrigation ditches damaged.

VIII. Steering of motor cars affected. Damage to masonry C; partial collapse. Some damage to masonry B; none to masonry A. Fall of stucco and some masonry walls. Twisting, fall of chimneys, factory stacks, monuments, towers, elevated tanks. Frame houses moved on foundations if not bolted down; loose panel walls thrown out. Decayed piling broken off. Branches broken from trees. Changes in flow or temperature of springs and wells. Cracks in wet ground and on steep slopes.

IX. General panic. Masonry D destroyed; masonry C heavily damaged, sometimes with complete collapse; masonry B seriously damaged. (General damage to foundations--CFR.) Frame structures, if not bolted, shifted off foundations. Frames racked. Serious damage to reservoirs. Underground pipes broken. Conspicuous cracks in ground. In alluviated areas, sand and mud ejected, earthquake fountains, sand craters.

[3]CFR refers to supplemental comments by Charles F. Richter.

X. Most masonry and frame structures destroyed with their foundations. Some well-built wooden structures and bridges destroyed. Serious damage to dams, dikes, embankments. Large landslides. Water thrown on banks of canals, rivers, lakes, etc. Sand and mud shifted horizontally on beaches and flat land. Rails bent slightly.

XI. Rails bent greatly. Underground pipelines completely out of service.

XII. Damage nearly total. Large rock masses displaced. Lines of sight and level distorted. Objects thrown into the air.

in figure 1, the distribution of stations varies significantly; thus detection-threshold levels also vary significantly.

The reliability of a hypocenter location can be assessed from two sets of information: the quality of the input data and the results of statistical tests. The number of P and S phases used to locate the earthquake (NP and NS), the largest azimuthal separation between stations as measured from the epicenter (GAP), and the distances from the epicenter to the closest and third closest station (D1, D3) are the most important parameters that control the reliability of the hypocenter location. A GAP of more than 180° means that the epicenter is located outside the seismic network; therefore, locations will generally be less reliable. Also, as D1 exceeds hypocentral depth, the reliability of hypocentral depth decreases. Magnitude threshold and location reliability vary throughout the state because of the uneven distribution of stations (fig. 1).

The RMS travel-time residual and the horizontal (ERH) and vertical (ERZ) projections of the maximum axes of the one-standard-deviation confidence ellipsoid reflect the precision of the solution. Because we use simplified velocity models, the RMS residuals probably measure the incompatibility of these models; they only secondarily account for random reading errors and phase misidentifications. Although the precision of hypocentral locations is fairly well indicated by ERH and ERZ, their absolute accuracy is difficult to determine because adequate calibration studies with known sources, such as explosions, have not been performed in the region.

Seismicity south of lat 61° N. (fig. 6) dominantly reflects the subduction of the North Pacific plate beneath the North American plate. A well-defined Benioff zone dips about 45° NW. below Cook Inlet and the Alaska Peninsula. Near lat 60° N., high seismic activity at depths greater than 70 km is typical of the area. The Benioff zone terminates at about lat 64° N. A cluster of hypocenters at an intermediate depth (>50 km) near lat 63° N. (below Mt. McKinley) pinpoints where the strike of the Benioff zone changes from north-northeast to more northeast. The cluster of shallow hypocenters near Fairbanks is characteristic of the seismic activity in central Alaska. Although the seismic-station distribution near Fairbanks is dense and provides the lowest detection threshold throughout the network (with the exception of Augustine Volcano), the concentration of epicenters indicates a very active seismic zone.

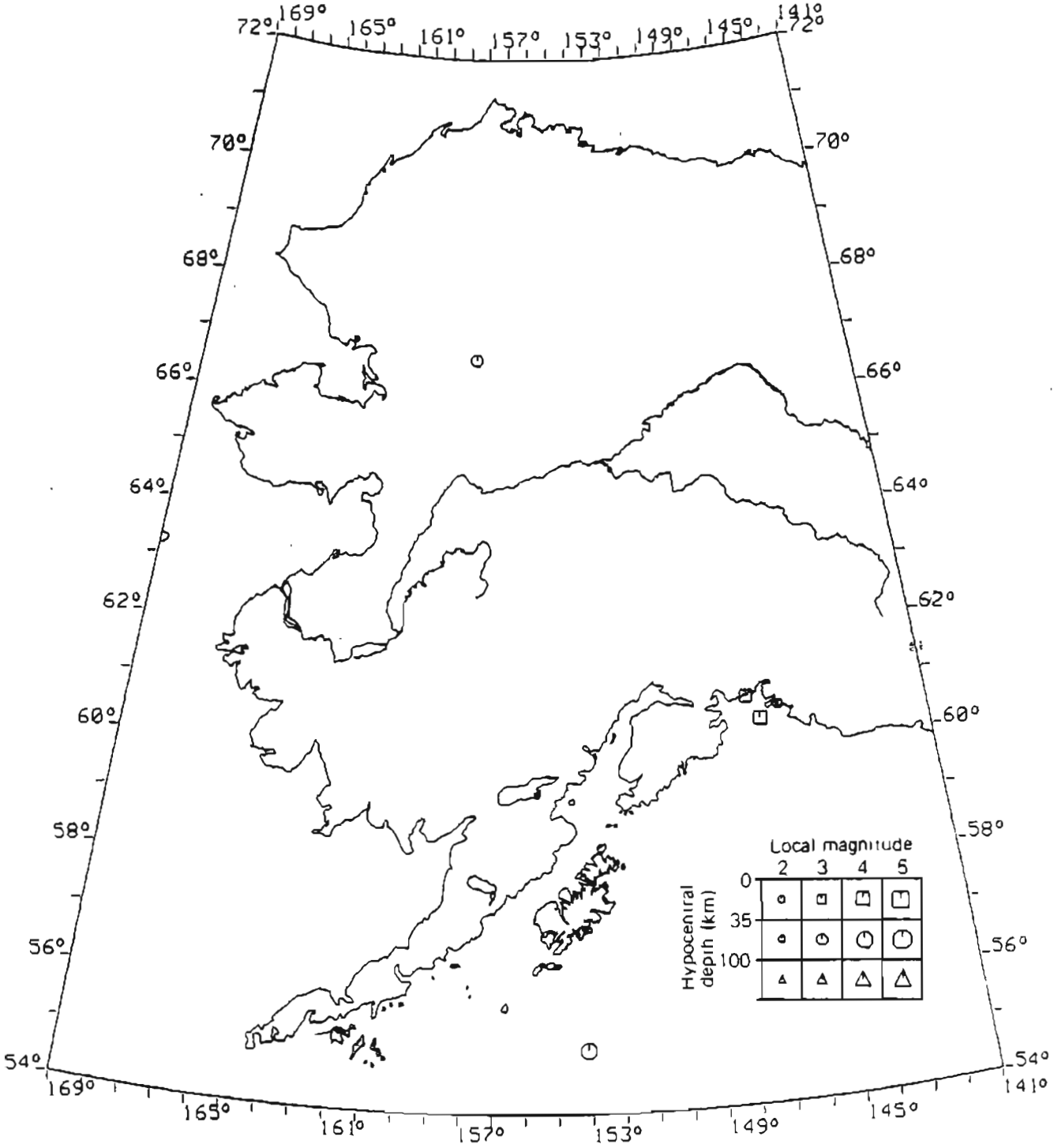

Figure 8. Epicenters of earthquakes that occurred in the fourth quarter of 1984 and are not shown in figures 4 or 5. Symbol sizes are shown for local magnitudes 2 through 5. Symbols larger or smaller than those shown reflect local magnitudes that must be interpolated relative to the symbol sizes shown.

There was no unusual seismic activity during the fourth quarter of 1984. The seismic network on Kodiak Island was not operating during a large part of this period and only a few events were recorded for the Kodiak area.

ACKNOWLEDGMENTS

We thank Tom Sokolowski and the staff of the NOAA Tsunami Warning System in Palmer for helping us to record several of their station signals on a continuous basis. We also thank John Lahr of the USGS for sharing information with us and providing the HYPOELLIPSE computer program.

The operation of the seismic networks and preparation and publication of this report were made possible by support from the Division of Geological and Geophysical Surveys of the State of Alaska and the University of Alaska Geophysical Institute.

REFERENCES

Biswas, N.N., and Bhattacharya, B., 1974, Travel-time relations for the upper mantle from central Alaskan data: Bulletin of the Seismological Society of America v. 64, p. 1953-1966.

Engdahl, E.R., and Tarr, A.A., 1976, Aleutian seismicity, Milrow seismic effects: U.S. Coast and Geodetic Survey Publication CGS-746-102, p. 1-54.

Herrin, E., Arnold, E.P., Bolt, B.A., and Engdahl, E.R., 1968, Seismological tables for P phases: Bulletin of the Seismological Society of America, v. 58, p. 1223-1226.

Lahr, J.A., 1980, HYPOELLIPSE/MULTICS: A computer program for determining local earthquake hypocentral parameters, magnitude and first motion pattern: U.S. Geological Survey Open-file Report 80-59, 68 p.

Matumoto, T., and Page, R.A., 1969, Micro aftershocks following the Alaska earthquake of 28 March 1964: determination of hypocenters and crustal velocities in the Kenai Peninsula - Prince William Sound area, in The Prince William Sound Alaska earthquake of 1964: Washington, D.C., U.S. Government Printing Office, v. 2B, p. 157-174.

Richter, C.F., 1958, Elementary Seismology: San Francisco, W.H. Freeman and Co., 768 p.

APPENDIX A

Data for Alaska earthquakes of M_L ≥3.0 that were located during the fourth quarter 1984.[a]

1984	ORIGIN HR	TIME MN	SEC	LAT N DEG	MIN	LONG W DEG	MIN	DEPTH KM	MAG	NP	NS	GAP DEG	DI KM	DO KM	RMS SEC	ERH KM	ERZ KM	Q
OCT 03	7	14	34.7	61	33.4	146	20.9	26.5	3.3	9	2	220	60	164	0.53	3.2	3.7	D
03	14	58	1.5	59	59.9	152	46.0	104.3	3.1	16	6	122	46	78	0.32	1.6	2.0	C
03	14	56	1.4	60	0.1	152	46.0	104.6	3.1	16	6	122	47	79	0.33	1.8	2.0	C
03	19	17	23.8	62	46.1	143	48.8	1.2	3.6*	11	1	172	86	133	0.25	2.0	2.4	C
									FELT II AT SALANA AND NEBESNA									
04	22	41	4.2	59	8.1	151	48.8	80.6	4.3*	17	0	157	44	81	0.17	1.7	4.9	C
									NEIS MB - 5.0. FELT III HOMER									
07	3	23	33.3	59	8.2	153	33.8	89.8	3.1	13	4	86	23	45	0.35	2.1	2.7	B
07	16	35	25.1	63	27.2	150	21.4	8.7	3.3*	15	0	72	77	140	0.46	1.8	2.2	D
08	0	49	38.7	63	14.8	151	4.8	71.0	3.2*	6	0	135	188	236	0.13	3.6	85.8	D
08	21	10	10.0	61	42.6	150	47.9	60.7	3.0	9	1	120	49	179	0.29	2.0	4.0	B
									PALMER ML - 3.8									
10	17	40	48.1	60	47.0	151	41.3	74.0	3.1	6	4	294	72	142	0.38	3.4	7.0	D
11	6	18	47.9	57	25.9	157	17.2	36.1	3.3	5	3	337	213	256	0.89	99.0	99.0	D
11	21	18	35.0	61	19.2	150	53.1	55.8	3.1	11	1	114	61	143	0.31	2.7	10.0	C
13	3	29	38.8	60	16.2	152	54.0	43.3	3.0	7	3	149	18	90	1.74	3.8	7.5	D
13	3	30	29.1	60	41.6	152	53.1	134.6	3.0	7	3	268	31	124	0.32	5.2	2.9	D
14	4	49	38.7	62	14.4	149	31.9	76.4	3.3*	14	0	108	78	124	0.37	2.7	4.4	C
									NEIS MB - 3.8									
14	10	19	46.8	60	57.8	147	13.3	17.7	3.4	8	0	260	97	242	0.10	20.2	8.2	D
									NEIS MB - 3.2, PALMER ML - 3.4									
14	18	45	36.7	60	31.9	151	59.9	74.9	3.3	9	3	229	44	120	0.32	2.6	4.3	D
18	5	19	56.5	63	5.9	150	56.7	151.4	4.9*	16	0	72	123	150	0.23	2.6	7.2	B
									NEIS MB - 4.6, FELT III AT PALMER AND WASILLA.									
18	10	7	41.8	65	46.9	145	40.0	66.2	3.0	12	0	164	119	161	0.29	4.0	13.4	D
18	12	35	18.8	60	9.3	153	21.2	147.8	3.0	7	1	178	44	82	0.35	3.8	6.4	C
18	23	47	27.4	63	1.2	148	7.7	74.1	3.6	20	0	71	89	130	0.44	1.4	4.7	C
19	4	44	45.0	61	40.4	150	47.0	67.2	4.2	10	0	247	176	241	0.37	20.0	52.9	D
									NEIS MB - 4.5, PALMER ML - 4.0 FELT II ANCHORAGE AND PALMER									
19	20	43	13.3	59	49.7	151	23.4	80.2	3.9	14	2	123	38	108	0.64	1.8	3.8	C
									PALMER ML - 3.7, FELT I AT ANCHORAGE.									
21	11	6	22.5	60	29.0	151	49.0	76.9	3.2	8	2	260	53	112	0.24	2.7	4.0	D
21	14	12	19.3	64	27.3	147	58.5	15.9	3.9*	15	0	71	6	31	0.29	1.0	1.2	B
22	17	48	51.7	61	12.9	147	48.8	8.9	3.9	8	1	329	267	284	0.29	99.0	99.0	D
29	1	39	18.8	65	20.5	144	29.5	37.2	3.7*	8	0	261	163	477	0.67	41.5	14.0	D
NOV 01	8	18	2.1	60	40.1	150	39.8	63.2	3.5	6	0	161	119	132	0.17	4.1	12.8	D
									PALMER ML - 3.5									
02	17	45	45.7	58	58.0	152	48.4	65.5	4.2*	9	0	98	43	57	0.15	2.0	4.5	B
									NEIS MB - 4.0									
03	13	19	4.6	55	5.1	153	6.2	42.6	4.3	8	0	335	299	430	0.39	99.0	43.5	D
									NEIS MB - 4.6, PALMER ML - 4.3									
04	9	26	38.6	60	33.5	146	48.4	30.8	3.7	5	1	328	272	328	0.18	48.3	89.4	D
04	19	50	15.2	60	7.9	153	36.1	181.6	3.1	7	4	254	91	122	0.34	3.6	4.8	D
08	1	11	21.1	59	34.9	152	23.0	87.3	3.6	8	2	91	43	65	0.36	2.2	3.5	C
08	15	19	58.1	60	30.3	151	31.3	67.1	3.2	6	3	269	69	110	0.38	2.8	9.3	D
09	6	38	6.8	63	52.4	147	49.0	14.4	4.2*	13	0	81	35	68	0.41	1.1	1.5	C
									NEIS MB - 3.7, FELT IV FAIRBANKS AND ESTER.									
09	19	51	40.2	63	3.3	150	21.2	90.9	3.1*	8	2	172	134	173	0.30	2.8	9.7	D
11	5	33	10.8	63	52.4	147	46.9	2.3	3.2	12	2	79	59	72	0.23	1.1	2.0	C
11	8	48	43.3	61	20.6	147	23.2	25.9	3.8	16	0	233	55	207	0.42	5.2	3.0	D
13	0	37	49.5	62	1.9	150	48.6	63.3	3.0*	13	2	143	41	182	0.27	2.9	6.3	C
13	16	2	60.0	60	2.8	152	42.2	106.9	3.4	6	2	130	42	89	0.31	2.8	4.5	C
14	11	57	58.6	60	38.4	153	15.7	161.3	3.6	15	4	174	34	106	0.34	2.6	3.5	C
17	9	3	21.0	63	24.5	153	1.1	31.2	5.3*	14	1	260	176	206	0.37	8.8	11.6	D
									NEIS MB - 4.9, FELT III AT MC GRATH AND LAKE MINCHUMINA, FELT II AT TALKEETNA.									
18	4	36	31.4	63	6.9	148	13.5	82.9	3.7*	17	0	89	77	127	0.35	1.6	5.3	B
18	8	29	15.0	56	19.5	151	50.7	0.6	4.2*	9	0	257	163	309	1.01	10.6	2.5	D
									NEIS MB - 4.8									

