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TIME-TERM SOLUTIONS AND CORRESPONDING DATA FOR THE CRUSTAL STRUCTURE OF NORTH CENTRAL NEW MEXICO

by

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ABSTRACT

A network of approximately 20 seismograph stations is operated in north central New Mexico by the Los Alamos Scientific Laboratories, the New Mexico Institute of Mining and Technology, and the Albuquerque Seismological Laboratory. The network has dimensions of approximately 200 km (E-W) by 300 km (N-S). The P-waves of 13 regional ($200 < \Delta < 1000$ km) earthquakes and explosions were timed at 20 stations of the network. Their travel-time data, together with the related epicentral distances, were processed by the time-term method. The tabulated results are presented here for the main data set and 10 subsets thereof. The subsets were chosen to test the stability of the estimates of the refractor velocity and time terms. These tests show that estimates of time terms for the subsets commonly are within ±0.5 sec of the related ones for the main set, and estimates of the velocity for the subsets commonly are within ±0.1 km/sec of that for the main set. Thus, the estimates show only small variations.

INTRODUCTION

A network of seismograph stations is operated in north central New Mexico by the Los Alamos Scientific Laboratories, the New Mexico Institute of Mining and Technology, and the Albuquerque Seismological Laboratory. We, at the Albuquerque Seismological Laboratory, are currently studying the crustal structure of the region of the network. To accomplish this, we timed P-arrivals from a number of earthquakes and explosions that were recorded by the network. The P-wave travel-time data of the events were processed by using the time-term method (Scheidegger and Willmore, 1957; Berry and West, 1966a, b). The method is designed to give an estimate of the velocity and time terms for the region of the network and has been employed previously by others (see McCollom and Crosson, 1975; Murdock and Steppe, in press). As noted by these authors, errors in the origin times of the earthquakes are not important, and since the earthquakes are far from the array of sensors, small errors in their locations produce negligible effects as well.

The purpose of this report is to give the travel-time information and the results (tabular) of processing these data. The data may be useful to those who study the structure of the crust and upper mantle of the region. The tabulated results, which will be referenced in a companion paper by the authors, may be useful to those interested in details of the solutions.

ACQUISITION OF DATA

Although some of the stations have been in operation for a much longer time, approximately one-half of the stations of the network (fig. 1, table 1) have operated only since late 1975. Therefore, almost all of the events studied occurred since that time. One exception is GASBUGGY, a nuclear device that was detonated in northwest New Mexico on December 10, 1967. It was recorded by ABQ and WTX (fig. 1, table 1).

For the period late 1975 through 1978, we read the Earthquake Data Reports of the U. S. Geological Survey and associated literature to search for regional events ($200 < \Delta < 1000$ km) that likely would be recorded by the network. Approximately 30 such events were found. Their seismograms commonly are on a develocorder film, and they were displayed with a scale of 1 cm/sec. Seismograms of each of the 30 events were examined and only well-recorded onsets were timed (examples in fig. 2). Each of the P-wave onsets was read by the authors separately, and the times were accepted for further processing if the readings agreed to within 0.2 sec. For those accepted, each set of two was averaged.

An event was acceptable if the P-waves were well recorded, as described above, by at least two stations of the network. A total of 14 events were initially found acceptable, and only one earthquake was later excluded. It occurred in northeast Utah on September 30, 1977, at 10:19:21 UTC (PDE 18-77). According to the Earthquake Data Reports (EDR 18-77, p. 78), the P-waves of it showed a 2-3 sec anomaly at ABQ, relative to stations of the northern part of the network (mainly the Los Alamos stations). (They arrived 3 sec earlier than expected at ABQ.) Because of the poor fit, the times of the southern part of the net were not used in the EDR hypocenter solution. The apparent

anomaly was manifest in our initial processing with the time-term program as well. Inclusion of data of the event appeared to exert an unusual effect on the solution: the velocity was as much as a few tenths of a kilometer per second higher than estimates made with data of the event excluded. The apparent anomaly might relate to observational error (such as picking the onset) or other experimental error (such as loss of synchronization in the time base of the develocorders, one at Albuquerque and the other at Los Alamos). Because data of the event appeared to affect the processing inordinately, its travel-time information was not used in the results described below. Parameters of the 13 events used are listed in table 2, and their locations are shown on figure 3.

As shown by table 2, five of the 13 events are explosions, and three of them are in New Mexico. The three are DICE THROW (a conventional device fired by the Air Force in central New Mexico, GASBUGGY, and a quarry blast in northwest New Mexico. Of the remaining two, one is a quarry blast in southeast Arizona, and the other is a nuclear device fired at the Nevada Test Site (NTS). Because we realized that the latter two would be recorded by the network, we deployed stations to record them also near the sites of GASBUGGY and DICE THROW. This was done to fulfill a requirement of the time-term technique. Namely, to estimate absolute time terms, as opposed only to relative[1] ones, at least one station and source must share a common position (see Scheidegger and Willmore, 1957; Berry and West, 1966a, b). The station at

[1]If no sources and receivers occupy common positions, the time-term solution is indeterminate in the sense that an arbitrary constant can be added to each station term and subtracted from each source term. Nevertheless, the station time terms relative to a reference station may be calculated. These are called relative time terms (Murdock and Steppe, in press). The value at the reference site is assumed.

DICE THROW (E08, table 1) recorded the NTS explosion plus the quarry blast in southeast Arizona, and the station at GASBUGGY (E11, table 1) recorded the NTS explosion. GASBUGGY was detonated 1.3 km below the surface, whereas the station (E11) was located on the surface. To compensate for the difference in elevation, we subtracted 0.4 sec from the observed E10-E11 travel time. This value was obtained by assuming V_o = 3 km/sec and V_1 = 8.1 km/sec (see Dobrin, 1960, p. 100).

METHOD

The time-term method was used to process the data. The method was proposed for reducing seismic refraction data by Scheidegger and Willmore (1957). The assumptions of the technique have been discussed by them, by Willmore and Bancroft (1960), and by Berry and West (1966a, b). The primary assumption is that the P-wave travel times can be partitioned into an elementary function of distance plus a constant for each site, and another one for each source. The time-term equation is commonly written

$$T_{ij} = \frac{\Delta_{ij}}{V} + t_i + t_j \qquad (1)$$

Where T_{ij} is the calculated travel time; Δ_{ij}, the corresponding distance; t_i and t_j, the time terms; and V, the refractor velocity. Primarily, the method of Berry and West (1966a) was used herein, with only a small modification, to estimate the time terms, V, and measures of the fit of the model. The most important measure of the fit of the model is the standard deviation of the solution (s) given by

$$s^2 = \frac{\sum_{i=1}^{N}\sum_{j=1}^{N} R_{ij}^2\,\gamma_{ij}}{\sum_{i=1}^{N}\sum_{j=1}^{N}\gamma_{ij} - 2(N+1)}. \qquad (2)$$

where $R_{mn} = R_{nm}$ is the travel-time residual between sites m and n,

$\gamma_{mn} = 1$ if data exist between sites m and n,

$= 0$ otherwise,

N is the number of sites,

N+1 is the number of parameters estimated, N time terms plus the velocity.

The term 2(N+1) of equation (2) above differs from a corresponding one of Berry and West (1966a), who use N only. Thus, our estimates of s^2 are larger than theirs. The factor of two is used in our equation because the sums are made on R_{mn} as well as on R_{nm}, where $R_{mn} = R_{nm}$, and on γ_{mn} as well as γ_{nm}, $\gamma_{mn} = \gamma_{nm}$. The modification gives results identical to those of another technique described below. The change in equation (2) is the only alteration to the method of Berry and West (1966a). The standard deviation of a time term's data ($\bar{s}_t$) measures the dispersion of the data associated with a given time term (Berry and West, 1966a)

$$\bar{s}_t^2 = \frac{\sum_{s=1}^{N} R_{st}^2 \gamma_{st}}{\sum_{s=1}^{N} \gamma_{st} - 1}. \tag{3}$$

The standard deviation of a time term s_t is defined (Berry and West, 1966a)

$$s_t = \frac{\bar{s}_t}{\sqrt{\sum_{s=1}^{N} \gamma_{st}}} \tag{4}$$

Berry and West (1966b) state that the standard deviations should be used as indicators of relative goodness of fit but not as accurate fiducial limit calculations. Their method does not provide for an estimate of the uncertainty of the refractor velocity, V, either.

However, estimates of the uncertainties may be made by employing straightforward multiple linear regression (Draper and Smith, 1966). In the matrix notation of Draper and Smith, the normal equations may be written

$$X'X B = X'Y \tag{5}$$

where X is the coefficient matrix, and X' is its transpose;

B is the vector of parameters to be estimated, the time terms and $1/V$;

Y is the vector of observations (travel times) of length L.

