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T 1547

THE INFLUENCE OF SITE CHARACTERISTICS ON THE MEASUREMENT OF TIDAL STRAIN

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by

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A thesis submitted to the Faculty and the Board of Trustees of the Colorado School of Mines in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Geophysical Engineering.

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ABSTRACT

Five quartz-strainmeter stations, each of which has three horizontal components, have been installed in central Colorado within a circle of about 25 km in radius. Tidal strains were observed at this strainmeter network during the time interval; August 16 through September 18, 1972.

Although the strainmeter stations of the network are located closely enough to experience practically the same tidal potentials, the observed tidal strains reveal magnitude differences in the amplitudes of the M_2 tidal constituent among stations. Since the Pacific Ocean is about 1400 km away from this strainmeter network, it seems that the dominant part of these perturbations in the amplitude of a tidal strain constituent is of local origin rather than from the oceanic loading effects.

From the examinations of topographic and geologic conditions around the stations, it has been tentatively concluded that the perturbations of tidal strain amplitude at this network are strongly dependent on the effective elastic properties of the base rocks in the vicinity (an order of a few miles) of the strainmeter installations.

T 1547

CONTENTS

	Page
ABSTRACT	iii
INTRODUCTION	1
INSTRUMENTATION	6
DATA ANALYSIS	21
DISCUSSIONS	47
CONCLUSIONS	68
DATA APPENDIX	70
BIBLIOGRAPHY	103

T 1547

ILLUSTRATIONS

Figure		Page
1.	Location Map - Central Colorado Strainmeter network.	7
2.	Topographic Map of GOL	10
3.	Geologic Map of GOL	10
4.	Topographic Map of QBC	11
5.	Topographic Map of RMA	12
6.	Sketch of Entrenched Surface Strainmeters	14
7.	Sketch of Compensating Element	15
8.	Amplitude Spectra of Temperature and Barometric Pressure Changes	18
9.	Amplitude Spectra of RMA #1 Observed Strain Data . .	19
10.	Theoretical Tidal Strains at GOL	26
11.	Theoretical Tidal Strains at RMA	27
12.	Observed Tidal Strains at GOL	30
13.	Observed Tidal Strains at BDC	31
14.	Observed Tidal Strains at QBC	32
15.	Observed Tidal Strains at RMA	33
16.	Amplitudes of K_1 Tidal Constituent	40
17.	Amplitudes of S_2 Tidal Constituent	41
18.	Earth Crust Structural Map-Denver Area	49
19.	Strain Amplitudes vs Rigidity of Base Rocks	59

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T 1547

TABLES

Table		Page
1.	Central Colorado Strainmeter Network Data	8
2.	Individual Parameters of Each Strainmeter	9
3.	Observed Amplitudes and Phases of the M_2 Tidal Constituent	44
4.	Amplitudes and Phases of Areal Strain of the M_2 Tidal Constituent	45
5.	Generalized Stratigraphic Section of the Golden - Morrison Area	54

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INTRODUCTION

During the past decade, developments of high-precision tidal instruments and new data processing techniques have provided much valuable information about the real earth, outdating the simplified version of a homogeneous mathematical model earth. Benioff (1959) developed a new fused-quartz strainmeter and many versions of this type instrument have been built and used in the measurements of earth strains in the United States. In this study, it will be shown that tidal strain measurements with such strainmeters are significantly influenced by the effective elastic properties of the rock near the instrument site. Site corrections, therefore, should be applied to all measurements of earth strains.

Most studies, made to date, concerning earth tidal measurements have been directed toward the determination of the earth's gross elastic parameters, such as Love's and Shida's numbers, from the observations of tidal amplitudes at different locations. Only a few authors have expressed their concern about the anomalous observations in the measurements of earth tides and even a smaller number have attempted to interpret these anomalies in terms of local parameters like faulting and seismicity.

The majority of studies have been trying to isolate the direct

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effects of tidal responses by considering the anomalous part to be the indirect effect of ocean loading and by attempting to establish good values for Love's and Shida's numbers at their stations by removing the indirect effect. After many years of such tidal studies, some investigators still find anomalous amplitudes and phases of tidal constituents clearly not due to noises such as ocean loading effects. Observation of significant local perturbations in tidal measurements was reported by Lennon (1972) and discussed at the First GEOP Research Conference: Solid Earth and Ocean Tides at Columbus, Ohio, on October 26 - 27, 1972.