[a] See explanation of column headings at end of appendix A.

*Magnitude value determined by Alaska Tsunami Warning System (NOAA Palmer Observatory).

APPENDIX A (con.)

1984	ORIGIN HR	MN	TIME SEC	LAT N DEG	MIN	LONG W DEG	MIN	DEPTH KM	MAG	NP	NS	GAP DEG	D1 KM	D3 KM	RMS SEC	ERH KM	ERZ KM	Q
NOV 19	0	44	24.4	58	12.5	136	51.0	223.8	4.6*	10	0	272	182	233	0.16	42.7	35.3	D
									NEIS MB - 4.8, FELT II AT EGEGIK									
21	20	8	24.4	60	6.3	152	24.8	96.9	3.9	10	2	162	42	67	0.31	2.0	3.6	C
22	13	10	59.7	63	0.1	149	37.9	87.6	3.7*	17	0	111	89	150	0.27	2.1	6.1	C
24	10	42	27.0	59	59.5	153	24.7	138.0	3.5	9	3	154	39	59	0.31	2.7	2.4	C
									PALMER ML - 3.4									
25	8	50	0.0	58	19.5	154	5.8	27.8	4.5*	5	0	254	72	124	0.36	89.5	15.5	D
									NEIS MB - 4.3									
26	1	42	14.8	62	56.8	150	41.4	25.7	3.0	16	0	181	116	156	1.15	2.8	3.8	D
									PALMER ML - 3.7									
26	2	41	40.8	62	56.0	150	33.7	98.8	3.3	16	0	175	117	157	0.39	3.4	9.6	D
									PALMER ML - 3.6									
28	3	52	46.1	58	59.5	152	40.0	60.2	3.9	9	4	122	57	80	0.31	1.4	2.7	C
30	1	19	37.4	64	5.2	148	11.4	100.0	3.6*	4	0	179	93	285	0.81	48 2	76 2	D
DEC 01	18	25	53.4	60	41.0	150	25.5	17.2	4.3	7	1	166	123	133	0.31	3.3	11 5	D
									NEIS MB - 3.8, PALMER ML - 4.1									
									FELT II AT ANCHORAGE AND SOLDOTNA.									
02	9	43	5.4	59	47.2	153	26.6	123.6	3.3	8	4	135	19	80	0.29	2.1	2.5	B
									PALMER ML - 3.7									
03	22	16	66.8	60	46.3	150	59.5	20.2	3.0	6	1	231	105	139	0.26	13.9	48.4	D
03	22	51	31.0	63	29.5	146	53.3	98.5	4.0*	18	0	104	27	90	0.24	1.9	3.8	B
04	8	36	21.1	60	0.8	153	5.4	120.9	3.2	5	4	133	41	67	0.15	2.1	2.3	C
04	8	38	21.3	59	59.7	153	2.7	121.6	3.0	13	4	180	40	72	0.33	2.2	2.2	C
04	19	42	28 7	60	4.2	152	33.3	93.2	3.6	13	2	321	220	345	0.38	10.6	22.8	D
									PALMER ML - 3.4									
08	13	58	55 0	61	41.4	149	37.9	81.6	3.0*	14	4	177	29	123	0.34	2.2	2.7	C
07	16	22	28.4	59	8 0	151	6.6	60.2	3.2	8	2	217	44	134	0.28	3 4	5.1	D
08	21	7	46.7	63	38.0	150	38.4	28.8	4.6*	19	0	139	85	130	0.37	2.2	4.3	D
									NEIS MB - 4.8, FELT FAIRBANKS.									
09	4	23	19.8	63	38.7	150	38.2	34.0	4.3*	17	0	138	83	128	0.43	2.1	2 7	D
12	3	21	57.0	60	18.1	153	5.3	126.3	4.0	9	3	80	22	84	0.23	2.6	3.1	B
12	4	50	53.8	61	32.3	151	3.3	82.5	3.7*	14	0	247	55	102	0.24	38.0	34.2	D
12	15	30	33.7	66	54.8	157	8.2	60.8	3.2	12	1	210	181	471	0.24	14.5	9.1	D
									PALMER ML - 3 3									
14	1	27	22.8	60	10.1	153	5 9	129.0	3.1	7	2	157	33	74	0.21	3.1	3 0	C
14	18	27	23.1	59	52.2	152	2.9	187.4	3.1	5	1	163	59	96	0 29	4 6	8 0	D
16	8	18	38.5	60	7.3	150	8.2	36.9	3.1	6	4	321	91	181	0.44	11.1	41.9	D
17	18	36	24.7	59	30.6	152	24.0	76.7	3.8	10	2	94	46	58	0 38	1.8	2 2	C
									PALMER ML - 3.8									
17	21	31	26.0	61	23.6	151	38.1	100.0	3.2	8	0	289	66	337	0.19	99.0	99.0	D
19	0	51	50.7	68	17.3	134	27.6	19.1	3.8*	11	1	217	43	334	0 31	13.2	2.9	D
									FELT II AT HUGES									
20	3	48	38.7	56	8.4	153	25.9	51.4	4.5*	7	0	233	188	391	0.39	14.9	21.6	D
									NEIS MB - 4.9									
22	10	27	40.8	61	4.7	146	24.8	9 9	3.2	13	1	280	97	217	0.31	5.4	2.3	D
									PALMER ML - 3.0									
23	22	2	1.3	62	18.2	150	50.8	58.9	3.7	14	0	153	51	191	0 27	2.7	7 4	D
24	7	13	45.9	58	11.8	133	12.9	44 5	3 6	7	1	204	66	133	0 31	6.3	9 5	D
24	13	29	34.6	58	40.8	154	19.8	1.2	3 4*	7	0	230	48	124	0 67	6 4	9 1	D
26	19	54	22.1	59	58.5	153	3.9	118.8	3.1	8	4	126	52	71	0.27	2.0	2.6	B
28	4	29	52.5	59	24.0	150	56.5	53.1	3.1	8	3	248	22	133	0 31	3.1	4.0	D

Explanation for Appendix A

Earthquakes are listed in chronological order. The following data are given for each earthquake.

1. ORIGIN TIME in Universal Time (UT): date, hour (HR), minute (MN), and second (SEC). To convert to Alaska Standard Time (AST), subtract 9 hr.
2. LAT N, LONG W: epicenter in degrees and minutes of north latitude and west longitude.
3. DEPTH: depth of focus (measured in kilometers).
4. MAG: local magnitude from maximum trace amplitude. Quotation marks around an entry mean that the value determined by the Alaska Tsumani Warning System (Palmer) was used.
5. NP: number of P arrivals used to locate earthquake.
6. NS: number of S arrivals used to locate earthquake.
7. GAP: largest azimuthal separation between stations (measured in degrees).
8. D1: distance from the closest station to the epicenter (measured in kilometers).
9. D3: distance from the third closest station to the epicenter (measured in kilometers).
10. RMS: root-mean-square error of the travel-time residuals (measured in seconds).
11. ERH: largest horizontal deviation (measured in kilometers), from the hypocenter within the one-standard-deviation confidence ellipsoid. The quantity measures the epicentral precision for an earthquake. Values of ERH >99 km are tabulated as 99 km.
12. ERZ: largest vertical deviation (measured in kilometers), from the hypocenter within the one-standard deviation confidence ellipsoid. This quantity measures the precision of the hypocentral depth. Values of ERZ that >99 km are listed as 99 km.
13. Q: reliability of the hypocenter. This index measures precision of the hypocenter location and also reflects the quality of the data used to derive the hypocenter parameters.

APPENDIX B

Data for Alaska earthquakes of all magnitudes that were located during the fourth quarter 1984.[a]