The coefficient matrix is mainly empty. For each of the L rows, of N+1 columns, the value for the last column is the distance between sites i and j (Δ_{ij}), and the values for the first N columns are either 1 or 0, depending on whether data exist or not. Thus, for a given row, the value 1 is in columns p and q, Δ_{pq} is in column N+1, and the values in the remainder of the columns are 0. We may solve for the parameters,

$$B = (X'X)^{-1} X'Y \qquad (6)$$

where the first N rows of B are the time terms, and the $(N+1)^{th}$ row is $1/V$. The product $(X'X)^{-1}\,\delta^2$ is called the variance-covariance matrix. By assuming that the time-term model is correct, and that $s^2 = \delta^2$ (the true variance), estimates of the standard errors of the parameters may be made (Draper and Smith, 1966): the estimate for the i^{th} parameter is $s\sqrt{c_{ii}}$, where c_{ii} is a principal diagonal element of $(X'X)^{-1}$ (Draper and Smith, 1966, pp. 120-121). The sum of the squares (S) of the residuals is

$$S = Y'Y - B'X'Y \qquad (7)$$

(Draper and Smith, 1966), and the mean square about regression is

$$s^2 = \frac{S}{L-(N+1)} \qquad (8)$$

where L-(N+1) is the number of degrees of freedom of the residuals.

We have processed a dozen different data sets, including the primary data set and subsets thereof described below, with the two different techniques. Direct comparisons can be made for three of the five types of estimates of Berry and West; the three are the time terms, the velocity, and the standard deviation of the solution. For these three, the two different data-reduction methods give identical results (tested to 3 decimal places).

DATA AND RESULTS

The P-wave travel times plus related distances of the primary data set (Set I) are displayed on Table 3. Table 4 shows the results of processing Set I by the time-term method, and the travel-time residual for each observation is shown on Table 3; these residuals may be valuable to those interested in details of the solution. The *std. dev. soln.* of Table 4 is the value calculated by equation (2); the *stnd. dev. of t.t. data*, by equation (3); and *stnd. dev. of t.t.*, by equation (4). The *mean residual* is the mean absolute travel-time residual, and *no. of data* is the number of travel times associated with an estimate. The *std. error of V* is the standard error of the velocity, and *D.F.* is the number of degrees of freedom of the residuals.

Note that E13, Table 4, shows a large time term and corresponding travel times (Table 3). The large values are artificial and result from our having no estimate of the origin time of this quarry explosion: errors in the origin time of a source are absorbed in the source time term (see Willmore and Bancroft, 1960; McCollom and Crosson, 1975), if a station is not located at that source.

Ten subsets of Set I were formed and processed in the same way Set I data were processed. This was done to test the stability of the solution for Set I. The subsets are described below.

Set II. E10-DICE THROW (E10-E08) and E12-DICE THROW (E12-E08) removed from Set I. (Absolute time terms estimated from E10-GASBUGGY.)

Set III. E10-GASBUGGY (E10-E11) and E12-DICE THROW (E12-E08) removed from Set I. (Absolute time terms estimated from E10-DICE THROW.)

Set IV. E10-GASBUGGY (E10-E11) and E10-DICE THROW (E10-E08) removed from Set I. (Absolute time terms estimated from E12-DICE THROW.)

Set V. Set I with distances of 600 km or more removed.

Set VI. Set I with distances of 300 km or less removed; the time terms are relative.

Set VII. Set I with data of nearby earthquakes removed.

Set VIII. Data of the southern part of the network, with the absolute time terms estimated from E12-DICE THROW (E12-E08).

Set IX. Data of the northern part of the network; the time terms are relative.

Set X. Data of stations of the Colorado Plateau that lies west of the rift; the time terms are relative.

Set XI. Set I with travel times of associated residuals greater than 0.5 sec removed.

The results of processing the subsets are displayed in tables 5-14, and the notation is that of table 4. Note that Sets VI, IX, and X (tables 9, 12, 13) show only relative[1] time terms. For these subsets, there are inadequate data to estimate the absolute values. The data are summarized by table 15. For the relative time terms, the value of the reference station is marked by an asterisk. Table 15 shows that the time-term values of the subsets commonly are within 0.5 sec of those of Set I, and that the estimate of the velocity for each of them commonly is within 0.1 km/sec of the value for Set I.

[1]See footnote on page 3.

Only one subset (Set IX) shows a larger deviation, 0.3 km/sec. Thus, the estimates show only small variations as a function of data set. Commonly, the standard error of the velocity is 0.1 km/sec or less.

The variation in time terms as a function of velocity (7.5 to 8.5 km/sec) is displayed on figure 4 for representative samples of Set I. Whereas the station time-term values commonly are within 1 sec of those for 8.0 km/sec, the values for the distant sources show much larger variations. Thus, the effect of an error in the estimated refractor velocity would be manifest mainly by changes in time terms of the sources that lie far from the array of sensors, as one might expect.

As emphasized above, and by Berry and West (1966a, b), the standard deviation of the time terms, shown on tables 4-14, are not formal estimates of the uncertainties. Formal estimates of these may be calculated from the principal diagonal of the variance-covariance matrix by the method explained previously. These estimates of the uncertainties of the time terms (standard errors, Draper and Smith, 1966) are shown on table 16. The values are for Set I. The standard errors for the sources commonly are larger than those for the stations. Many of the sources, particularly E07 and E10, lie far from the array of stations. Thus, errors in the estimate of the velocity will be absorbed mainly by the time terms of the sources, as demonstrated above (fig. 4). Indeed, for the sources, the values of the standard errors increase approximately linearily as a function of average epicentral distance, as one might expect. The standard errors for the stations are small, commonly only 0.3 sec or less.

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Scheidegger, A. E., and Willmore, P. L., 1957, The use of a least squares method for the interpretation of data from seismic surveys: *Geophysics, V. 22,* p. 9-22.

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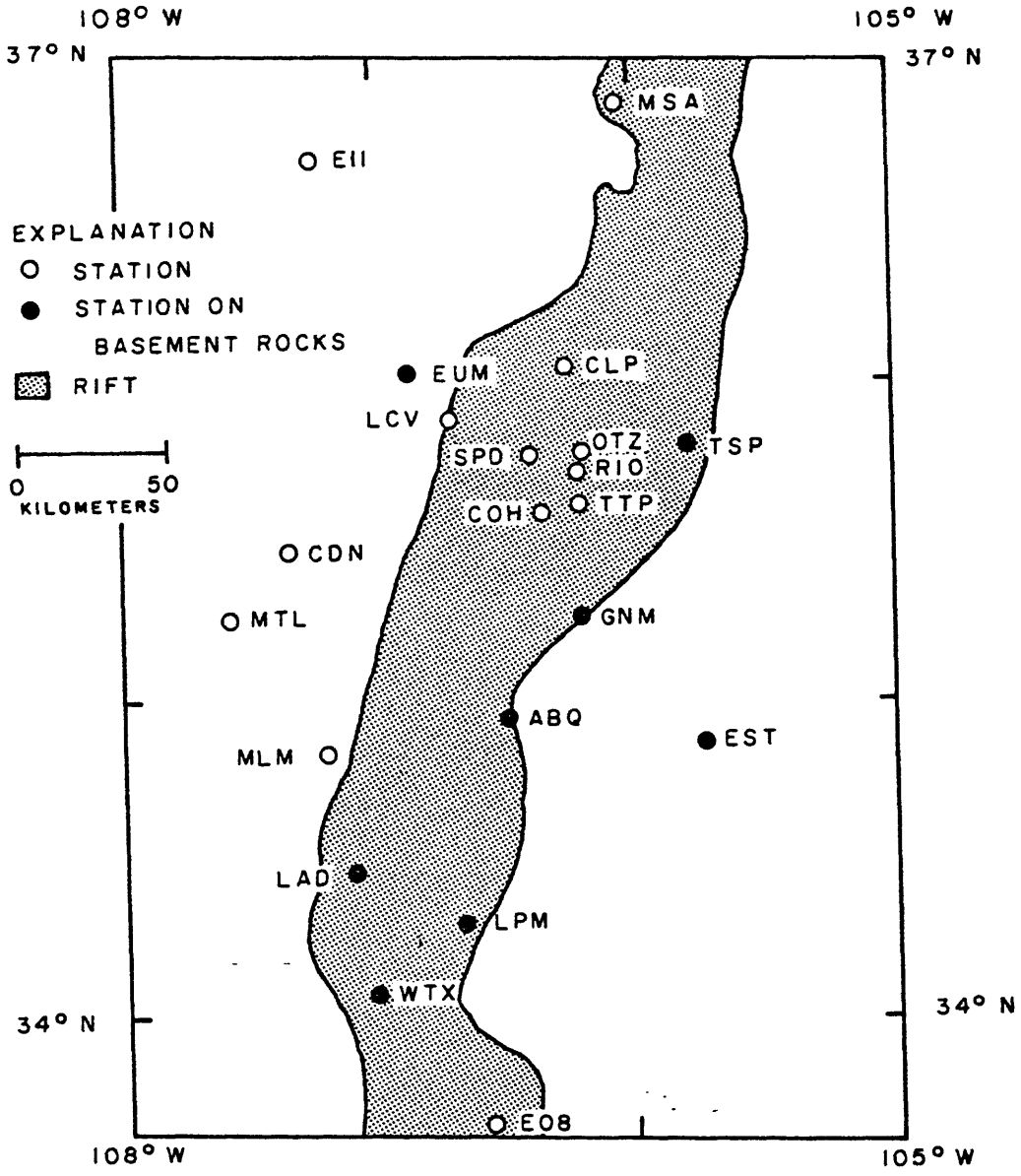

Figure 1. Stations of the network referenced in this report; coordinates are given in table 1. The Rio Grande rift, a structural depression, is shown as gray.