Several observations of anomalous local perturbations in earth tide studies have been reported in eastern Europe and Japan according to Melchior (1966). Although no one has successfully explained quantitatively these strange phenomena, selected reports with qualitative discussions follow:

1) Melchior (1967) reported that an east-west strip of very important tidal tilt anomalies have been detected in the Ardennes of Belgium which show 20% or more regional variations in the elastic parameters (γ) where represents a combination of Love's numbers ($\gamma = 1 + k - h$). The instruments used were quartz horizontal pendulums of the Verbaandert-Melchior design. He said that it seems logical to ascribe these regional variations to possible heterogeneities

in the crust or in the upper mantle.

2) Tomaschek (1954) related his anomalous observations in gravity tidal measurements in England to two mountain ranges, the Welsh and Pennine Mountains. He suggested that each mountain range seems to act as a sort of long rigid bar, more easily tilted around an axis parallel to its length than an axis perpendicular to its length..

3) Nishimura (1950) has demonstrated the role of an active fault in the flexions of the upper crust by placing six pairs of tiltmeters along the active fault at Beppu ($\varphi = 33^\circ 15'N, \lambda = 131^\circ 30'E$, Kyushu, Japan) spaced out 400 to 1800 meters from the coast. He found very strange residuals after removing the direct and indirect (ocean loading) effects. He suggested that the fault acts as a vertical boundary between two elastic planes, to such an extent that certain points close to both the fault and the sea bend towards the fault rather than in the direction of the bay.

4) Nishimura also reported another, even more unusual, observation in the same paper. Tidal tilt measurements were made at Makimine ($\varphi = 32^\circ 38'N, \lambda = 131^\circ 24'E$, Kyushu, Japan) in 1942 - 1945 with 2 horizontal pendulums. He found large (20%) variations in the amplitude of the tidal constituent M_2 with time when the four years of data were harmonically analysed for each one month period with 10 day intervals

between successive periods of analysis. From consideration of many possibilities for the cause of this time variation, he could not find any significant geophysical phenomena which could be related to this phenomena, except, perhaps, the seismic activity nearby.

5) Two studies of tidal strain measurements in Colorado have been made previously using data from the Bergen Park station (Humuth, 1968) and from the Rocky Mountain Arsenal (Suh, 1971). Their results show large perturbations of amplitude and phase in the M_2 tidal constituent compared to theoretical tidal strain values.

6) These results contradict those of others (Kuo, 1969; Harrison, 1972) from gravity observations in this region. These results show no appreciable amount of anomalies either in amplitude or in phase of the M_2 tidal constituent. Tiltmeter observations do show anomalous values, however, in some cases deviating 50% from the expected values.

This might be due to the fact, as Farrell and Levine (personal communications) pointed out, that the tidal strain measurements are much more sensitive to local perturbing sources than the tidal gravity or tilt measurements. Their numbers show up to 10% perturbations in gravity or tilt measurements and up to 100% in tidal strain measurements.

The Colorado School of Mines has now 15 strainmeters

within a circle about 25 km in radius near Denver, Colorado. The strainmeters have operated in conjunction with the National Oceanic and Atmospheric Administration (NOAA) and Westinghouse Geoscience Laboratory. This network consists of five strainmeter stations, each having three horizontal components. In the study of local perturbations in earth tidal measurements, this network will provide a unique set of data because no other place in the United States has a comparable concentration of strainmeters, instruments which are expected to have great sensitivity to the local perturbations. Also, the ocean loading effects will be comparatively much smaller than at other strainmeter stations in the United States and Japan due to the fact that Denver is about 1400 km from the Pacific Ocean.

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INSTRUMENTATION

A brief discussion about strainmeter deployment, principles of strain measurements with these strainmeters, characteristics of this network and the reliabilities of strain data from these strainmeters will be presented next to enable the interested reader to appreciate the limitations of the data, the interpretation of which is the main purpose of this paper.

A network of 15 Benioff-type, fused-quartz strainmeters has been installed in central Colorado near Denver. The network is comprised of five strain observatories located at Bergen Park (GOL), Boulder (BDC), Quimby (QBC) and Rocky Mountain Arsenal (RMA #1 and RMA #3). Each station has three horizontal components, two of them are perpendicular to each other (eg. N/S and E/W) and the third is diagonal (eg. NW/SE or NE/SW). Fig. 1 shows the locations of all the strainmeter stations in the network. The geographic coordinates and other instrumental parameters are shown in Tables 1 and 2. Figs. 2 to 5 show topographic maps of the vicinity of the strainmeter stations and the strainmeter orientations at each site.