1984	ORIGIN HR	MN	TIME SEC	LAT N DEG	MIN	LONG W DEG	MIN	DEPTH KM	MAG	NP	NS	GAP DEG	D1 KM	D3 KM	RMS SEC	ERH KM	ERZ KM	Q
OCT 01	1	59	31.6	62	51.8	149	49.1	87.4	2.6	15	5	148	107	148	0.33	1.2	4.6	D
01	2	9	6.0	60	1.4	152	48.0	88.4	2.2	7	5	145	44	74	0.28	1.7	2.5	C
01	8	7	57.7	60	2.3	152	40.5	87.6	2.4	5	5	132	43	68	0.35	1.8	3.7	C
01	9	26	25.2	60	12.8	151	48.1	84.2	2.8	5	5	223	59	83	0.32	2.5	4.0	D
01	17	47	1.4	60	6.2	153	21.8	143.0	2.8	9	4	151	48	58	0.39	2.2	2.9	C
02	1	6	28.2	64	48.0	149	4.9	12.8	0.7	4	4	266	25	60	0.13	1.9	4.3	C
02	2	36	17.9	64	36.2	147	46.3	19.9	1.4	10	6	96	5	31	0.37	0.7	0.7	C
02	4	8	19.5	59	56.5	152	51.8	109.7	2.5	8	4	140	38	78	0.39	2.2	2.6	C
02	15	39	48.2	59	20.9	153	11.0	82.7	2.2	6	5	138	14	75	0.28	2.6	2.3	C
02	18	5	33.5	62	20.8	151	11.0	79.4	2.6	12	4	178	45	192	0.57	2.8	6.7	D
02	23	15	26.0	58	16.5	152	28.7	37.4	2.5	7	3	220	38	97	0.26	3.3	4.3	C
03	1	39	23.1	62	23.4	151	32.5	87.7	2.4	11	3	208	48	229	0.41	4.1	8.3	D
03	3	51	39.1	61	43.8	150	59.2	63.4	2.5	15	6	111	40	175	0.43	1.1	1.5	C
03	5	46	27.2	60	8.8	152	32.4	99.2	2.9	9	6	160	33	74	0.36	1.8	2.8	C
03	8	53	9.1	59	50.7	153	44.6	152.8	2.9	8	4	219	36	129	0.41	3.5	5.9	D
03	7	14	34.7	61	33.4	146	20.9	26.5	3.3	9	2	220	60	164	0.53	3.2	3.7	D
03	14	56	1.5	59	59.9	152	46.0	104.3	3.1	15	6	122	46	78	0.32	1.6	2.0	C
03	19	17	23.8	62	45.1	143	48.5	1.2	3.0*	11	1	172	88	133	0.25	2.0	2.4	C
									FELT II AT SALAMA AND NEBESNA									
03	20	33	28.9	65	30.5	147	58.8	4.0	1.8	8	2	307	84	97	0.32	3.9	1.8	D
03	21	2	0.7	61	29.4	149	11.9	43.8	2.5	12	3	227	12	135	0.44	2.7	3.4	D
04	1	29	31.5	64	3.4	146	30.0	6.8	1.2	8	6	181	45	90	0.43	2.6	2.4	D
04	8	8	26.2	65	31.3	147	50.3	11.1	1.3	8	5	311	63	98	0.37	2.3	1.1	D
04	11	35	43.8	65	12.1	148	59.8	7.7	0.9	6	6	284	58	79	0.25	1.4	1.5	C
04	17	28	2.4	65	44.0	151	50.0	36.5	2.0	7	0	323	183	223	0.25	58.0	99.0	D
04	18	15	15.8	65	1.9	149	29.9	45.3	1.4	8	0	279	54	91	0.80	9.7	7.8	D
04	22	41	4.2	59	5.1	151	45.5	50.6	4.3*	17	0	187	44	61	0.17	1.7	4.9	C
									NEIS MB - 5.0, FELT III HOMER									
05	13	13	38.6	60	9.6	153	8.7	129.0	2.7	11	7	90	34	73	0.32	1.8	1.8	C
05	15	26	49.0	65	26.9	147	58.9	8.8	1.4	7	7	304	58	90	0.35	1.3	1.1	D
05	16	43	52.9	64	45.4	147	27.3	9.4	1.2	8	4	141	21	34	0.39	1.0	1.4	C
05	22	41	4.2	59	5.1	151	45.5	50.6	2.8	17	0	187	44	61	0.17	1.7	4.9	C
06	0	14	10.8	63	25.4	152	22.5	63.7	2.2	8	5	245	187	206	0.89	7.8	21.8	D
06	1	35	58.2	62	19.3	149	10.9	39.5	2.2	13	2	107	81	128	0.42	9.2	27.5	D
06	2	9	58.5	63	54.3	148	54.3	0.8	2.6	10	0	150	19	56	0.38	1.4	3.8	C
06	12	55	26.1	59	47.1	153	24.5	120.5	2.6	6	4	116	18	43	0.31	1.6	2.9	C
07	1	40	13.3	59	60.0	151	13.2	65.7	2.8	8	4	242	43	98	0.42	2.4	2.7	D
07	2	24	28.0	64	24.8	148	36.5	9.8	0.6	7	7	145	26	38	0.39	0.8	3.8	C
07	3	23	33.3	59	8.2	153	33.8	89.5	3.1	13	4	86	23	45	0.35	2.1	2.7	B
07	6	42	12.9	59	48.2	153	21.8	129.6	2.8	10	4	117	18	52	0.35	1.8	2.4	C
07	14	22	59.9	62	49.0	148	27.0	60.7	2.0	11	8	194	105	152	0.47	1.3	4.5	D
07	16	35	25.1	63	27.2	150	21.2	6.7	3.3*	15	0	72	77	140	0.46	1.8	2.2	D
07	17	24	56.0	63	31.5	151	8.2	0.9	2.3	14	8	151	112	155	0.38	1.5	1.0	D
									PALMER ML - 3.7									
07	22	35	10.4	62	15.1	151	20.2	24.0	2.5	13	3	184	32	218	0.37	8.5	10.1	D
08	0	49	38.7	63	14.5	151	4.6	71.0	3.2*	6	0	135	188	236	0.13	3.6	35.8	D
08	14	20	55.8	63	13.8	149	33.9	84.3	1.7	10	6	225	64	152	0.44	1.7	2.4	D
08	17	9	8.3	58	29.1	151	17.5	0.3	2.5	7	1	220	64	116	0.47	3.5	1.6	D
08	17	55	31.9	59	47.8	153	20.2	134.5	2.8	8	5	115	17	48	0.41	2.0	2.4	C
08	19	23	11.1	64	40.7	149	14.9	17.7	0.7	6	6	284	14	60	0.25	1.5	0.9	C
08	20	29	55.4	62	28.8	151	0.4	76.0	1.9	11	2	175	61	205	0.35	3.2	4.6	D
08	21	10	10.0	61	42.6	150	47.9	60.7	3.0	9	1	120	49	179	0.29	2.0	4.0	B
									PALMER ML - 3.5									
09	1	19	7.8	64	44.0	146	52.2	14.8	1.0	7	7	227	37	46	0.35	1.1	1.0	D
09	2	29	8.4	59	44.8	152	42.8	85.5	2.6	9	5	101	31	61	0.38	1.3	1.9	C
09	4	12	32.0	59	27.0	152	43.3	86.0	2.3	6	4	86	37	85	0.34	1.3	2.7	B
09	4	59	51.0	59	55.4	153	13.6	109.1	2.6	5	3	130	96	62	0.27	2.1	2.9	B
09	5	19	35.9	58	59.8	152	42.9	56.6	2.2	6	4	123	46	103	0.29	1.3	3.5	B
09	11	36	9.2	63	42.0	142	33.0	58.5	2.2	6	6	280	239	273	0.55	5.1	60.8	D

[a] See explanation of column headings at end of appendix B.

*Magnitude value determined by Alaska Tsunami Warning System (NOAA Palmer Observatory).

APPENDIX B (con.)

1984	ORIGIN HR	MN	TIME SEC	LAT N DEG	MIN	LONG W DEG	MIN	DEPTH KM	MAG	NP	NS	GAP DEG	D1 KM	D3 KM	RMS SEC	ERH KM	ERZ KM	Q
OCT 09	17	36	25.9	64	39.2	147	0.5	10.8	1.2	9	6	181	26	41	0.44	0.9	1.2	D
09	23	4	23.0	65	46.0	145	28.9	48.3	1.8	6	4	334	124	166	0.79	4.4	27.2	D
10	9	16	50.9	59	33.9	151	54.9	60.4	2.2	7	3	139	19	75	0.14	1.9	3.0	C
10	13	3	25.3	64	27.6	151	7.9	40.5	1.4	5	5	327	95	146	0.92	3.6	99.0	D
10	18	2	17.5	64	32.7	147	50.3	12.0	0.8	6	4	100	11	35	0.18	0.9	1.9	B
10	17	40	48.1	60	47.0	151	41.3	74.0	3.1	6	4	294	72	142	0.38	3.4	7.0	D
10	19	55	33.3	63	14.2	149	19.8	84.7	1.7	9	4	265	59	126	0.46	2.3	2.5	D
10	20	3	54.8	62	15.6	149	6.7	63.5	2.2	7	5	192	130	216	0.17	1.9	9.8	D
10	21	17	17.4	59	43.8	152	46.9	88.2	2.4	9	5	104	27	77	0.25	1.5	2.2	B
11	4	14	32.7	60	3.7	151	13.6	50.9	2.5	5	4	245	51	94	0.31	3.7	3.9	D
11	5	1	34.3	59	47.1	152	43.3	89.0	2.0	6	4	111	32	71	0.23	1.4	3.1	B
11	8	16	47.9	57	25.9	157	17.2	36.1	3.3	5	3	337	213	256	0.89	99.0	99.0	D
11	12	37	47.3	59	23.4	152	42.8	76.8	2.1	7	5	96	41	68	0.19	1.2	2.8	B
11	21	18	38.0	61	19.2	150	53.1	56.8	3.1	11	1	114	81	143	0.31	2.7	10.0	C
12	5	14	34.2	59	54.5	152	50.3	98.2	2.4	8	5	111	36	72	0.25	1.7	2.7	B
12	5	17	24.2	64	53.3	147	31.7	2.7	1.5	7	5	133	13	30	0.45	1.0	11.3	C
12	5	18	18.8	64	56.0	147	35.1	9.2	1.2	6	6	171	11	34	0.39	1.0	2.5	C
12	6	3	19.6	59	28.5	152	47.3	76.9	2.8	10	6	79	32	68	0.28	1.2	1.8	B
12	8	6	8.5	64	13.0	148	3.2	18.6	1.0	9	5	92	7	49	0.37	0.8	1.1	C
12	8	27	6.0	64	47.0	147	20.8	18.9	1.0	7	6	161	23	38	0.27	0.8	1.2	C
12	8	42	39.5	64	44.2	147	32.6	18.5	0.6	7	5	91	11	31	0.45	0.7	1.9	C
12	13	27	23.8	64	10.5	151	11.2	4.1	1.8	9	8	309	94	121	0.46	1.5	1.1	D
12	17	25	48.6	61	44.7	149	47.8	72.6	2.0	9	3	202	95	262	0.49	5.3	5.1	D
13	3	30	29.1	60	41.8	152	53.1	134.8	3.0	7	3	288	31	124	0.32	3.2	2.9	D
13	4	29	12.8	64	13.0	147	57.9	8.3	0.9	9	7	95	5	49	0.32	0.7	1.4	C
14	0	8	28.1	63	41.7	147	33.4	77.1	1.7	11	5	97	68	88	0.40	1.5	3.8	C
14	0	48	5.9	60	32.8	149	49.8	146.4	2.9	5	2	309	138	214	0.65	13.9	11.8	D
14	4	30	17.5	64	9.0	148	43.6	11.4	1.0	9	7	108	27	47	0.46	0.7	1.2	C
14	4	49	38.7	62	14.4	149	31.9	75.4	3.3	14	0	108	75	124	0.37	2.7	4.4	C
									NEIS MB - 3.8									
14	10	19	48.8	60	57.8	147	13.3	17.7	3.4	8	0	250	97	242	0.10	20.2	8.2	D
									NEIS MB - 3.2, PALMER ML - 3.4									
14	15	16	12.9	60	7.1	152	6.7	78.7	2.3	9	4	190	30	81	0.26	2.3	2.8	C
14	18	45	55.7	60	31.9	151	59.9	74.9	3.3	9	3	229	44	120	0.32	2.6	4.3	D
15	4	15	20.2	62	9.4	149	32.5	86.9	2.8	13	9	103	67	122	0.46	1.4	5.1	C
15	7	2	22.1	60	5.6	152	33.1	103.5	2.7	9	8	149	38	70	0.29	1.8	2.2	C
15	11	13	20.8	63	32.4	150	48.4	4.2	1.4	7	7	203	95	143	0.34	1.9	1.3	D
15	14	7	16.3	64	37.3	146	57.5	16.6	2.2	9	2	183	24	46	0.39	1.2	1.0	D
15	14	30	8.4	64	38.4	147	4.4	14.9	0.9	6	6	185	23	45	0.44	1.0	1.0	D
15	14	34	42.1	64	37.8	150	29.0	27.7	1.4	5	5	313	80	112	0.40	3.0	43.2	D
15	18	40	32.6	61	2.1	146	41.1	2.0	2.5	13	1	248	95	278	0.23	4.2	1.6	D
16	0	34	42.1	61	25.8	150	38.4	35.9	2.7	16	2	112	77	161	0.42	1.7	2.7	D
16	1	16	35.8	64	38.8	149	32.1	20.3	1.1	6	6	265	23	69	0.21	1.8	0.7	C
16	1	40	51.4	64	44.4	150	54.5	24.6	1.4	7	7	300	89	132	0.62	1.8	99.0	D
16	6	5	53.1	60	16.4	151	31.0	86.4	2.0	3	3	245	69	85	0.11	24.3	27.1	D
16	7	11	42.0	59	56.2	152	53.5	109.2	2.9	12	4	109	37	73	0.25	2.2	3.2	C
16	12	14	48.8	64	44.9	147	3.2	1.2	0.7	5	4	203	31	39	0.30	1.1	51.1	D
16	13	25	25.2	59	2.7	151	42.6	45.2	2.1	7	3	192	59	103	0.22	1.9	7.9	D
16	13	42	40.7	59	4.6	153	37.3	92.7	2.3	6	2	195	17	68	0.14	3.0	4.7	D
16	14	22	16.9	61	59.0	148	53.4	38.9	2.1	11	3	96	45	138	0.33	1.7	2.5	C
16	16	32	27.7	63	58.0	147	7.0	12.3	1.2	10	6	120	46	73	0.48	0.8	0.9	C
16	16	44	46.0	58	47.9	153	1.3	61.8	2.3	10	6	91	39	64	0.29	1.3	2.2	B
16	21	27	18.8	59	59.0	153	44.0	169.1	2.7	10	2	177	34	71	0.31	3.8	2.8	C
16	23	11	7.0	63	54.8	148	54.4	0.1	2.1	11	0	121	20	56	0.30	1.3	1.4	C
17	2	1	40.4	64	38.8	146	48.7	2.6	1.0	7	5	230	28	48	0.46	1.3	14.5	D
17	11	33	53.8	59	42.1	153	16.3	108.2	2.4	8	5	98	6	53	0.22	1.4	2.1	B
17	11	34	24.3	59	22.2	152	9.9	64.5	2.6	8	4	131	44	68	0.25	1.3	3.1	B
17	15	22	34.7	58	52.9	152	17.3	91.3	2.3	7	4	148	29	83	0.33	1.2	3.9	C
17	17	32	10.2	59	11.8	152	33.6	72.8	2.3	5	3	224	52	84	0.15	2.2	3.9	D
17	17	48	47.1	59	27.9	153	16.6	97.3	2.3	7	6	95	17	63	0.37	1.6	2.8	C
17	19	0	41.0	63	11.0	149	47.6	90.4	2.2	13	4	158	75	144	0.33	1.7	2.6	D
17	22	35	30.3	63	6.1	150	47.6	128.6	2.6	14	3	189	118	146	0.27	2.2	2.8	C
18	0	57	10.3	63	26.7	149	7.3	81.5	1.9	13	9	138	33	101	0.44	1.1	1.8	C
18	3	18	38.0	59	48.7	153	19.3	116.4	2.4	8	3	117	19	94	0.31	2.3	3.9	C
18	3	27	2.1	60	1.4	153	3.3	113.5	2.7	10	4	131	42	69	0.36	1.8	2.3	C
18	4	4	13.1	63	12.6	151	56.0	68.7	2.2	5	4	230	139	207	0.35	8.2	17.1	D

APPENDIX B (con.)