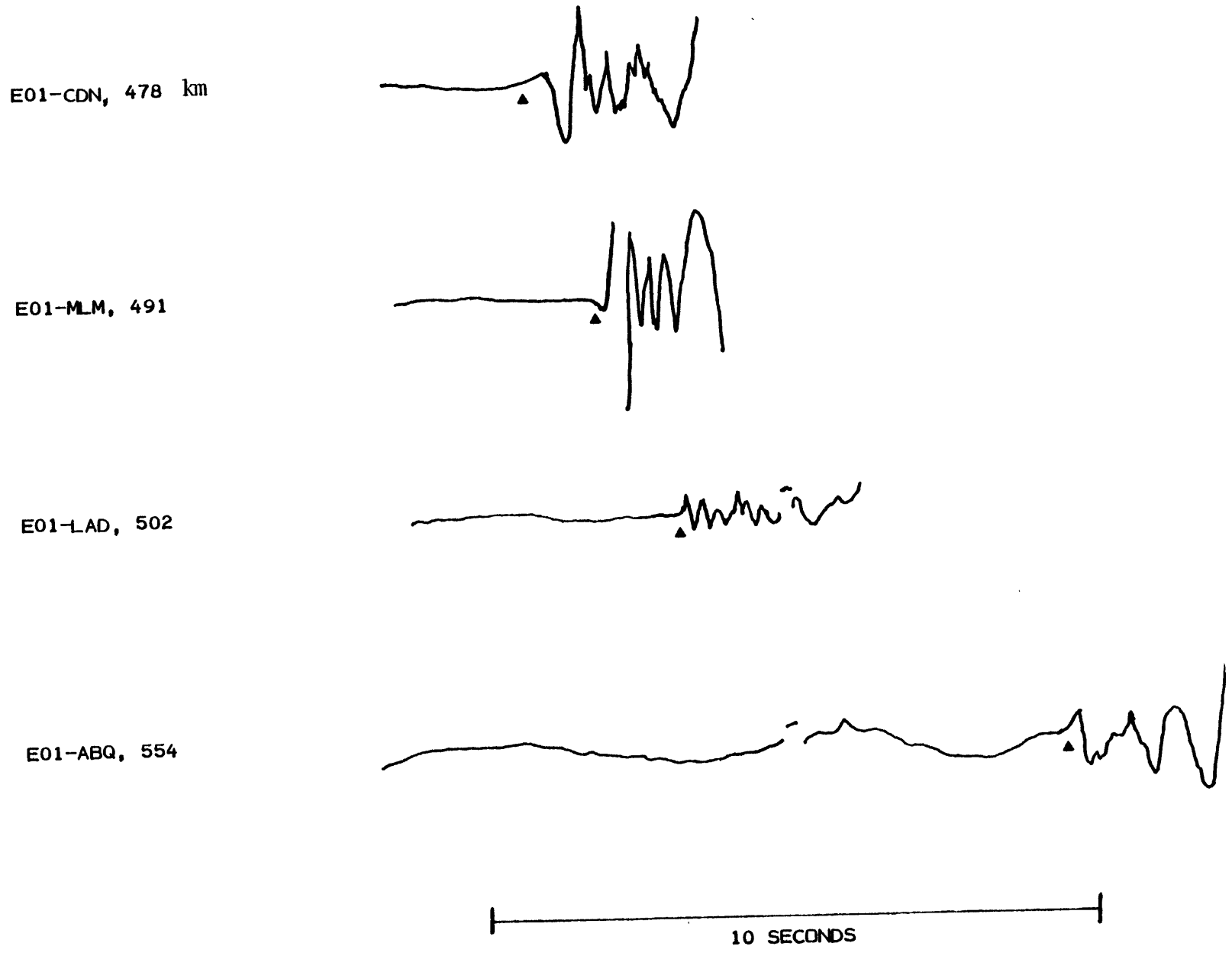

Figure 2. Examples of P-wave onsets that were timed (tracings). The picks are indicated. The event is an earthquake.

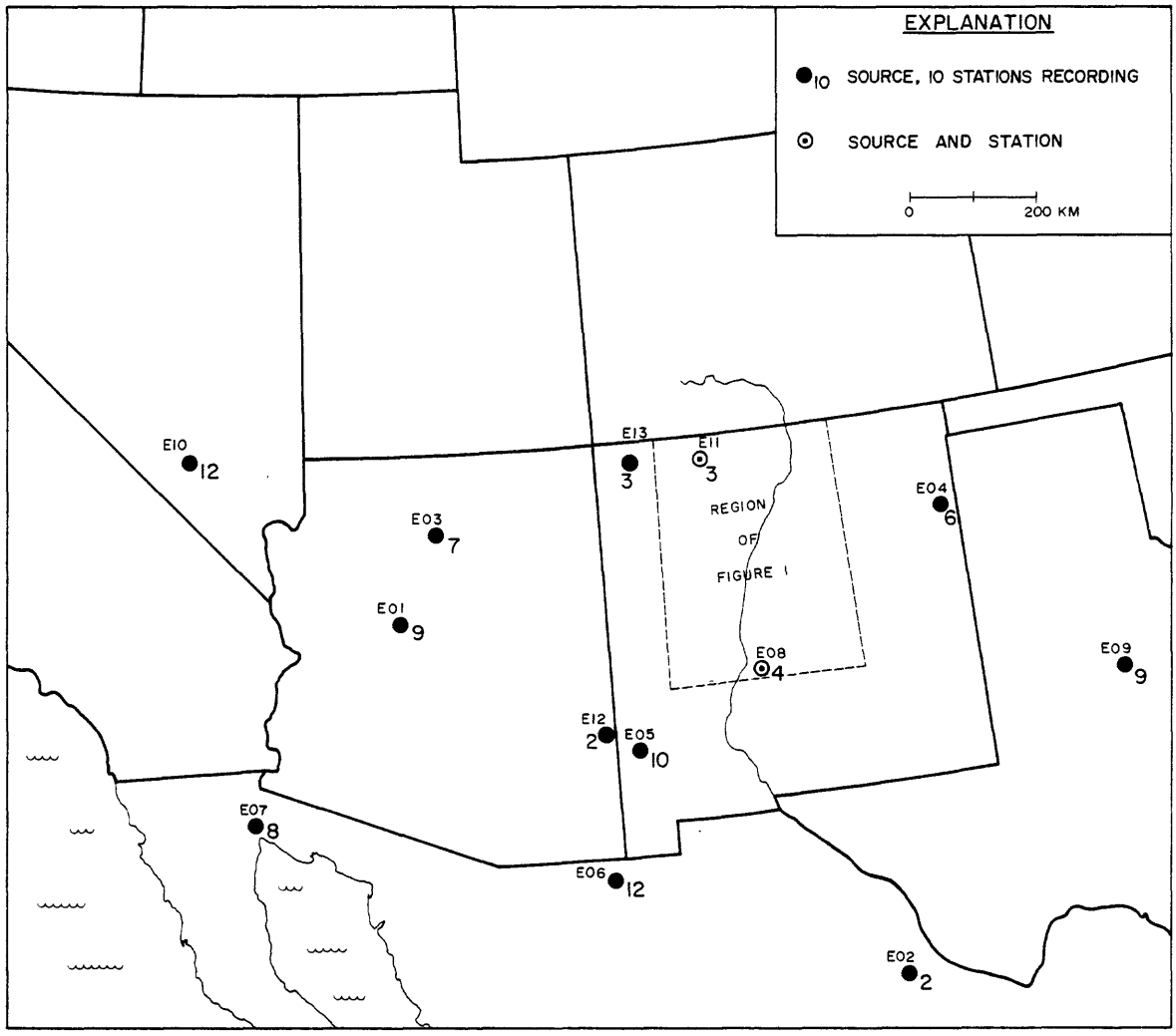

Figure 3. Epicenters of the 13 events. The subscripts indicate the number of stations that recorded the P waves of an event. The event code is noted, as well.