The details of instrumentation of these Benioff-type strainmeters (or extensometers) are well described by Homuth (1968) for the GOL station and by Romig (1969) for the RMA

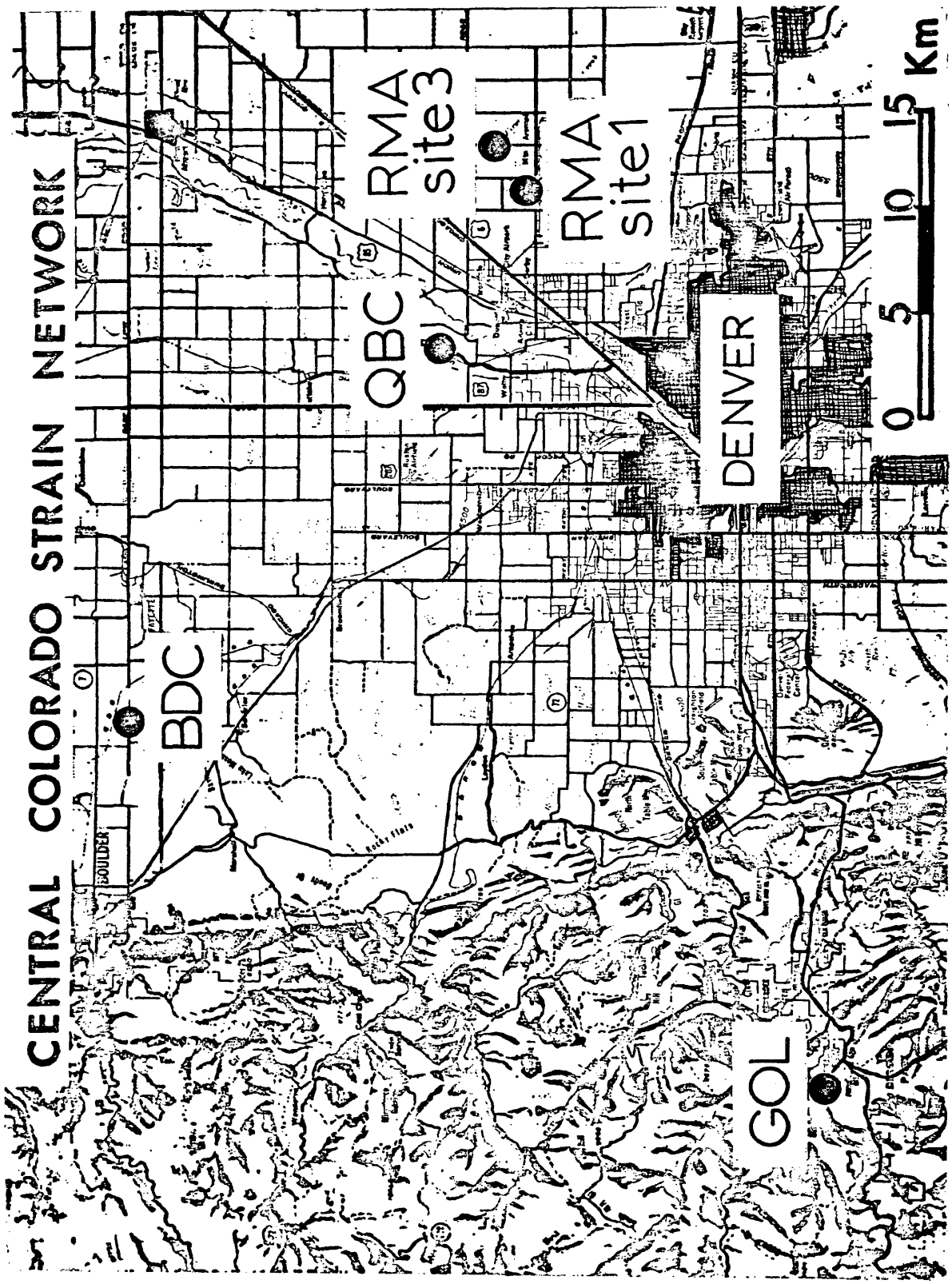

Figure 1. Location Map - Central Colorado Strainmeter Network. Map of central Colorado showing the locations of the strainmeters of the Central Colorado Strainmeter Network.

Table 1

CENTRAL COLORADO STRAINMETER NETWORK DATA

Station	Longitude	Latitude	Elevation	Instrument orientation	Instrument type
GOL	105°22'36"W	39°42'00"N	2328 m	N/S, E/W, NW/SE	underground surface
BDC	105°09'36"W	40°00'12"N	1628 m	N/S, E/W, NW/SE	surface surface
QBC	104°56'39"W	39°52'19"N	1580 m	N/S, E/W, NE/SW	surface surface
RMA #1	104°49'10"W	39°50'25"N	1600 m	N/S, E/W, NW/SE	surface surface
RMA #3	104°51'09"W	39°51'50"N	1576 m	N19 W, N71 E, N26 E	surface surface surface