1984	ORIGIN HR	MN	TIME SEC	LAT N DEG	MIN	LONG W DEG	MIN	DEPTH KM	MAG	NP	NS	GAP DEG	D1 KM	D3 KM	RMS SEC	ERH KM	ERZ KM	Q
OCT 18	5	19	56.5	63	5.9	150	58.7	151.4	4.9*	16	0	72	123	150	0.23	2.6	7 2	B
									NEIS MB - 4.6. FELT III AT PALMER AND WASILLA.									
18	9	17	49.8	60	5.9	152	37.8	96.0	2.7	9	8	141	37	74	0.33	1.7	2.3	C
18	10	7	41.8	65	46.9	145	40.0	66.2	3.0	12	0	164	119	161	0.29	4.0	13.4	D
18	12	35	15.8	60	9.3	153	21.2	147.8	3.0	7	1	178	44	62	0.35	3.8	8.4	C
18	17	0	23.9	60	14.2	152	32.0	97.2	2 9	5	3	170	24	81	0.31	3.1	5.0	C
18	17	21	51.3	64	56.8	147	12.1	2.8	1.7	10	2	217	10	47	0.26	1.5	1.6	C
18	23	47	27.4	63	1.2	148	7.7	74.1	3.6	20	0	71	89	130	0.44	1.4	4.7	C
19	0	48	30.4	64	38.4	148	2.8	12.9	1.1	8	6	88	12	21	0.42	0.6	2.6	B
19	1	50	54.3	63	16.7	150	33.1	124.7	2.0	11	3	186	98	162	0.28	3.5	2 7	D
19	4	44	48.0	61	40.4	150	47.0	87.2	4.2	10	0	247	176	241	0.37	20.0	52.9	D
									NEIS MB - 4.5. PALMER ML - 4.0 FELT II ANCHORAGE AND PALMER									
19	5	47	14.7	59	5.0	152	6.6	53.3	2.4	8	3	215	69	80	0.13	3.4	5.8	D
19	19	23	1.9	62	7.4	151	52.7	30.5	2.3	9	1	255	24	234	0 24	6.5	3.8	D
19	20	43	13.3	59	49.7	151	23.4	60.2	3.9	14	2	123	35	105	0.84	1.8	3 8	C
									PALMER ML - 3 7. FELT I AT ANCHORAGE.									
20	7	45	11.9	62	3.2	148	42.0	21.7	2.0	11	4	98	56	148	0.37	2.4	2.9	D
20	10	29	29.1	62	16.9	151	44.8	103.1	2.3	12	5	225	35	215	0.42	2.4	4 1	D
20	11	2	45.1	59	47.0	152	15.0	74.3	2.1	7	4	134	37	64	0.33	2.1	2.3	C
20	17	14	18 7	64	42.1	146	56.0	2.2	1.8	10	2	192	33	42	0.46	1.2	2.7	D
20	19	26	41.7	62	46.3	148	24.5	65.6	1.7	10	6	194	110	151	0 39	1.6	4 4	D
21	11	8	22.5	60	29.0	151	49 0	75.9	3.2	8	2	260	53	112	0 24	2.7	4.0	D
21	11	13	49.3	59	33.3	153	1.2	91.0	1.9	6	3	82	71	85	0.33	1.5	4 6	B
21	14	3	49.5	60	3.8	152	45.7	107.7	2.0	5	2	125	40	89	0.19	2.7	3.7	C
21	14	12	19.3	64	27.3	147	58 5	15.9	3.9*	15	0	71	6	31	0.29	1 0	1.2	B
22	4	27	22.7	62	19.0	148	23 7	14.5	2.1	12	6	125	78	167	0 37	2.1	3 3	D
22	13	34	21.8	60	45.8	146	9 2	39.0	2.5	6	2	290	135	249	1.66	8.2	5.7	D
22	13	49	14.8	61	4.3	146	25.1	4.8	2 2	8	2	280	98	217	0 38	5.2	2 7	D
22	16	15	44.1	62	45.5	150	56.3	90.4	1 7	6	0	184	92	223	0.01	8.3	14 6	D
22	17	46	51.7	61	12.9	147	48 8	5.9	3.9	8	1	329	267	284	0.29	99.0	99.0	D
22	22	43	6.7	63	15.6	146	57 4	87.6	2.3	13	3	128	53	114	0.32	1.9	3 9	C
23	1	9	9.0	64	47.7	148	55.0	12.7	1.4	8	2	235	26	54	0.28	2.9	1 8	D
23	3	5	30.6	59	31.0	152	57.2	92.6	1.8	7	4	83	22	76	0.24	1.8	2.6	B
23	3	45	11.5	58	31.8	152	45.4	52.3	2.8	12	4	105	26	68	0.29	1.4	3 6	B
23	5	16	31.8	63	9.8	149	18.2	85 2	2.1	12	7	139	66	132	0 29	1.3	2.4	C
23	8	46	4.8	63	29.2	147	37.0	19.1	1.9	12	4	118	71	88	0 43	1.7	2 0	D
23	9	54	14 0	61	5.3	146	20.2	19.7	2 7	12	2	280	98	215	0 23	3.7	2.9	D
23	18	47	54.4	63	55.5	148	56.9	0.4	1.9	13	0	123	22	57	0 44	1.3	1.4	C
23	20	28	47 1	61	29 6	150	9.4	47.3	2.0	6	2	239	58	157	0.50	5.0	3.7	D
23	21	7	35.7	59	16.8	153	19.4	89.6	2.6	9	6	128	9	43	0.23	1.6	1 8	B
23	21	48	38 3	63	17.6	150	26.2	110.1	2.3	11	4	250	89	158	0.48	3 4	3 0	D
24	13	47	3.2	60	16.8	151	52.1	74.8	2.8	6	4	229	52	91	0.39	2.4	3.7	D
25	2	33	20.3	61	33.6	147	53 3	52.4	1.8	7	1	230	43	198	0 18	7 1	5 4	D
25	4	22	51.2	58	42.1	151	45.3	130.8	2.4	3	2	239	38	135	1.89	8.4	3 0	D
25	18	18	26.1	64	38.4	148	44.0	18 9	1.3	8	3	168	18	36	0 39	1 1	1 0	C
25	20	25	5.3	62	59.9	149	38.3	81.3	1.8	10	7	150	89	157	0.31	2.1	2.9	D
26	1	17	8.6	58	18.2	153	18.0	55.4	2.2	5	2	273	65	115	0.25	4.1	9 2	D
26	5	5	52.8	59	44.7	153	17.4	107.7	2.2	8	5	105	11	51	0 27	1.4	2.7	B
26	15	50	46 7	62	37 2	151	37 4	100 0	1.9	8	1	213	72	240	0 29	6.2	7 6	D
26	15	54	54 8	59	39 3	153	8 8	106 5	2 4	7	5	89	5	61	0 30	1 9	2 4	B
26	16	17	42.2	62	29.8	149	53.9	76 8	2.1	10	5	133	102	153	0.32	1.4	4.5	C
26	17	1	39.8	59	6.5	152	12 1	52.7	2 4	5	3	140	54	72	0 39	2 4	6 5	D
26	18	25	20.3	59	14.3	153	38 7	93 9	2.4	6	5	131	16	40	0.09	2.8	2.1	C
26	19	51	4.0	62	48.7	149	1 6	68 2	1 4	6	4	153	103	182	0 31	1.5	5 0	D
26	20	32	53.1	61	46.9	149	59 7	45 0	2.4	9	3	172	50	141	0 37	3.5	5 3	D
26	21	59	38.0	64	29.3	147	17.1	17.5	1.1	8	4	125	18	39	0.46	1 2	1 1	C
26	23	44	45.8	64	41.2	149	0.9	21 1	1 3	10	0	222	13	50	0.19	2.7	1 1	D
27	0	45	21.7	62	48.7	149	14 7	2 4	1 8	7	3	152	108	160	0 91	2.3	1.8	D
27	1	49	38.1	61	12.3	149	57 3	32 1	2.2	7	2	254	62	156	0 25	5 6	2 5	D
27	4	57	16.6	63	10.7	150	33 5	119 8	2.1	13	4	183	102	142	0 33	1 8	2 7	D
27	6	45	18.7	59	37.1	152	39 7	78.8	2.1	6	5	101	54	88	0 24	1.1	3 2	B
27	7	14	6.3	63	12.9	150	16 5	99.3	1 8	7	3	178	88	152	0 33	2.2	3 0	D
27	10	54	28.1	59	19.8	153	21.5	104.0	2.4	9	3	94	4	48	0.35	3.1	2 4	C
27	13	53	12.0	59	14.9	153	39 8	120 5	2.3	8	3	81	16	39	0.22	3.3	2 2	B
27	16	57	42.5	60	8.6	152	11 9	77 4	2 9	8	3	187	44	80	0 25	2.2	3 3	D

APPENDIX B (con.)

1984	ORIGIN HR	MN	TIME SEC	LAT N DEG	MIN	LONG W DEG	MIN	DEPTH KM	MAG	NP	NS	GAP DEG	D1 KM	D3 KM	RMS SEC	ERH KM	ERZ KM	Q
OCT 27	20	1	22.5	59	37.9	152	27.0	98.6	2.6	6	2	146	34	65	0.32	2.8	5.4	D
28	2	47	44.0	64	48.3	147	33.4	9.1	1.0	7	6	126	21	28	0.48	0.7	4 0	C
28	10	4	39.0	62	52.2	150	51.9	97.6	2.0	10	1	185	105	170	0 38	2.7	10 0	D
28	15	0	42.5	61	30.3	147	26.4	26.6	2.9	13	2	246	37	193	0.39	5.0	2.3	D
28	20	50	14.1	63	51.2	149	31.2	121.1	1.8	8	3	260	32	98	0.38	3.2	2.2	D
29	1	39	18.8	65	20.5	144	29.5	37.2	3.7*	6	0	261	163	477	0.67	41.5	14.0	D
29	2	19	47.7	63	9.0	149	23.8	76.6	2.1	12	5	142	69	180	0.49	1.5	2.3	D
29	9	47	57.9	59	49.0	152	9.7	73.3	2.2	6	3	148	82	78	0.25	1.6	2.8	C
29	10	0	58.3	59	3.6	152	37.0	78.2	2.4	7	5	106	51	61	0.30	1.3	2.7	B
29	14	21	10.9	64	28.2	149	19.5	12.8	1.2	8	7	232	17	59	0.31	1.2	1.0	D
29	14	45	59.5	63	19.9	151	5.6	76.9	2.6	6	2	151	116	152	0.31	5.2	10.2	D
30	1	8	20.0	59	30.5	152	9.5	68.1	1.8	4	3	151	63	114	0.08	2 2	4.2	C
30	3	29	2.2	64	47.6	148	56.7	2.9	1.3	7	4	238	29	54	0.44	1.6	13.4	D
30	9	42	34.5	59	5.9	152	46.4	68.5	2.0	6	4	155	46	58	0.28	2.9	2.9	C
30	19	13	5.6	62	58.5	149	48.6	65.3	2.4	15	5	152	141	158	0.41	1.1	6.4	D
30	23	7	22.8	64	42.3	147	31.2	23.6	1.5	9	2	130	15	33	0.37	1.5	1.1	C
NOV 01	0	53	44.4	59	31.7	152	29.9	74.4	2.8	9	3	114	44	72	0.13	1.7	2 9	B
01	5	14	46.9	64	48.0	149	9 5	23.5	1.5	9	5	251	25	63	0 33	2.1	1 1	D
01	8	18	2.1	60	40.1	150	39.8	63.2	3.8	8	0	161	119	132	0.17	4.1	12 8	D
									PALMER ML = 3.5									
01	20	11	9.8	63	11.2	150	22.4	92.1	2.2	13	4	177	94	147	0.43	1 9	3 2	D
02	9	27	12 8	60	22 8	152	13 6	91.8	2.6	5	3	231	30	99	0 31	2.8	4.2	D
02	10	41	16.6	63	28.6	146	54 1	18.1	1.7	11	9	159	53	93	0.79	1.0	1.2	D
02	12	7	12.6	60	0.8	152	56.4	102.2	2.5	7	5	121	43	75	0.30	2.1	3.1	B
02	17	45	45.7	58	56.0	152	48.4	65.8	4.2*	9	0	98	43	57	0.15	2.0	4 5	B
									NEIS MB = 4.0									
02	18	55	36.4	60	16.4	152	33.4	98.9	1.9	4	4	174	20	106	0 19	2.8	3 0	C
02	23	3	1.6	60	6.4	152	30.8	88.1	1.5	4	2	154	38	97	0.08	2.8	5.3	C
03	9	14	27.4	64	55.7	148	26.1	15.6	0.8	6	6	224	18	50	0.42	1.2	2.1	D
03	9	19	21.5	64	3.9	148	34.3	18.0	1.0	9	9	138	34	41	0.43	0.7	0.7	C
03	13	19	4.6	55	5.1	153	6.2	42.6	4.3	8	0	336	299	430	0.39	99.0	43.5	D
									NEIS MB = 4 6, PALMER ML = 4.3									
04	2	55	9.1	62	42.7	149	0.7	57.9	1 9	12	2	117	114	154	0 37	1.7	5.8	C
04	3	16	48.3	63	49.8	149	4.9	13.8	1.2	8	5	202	13	68	0.31	1.8	1.1	D
04	8	37	24.1	64	48.4	147	17 6	8.7	1.8	7	1	172	21	41	0.12	1.8	11.2	C
04	9	26	56.6	60	33.5	146	48 4	30.8	3 7	5	1	328	272	328	0.18	48.3	89 4	D
04	10	55	57.3	61	30.2	150	22.8	34.3	2.8	11	2	231	67	186	0.46	4.7	3.1	D
04	13	14	38.8	59	59.3	152	45.7	92.7	2.1	6	3	121	46	73	0.18	2.5	4.4	B
04	13	50	19.6	59	42.6	151	48 0	68.8	2.2	4	3	197	11	96	0 18	4.3	3 0	C
04	16	3	21.8	64	47.3	147	33 2	10.4	1.9	8	4	127	20	28	0.42	1 1	5.0	C
04	18	1	2.0	59	15.3	154	43 3	7.2	2.1	5	2	267	23	72	0.63	2.8	1.9	D
04	19	50	15.2	60	7.9	153	36.1	181 6	3.1	7	4	254	51	122	0 34	3.6	4 6	D
04	23	26	56.3	59	34.8	152	52.2	87.1	2.8	7	3	79	22	70	0 29	1.6	2 9	B
05	0	18	28.3	59	54.0	153	13.5	117.7	2.8	7	6	126	28	59	0.32	1 6	1 9	C
05	6	37	52.1	64	20.0	149	40.9	19.6	1.0	7	5	256	25	76	0 46	2.1	1 0	D
05	8	26	25.8	63	2.0	151	3.1	134.8	2.0	10	4	300	120	159	0.31	2 7	2.8	D
05	13	23	8.0	58	58.5	153	48.1	11.1	2.4	5	1	189	10	50	0.59	3.1	3.1	D
05	17	34	59.2	64	3.5	148	5.1	110 8	1.7	13	6	91	15	55	0.27	1 7	2 0	B
06	4	45	52.4	58	59.4	152	38.1	66.3	2.3	8	6	106	44	60	0 34	1 3	2.7	C
06	7	43	47.2	59	7.1	151	59.9	53.9	2.2	6	4	157	58	85	0.18	1 5	4.4	C
06	10	25	18.4	59	58.3	153	17.7	127.8	2.6	6	3	142	36	58	0.32	3.0	2.5	C
07	11	39	21.8	59	46.6	152	41.0	84 8	2.3	4	1	202	35	85	0 10	7 1	8 2	D
07	22	28	18.9	59	46.0	151	13.1	96.3	2.9	4	3	299	27	114	0.33	4.1	3.5	D
08	1	11	21.1	59	34.9	152	23 0	87.3	3.6	8	2	91	43	65	0.36	2.2	3 5	C
08	1	34	35.1	64	46.2	147	47 6	17.5	0.6	6	6	106	14	31	0.43	0.7	1 5	C
08	1	42	23.7	63	0.8	149	25.7	79.8	1.5	11	5	139	84	158	0 38	1.6	2.9	D
08	9	5	4.9	60	6.2	153	6 5	131.9	2.3	5	2	196	40	87	0 24	3.8	4.3	D
08	10	52	52.4	62	57.7	148	10 4	61.5	1.8	10	7	140	94	150	0 35	1 4	4 2	D
08	14	48	20.2	64	51 5	148	13.0	14.6	0 7	6	6	197	5	42	0 42	0.9	1 3	D
08	15	19	58.1	60	30.3	151	31 3	67.1	3.2	8	3	269	69	110	0 36	2.8	5 3	D
08	17	6	9 4	60	4.3	153	1 8	113.1	2.3	4	3	136	41	72	0 15	2.8	2 7	C
08	19	8	39.9	64	36 5	149	12 1	16.3	0.9	6	5	240	7	56	0.38	1.5	1.1	D
09	1	49	26 4	59	57.3	153	4.6	112.2	2.3	8	4	124	35	65	0 28	2 4	3.2	B
09	4	50	14 2	64	46.2	147	30 4	10.3	1 1	7	3	134	20	31	0.42	1.0	5 2	C
09	6	56	6.5	63	52 4	147	49.0	14.4	4 2*	13	0	81	35	68	0 41	1.1	1 5	C
									NEIS MB = 3 7, FELT IV FAIRBANKS AND ESTER.									
09	8	13	20.5	63	52.1	147	47.7	19.6	1.2	9	9	143	35	73	0 42	0.6	0.6	C
09	8	25	58.1	63	51.9	147	49.5	18.6	1 2	9	9	145	36	70	0.42	0.6	0 6	C
09	12	30	39.7	58	28.3	154	37 8	0.0	2 3	3	1	322	77	119	0.42	26.0	10.1	D