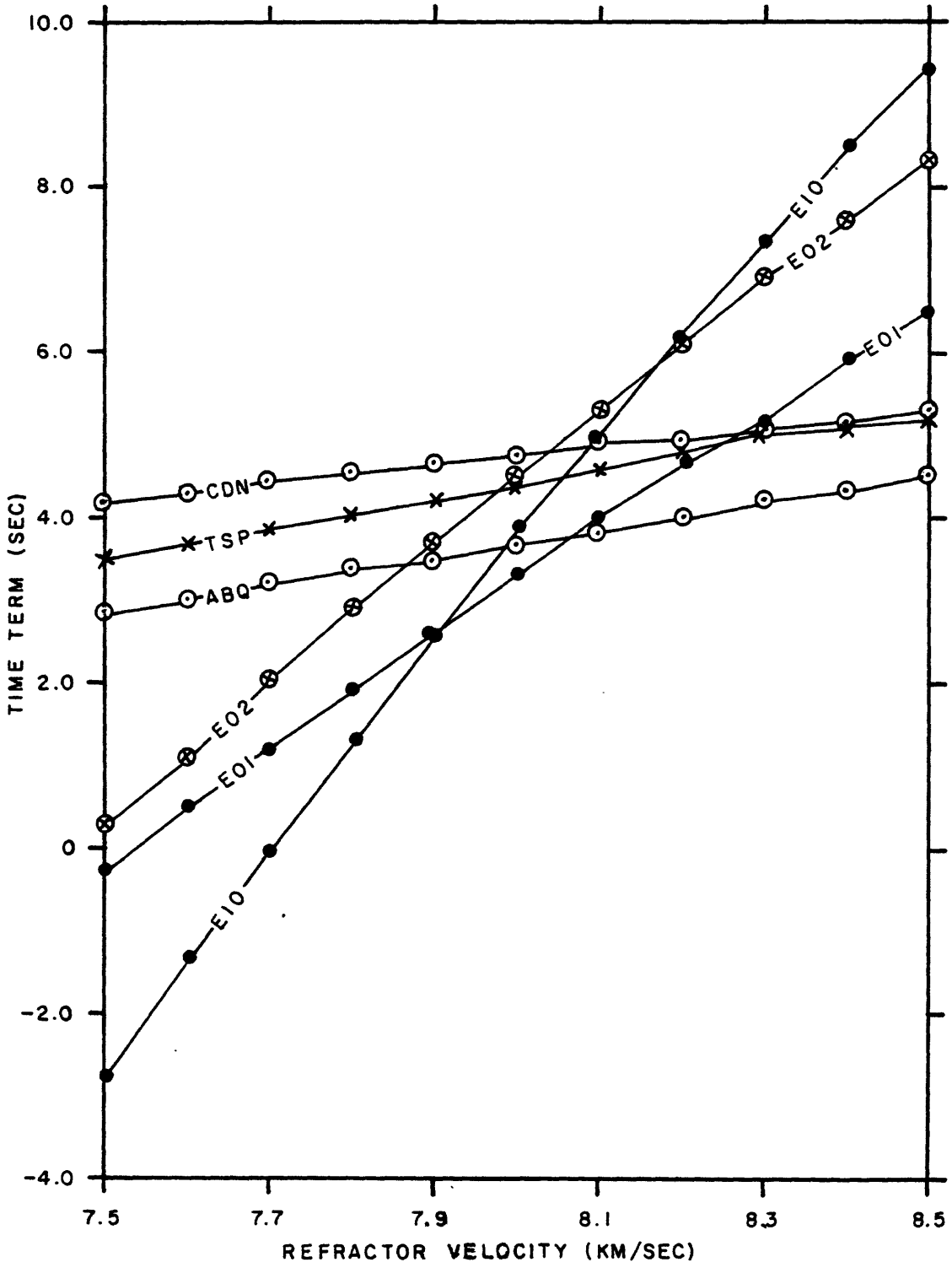

Figure 4. Representative variation of time terms as a function of refractor velocity. Set I values are shown.

Table 1. Stations of the network in New Mexico referenced in this report. The notation ASL means Albuquerque Seismological Laboratory; LAS, Los Alamos Scientific Laboratory; and NMI, New Mexico Institute of Mining and Technology. Note that there are two locations given for WTX: one for all events except E11; the second for E11.

STA	OPERATED BY	LAT	LONG	EL(km)
ABQ	ASL	34° 56.55'	106° 27.45'	1.85
CLP	LAS	36° 2.15'	106° 14.42'	2.60
CDN	ASL	35° 27.28'	107° 20.91'	2.59
COH	ASL	35° 34.81'	106° 18.29'	1.65
E08	ASL	33° 40.68'	106° 31.32'	1.44
E11	ASL	36° 40.70'	107° 13.72'	2.18
EST	ASL	34° 51.87'	105° 43.36'	2.01
EUM	LAS	36° .78'	106° 50.63'	2.75
GNM	ASL	35° 14.98'	106° 11.56'	2.42
LAD	ASL	34° 27.50'	107° 2.25'	1.77
LCV	LAS	35° 52.97'	106° 40.45'	2.64
LPM	ASL	34° 18.46'	106° 38.02'	1.74
MLM	ASL	34° 48.86'	107° 8.70'	2.09
MSA	LAS	36° 52.15'	106° 1.30'	3.32
MTL	LAS	35° 15.10'	107° 36.52'	3.34
OTZ	LAS	35° 45.62'	106° 10.37'	2.09
RIO	LAS	35° 45.28'	106° 10.53'	2.07
SPD	LAS	35° 45.47'	106° 22.16'	2.58
TSP	LAS	35° 47.10'	105° 46.90'	3.43
TTP	LAS	35° 36.56'	106° 12.38'	2.10
WTX	NMI	34° 4.33'	106° 56.75'	1.56
		34° 4.20'	106° 56.58'	1.56

Table 2. Parameters of the 13 events that were sources of the P waves. Numbers E08, E10, E11, E12, E13 are explosions. The origin time for E13 is not known exactly. The remainder of the events are earthquakes.

Code	Region	Location	h	Origin Time
			km	UTC
E01	W. Arizona	34.655 N 112.500 W	12	Feb. 4, 1976 00:04:58.10
E02	Texas-Mexico Border	29.436 N 104.903 W	5	March 9, 1976 06:49:40.00
E03	N. Central Arizona	35.910 N 111.788 W	5	Feb. 28, 1976 20:53:58.50
E04	N.E. New Mex.	35.618 N 103.278 W	5	June 24, 1976 15:27:32.00
E05	S.W. New Mex.	32.830 N 108.663 W	27	Dec. 3, 1975 10:12:22.80
E06	E. Arizona-Mexico Border	31.024 N 109.227 W	5	June 8, 1977 13:09:07.40
E07	W. Arizona-Mexico Border	31.983 N 114.783 W	8	Dec. 7, 1976 12:59:56.30
E08	S. Central New Mexico	33.679 N 106.521 W	0	Oct. 6, 1976 14:00:00.05
E09	Snyder, Texas	33.020 N 100.720 W	8	June 16, 1978 11:46:53.20
E10	S. Nevada	37.276 N 116.357 W	0	August 31, 1978 14:00:00.00
E11	N.W. New Mex.	36.678 N 107.208 W	0	Dec. 10, 1967 19:30:00.10
E12	S.E. Arizona	33.097 N 109.369 W	0	August 31, 1978 22:29:53.64
E13	N.W. New Mex.	36.584 N 108.529 W	0	August 30, 1978 $\sim$23:23:30

Table 3. The sites, estimated time terms, distances, travel times, and travel-time residuals for Set I. The estimated velocity of the refractor and standard deviation of the solution are shown as well. The distances are those calculated by using DISTAZ, unpublished computer program of the Office of Earthquake Studies, Menlo Park.

SET I. PRIMARY DATA SET.

VELOCITY = 6.02KM/SEC STD.DEV.SOLN. = .365E+00 SEC

SITE	TIME TERM SEC	SITE	TIME TERM SEC	DIST KM	TIME SEC	RESID SEC
CDN	4.78	E01	3.40	478.22	67.82	-.027
LAD	3.98	E01	3.40	501.78	70.21	.221
MLM	3.94	E01	3.40	490.71	68.90	.330
MTL	4.98	E01	3.40	451.62	65.06	.328
GNM	4.06	E01	3.40	573.81	80.05	.248
ABQ	3.75	E01	3.40	553.62	76.64	.388
RIO	5.05	E01	3.40	588.60	81.12	-.774
SPD	4.53	E01	3.40	571.42	79.03	-.201
EUM	4.62	E01	3.40	535.78	74.36	-.514
E01	3.40	CDN	4.78	478.22	67.82	-.027
E05	1.03	CDN	4.78	315.37	45.34	.189
E06	3.87	CDN	4.78	521.64	73.87	.138
E10	3.99	CDN	4.78	833.03	112.40	-.300
E01	3.40	LAD	3.98	501.78	70.21	.221
E06	3.87	LAD	3.98	432.62	61.83	.002
E07	6.52	LAD	3.98	772.23	106.46	-.389
E10	3.99	LAD	3.98	897.42	120.25	.314
E11	3.96	LAD	3.98	246.49	38.72	.024
E13	35.59	LAD	3.98	271.69	73.32	-.172
E01	3.40	MLM	3.94	490.71	68.90	.330
E03	4.38	MLM	3.94	439.11	62.87	-.240
E04	2.99	MLM	3.94	363.18	51.83	-.418
E05	1.03	MLM	3.94	261.14	37.66	.111
E06	3.87	MLM	3.94	463.27	65.77	.156
E07	6.52	MLM	3.94	776.60	106.86	-.496
E10	3.99	MLM	3.94	873.49	117.24	.327
E13	35.59	MLM	3.94	232.90	68.82	.230
E01	3.40	MTL	4.98	451.62	65.06	.328
E03	4.38	MTL	4.98	395.77	57.58	.086
E05	1.03	MTL	4.98	285.71	41.67	.016
E08	4.17	MTL	4.98	201.05	33.71	-.528
E10	3.99	MTL	4.98	817.29	111.04	.099