Table 2

INDIVIDUAL PARAMETERS OF EACH STRAINMETER

Station	Component	A	B	C	D	E
GOL	N/S	75	1	10:1	25	2.778
	E/W	75	1	10:1	25	2.778
	NW/SE	75	10	1:1	25	2.778
BDC	N/S	100	10	1:1	25	2.083
	E/W	100	10	1:1	25	2.083
	NW/SE	100	10	1:1	25	2.083
QBC	N/S	40	10	1:1	25	5.208
	E/W	40	10	1:1	25	5.208
	NE/SW	40	10	1:1	25	5.208
RMA #1	N/S	100	5	1:1	50	4.167
	E/W	100	5	1:1	50	4.167
	NW/SE	100	10	1:1	25	2.083
RMA #3	N71 E	100	10	1:1	25	2.083
	N19 W	100	10	1:1	25	2.083
	N26 E	100	10	1:1	25	2.083

A = Quartz length in ft.
B = Number of steps in brass bellows
C = Displacement ratio between actual displacement and table displacement at the micrometer end
D = Table motion per step of brass bellows in microinches
E = Sensitivity per step in microinches

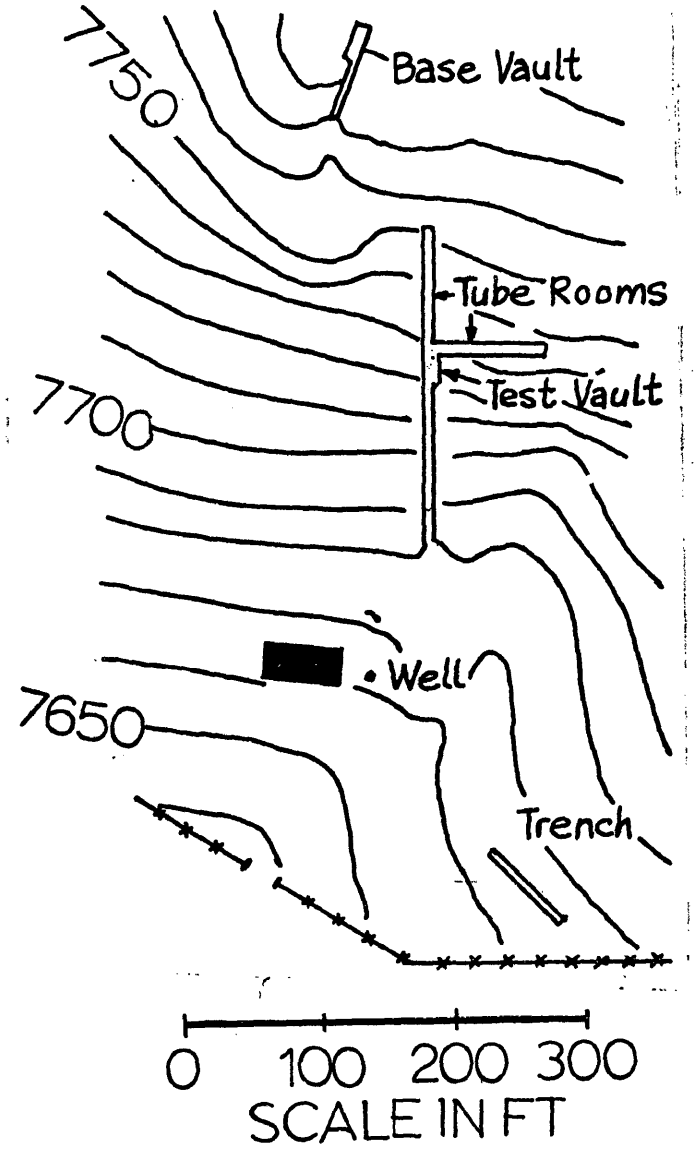

Figure 2. Topographic Map of GOL. Relative positions of the tube rooms and recording house at the GOL station.