APPENDIX B (con.)

1984	ORIGIN HR	MN	TIME SEC	LAT N DEG	MIN	LONG W DEG	MIN	DEPTH KM	MAG	NP	NS	GAP DEG	D1 KM	D3 KM	RMS SEC	ERH KM	ERZ KM	Q
NOV 09	12	41	13.7	59	33.1	151	24.0	73.7	2.1	3	5	297	10	118	0.11	2.3	2.9	D
09	13	58	16.9	60	0.9	152	54.8	108.2	2.0	5	3	119	44	76	0.17	2.1	3.1	B
09	15	17	24.2	59	48.6	151	26.6	44.8	1.9	5	3	206	34	102	0.21	2.0	3.0	C
09	17	43	2.1	63	53.0	147	52.0	15.8	1.4	10	8	123	33	66	0.37	0.7	0.7	C
09	19	51	40.2	63	3.3	150	21.2	90.9	3.1*	6	2	172	134	173	0.30	2.8	9.7	D
10	1	31	44.4	58	30.9	154	0.9	1.3	2.3	5	1	267	23	64	0.37	11.1	4.3	D
10	3	43	48.5	63	46.1	148	30.5	27.3	2.1	9	3	149	44	84	0.70	1.8	24.4	D
10	14	33	55.0	64	43.7	147	35.4	3.2	0.9	6	5	121	14	30	0.28	0.8	10.1	C
10	15	19	3.9	60	43.8	151	45.5	73.1	2.7	6	2	289	66	137	0.37	3.6	6.8	D
10	16	28	49.7	64	43.4	147	38.2	0.7	0.4	8	4	121	14	31	0.19	0.8	48.4	C
10	22	37	24.1	59	57.7	153	11.0	111.3	2.4	5	2	132	38	60	0.16	3.2	4.1	C
11	4	14	24.9	65	5.5	146	32.8	10.0	1.3	6	6	300	41	79	0.29	1.4	1.4	C
11	5	33	10.8	63	52.4	147	46.9	2.3	3.2	12	2	79	59	72	0.23	1.1	2.0	C
11	5	45	43.3	61	20.6	147	23.2	25.9	3.8	16	0	233	55	207	0.42	5.2	3.0	D
11	10	8	46.1	64	56.6	148	59.0	6.8	0.7	5	5	259	41	65	0.27	1.8	11.0	D
11	14	18	51.2	59	7.2	152	46.8	74.0	2.3	6	4	148	44	65	0.29	2.0	3.0	C
12	2	9	43.0	64	51.2	147	42.5	9.5	0.3	9	4	143	21	24	0.25	0.9	3.3	C
12	4	54	3.2	63	24.8	150	23.5	138.5	2.6	13	5	185	81	145	0.34	2.0	2.5	D
12	6	18	40.8	63	35.7	151	17.8	0.7	2.2	11	6	220	118	178	0.48	1.6	0.9	D
12	7	44	48.2	63	51.9	147	50.8	19.4	1.2	8	7	144	35	69	0.48	0.7	0.7	C
12	13	59	37.5	63	9.3	150	59.9	124.3	1.8	6	3	210	121	205	0.31	2.9	6.7	D
12	20	15	19.9	59	27.2	152	42.2	92.9	2.8	8	3	84	37	64	0.22	1.8	3.1	B
12	23	18	22.3	59	50.8	152	30.3	78.7	1.9	5	4	129	46	77	0.20	2.0	3.0	B
13	0	37	49.5	62	1.9	150	45.6	63.3	3.0*	13	2	143	41	182	0.27	2.9	6.3	C
13	1	46	41.6	59	17.5	152	52.2	88.7	2.6	8	3	84	32	60	0.35	1.9	5.6	B
13	3	17	50.2	64	41.8	150	22.3	11.3	1.8	9	2	289	63	107	0.37	3.1	1.4	D
13	3	23	45.4	63	32.6	148	2.0	18.8	1.3	8	5	180	49	104	0.34	1.5	1.2	D
13	5	16	30.5	63	53.1	147	53.3	11.6	1.1	8	4	214	33	66	0.38	1.4	2.2	D
13	8	1	16.9	60	4.4	152	54.9	107.0	2.5	9	3	125	39	78	0.34	2.3	2.7	C
13	8	58	45.8	63	12.6	148	58.7	8.8	1.8	9	3	133	58	147	0.48	1.5	1.6	D
13	16	2	60.0	60	2.8	152	42.2	108.9	3.4	8	2	130	42	89	0.31	2.8	4.5	C
13	16	9	5.9	62	29.2	149	32.7	71.4	1.9	10	6	123	102	137	0.71	1.0	4.0	C
13	22	11	30.9	61	57.9	149	47.2	57.1	2.2	9	3	132	54	130	0.54	3.0	5.9	C
13	22	20	23.4	62	51.6	150	50.2	78.1	2.4	13	4	183	104	167	0.31	2.2	6.9	D
13	23	29	44.5	61	51.5	149	38.4	15.7	2.3	11	2	141	40	122	0.24	3.1	4.7	C
14	3	11	13.4	63	8.9	150	42.9	113.4	2.0	11	4	188	110	139	0.33	5.5	4.3	D
14	11	37	58.6	60	36.4	153	15.7	161.3	3.6	15	4	174	34	106	0.34	2.6	3.5	C
14	15	54	32.5	64	59.8	150	26.4	28.5	1.9	7	5	297	81	128	0.37	2.6	50.2	D
14	19	42	38.1	61	50.8	151	8.5	100.0	2.3	5	0	217	28	319	0.62	99.0	99.0	D
14	23	0	21.4	59	51.7	152	49.4	95.0	2.5	5	3	138	33	70	0.22	1.9	2.8	C
15	0	33	47.9	63	52.2	147	47.2	6.1	2.8	13	0	94	35	69	0.41	1.1	2.7	C
15	8	19	25.9	63	8.2	150	53.7	63.5	1.9	6	2	306	118	187	0.35	2.8	12.2	D
15	10	41	1.8	64	53.4	148	52.2	16.3	1.6	7	2	250	27	54	0.19	2.9	1.4	D
15	16	58	37.8	64	12.9	150	57.4	7.4	1.7	9	7	304	83	113	0.40	1.5	1.1	D
15	17	2	30.6	63	54.6	148	55.5	6.9	1.4	8	0	154	20	57	0.22	1.7	2.9	C
16	3	44	5.6	64	25.6	149	31.0	12.6	1.3	9	9	252	27	69	0.44	1.2	0.8	D
16	10	22	33.3	62	55.3	150	29.8	89.5	2.2	11	4	173	118	137	0.38	2.9	6.9	D
16	18	22	5.8	64	48.8	147	33.4	13.2	1.0	7	6	125	21	28	0.28	0.7	2.9	B
16	17	1	50.9	61	47.3	148	47.8	29.8	2.0	9	3	134	28	146	0.34	3.5	5.0	C
16	18	57	1.2	59	44.7	151	43.5	125.3	2.5	5	3	189	37	98	0.29	2.8	4.3	C
16	19	10	1.1	62	25.0	148	30.3	64.8	1.6	7	3	118	89	168	1.11	1.3	7.2	C
17	0	39	32.8	58	49.8	152	29.9	42.2	2.5	9	2	121	24	78	0.25	1.6	5.0	C
17	0	43	41.3	63	5.8	149	27.8	84.9	1.6	7	6	156	76	184	0.43	1.8	2.9	D
17	0	53	42.5	62	49.7	149	5.7	63.6	2.0	12	4	123	101	155	0.44	1.4	4.4	C
17	3	39	24.2	60	9.1	153	7.4	124.2	2.8	7	3	157	36	72	0.34	2.3	3.3	C
17	6	39	6.9	64	15.5	150	32.1	24.6	1.3	6	6	296	62	98	0.39	2.0	99.0	D
17	9	3	21.0	63	24.5	153	1.1	31.2	5.3*	14	1	260	178	206	0.37	8.8	11.6	D
									NEIS MB - 4.9. FELT (II AT MC GRATH AND LAKE MINCHUMINA. FELT (I AT TALKEETNA.								
17	10	12	59.0	63	5.0	153	12.2	85.3	2.5	6	6	268	150	263	1.00	8.4	21.4	D
17	11	35	8.1	64	25.3	148	0.4	7.7	1.0	7	2	116	7	27	0.27	1.1	3.3	B
17	13	53	48.0	63	8.3	153	47.8	45.2	2.2	7	4	276	174	255	0.80	7.1	99.0	D
17	14	30	47.5	62	13.5	148	4.6	41.6	2.9	14	3	83	59	158	0.48	2.3	13.5	C
17	19	21	28.3	59	57.0	152	40.4	89.1	2.2	7	4	125	46	66	0.27	1.7	2.7	B
17	21	54	19.4	64	41.0	149	11.6	15.8	1.2	9	9	244	13	52	0.42	1.1	0.6	D
17	23	15	26.9	58	36.8	151	41.6	39.7	2.8	6	4	259	38	118	0.13	2.7	4.7	D

APPENDIX B (con.)