Table 3 (Continued)

SITE	TIME TERM SEC	SITE	TIME TERM SEC	DIST KM	TIME SEC	RESID SEC
E01	3.40	GNM	4.06	579.81	80.05	.248
E03	4.38	GNM	4.06	512.38	72.57	.203
E05	1.03	GNM	4.06	352.23	48.74	-.290
E06	3.87	GNM	4.06	547.52	76.08	-.161
E01	3.40	ABQ	3.75	553.82	76.64	.388
E02	4.66	ABQ	3.75	627.94	86.60	-.155
E03	4.38	ABQ	3.75	495.79	69.80	-.190
E04	2.99	ABQ	3.75	298.81	44.52	.494
E05	1.03	ABQ	3.75	310.69	43.34	-.200
E06	3.87	ABQ	3.75	505.82	70.63	-.101
E07	6.52	ABQ	3.75	840.35	115.21	.092
E10	3.99	ABQ	3.75	927.71	123.02	-.466
E11	3.96	ABQ	3.75	204.16	33.38	.195
E13	35.59	ABQ	3.75	261.27	71.88	-.058
E01	3.40	RIO	5.05	588.60	81.12	-.774
E05	1.03	RIO	5.05	397.11	55.57	-.055
E07	6.52	RIO	5.05	899.15	124.38	.623
E08	4.17	RIO	5.05	232.43	38.43	.206
E01	3.40	SPO	4.53	571.42	79.03	-.201
E03	4.38	SPO	4.53	489.84	70.09	.059
E04	2.99	SPO	4.53	280.25	42.28	-.214
E05	1.03	SPO	4.53	387.38	54.06	.169
E06	3.87	SPO	4.53	588.49	81.74	-.089
E08	4.17	SPO	4.53	231.03	37.49	-.040
E09	4.15	SPO	4.53	601.64	84.06	.316
E01	3.40	EUM	4.62	535.78	74.36	-.514
E03	4.38	EUM	4.62	446.11	64.64	-.025
E10	3.99	EUM	4.62	861.84	116.68	.539
ABQ	3.75	E02	4.66	627.94	86.60	-.155
LPM	3.42	E02	4.66	564.45	78.66	.155
E02	4.66	LPM	3.42	564.45	78.66	.155
E05	1.03	LPM	3.42	249.73	35.64	.036
E06	3.87	LPM	3.42	437.92	62.24	.310
E07	6.52	LPM	3.42	802.60	109.67	-.409
E09	4.15	LPM	3.42	566.70	78.18	-.092

Table 3 (Continued)

SITE	TIME TERM SEC	SITE	TIME TERM SEC	DIST KM	TIME SEC	RESID SEC
MLM	3.94	E03	4.38	439.11	62.87	-.240
MIL	4.98	E03	4.38	385.77	57.58	.086
GNM	4.06	E03	4.38	512.38	72.57	.203
ABQ	3.75	E03	4.38	495.79	69.80	-.190
SPD	4.53	E03	4.38	489.64	70.09	.059
EUM	4.62	E03	4.38	446.11	64.64	-.025
LCV	4.74	E03	4.38	461.67	66.83	.106
E03	4.38	LCV	4.74	461.67	66.83	.106
E05	1.03	LCV	4.74	384.91	53.88	.089
E10	3.99	LCV	4.74	879.92	118.32	-.195
MLM	3.94	E04	2.99	363.18	51.83	-.418
ABQ	3.75	E04	2.99	298.61	44.52	.494
SPD	4.53	E04	2.99	280.25	42.28	-.214
EST	4.02	E04	2.99	237.70	37.08	.413
TTP	4.90	E04	2.99	265.31	40.72	-.275
TSP	4.44	E04	2.99	227.35	35.80	-.001
E04	2.99	EST	4.02	237.70	37.08	.413
E06	3.87	EST	4.02	537.37	75.00	.066
E07	6.52	EST	4.02	900.82	122.62	-.309
E09	4.15	EST	4.02	505.65	71.08	-.170
E04	2.99	TTP	4.90	265.31	40.72	-.275
E05	1.03	TTP	4.90	382.48	53.58	-.065
E06	3.87	TTP	4.90	581.14	81.07	-.207
E07	6.52	TTP	4.90	883.84	123.08	.638
E08	4.17	TTP	4.90	216.07	36.05	.021
E09	4.15	TTP	4.90	580.83	81.40	-.113
E04	2.99	TSP	4.44	227.35	35.80	-.001
E09	4.15	TSP	4.44	557.28	78.32	.203
E10	3.99	TSP	4.44	960.94	128.12	-.203
CON	4.78	E05	1.03	315.37	45.34	.189
MLM	3.94	E05	1.03	261.14	37.66	.111
MIL	4.98	E05	1.03	285.71	41.67	.016
GNM	4.06	E05	1.03	352.23	48.74	-.290
ABQ	3.75	E05	1.03	310.69	43.34	-.200
RIO	5.05	E05	1.03	397.11	55.57	-.055
SPD	4.53	E05	1.03	387.38	54.06	.169
LPM	3.42	E05	1.03	249.73	35.64	.036
LCV	4.74	E05	1.03	384.91	53.88	.089
TTP	4.90	E05	1.03	382.48	53.58	-.065

Table 3 (Continued)

SITE	TIME TERM SEC	SITE	TIME TERM SEC	DIST KM	TIME SEC	RESID SEC
CDN	4.78	E06	3.87	521.64	73.87	.138
LAD	3.98	E06	3.87	432.62	61.83	.002
MLM	3.94	E06	3.87	463.27	65.77	.156
GNM	4.06	E06	3.87	547.52	76.08	-.161
ABQ	3.75	E06	3.87	505.82	70.63	-.101
SPD	4.53	E06	3.87	588.49	81.74	-.089
LPM	3.42	E06	3.87	437.92	62.24	.310
EST	4.02	E06	3.87	537.37	75.00	.066
TTP	4.90	E06	3.87	581.14	81.07	-.207
COH	4.86	E06	3.87	573.93	80.39	.052
CLP	5.17	E06	3.87	621.18	86.38	-.164
E06	3.87	COH	4.86	573.93	80.39	.052
E09	4.15	COH	4.86	537.23	82.22	-.052
E06	3.87	CLP	5.17	621.18	86.38	-.164
E09	4.15	CLP	5.17	607.13	85.23	.164
LAD	3.98	E07	6.52	772.23	106.46	-.339
MLM	3.94	E07	6.52	776.60	106.86	-.496
ABQ	3.75	E07	6.52	840.35	115.21	.092
RIO	5.05	E07	6.52	899.15	124.38	.623
LPM	3.42	E07	6.52	802.60	109.67	-.409
EST	4.02	E07	6.52	900.82	122.62	-.309
TTP	4.90	E07	6.52	889.84	123.08	.638
MSA	4.25	E07	6.52	970.10	132.06	.251
E07	6.52	MSA	4.25	970.10	132.06	.251
E10	3.99	MSA	4.25	919.79	122.75	-.251
MTL	4.98	E08	4.17	201.05	33.71	-.528
RIO	5.05	E08	4.17	232.43	38.43	.206
SPD	4.53	E08	4.17	231.03	37.49	-.040
TTP	4.90	E08	4.17	216.07	36.05	.021
E10	3.99	E08	4.17	977.15	130.62	.544
E12	3.36	E08	4.17	272.62	41.34	-.203
SPD	4.53	E09	4.15	601.64	84.06	.316
LPM	3.42	E09	4.15	566.70	78.18	-.092
EST	4.02	E09	4.15	505.65	71.08	-.170
TTP	4.90	E09	4.15	580.83	81.40	-.113
TSP	4.44	E09	4.15	557.23	78.32	.203
COH	4.86	E09	4.15	587.23	82.22	-.052
CLP	5.17	E09	4.15	607.13	85.23	.164
WTX	3.77	E09	4.15	589.30	80.88	-.624
OTZ	4.62	E09	4.15	586.26	82.28	.367

Table 3 (Continued)