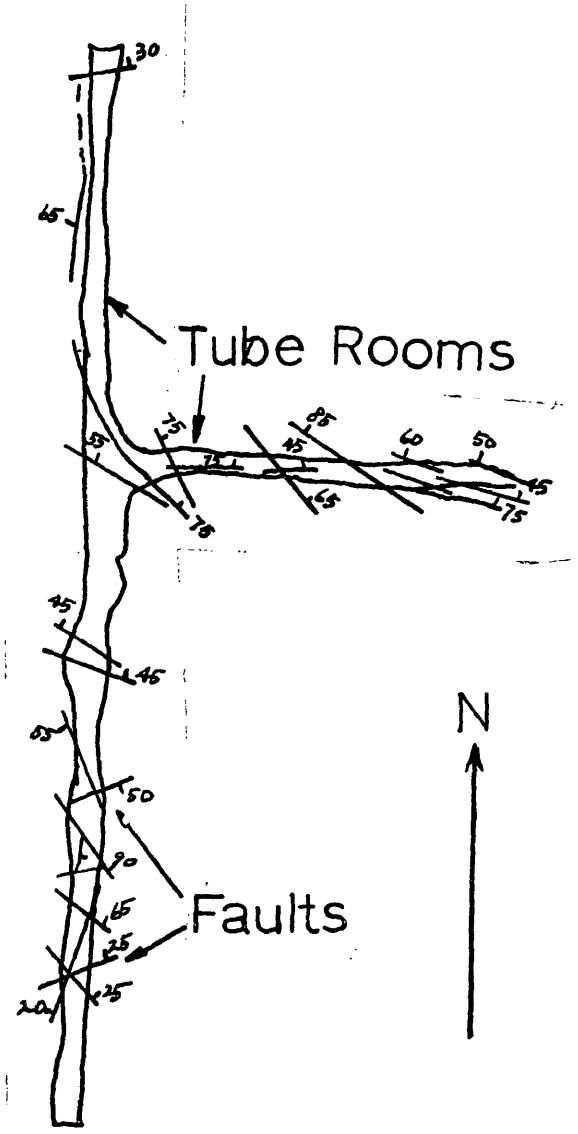

Figure 3. Geologic Map of GOL. Faults in the tube rooms adapted from Klugman (1964).