1984	ORIGIN HR	MN	TIME SEC	LAT N DEG	MIN	LONG W DEG	MIN	DEPTH KM	MAG	NP	NS	GAP DEG	D1 KM	D3 KM	RMS SEC	ERH KM	ERZ KM	Q
NOV 17	23	36	28.6	61	24.2	148	4 8	20.0	2.1	8	4	252	60	221	0.46	3.1	1 4	D
18	3	12	18.9	65	16.9	148	55 9	34.3	1.3	6	5	289	63	80	0.47	2.1	7 5	D
18	4	36	31.4	63	6.9	148	13.5	62.9	3.7*	17	0	89	77	127	0.35	1.8	5.3	B
18	7	26	18.9	58	18.1	151	26.5	13.7	2.7	5	3	223	66	141	0.25	2.4	2 6	C
18	8	29	15.0	56	19.5	151	50.7	0.6	4.2*	9	0	257	163	309	1.01	10.6	2.5	D
									NEIS MB - 4.8									
18	11	24	53.0	61	37.6	148	20.5	17.5	2.1	5	4	253	57	157	0 50	3.4	2 0	D
18	11	33	35.9	64	20.7	148	33.7	16.3	1.0	9	6	74	27	36	0.25	0.7	0.9	B
18	16	46	11.6	66	4.8	144	32.9	4.9	2.8	10	4	189	62	179	0.49	3.1	3.0	D
19	0	44	24.4	58	12.5	138	51.0	223.5	4.6*	10	0	272	182	233	0.18	42.7	35 3	D
									NEIS MB - 4.8, FELT II AT EGEGIK									
19	2	17	46.8	61	32.5	149	43.1	39.0	2.5	12	5	218	32	131	0.59	4.2	2 4	D
19	13	55	13.7	63	32.3	147	58.3	15.5	1.3	9	7	179	52	98	0.45	1.0	1.0	D
19	15	6	41.5	64	21.2	148	32.2	15.9	0.9	8	6	118	25	36	0.45	0.7	2.7	C
20	1	17	23.6	59	30.6	152	59.1	17.2	1.7	4	3	226	21	85	0.22	3.9	3 2	D
20	6	16	48.3	64	48.3	150	31.6	0.4	1.5	7	6	294	74	122	0.47	1.9	2.2	D
20	12	17	29.1	62	20.2	149	50.2	68.0	2.0	10	4	122	91	143	0.45	1.2	5.1	C
21	3	52	5.8	59	52.3	151	58.3	74.5	2.0	4	3	171	55	77	0.20	1.7	3.8	C
21	4	48	25.5	62	41.6	151	56.9	168.4	2.9	6	2	226	82	217	2.18	15.4	9.7	D
21	14	14	12.8	64	42.1	146	52.5	7.7	1.6	9	4	198	33	45	0.35	1.1	1.4	D
21	16	38	1.6	57	31.5	154	57.0	61.5	2.9	8	1	290	149	188	0.18	8.2	26.1	D
21	20	6	24.4	60	5.3	152	24.5	96.9	3.9	10	2	162	42	67	0.31	2.0	3 6	C
22	6	45	43.7	64	52.3	148	32.8	25.0	0.8	5	4	218	20	43	0.48	2.0	2.2	D
22	9	47	20.0	58	54.8	153	56.7	97.3	2.3	6	3	215	17	56	0 28	3.9	2 8	D
22	12	23	18.2	59	36.9	152	41.5	84.0	2.2	6	4	181	52	83	0.30	1.6	3.5	C
22	13	10	59.7	63	0.1	149	37.9	87.6	3.7*	17	0	111	89	130	0.27	2.1	6.1	C
22	14	43	54.7	60	8.1	152	48.5	101.4	2.5	9	6	127	32	83	0.28	1.8	2.3	B
22	16	10	47.5	64	48.1	147	18.0	2.7	0.5	5	1	171	21	40	0.21	1.5	21.3	C
22	18	17	30.4	62	7.6	148	39.6	44.2	1.5	7	2	151	77	180	0.41	2.4	13.3	D
22	18	34	14 1	60	8.4	152	28 1	109.9	2.9	9	4	162	35	71	0 35	2.2	2.4	C
22	22	3	46.6	61	57.1	150	34 8	73.1	2.2	13	3	164	33	189	0 28	2.2	2.2	C
23	1	15	42.8	59	57.1	152	10.6	73 1	1.4	7	5	164	44	68	0 32	1.4	2.8	C
23	23	10	38.5	62	23.3	150	59.7	104.4	2.1	8	1	172	53	262	0.13	11.7	21.0	D
23	23	16	1.1	64	10.4	147	30 9	17.5	1.0	8	3	189	20	43	0.55	1.3	1 3	D
24	2	14	40 8	59	38.2	152	58.2	88.8	2.7	9	6	82	17	73	0.32	1.3	1 8	B
24	7	0	45 9	64	11.6	148	2.5	9.9	1.7	10	2	88	6	52	0.45	0.9	1.3	B
24	7	4	31.7	63	18.2	151	0 0	41.8	1.8	8	6	202	113	150	0.33	3.7	49.5	D
24	10	27	51.1	64	40.9	149	3.8	13.2	1.1	9	8	238	12	52	0.30	1.1	0.7	C
24	10	42	27.0	59	59.5	153	24.7	138.0	3.5	9	3	154	39	99	0.31	2.7	2.4	C
									PALMER ML - 3.4									
24	11	30	38.1	62	45.3	143	25.5	0.2	2.5	8	1	178	90	148	0.23	3.5	3 5	C
25	0	31	50 5	64	36 7	147	14.8	13.9	2.3	11	0	158	27	43	0.46	1 3	1 4	C
25	8	50	0.0	58	19.5	154	5.8	27.8	4.5*	5	0	254	72	124	0 36	89 5	15.5	D
									NEIS MB - 4.3									
25	16	58	15.6	64	30.0	149	37.3	22.0	2.1	12	1	198	39	71	0.49	3.3	1 8	D
25	19	53	26.4	63	55.6	148	55.6	1.1	1.3	10	0	153	22	56	0 37	1.4	3 1	C
26	1	42	14 8	62	56.8	150	41.4	25.7	3.0	16	0	181	116	158	1 15	2.8	3.8	D
									PALMER ML - 3.7									
26	2	41	40.8	62	56.0	150	33.7	98.8	3.3	15	0	175	117	157	0 39	3.4	9.6	D
									PALMER ML - 3.6									
26	6	13	10 0	59	37.7	152	58.9	109.5	2.9	8	2	81	17	73	0.31	2.4	5 4	B
									PALMER ML - 3.9									
26	18	26	39.4	63	50.9	149	2.7	18.4	1.1	8	6	189	14	66	0.59	2.0	1.5	D
27	1	21	27.6	64	51.5	147	21.9	9.5	1 6	8	6	163	14	37	0.26	0.9	1 2	C
27	5	3	59.8	60	9.1	152	54.5	120.0	2.5	5	4	175	31	82	0.29	2.0	2.5	C
27	11	57	32.3	63	1.8	149	27 2	87.1	2.3	15	5	108	83	149	0 38	1.1	3 6	C
27	12	38	5.2	63	11.0	149	40.4	85.7	1.7	8	5	165	71	165	0.33	1 6	2 7	D
27	13	59	39.2	63	1.8	149	57.1	84.7	2.2	13	2	158	93	163	0 37	1.7	3.1	D
28	3	52	48.1	58	59 5	152	40.0	80.2	3.9	9	4	122	57	80	0 31	1.4	2.7	C
28	8	25	34.9	62	35.2	148	8 3	58.5	2.3	12	8	105	94	134	0 32	1.2	5 4	C
28	10	1	38.5	63	58.0	148	50 2	0 9	1.8	12	0	114	23	52	0 42	1.2	1.1	C
28	23	33	21.1	62	12.0	147	17 8	63.6	2.0	5	3	156	41	190	0.39	4.1	5.4	C
29	4	37	46.3	59	31.9	152	39 5	71 9	2.0	5	3	160	35	81	0 37	1.7	2 7	C
29	4	38	24.2	63	51.2	149	10 4	12.5	1.4	8	5	216	18	71	0 90	2.5	1.2	D
29	6	29	17.9	64	23.0	147	17 6	10.6	1.4	9	3	121	17	39	0.44	1.0	1.6	C
29	8	0	38.2	63	22.8	151	22 0	1.5	2.1	9	4	216	127	156	0 39	3.4	1 3	D
29	13	8	3.0	59	7 6	151	30 6	4.0	2.3	6	3	266	47	114	0 36	8.3	6.4	D
29	22	36	25.7	60	12.8	153	8 2	131.0	2 8	7	3	94	31	76	0.27	2 7	2.9	C
30	1	0	21 3	63	55.9	149	5 2	1 7	1.4	10	3	184	23	63	0 41	1.3	3.6	D

APPENDIX B (con.)

1984	ORIGIN HR	TIME MN	SEC	LAT N DEG	MIN	LONG W DEG	MIN	DEPTH KM	MAG	NP	NS	GAP DEG	D1 KM	D3 KM	RMS SEC	ERH KM	ERZ KM	Q
NOV 30	1	19	37.4	64	5.2	148	11.4	100.0	3.6*	4	0	179	93	285	0.81	46.2	76.2	D
30	6	46	21.8	62	25.4	150	19.3	62.1	1.8	9	3	149	80	162	0.53	1.9	6.3	D
30	15	46	21.5	64	42.1	147	25.9	2.4	1.0	7	5	184	19	37	0.32	1.0	16.7	D
DEC 01	4	1	12.6	59	34.1	153	3.7	95.3	1.8	5	2	113	13	78	0.17	2.1	5.7	C
01	8	12	29.1	59	42.8	152	56.8	93.1	2.4	7	4	104	18	72	0.28	2.0	2.4	B
01	11	47	30.3	64	2.2	148	7.4	108.9	1.9	8	1	99	49	59	0.17	3.1	4.7	C
01	15	58	22.8	63	30.3	147	58.7	24.8	1.5	11	5	184	54	101	0.46	1.3	99.0	D
01	18	25	53.4	60	41.0	150	25.5	17.2	4.3	7	1	166	123	133	0.31	3.3	11.5	D
									NEIS MB - 3.8. PALMER ML - 4.1									
									FELT II AT ANCHORAGE AND SOLDOTNA.									
02	1	44	51.2	64	24.2	147	24.1	8.5	1.5	9	6	108	22	34	0.23	0.8	1.6	C
02	2	42	43.7	63	34.0	149	7.1	12.9	1.9	11	8	247	21	90	0.39	1.3	0.8	D
02	4	22	27.1	58	58.2	154	4.4	118.5	2.8	7	2	211	25	90	0.17	2.7	2.6	D
02	4	51	51.2	61	37.3	151	2.9	61.2	2.8	12	2	237	47	196	0.39	4.8	2.9	D
02	5	9	28.5	63	9.9	149	41.8	88.5	2.0	10	5	154	74	143	0.37	1.7	2.6	D
02	5	26	51.4	63	7.4	150	30.2	71.6	2.7	14	3	191	117	145	0.46	2.6	4.8	D
02	7	58	0.2	64	40.9	149	30.0	18.3	1.8	9	7	266	23	67	0.40	1.4	0.7	D
02	8	56	52.1	61	23.8	147	2.4	15.9	2.0	6	3	258	51	194	0.44	2.8	1.8	D
02	9	43	5.4	59	47.2	153	26.6	123.6	3.3	8	4	135	19	80	0.29	2.1	2.5	B
									PALMER ML - 3.7									
02	17	4	22.6	63	23.0	149	28.1	95.9	2.2	14	9	181	47	117	0.47	1.2	2.0	C
03	4	3	39.3	59	41.8	152	56.5	105.7	2.1	5	3	118	17	71	0.30	1.7	2.9	C
03	9	12	44.4	63	32.4	150	50.6	14.4	1.4	5	2	214	97	170	0.09	7.1	4.2	D
03	14	13	53.0	64	39.2	148	20.1	8.1	1.2	5	6	295	41	75	0.36	1.7	10.1	D
03	17	22	43.3	65	14.2	147	23.3	35.8	1.8	8	4	329	42	69	0.45	2.8	3.7	D
03	17	23	34.5	65	2.5	148	41.3	16.6	1.8	9	7	270	35	55	0.31	1.5	0.7	D
03	17	40	20.1	64	59.2	148	45.4	24.4	1.1	5	4	263	34	48	0.20	2.0	72.4	D
03	22	16	56.8	60	46.3	150	59.5	20.2	3.0	6	1	231	105	139	0.28	13.9	45.4	D
03	22	51	31.0	63	29.5	148	53.3	98.5	4.0*	18	0	104	27	90	0.24	1.9	3.8	B
04	8	36	21.3	59	59.7	153	2.7	121.8	3.0	13	4	180	40	72	0.33	2.2	2.2	C
04	11	10	2.7	63	31.0	151	0.3	0.2	1.4	7	5	209	105	151	0.43	1.9	1.1	D
04	15	7	26.6	60	58.9	149	36.7	31.8	2.5	10	5	159	73	155	0.38	1.6	2.0	D
04	19	42	28.7	60	4.2	152	33.3	93.2	3.8	13	2	321	220	348	0.38	10.6	22.8	D
									PALMER ML - 3.4									
05	3	9	21.5	61	27.6	146	21.8	13.2	2.0	6	3	262	66	175	0.51	2.5	1.9	D
05	7	52	39.9	62	35.5	153	12.5	37.2	2.4	5	2	278	111	250	0.29	6.5	14.7	D
05	9	22	35.1	64	46.0	149	10.3	13.6	0.9	6	6	249	22	61	0.27	1.6	3.0	C
06	13	58	55.0	61	41.4	149	37.9	51.6	3.0*	14	4	177	29	123	0.34	2.2	2.7	C
06	0	3	39.3	62	42.0	148	51.4	74.8	1.7	10	3	112	115	160	0.83	1.3	3.5	C
06	0	44	45.3	62	20.8	148	4.9	26.9	2.4	14	3	114	69	181	0.46	2.0	4.8	D
06	3	47	18.9	59	53.8	152	54.8	113.3	2.4	5	3	107	33	65	0.27	2.2	3.6	B
06	8	58	8.8	59	48.3	153	23.2	113.8	2.5	8	3	110	15	45	0.24	2.2	3.2	B
06	18	8	18.8	61	47.2	146	57.7	75.1	1.5	5	1	256	20	200	0.09	7.6	3.4	D
06	19	34	38.5	59	41.3	152	20.9	64.7	2.5	7	3	116	40	65	0.34	1.8	5.3	C
06	19	40	49.5	64	53.9	148	44.8	15.5	0.8	7	6	237	30	53	0.36	1.3	1.1	D
07	1	38	42.3	65	57.7	135	58.3	70.2	2.5	5	1	320	426	544	0.19	99.0	99.0	D
07	12	50	3.6	60	20.6	152	20.6	86.5	2.0	5	4	215	25	92	0.17	2.1	2.6	C
07	15	40	23.7	62	7.4	149	19.0	66.3	1.8	9	3	98	60	117	0.31	2.9	5.8	C
07	16	22	28.4	59	8.0	151	6.6	60.2	3.2	8	2	217	44	134	0.28	3.4	5.1	D
07	22	53	43.3	64	46.4	147	48.9	18.0	0.4	5	5	147	14	30	0.31	0.9	1.8	C
07	23	43	3.7	65	23.5	144	1.3	80.0	2.6	12	1	210	142	177	0.34	3.5	13.6	D
08	5	22	8.1	64	44.0	148	59.3	18.6	1.4	9	8	235	18	92	0.48	1.1	0.8	D
08	9	11	12.1	64	2.9	147	35.6	18.2	1.2	9	6	205	22	83	0.29	1.2	0.7	C
08	9	27	52.8	64	28.1	147	11.2	0.6	2.3	13	2	101	13	44	0.39	0.9	1.4	C
08	13	14	17.9	62	45.9	149	51.6	75.2	2.0	10	3	145	117	138	0.77	1.4	8.0	D
08	14	22	40.0	64	28.6	148	29.2	8.6	0.8	9	8	91	19	38	0.39	0.5	2.8	C
08	18	35	18.1	58	34.7	152	54.4	89.7	2.5	6	4	271	58	121	0.26	2.7	3.5	D
08	15	43	4.4	64	26.0	147	43.4	11.5	0.7	8	6	105	18	30	0.33	0.8	2.1	C
08	21	7	48.7	63	38.0	150	38.4	28.8	4.6*	15	0	139	85	130	0.37	2.2	4.3	D
									NEIS MB - 4.6. FELT FAIRBANKS.									
08	21	19	43.6	63	37.7	150	47.9	3.6	1.6	9	6	206	93	135	0.41	2.3	1.4	D
08	22	2	19.0	63	39.0	150	41.3	12.6	2.1	8	3	203	87	130	0.47	3.1	1.5	D
09	0	25	40.7	62	46.2	149	38.2	74.2	2.4	11	7	139	113	134	0.33	1.1	2.7	D
09	4	23	19.3	63	38.7	150	36.2	34.0	4.3*	17	0	138	83	128	0.43	2.1	2.7	D
09	6	10	27.6	62	39.2	151	26.2	70.5	2.5	14	6	204	75	174	0.64	2.0	2.4	D
09	7	25	4.2	63	7.1	150	50.4	113.4	1.9	9	3	191	117	184	0.25	2.3	3.1	D
09	7	53	44.7	63	38.1	150	53.9	0.4	1.8	9	7	297	98	138	0.40	1.5	0.9	D