SITE	TIME TERM SEC	SITE	TIME TERM SEC	DIST KM	TIME SEC	RESID SEC
E09	4.15	WTX	3.77	589.80	80.88	-.624
E10	3.99	WTX	3.77	922.69	123.18	.300
E11	3.96	WTX	3.77	290.35	44.08	.121
E12	3.36	WTX	3.77	249.74	38.49	.203
E09	4.15	OTZ	4.62	586.26	82.28	.367
E10	3.99	OTZ	4.62	927.14	123.92	-.367
CON	4.78	E10	3.99	833.03	112.40	-.300
LAD	3.98	E10	3.99	897.42	120.25	.314
MLM	3.94	E10	3.99	873.49	117.24	.327
MTL	4.98	E10	3.99	817.29	111.04	.099
ABQ	3.75	E10	3.99	927.71	123.02	-.466
EUM	4.62	E10	3.99	861.84	116.68	.539
LCV	4.74	E10	3.99	879.92	118.32	-.195
TSP	4.44	E10	3.99	960.94	128.12	-.203
MSA	4.25	E10	3.99	919.79	122.75	-.251
E08	4.17	E10	3.99	977.15	130.62	.544
WTX	3.77	E10	3.99	922.69	123.18	.300
OTZ	4.62	E10	3.99	927.14	123.92	-.367
E11	3.96	E10	3.99	815.20	109.32	-.341
LAD	3.98	E11	3.96	246.49	38.72	.024
ABQ	3.75	E11	3.96	204.16	33.38	.195
WTX	3.77	E11	3.96	290.35	44.08	.121
E10	3.99	E11	3.96	815.20	109.32	-.341
E08	4.17	E12	3.36	272.62	41.34	-.203
WTX	3.77	E12	3.36	249.74	38.49	.203
LAD	3.98	E13	35.59	271.89	73.32	-.172
MLM	3.94	E13	35.59	232.90	68.82	.230
ABQ	3.75	E13	35.59	261.27	71.88	-.058

Table 4. Results of processing Set I by the time-term method. See text for meaning of the parameters that are described. The absolute time terms are estimated from the three pairs: E10-E08, E12-E08, and E10-E11.

NUMBER OF SITES IS 32

VELOCITY = 8.02KM/SEC STD.DEV.SOLN. = .365E+00 SEC

Std. Err. V 0.08 km/sec DF 54

SITE ID	TIME TERM SEC	STND.DEV. OF T.T.DATA SEC	STND.DEV. OF T.T. SEC	MEAN RESIDUAL SEC	NO OF DATA
E01	3.40	.42	.14	.34	9
CON	4.78	.22	.11	.16	4
LAO	3.38	.25	.10	.19	6
MLM	3.94	.33	.12	.29	8
MTL	4.98	.32	.14	.21	5
GNM	4.06	.27	.13	.23	4
ABQ	3.75	.29	.09	.23	10
RIO	5.05	.59	.29	.41	4
SPD	4.53	.19	.07	.16	7
EUM	4.62	.53	.30	.36	3
E02	4.66	.22	.16	.16	2
LPM	3.42	.27	.12	.20	5
E03	4.38	.16	.06	.13	7
LCV	4.74	.17	.10	.13	3
E04	2.99	.38	.15	.30	6
EST	4.02	.32	.16	.24	4
TTP	4.30	.33	.13	.22	6
TSP	4.44	.20	.12	.14	3
E05	1.03	.16	.05	.12	10
E06	3.87	.16	.05	.13	11
COH	4.86	.07	.05	.05	2
CLP	5.17	.23	.16	.16	2
E07	6.52	.47	.17	.40	8
MSA	4.25	.35	.25	.25	2
E08	4.17	.36	.15	.26	6
E09	4.15	.31	.10	.23	9
WTX	3.77	.42	.21	.31	4
OTZ	4.62	.52	.37	.37	2
E10	3.99	.36	.10	.33	13
E11	3.96	.24	.12	.17	4
E12	3.36	.29	.20	.20	2
E13	35.59	.21	.12	.15	3

Table 5. Results of processing Set II by the time-term method. See text for meaning of parameters that are described. The absolute time terms are estimated from the pair E10-E11. This is a test for the stability of the absolute values of the time terms.

NUMBER OF SITES IS 32

VELOCITY = [illegible] STD.DEV.OBSN. = .3531+00 SEC

Std. Err. V 0.09 km/sec DF 52

SITE ID	T.T. TERM SEC	STND.DEV. OF T.T.DATA SEC	STND.DEV. OF T.T. SEC	MEAN RESIDUAL SEC	NO OF DATA
E01	3.71	.42	.14	.34	9
CDN	3.19	.24	.12	.19	4
LAD	4.33	.28	.12	.21	6
MLM	4.32	.32	.11	.27	8
MTL	3.38	.25	.11	.16	3
GNM	4.51	.28	.14	.24	4
ABQ	-.14	.29	.09	.21	10
RIO	3.34	.59	.30	.43	-
SPD	5.03	.23	.08	.16	7
EUM	5.02	.51	.30	.35	7
E02	4.37	.20	.14	.14	2
LPM	3.73	.28	.11	.18	9
E03	4.42	.15	.06	.11	7
LOV	3.17	.19	.11	.15	5
E04	2.39	.36	.13	.31	6
EST	4.42	.30	.15	.24	4
TTP	3.36	.34	.14	.24	6
TSP	4.33	.17	.10	.12	3
E05	.93	.16	.05	.12	10
E06	3.37	.15	.05	.13	11
COH	3.30	.09	.07	.07	2
CLP	3.55	.19	.14	.14	2
E07	3.94	.47	.16	.40	4
MSH	-.74	.41	.23	.23	2
E08	3.33	.25	.14	.20	-
E09	4.23	.25	.09	.22	9
WTX	4.03	.39	.19	.29	4
OTZ	5.00	.50	.36	.36	2
E10	-.44	.34	.13	.29	12
E11	3.35	.07	.04	.04	4
E12	3.43	.00	.00	.00	1
E13	33.43	.13	.13	.13	3

Table 6. Results of processing Set III by the time-term method. See text for meaning of parameters that are described. The absolute time terms are estimated from the pair E10-E08. This is a test for the stability of the absolute values of the time terms.

NUMBER OF SITES IS 31

VELOCITY = 5.08KM/SEC STD.DEV.SOLN. = .353E+00 SEC

Std. Err. V 0.08 km/sec DF 52

SITE ID	TIME TERM	STND.DEV. OF T.T.DATA	STND.DEV. OF T.T.	MEAN RESIDUAL	NO OF DATA
	SEC	SEC	SEC	SEC	
E01	+.13	.42	.14	.34	9
CDN	4.48	.24	.12	.19	4
LAO	3.95	.23	.12	.21	6
MLM	3.64	.32	.11	.27	8
MTL	+.63	.25	.11	.16	5
GNM	3.83	.28	.14	.24	4
ABQ	3.46	.29	.09	.21	10
RLO	4.36	.59	.30	.43	4
SPO	4.32	.20	.08	.16	7
EUM	4.34	.51	.30	.35	3
E02	5.55	.20	.14	.14	2
LPM	3.10	.26	.11	.18	5
E03	5.10	.15	.06	.11	7
LCV	4.43	.19	.11	.15	3
E04	3.53	.35	.15	.31	6
EST	3.74	.30	.15	.24	4
TTP	+.08	.34	.14	.24	6
TSP	4.13	.17	.10	.12	3
E05	1.01	.15	.05	.12	10
E06	+.65	.15	.05	.13	11
COH	+.62	.09	.07	.07	2
CLP	4.37	.19	.14	.14	2
E07	7.62	.47	.16	.40	8
MSA	+.06	.41	.29	.29	2
E08	+.53	.24	.11	.16	5
E09	4.97	.25	.09	.22	9
WTX	3.+1	.47	.27	.34	3
OTZ	+.38	.50	.30	.36	2
E10	5.12	.34	.10	.29	12
E11	4.04	.08	.05	.06	3
E13	36.1+	.18	.10	.13	3

Table 7. Results of processing Set IV by the time-term method. See text for meaning of parameters that are described. The absolute time terms are estimated from the pair E12-E08. This is a test for the stability of the absolute values of the time terms.