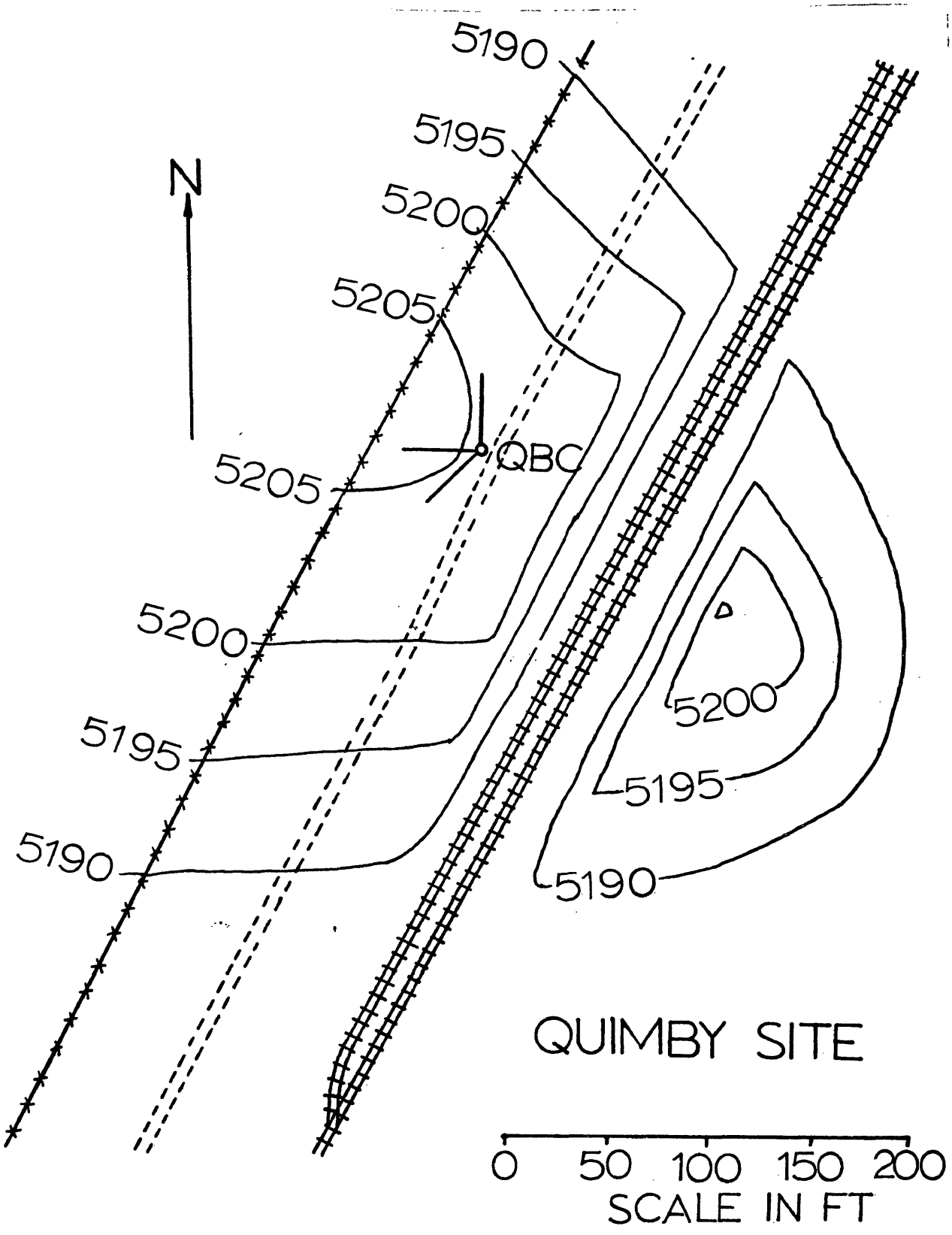

Figure 4. Topographic Map of QBC showing the railroad cut. Elevations are in feet above sea level with a contour interval of 5 feet.

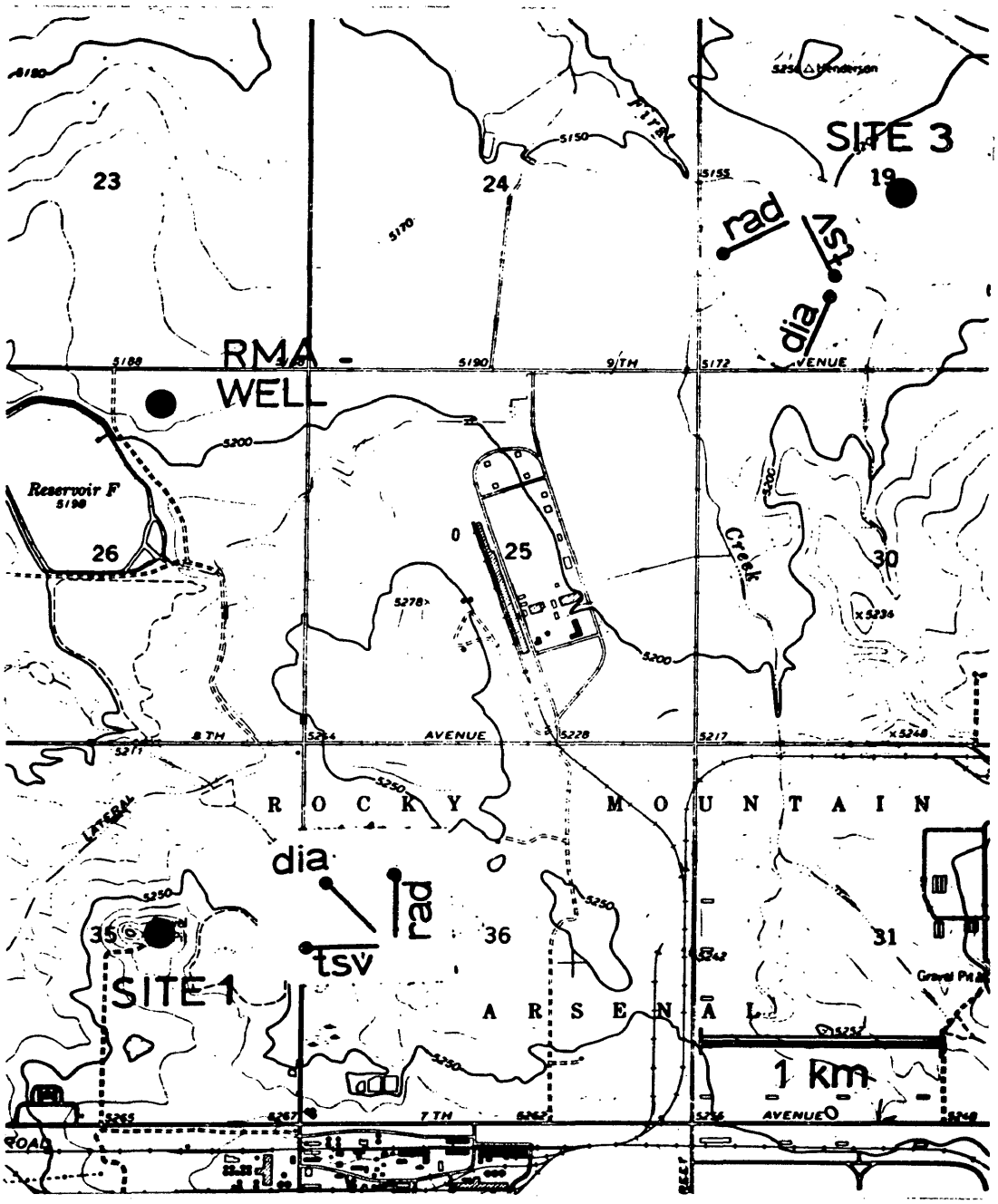

Figure 5. Topographic map of RMA showing the strainmeter orientations with respect to the RMA Well.