APPENDIX B (con.)

1984	ORIGIN HR	MN	TIME SEC	LAT N DEG	MIN	LONG W DEG	MIN	DEPTH KM	MAG	NP	NS	GAP DEG	D1 KM	D3 KM	RMS SEC	ERH KM	ERZ KM	Q
DEC 09	9	11	40.3	64	21.1	148	32.9	14.5	0.9	9	7	73	26	36	0.42	0.6	2.8	C
09	10	49	8.3	64	46.6	147	25.8	12.9	1.0	7	7	148	23	34	0.32	0.6	2.4	C
09	11	46	45.5	60	14.2	153	18.6	140.1	2.9	5	3	226	36	113	0.11	3.9	2.5	D
09	15	7	23.3	61	28.1	149	38.4	39.4	2.3	8	3	230	30	129	0.28	4.5	1.8	D
09	16	54	50.9	59	52.8	152	56.3	103.6	2.9	6	5	181	29	61	0.29	1.5	2.4	C
10	2	48	23.1	63	13.6	150	12.0	92.8	1.8	12	4	173	85	154	0.38	2.5	2.6	D
10	3	7	21.0	64	11.5	148	1.6	9.0	1.0	9	8	114	5	52	0.40	0.7	1.4	C
10	9	37	17.8	63	8.4	151	30.3	91.2	2.1	12	3	215	129	164	0.50	2.9	8.6	D
10	18	50	20.5	62	30.4	149	26.0	86.4	2.5	9	3	122	103	133	0.48	2.9	7 9	C
									PALMER ML = 2.9									
11	1	49	46.1	65	11.1	148	39.9	13.0	1.3	7	8	273	47	70	0.34	1.3	0.9	D
11	3	21	35.2	63	42.1	151	1.5	3.3	1.9	10	6	299	103	136	0.41	2.4	1.3	D
11	5	3	38.5	61	53.3	149	30.8	42.8	1.9	11	3	128	39	115	0.43	2.6	4.7	C
11	6	49	13.2	63	58.0	150	18.6	24.6	1.8	7	8	323	91	122	0.54	2.6	99.0	D
11	7	24	22.9	64	29.3	146	45.8	9.1	1.6	10	5	186	13	63	0.22	0.9	1.3	C
11	9	42	40.9	63	38.9	150	40.9	4.8	1.5	7	3	203	87	130	0.56	1.5	1.6	D
11	13	27	0.7	64	44.7	150	84.0	21.7	1.9	8	6	300	89	131	0.37	9.8	11.8	D
11	16	44	15.4	64	46.4	151	27.5	44.5	1.8	7	5	322	116	158	0.67	3.9	32.5	D
11	23	9	58.0	59	23.1	152	26.9	66.4	2.0	6	3	157	53	71	0.21	1.5	5 0	C
12	2	50	17.9	63	29.5	150	29.2	0.9	1.9	10	8	191	82	139	0.49	1.8	0.8	D
12	3	21	57.0	60	18.1	153	5.3	126.3	4.0	9	3	80	22	84	0.23	2.6	3.1	B
12	4	50	53.8	61	32.3	151	3.3	82.5	3.7*	14	0	247	55	102	0.24	38.0	34.2	D
12	6	20	56.0	58	56.8	153	14.2	77.4	2.4	5	3	268	24	75	0.28	3.0	3.1	D
12	8	1	33.6	63	17.2	150	24 8	118.1	2.0	12	4	182	89	166	0.37	1.8	2.6	D
12	10	57	55.9	64	45.2	147	26.1	10.2	1.7	11	4	144	21	35	0.32	1.1	1 3	C
12	15	30	33.7	66	54.8	157	8 2	80.6	3.2	12	1	210	161	471	0.24	14.5	9.1	D
									PALMER ML = 3.3									
12	16	8	51.0	62	57.2	150	51.0	121 9	2.0	13	3	187	114	162	0.32	2.0	3.7	D
12	19	11	48.5	63	40.3	150	50 0	5.9	1.9	11	8	209	94	132	0.45	2.3	1.2	D
13	0	26	3.4	62	59.8	148	39.3	74.2	2.0	13	4	196	83	139	0 50	2.6	4.7	D
13	4	52	25 3	61	54.1	149	28 4	57.7	2 0	13	5	123	39	113	0.38	2.0	5.6	C
13	7	51	46 9	64	58 5	147	34 7	13.4	1.9	11	3	141	11	33	0.49	1.1	0.9	C
13	15	28	9.8	58	44 7	152	52 2	69.2	2.4	5	4	249	49	128	0.24	2.3	3 4	D
13	16	37	40.3	63	34.8	150	33 7	8.7	1.8	6	6	196	82	133	0 27	1.8	1.3	C
14	1	27	22.6	60	10.1	153	5 9	128.0	3.1	7	2	157	33	74	0.21	3.1	3.0	C
14	1	38	52.9	64	49.3	147	31.6	15.6	0.9	7	8	130	20	29	0.36	0.8	3.0	C
14	8	23	54.4	61	35.3	149	48.2	39.2	1.8	9	3	207	33	131	0 31	4.9	3.0	D
14	9	6	3 0	64	46.0	147	29 1	21.7	0.7	7	7	138	21	32	0.37	0.7	0.7	C
14	10	50	49.0	59	26.5	153	6.6	110.9	3.0	7	1	124	20	65	0.18	2.6	2.8	C
14	15	43	25.5	62	32.7	149	36.0	107.0	2.3	14	7	126	109	143	0.63	1.2	3.7	C
14	18	27	23 1	59	52.2	152	2.5	187.4	3.1	5	1	183	59	96	0.29	4.6	6.0	D
15	1	44	33.2	59	50.5	151	45.3	99.3	2.7	7	3	181	21	86	0.23	2.3	2.4	C
15	3	7	31.0	64	40.0	147	35.1	11.4	1 0	7	5	119	11	33	0.36	0.8	3 3	C
15	3	10	25.1	63	0.5	150	38.0	98.4	2.0	12	4	181	117	151	0.21	2.3	3.1	C
15	4	48	34.3	62	7.0	147	28.8	41.8	2.4	15	6	103	32	139	0.48	1.9	3 8	C
15	7	45	2.0	64	26.6	147	59.3	11.9	1.3	10	5	89	6	30	0 30	0.7	1.4	B
15	13	58	23.4	62	46.6	151	31.9	19.9	1.9	11	3	210	89	197	0.48	3.7	3.8	D
15	15	47	45.1	64	28.8	146	46.5	1.9	1.1	10	9	184	12	63	0.44	1.0	14.2	D
15	20	45	52 3	64	44.7	147	23.8	15.1	0.7	6	5	150	22	37	0.36	0.7	2.4	C
15	22	39	49.2	64	41.4	150	24.6	22.7	2.2	9	3	171	65	109	0.48	1.7	3 4	D
16	1	24	50.2	60	19.4	152	8.0	93.8	2.0	8	4	223	37	97	0.35	2.2	2.5	D
16	1	37	54.5	63	33.8	150	49.7	8.1	1.5	6	5	205	96	142	0.42	2.0	1.5	D
16	2	54	31.8	58	48.0	153	57.5	76.8	2.6	6	4	292	23	104	0.30	3.0	3.1	D
16	8	18	38.5	60	7.3	150	8.2	36.9	3 1	6	4	321	91	181	0.44	11.1	41.8	D
16	18	33	10.6	59	15.8	153	35.5	108.4	2.9	5	4	146	16	48	0.24	1.9	2.5	C
16	18	38	3.8	63	37.2	150	36.5	4.7	1.2	7	8	199	84	130	0.45	1.6	1.3	D
16	21	37	48.5	59	49.2	151	46.9	62.9	2.8	6	2	176	45	87	0.23	1.8	4.1	C
17	0	49	3.1	63	13.1	150	2.9	89.3	2.0	13	7	167	80	180	0.42	1.6	2.6	D
17	6	45	11.9	62	28.5	150	22.3	71.0	2 2	8	7	145	79	206	0.40	1.5	5.5	D
17	9	12	47.1	62	15.2	147	13 9	58.3	1.7	8	4	138	47	156	0.59	3.1	5 6	D
17	12	1	34.0	62	53.8	148	46.4	1.0	1.8	7	4	150	94	150	0.38	1.3	1.2	D
17	13	58	14.3	59	31.3	152	0.4	78.0	2.0	8	3	146	44	82	0.25	1 7	2 8	C
17	16	19	19.5	64	52.8	147	18.9	4.8	0.8	6	5	178	12	40	0.24	1.1	5.4	C
17	17	12	20.2	68	29.6	152	41.1	40.9	2.3	7	5	189	79	225	0 48	4.2	66.9	D
17	17	51	44.2	63	35.9	149	44.3	116.6	1.7	9	3	171	43	126	0.42	1 6	4.8	C
17	18	36	24.7	59	30.8	152	24 0	78.7	3.8	10	2	94	48	58	0 35	1.8	2 2	C
									PALMER ML = 3 8									

APPENDIX B (con.)