NUMBER OF SITES IS 32

VELOCITY = [illegible] KM/SEC STD.DEV.SOLN. = .353E+00 SEC

Std. Err. V 0.08 km/sec DF 52

SITE ID	T.T. TERM SEC	STND.DEV. OF T.T.DATA SEC	STND.DEV. OF T.T. SEC	MEAN RESIDUAL SEC	NO OF DATA
E01	3.6-	.-2	.1-	.3-	3
CDN	5.03	.2-	.12	.19	4
LAD	4.2.	.26	.12	.21	6
MLM	+.27	.32	.11	.27	[illegible]
MTL	5.2-	.26	.11	.16	[illegible]
GNM	-.3[illegible]	.25	.14	.24	4
ABQ	4.32	.29	.19	.21	10
RIO	3.41	.53	.30	.43	4
SPD	-.57	.20	.03	.16	7
ELM	-.90	.51	.30	.35	3
E02	4.39	.20	.14	.14	2
LPM	3.[illegible]	.26	.11	.18	5
E03	-.3-	.15	.16	.11	7
LCV	3.0-	.19	.11	.15	3
E04	2.97	.36	.15	.31	6
EST	-.2[illegible]	.30	.15	.24	4
TTP	3.23	.34	.14	.2-	6
TSP	+.[illegible]3	.17	.10	.12	3
E05	1.06	.16	.05	.12	10
E06	4.1[illegible]	.15	.05	.13	11
COH	5.1[illegible]	.09	.07	.07	2
CLP	3.02	.19	.14	.1-	2
E07	7.07	.47	.16	.40	[illegible]
MSA	-.[illegible]1	.41	.[illegible]	.2[illegible]	2
E08	3.[illegible]0	.2-	.11	.16	3
E09	-.-1	.2[illegible]	.[illegible]	.22	3
WTX	3.96	.39	.19	.25	4
UTZ	-.[illegible]4	.[illegible]0	.[illegible]0	.3[illegible]	2
E10	4.57	.35	.11	.32	11
E11	-.[illegible]9	.[illegible]	.[illegible]3	.[illegible]6	3
E12	3.61	.[illegible]3	.[illegible]0	.[illegible]3	2
E13	35.[illegible]3	.1[illegible]	.10	.13	3

Table 8. Results of processing Set V by the time-term method. See text for meaning of parameters that are described. Data with distances of 600 km or more have been removed from Set I ($200 < \Delta < 1000$ km). Therefore absolute values of time terms are estimated from E12-E08. This is a test for distance-related stability of the velocity and time terms.

NUMBER OF SITES IS 25

VELOCITY = 8.12KM/SEC STD.DEV.OBS. = .279E+00 SEC

Std. Err. V 0.09 km/sec DF 33

SITE ID	TIME TERM SEC	STND.DEV. OF T.T.DATA SEC	STND.DEV. OF T.T. SEC	MEAN RESIDUAL SEC	NO OF DATA
E01	5.5-	.32	.11	.2[illegible]	9
CDN	5.28	.19	.11	.15	3
LAO	-.35	.13	.07	.10	4
MLM	-.51	.22	.08	.17	6
MTL	5.30	.30	.15	.21	4
GNM	4.55	.25	.13	.22	4
ABQ	4.25	.31	.12	.24	7
RIC	5.35	.52	.30	.39	3
SPO	4.98	.15	.07	.12	5
ECM	-.75	.3-	.24	.24	2
E03	-.9[illegible]	.23	.08	.16	7
LCV	5.31	.07	.05	.05	2
E04	2.92	.32	.13	.26	6
EST	4.62	.23	.14	.17	3
TTP	5.31	.13	.0[illegible]	.10	5
TSP	5.0[illegible]	.30	.21	.21	2
E05	1.0[illegible]	.19	.06	.15	10
LPM	3.9[illegible]	.15	.05	.11	3
E06	4.20	.10	.03	.08	10
COH	5.-1	.02	.01	.01	2
E08	4.[illegible]0	.29	.13	.18	5
E09	-.3[illegible]	.17	.07	.14	6
WTX	4.0[illegible]	.19	.11	.13	3
E11	4.[illegible]	.17	.10	.13	3
E12	3.[illegible]9	.00	.00	.00	2
E13	35.55	.17	.10	.13	3

Table 9. Results of processing Set VI by the time-term method. See text for meaning of parameters that are described. Data with distances of 300 km or more have been removed from Set I ($200 < \Delta < 1000$ km). Because this criterion excludes E08 and E11, the time terms have relative values only. This is a test for the effect of our inadvertently mixing Pg and Pn data in Set I.

NUMBER OF SITES IS 27

VELOCITY = 7.95KM/SEC STD.DEV.SOLN. = .372E+00 SEC

Std. Err. V 0.13 km/sec DF 37

SITE ID	TIME TERM SEC	STND.DEV. OF T.T.DATA SEC	STND.DEV. OF T.T. SEC	MEAN RESIDUAL SEC	NO OF DATA
E01	8.22	.40	.13	.32	9
CON	-.56	.19	.10	.13	4
LAD	-1.32	.31	.15	.22	4
MLM	-1.38	.37	.17	.31	5
MTL	-.12	.14	.08	.10	3
GNM	-1.34	.27	.13	.23	4
ABQ	-1.73	.25	.09	.16	8
RIO	-.45	.67	.39	.46	3
SPD	-.44	.17	.07	.14	6
EUM	-.72	.54	.31	.36	3
E02	9.50	.20	.14	.14	2
LPM	-1.98	.34	.17	.27	4
E03	9.26	.15	.06	.12	7
LCV	-.62	.16	.09	.12	3
E05	6.05	.15	.06	.11	7
TTP	-.49	.38	.19	.28	4
E06	8.75	.20	.06	.16	11
COH	-.61	.08	.06	.06	2
EST	-1.55	.21	.12	.14	3
CLP	-.33	.24	.17	.17	2
E07	11.08	.46	.16	.39	8
MSA	-1.21	.25	.17	.17	2
E09	9.03	.26	.09	.20	9
WTX	-1.83	.71	.50	.50	2
OTZ	-.81	.46	.33	.33	2
TSP	-1.00	.28	.20	.20	2
E10	8.45	.34	.10	.29	11

Table 10. Results of processing Set VII by the time-term method. See text for meaning of parameters that are described. Data of nearby earthquakes (E02, E04, E05, E06, E07) have been removed from Set I. This is a test for conceivable large bias associated with them.

NUMBER OF SITES IS 27

VELOCITY = 7.92KM/SEC STD.DEV.SOLN. = .425E+00 SEC

Std. Err. V 0.13 km/sec DF 29

SITE ID	TIME TERM SEC	STND.DEV. OF T.T.DATA SEC	STND.DEV. OF T.T. SEC	MEAN RESIDUAL SEC	NO OF DATA
E01	2.72	.43	.14	.35	9
CDN	4.54	.23	.16	.16	2
LAD	3.83	.28	.12	.23	5
MLM	3.87	.37	.17	.31	5
MTL	4.95	.38	.19	.27	4
GNM	4.09	.02	.01	.01	2
ABQ	3.57	.32	.13	.23	6
RIO	4.67	.70	.41	.54	3
SPD	4.39	.17	.09	.12	4
EUM	4.51	.52	.30	.35	3
E03	3.77	.15	.06	.11	7
LCV	4.56	.26	.19	.19	2
E07	5.44	.35	.12	.28	8
MSA	3.93	.23	.16	.16	2
TTP	4.87	.37	.21	.25	3
LPM	2.97	.15	.11	.11	2
EST	3.55	.20	.14	.14	2
E08	3.91	.37	.15	.26	6
E09	3.52	.33	.12	.25	8
WTX	3.51	.44	.22	.32	4
COH	4.53	.00	.00	.00	1
OTZ	4.36	.49	.35	.35	2
TSP	4.18	.33	.23	.23	2
E10	2.81	.33	.09	.29	13
E11	3.81	.21	.10	.15	4
E12	3.22	.31	.22	.22	2
E13	35.33	.19	.11	.13	3

Table 11. Results of processing Set VIII by the time-term method. See text for meaning of parameters that are described. Data of the northern part of the network (RIO, SPD, EUM, LCV, TTP, TSP, COP, MSA, OTZ, E11) have been removed from Set I. Absolute time terms are estimated from E12-E08. This is a test for the stability of the solution as related to geographic region of the stations.

NUMBER OF SITES IS 23

VELOCITY = 3.11KM/SEC STD.DEV.SOLN. = .259E+00 SEC

Std. Err. V 0.08 km/sec DF 29

SITE ID	TIME TERM	STND.DEV. OF T.T.DATA	STND.DEV. OF T.T.	MEAN RESIDUAL	NO OF DATA
	SEC	SEC	SEC	SEC	
E01	-.36	.14	.06	.10	6
CDN	4.73	.34	.17	.29	4
LAD	3.[illegible]	.15	.07	.11	6
MLM	3.93	.24	.09	.20	3
MTL	5.02	.03	.01	.02	5
GNM	4.13	.22	.11	.17	4
ABQ	3.[illegible]	.27	.08	.20	10
E02	3.41	.03	.06	.06	2
LPM	3.53	.15	.07	.13	5
E03	4.[illegible]	.21	.11	.16	4
E04	3.50	.39	.23	.28	3
EST	4.21	.04	.02	.03	4
E05	1.34	.21	.06	.16	5
E06	4.56	.14	.05	.12	3
COH	3.15	.15	.11	.11	2
E07	7.31	.27	.12	.19	5
E08	3.[illegible]0	.00	.00	.00	2
E09	-.[illegible]3	.13	.10	.14	4
WTX	3.07	.21	.10	.13	4
E10	5.27	.34	.14	.29	5
E11	4.3[illegible]	.03	.02	.03	3
E12	3.92	.00	.00	.00	2
E13	3[illegible].87	.15	.11	.14	3

Table 12. Results of processing Set IX by the time-term method. See text for meaning of parameters that are described. Data of the southern part of the network (CDN, LAD, MLM, MTL, GNM, ABQ, LPM, EST, COH, WTX, station E08) have been removed from Set I. The time terms are relative. This is a test for the stability of the solution as related to geographic region of the stations.