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and QBC stations. The BDC station (of Westinghouse Georesearch Laboratory) has been added recently to this network. It also has three horizontal components, oriented in the N/S, E/W and NW/SE directions. The instrumentation at the BDC station is the same as at the rest of the network stations.

Among the 15 strainmeters of this network, two components (N/S and E/W) at the GOL station are the only strainmeters built in underground tunnels. These two instruments are sealed in tube rooms with tight doors made of steel. These instruments were calibrated about every week by means of a motor-driven millimicron-displacement transducer (Romig, 1967).

The remainder of the strainmeters in this network are entrenched, near-surface strainmeters. At each site a standard of length, consisting of 10-foot sections of fused-quartz tubing shielded by 5-inch-diameter jacket pipe, is buried in a shallow trench (5 to 15 feet below the surface) with one end fixed to a concrete pier. The sections of quartz are thermally compensated by aluminium cups whose coefficient of thermal expansion is much larger than that of fused quartz (Fig. 6 and Fig. 7). The free end of the quartz extends into a concrete instrument vault which contains a transducer to measure the relative displacement of the free end of the quartz with respect to the instrument vault pier.

At the BDC and QBC stations, all three instruments

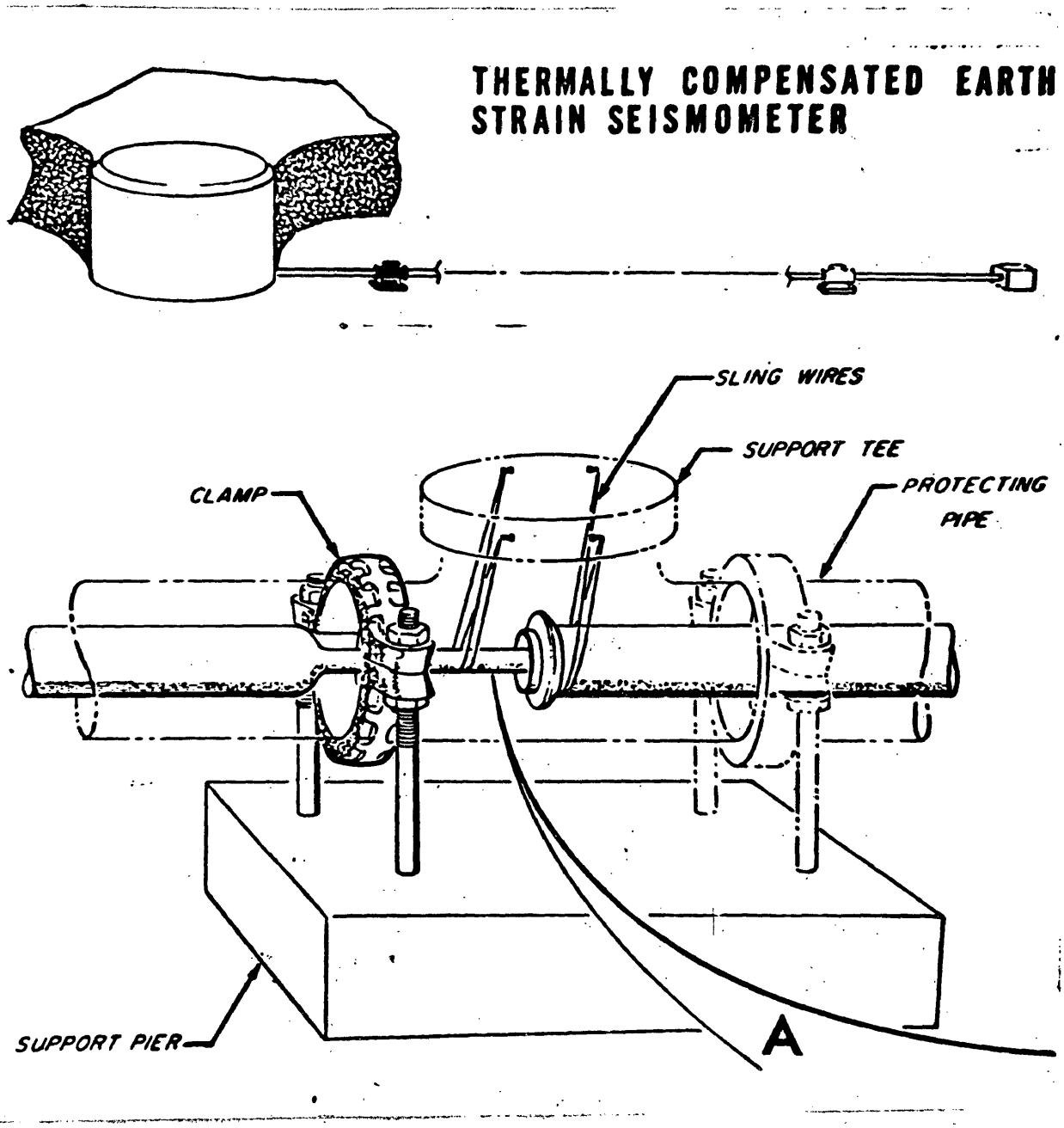

Figure 6. Sketch of the entrenched surface strainmeter.