1984	ORIGIN HR	MN	TIME SEC	LAT N DEG	MIN	LONG W DEG	MIN	DEPTH KM	MAG	NP	NS	GAP DEG	D1 KM	D3 KM	RMS SEC	ERH KM	ERZ KM	Q
DEC 17	20	19	46.4	64	35.9	149	51.4	17.1	1.7	9	6	274	37	86	0.42	1.8	0.8	D
17	21	31	26.0	61	23.6	151	38.1	100.0	3.2	5	0	289	66	337	0.19	99.0	99.0	D
18	4	2	37.5	62	51.3	149	30.1	95.9	1.5	8	7	143	102	193	0 25	1.6	3.2	C
18	4	51	4.9	64	50.6	147	23.1	6.6	1.0	7	5	158	16	38	0.32	1.0	5.4	C
18	7	19	5.1	63	7.9	151	49.4	45.0	2.0	8	4	226	129	176	0.77	3.9	25.6	D
18	16	40	34.7	59	39.2	152	0.6	62.3	2.9	7	4	122	21	69	0.14	1.4	2.3	B
18	17	13	23.0	63	35.1	149	55.7	97.4	1.5	3	3	180	82	197	0.13	5.4	5.0	D
18	18	35	5.6	58	57.8	152	4.8	54.6	2.4	5	3	231	79	90	0.14	3.0	3 2	D
19	0	51	50.7	66	17.5	154	27.6	19.1	3.8*	11	1	217	43	334	0.31	13.2	2.9	D
									FELT II AT HUGES									
19	1	6	27.7	64	42.6	148	6.4	14.2	1.1	9	9	241	15	55	0.48	1.1	0.7	D
19	23	29	35.5	62	37.0	149	40.3	75.2	2.0	11	8	132	118	150	0.48	1.1	2.4	C
20	0	43	39.4	61	50.5	147	21.1	40.5	2.2	13	5	130	2	159	0.38	2.2	1 8	C
20	2	59	35.8	64	34.9	146	59.4	10 2	1.7	10	5	177	20	49	0.35	0.9	1.0	C
20	3	48	38.7	56	8.4	153	28.9	51.4	4.5*	7	0	233	188	391	0.39	14.9	21 6	D
									NEIS MB - 4.9									
20	11	45	23.7	63	45.2	149	17.6	28.8	1.1	9	1	265	18	82	0.61	5.7	3.8	D
20	14	3	37.3	64	27.3	147	21.8	4.0	0.8	5	6	168	21	35	0.24	0.7	8.3	C
20	14	11	34.0	59	3.9	152	55.4	74.4	2.3	6	3	189	44	68	0.26	2.1	3.6	C
20	22	26	13.1	63	19.9	149	49.0	113.4	2.5	15	3	163	63	133	0.33	2.0	3.4	D
									PALMER ML - 3 1									
20	23	55	12.2	59	59.9	153	30.3	157.4	2.7	5	3	224	41	82	0.31	4.5	3.0	D
21	1	45	5.0	64	49.0	147	16.6	9.4	0.3	5	5	177	20	41	0.16	0.9	4.3	C
21	7	51	15.8	63	39.6	150	56.2	0.2	2.1	10	4	211	99	137	0.43	2.2	1.3	D
21	8	15	35.0	63	35.7	150	43.2	2.3	1.5	8	5	202	90	136	0.38	1.6	1.2	D
21	11	11	9.0	64	41.7	146	47.7	0.7	0.9	6	6	234	33	49	0.14	1.1	67.2	D
21	12	33	3.3	64	37.2	148	43.9	16.9	0.9	8	8	156	17	36	0.36	0.8	0 9	C
21	15	0	16.0	59	58.4	150	58.1	44.5	2.9	8	4	260	52	112	0.20	2.4	3 3	D
21	17	38	29.1	60	14.7	152	51.4	115.6	2.4	4	3	137	20	90	0.18	3.4	4 2	C
21	21	17	5.8	63	7.3	153	25.9	43.2	2.5	7	4	269	160	240	0.55	10.8	99 0	D
21	22	53	36.1	60	4.3	153	23.6	132 4	2.5	6	2	186	48	98	0.16	3.2	3 3	C
22	2	23	51.3	63	17.2	149	29.4	102.3	1.7	10	5	150	57	126	0 42	1.5	2 3	D
22	2	50	19 9	60	18.9	152	38.6	107.8	2 1	5	5	161	17	89	0.26	2.0	2.3	C
22	6	12	2 5	64	42.9	149	7.7	15.5	1.6	9	6	243	16	56	0.42	1.2	0.8	D
22	7	19	3 8	63	8.8	150	48 0	127.1	1.7	8	1	196	114	142	0.14	5.5	8 9	D
22	10	7	8.7	58	51 1	154	29.4	128.2	2.5	5	2	309	50	115	0.29	7.4	6.1	D
22	10	27	40.8	61	4.7	148	24.8	9 9	3.2	13	1	280	97	217	0 31	3 4	2 3	D
									PALMER ML - 3.0									
22	13	47	23.6	63	53.0	149	47.9	9.2	1.4	8	5	273	46	85	0 46	2.2	1.1	D
22	15	2	10 1	62	52.9	149	35.7	83.4	2.1	12	8	141	101	146	0 36	1.2	3.0	D
22	23	38	1 4	63	55.2	148	54.7	0.4	1.8	12	0	121	21	56	0.33	1.2	1.4	C
23	1	56	41.0	63	31.2	149	18.3	98.7	2.6	14	3	146	29	99	0 36	2.1	3 6	C
23	3	6	8.3	63	15.6	150	28.6	117.5	1.8	10	3	182	92	153	0.29	2.3	2 8	C
23	4	0	57.8	63	18.6	152	38.6	88.6	2.3	9	5	251	155	197	0.83	3.7	19.8	D
23	5	50	19.0	63	38.8	150	43.2	1.7	1 7	10	8	293	89	134	0.31	2.3	0 9	D
23	22	2	1.3	62	18.2	150	50.8	55.9	3.7	14	0	193	91	191	0 27	2.7	7 4	D
23	23	25	23.0	64	56.3	148	30.8	16.4	1.6	9	4	230	22	48	0.33	2.1	1 0	D
24	5	42	21.7	61	45.0	148	51.7	17.1	2.8	10	4	137	23	143	0.33	3.3	3.0	C
24	6	10	14.0	61	30.6	150	5.4	44 8	2.4	7	2	226	52	151	0 48	4.6	3.5	D
24	7	13	45.9	58	11.6	153	12.9	44.5	3.6	7	1	204	66	133	0 31	6 3	5 5	D
24	10	26	20.2	59	21.6	153	31.4	97 2	2.0	6	3	134	6	49	0 22	2.3	2.8	C
24	12	45	29.3	64	41.2	149	10.6	15.1	1.4	9	8	244	13	53	0 49	1.1	0.7	D
24	13	29	54.6	58	40.8	154	19 6	1.2	3.4*	7	0	230	48	124	0.67	6.4	9.1	D
24	15	44	36.3	62	13 7	150	35 8	73.9	2.0	11	3	138	56	188	0 33	2 5	2.8	D
24	16	15	59.7	59	35.0	153	26 7	109 7	2.8	7	5	110	14	48	0 38	2.4	3.4	C
24	17	40	3.5	63	11.0	150	38.8	125 8	1 5	7	1	187	103	142	0.28	5 0	7.2	D
24	20	25	33.8	63	0.8	150	47.2	112.0	2.0	11	3	186	121	154	0.35	2.4	4.8	D
24	20	38	14.3	62	54.3	150	9 9	87 3	1.8	6	2	174	125	226	0.25	3.4	12.4	D
25	0	21	2.3	59	31.1	153	1 3	24.6	1.9	4	2	208	19	101	0.29	1.8	2.3	C
25	2	39	48.0	63	4 3	149	49.8	81 8	1.9	13	4	156	86	150	0 29	1.7	2 8	C
25	8	52	42.0	64	21.8	149	45.9	18.5	1.1	5	6	264	30	81	0 66	1.6	0.9	D
25	16	53	13.1	64	43.2	149	9 1	18.8	1.2	9	7	244	16	56	0.41	1.4	0 6	D
25	17	10	15.9	63	10.0	148	9 6	31 5	1.5	13	6	95	113	129	0.64	1 1	2 3	D
25	20	11	8.6	60	0.4	152	51 0	96 6	2.8	8	4	114	45	77	0 21	1.9	2 5	B
25	21	15	24.4	65	38.0	145	2.6	57.1	2.7	8	1	220	110	159	0.23	7.9	26.1	D
25	22	6	8.7	65	27.9	149	43.1	24.7	1.7	8	6	304	103	121	0 81	1 7	99.0	D

APPENDIX B (con.)

1984	ORIGIN HR	ORIGIN MN	TIME SEC	LAT N DEG	LAT N MIN	LONG W DEG	LONG W MIN	DEPTH KM	MAG	NP	NS	GAP DEG	01 KM	D3 KM	RMS SEC	ERH KM	ERZ KM	Q
DEC 26	0	55	57.5	63	13.7	147	9.8	16.5	1.8	8	0	299	105	132	0.50	16.5	99.0	D
26	8	28	50.7	63	53.4	149	20.1	119.7	1.2	8	1	257	28	89	0.20	6.6	3.6	D
26	14	32	24.7	61	56.4	149	12.7	53.4	1.8	5	3	100	39	122	0.21	2.0	6.7	C
26	15	58	51.3	63	5.7	150	58.8	132.0	2.1	6	0	201	124	152	0.18	6.4	11.5	D
26	19	54	22.1	59	68.5	153	3.9	118.8	3.1	6	4	126	52	71	0.27	2.0	2.6	B
27	8	12	25.9	64	46.1	149	9.1	18.9	1.1	8	7	248	22	61	0.38	1.3	0.8	D
27	9	5	12.0	63	38.5	147	31.0	73.3	1.3	10	5	154	71	89	0.31	1.4	2.8	D
27	9	34	30.7	64	7.3	148	43.3	19.5	0.9	8	7	113	28	45	0.90	0.7	0.8	C
27	10	36	23.9	59	33.0	153	10.5	102.3	2.0	6	5	111	24	74	0.32	1.6	3.1	C
27	13	58	41.1	61	41.3	151	0.6	78.2	1.9	8	1	225	43	251	0.24	6.8	5.6	D
27	21	18	56.8	58	50.3	154	23.5	113.0	2.5	6	3	229	44	106	0.34	4.8	2.6	D
28	0	58	10.0	59	13.5	154	34.4	8.9	2.8	7	4	224	83	67	1.07	2.8	3.6	D
28	1	4	21.8	64	39.6	149	13.4	17.0	1.1	9	9	245	12	55	0.34	1.1	0.6	D
28	2	19	37.6	65	17.3	145	23.4	100.0	2.3	10	0	320	379	439	0.38	99.0	99.0	D
28	4	29	52.5	59	24.0	150	56.5	53.1	3.1	8	3	248	22	133	0.31	3.1	4.0	D
28	9	8	13.9	60	10.2	152	43.9	109.4	3.0	6	4	134	28	83	0.30	2.1	2.3	B
28	13	23	2.2	63	37.3	150	41.5	11.2	1.5	6	4	202	88	133	0.26	2.0	1.6	C
28	17	26	24.2	63	12.1	151	57.0	55.7	2.0	8	3	233	136	175	0.92	5.9	20.2	D
28	20	58	46.2	64	36.9	150	24.4	25.0	1.6	7	4	293	64	110	0.90	3.1	99.0	D
29	0	50	55.7	63	55.3	149	49.6	12.1	1.2	7	6	271	43	82	0.40	1.5	1.0	D
29	3	2	14.8	60	7.0	153	27.4	151.4	3.8	9	4	88	81	55	0.30	2.6	2.7	B
29	3	28	38.4	64	31.1	147	43.5	18.7	0.7	6	6	91	15	39	0.31	0.8	1.7	C
29	4	32	56.4	61	18.3	146	56.5	19.7	2.0	10	4	264	62	201	0.58	2.5	1.6	D
29	6	23	10.7	62	37.6	149	38.1	75.3	2.2	13	6	130	118	128	0.39	1.3	2.0	C
29	16	42	57.7	64	40.1	146	47.2	4.2	1.3	9	6	199	30	49	0.46	1.1	2.3	D
29	17	9	44.1	62	37.8	151	15.8	77.9	2.4	11	3	195	74	203	0.30	3.2	6.1	D
29	19	42	58.5	64	40.9	146	56.6	7.3	1.6	9	3	189	31	41	0.30	1.2	2.2	D
30	2	27	59.1	62	11.2	151	19.9	92.4	2.6	13	3	178	25	211	0.37	2.4	4.2	C
30	6	34	47.4	62	6.7	149	34.0	45.8	2.5	14	3	105	62	121	0.39	2.0	7.4	C
30	8	3	31.4	62	54.1	150	55.8	76.4	1.9	13	1	188	107	189	0.29	3.7	9.1	D
30	8	15	38.2	59	25.4	151	40.4	67.8	2.4	8	3	180	26	92	0.17	2.1	4.4	C
30	11	42	46.9	61	48.8	149	26.4	33.0	2.2	13	3	134	30	112	0.47	1.8	1.9	C
30	12	5	19.6	64	58.4	147	54.7	6.0	0.8	7	5	214	20	37	0.28	1.1	3.7	C
30	12	43	4.2	64	53.4	147	17.6	10.9	1.8	8	6	185	12	41	0.44	1.0	1.2	D
30	16	33	57.4	63	33.2	147	12.3	9.6	1.8	11	5	102	68	68	0.32	1.0	1.1	D
30	18	16	37.2	58	51.6	154	18.8	126.1	3.0	6	3	247	39	108	0.28	3.8	2.7	D
30	21	13	41.3	63	33.4	150	36.0	1.7	1.6	6	3	197	83	148	0.31	2.2	1.4	D
31	0	44	46.7	64	46.7	150	1.3	12.3	1.1	6	4	283	50	107	0.32	2.5	1.5	D

Explanation for Appendix B

Earthquakes are listed in chronological order. The following data are given for each earthquake.

1. ORIGIN TIME in Universal Time (UT): date, hour (HR), minute (MN), and second (SEC). To convert to Alaska Standard Time (AST), subtract 9 hr.
2. LAT N, LONG W: epicenter in degrees and minutes of north latitude and west longitude.
3. DEPTH: depth of focus (measured in kilometers).
4. MAG: local magnitude from maximum trace amplitude. An asterisk that follows an entry means that the value determined by the Alaska Tsumani Warning System (Palmer) was used.
5. NP: number of P arrivals used to locate earthquake.
6. NS: number of S arrivals used to locate earthquake.
7. GAP: largest azimuthal separation between stations (measured in degrees).
8. D1: distance from the closest station to the epicenter (measured in kilometers).
9. D3: distance from the third closest station to the epicenter (measured in kilometers).
10. RMS: root-mean-square error of the travel-time residuals (measured in seconds).
11. ERH: largest horizontal deviation (measured in kilometers), from the hypocenter within the one-standard-deviation confidence ellipsoid. The quantity measures the epicentral precision for an earthquake. Values of ERH >99 km are tabulated as 99 km.
12. ERZ: largest vertical deviation (measured in kilometers), from the hypocenter within the one-standard deviation confidence ellipsoid. This quantity measures the precision of the hypocentral depth. Values of ERZ that >99 km are listed as 99 km.
13. Q: reliability of the hypocenter. This index measures precision of the hypocenter location and also reflects the quality of the data used to derive the hypocenter parameters.