NUMBER OF SITES IS 16

VELOCITY = 6.33KM/SEC STD.DEV.SOLN. = .139E+00 SEC

Std. Err. V 0.17 km/sec DF 14

SITE ID	TIME TERM	STND.DEV. OF T.T.DATA	STND.DEV. OF T.T.	MEAN RESIDUAL	NO OF DATA
	SEC	SEC	SEC	SEC	
E01	10.36	.22	.13	.17	3
R10	-.57	.12	.06	.09	4
SPD	-.64	.15	.06	.11	7
EUM	-.61	.24	.12	.17	6
E03	11.36	.15	.06	.12	3
LCV	-.60	.15	.10	.14	3
E04	9.53	.07	.04	.05	3
TTP	-.63	.09	.04	.06	5
TSP	-1.15	.07	.04	.05	4
E05	3.33	.05	.02	.03	4
E06	11.33	.06	.03	.04	3
SLP	-.32	.03	.02	.02	2
E07	10.35	.04	.02	.03	3
MSA	-1.43	.00	.00	.00	2
E08	10.41	.20	.12	.15	3
E09	12.42	.15	.07	.12	5
OTZ	-.39	.29	.21	.21	2
E10	13.43	.23	.10	.17	5

Table 13. Results of processing Set X by the time-term method. See text for meaning of parameters that are described. The solution is for stations that are located on the Colorado Plateau (CDN, LAD, MLM, MTL, EUM). The time terms are relative. This is a test for the stability of the solution as related to geographic region of the stations.

VELOCITY = [illegible] STD.DEV.OBS. = .297E+01 SEC

Std. Err. V 0.19 km/sec DF 11

SITE ID	TIME Term SEC	STND.DEV. OF T.T.DATA SEC	STND.DEV. OF T.T. SEC	MEAN RESIDUAL SEC	NO OF DATA
E01	[illegible]	.30	.13	.21	5
CDN	-1.[illegible]	.23	.10	.15	5
LAD	-2.08	.14	.06	.12	5
MLM	-2.[illegible]	.15	.06	.12	7
MTL	-1.[illegible]	.16	.07	.12	5
EUM	-1.53	.48	.27	.35	3
E03	1.[illegible]	.20	.12	.16	3
E05	7.21	.19	.11	.14	3
E06	10.[illegible]	.14	.08	.10	3
E07	12.10	.11	.08	.08	2
E10	10.2[illegible]	.29	.13	.22	5
E13	41.[illegible]	.25	.17	.17	2

Table 14. Results of processing Set XI by the time-term method. See text for meaning of parameters that are listed. Data of residuals greater that 0.5 sec (table 3) are removed from Set I. This is a test for inordinate effect of a few or less data.

NUMBER OF SITES IS 32

VELOCITY = 8.02KM/SEC STD.DEV.OBSN. = .2566+00 SEC

Std. Err. V 0.06 km/sec DF 46

SITE ID	TIME TERM	STND.DEV. OF T.T.DATA	STND.DEV. OF T.T.	MEAN RESIDUAL	NO OF DATA
	SEC	SEC	SEC	SEC	
E01	3.53	.18	.07	.14	7
CCN	+.13	.19	.10	.16	4
LAD	+.14	.22	.09	.15	6
MLM	4.03	.30	.11	.24	8
MTL	3.22	.10	.05	.07	4
GNM	4.14	.24	.12	.20	4
ABQ	3.60	.26	.08	.23	10
SPD	4.53	.22	.03	.18	7
E02	4.03	.22	.15	.15	2
LPM	3.26	.20	.09	.16	5
E03	4.31	.18	.07	.14	7
LOV	+.02	.09	.05	.07	3
EUM	+.74	.00	.00	.00	1
E04	2.54	.34	.14	.27	6
EST	4.16	.25	.14	.13	4
TTP	4.53	.10	.04	.08	5
TSP	+.36	.07	.04	.05	3
E05	.36	.17	.05	.13	10
RIO	3.11	.05	.03	.06	2
E06	3.35	.15	.04	.11	11
COH	4.31	.14	.10	.11	2
CLP	3.23	.15	.12	.12	3
E07	3.25	.26	.11	.22	6
MSA	+.33	.43	.32	.32	2
E08	4.22	.04	.04	.06	4
E09	4.22	.21	.07	.17	5
OTZ	+.78	.33	.23	.23	2
E10	3.34	.27	.08	.21	11
E11	3.37	.14	.07	.09	4
WTX	+.19	.15	.05	.11	3
E12	3.16	.02	.01	.01	2
E13	35.47	.21	.12	.15	3

Table 15. Summary of velocities, time terms, standard errors of the velocity, standard deviation of the solution, degrees of freedom of the residuals, and number of data for Sets I-XI. For stations of Sets VI, IX, and X, the time-term values are relative only. For them, the fiducial values are marked by an asterisk. These marked values are those of Set I.

SET	I	II	III	IV	V	VI	VII	VIII	IX	X	XI
V (km/sec)	8.02	8.08	8.08	8.08	8.12	7.95	7.92	8.11	8.30	8.01	8.02
Std. err. V (sec)	±0.08	0.09	0.08	0.08	0.09	0.13	0.13	0.08	0.17	0.19	0.06
SDS (sec)	0.36	0.35	0.35	0.35	0.28	0.37	0.42	0.26	0.20	0.30	0.26
D.F.	54	52	52	52	33	37	29	29	14	11	46
N Data	87	85	85	85	60	65	57	53	33	24	79
						TIME TERMS (sec)					
SITE											
ABQ	3.8	4.1	3.5	4.0	4.2	3.6	3.6	3.8			3.9
CDN	4.8	5.2	4.5	5.0	5.3	4.8	4.5	4.7		4.5	4.9
CLP	5.2	5.6	5.0	5.5		5.0			5.1		5.2
COH	4.9	5.3	4.6	5.2	5.5	4.7	4.5	5.2			4.9
EST	4.0	4.4	3.7	4.3	4.6	3.8	3.6	4.2			4.2
EUM	4.6	5.0	4.3	4.9	4.7	4.6	4.5		4.5	4.4	4.7
GNM	4.1	4.5	3.8	4.4	4.5	4.0	4.1	4.1			4.1
LAD	4.0	4.3	3.6	4.2	4.4	4.0	3.8	4.0		3.9	4.1
LCV	4.7	5.2	4.5	5.0	5.3	4.7	4.6		4.5		4.9
LPM	3.4	3.8	3.1	3.6	3.9	3.4	3.0	3.6			3.6
MLM	3.9	4.3	3.6	4.2	4.4	4.0	3.9	4.0		3.9*	4.1
MSA	4.2	4.7	4.1	4.6		4.1	3.9		4.0		4.6
MTL	5.0	5.4	4.7	5.2	5.3	5.2	5.0	5.0		4.9	5.2
OTZ	4.6	5.1	4.4	4.9		4.5	4.4		4.5		4.8
RIO	5.0	5.5	4.9	5.4	5.3	4.9	4.9		4.9		5.2
SPD	4.5	5.0	4.3	4.9	5.0	4.5*	4.4		4.5*		4.6
TSP	4.4	4.9	4.2	4.7	5.1	4.3	4.2		4.3		4.6
TTP	4.9	5.4	4.7	5.2	5.3	4.9	4.9		4.6		4.8
WTX	3.8	4.1	3.4	4.0	4.0	3.5	3.5	3.9			4.2
E08	4.2	3.9	4.5	4.0	4.1		3.9	3.9			4.2
E11	4.0	4.0	4.6	4.1	4.1		3.8	4.4			3.9

Table 16. Time terms for Set I together with the corresponding standard errors. The time term for E13 is unknown (UNK) because there is no time of origin for it. The number of data associated with each site is shown.

Site	N Data	Time Term (sec)	Std. Error (sec)
ABQ	10	3.75	0.23
CDN	4	4.78	0.25
CLP	2	5.17	0.38
COH	2	4.86	0.36
EST	4	4.02	0.28
EUM	3	4.62	0.28
GNM	4	4.06	0.30
LAD	6	3.98	0.23
LCV	3	4.74	0.30
LPM	5	3.42	0.24
MLM	8	3.94	0.22
MSA	2	4.25	0.37
MTL	5	4.98	0.22
OTZ	2	4.62	0.34
RIO	4	5.05	0.29
SPD	7	4.53	0.26
TSP	3	4.44	0.30
TTP	6	4.90	0.26
WTX	4	3.77	0.29
E01	9	3.40	0.56
E02	2	4.66	0.70
E03	7	4.38	0.49
E04	6	2.99	0.30
E05	10	1.03	0.34
E06	11	3.87	0.54
E07	8	6.52	0.93
E08	6	4.17	0.24
E09	9	4.14	0.58
E10	13	3.99	0.96
E11	4	3.96	0.25
E12	2	3.56	0.33
E13	3	UNK	