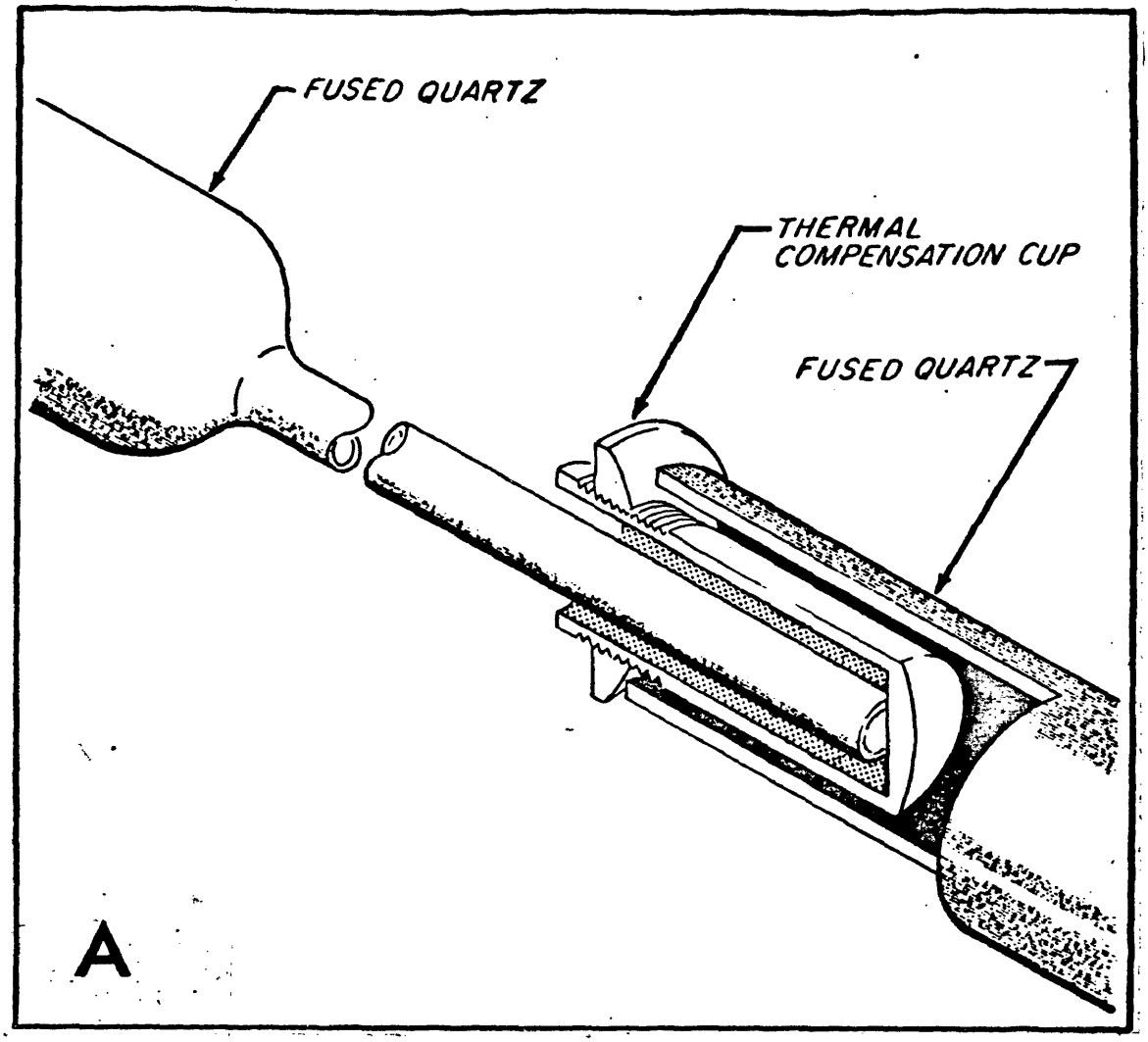

Figure 7. Sketch of Compensating Element.
Quartz section with tip (upper left) rests on inside bottom of aluminum cup. Quartz section in lower right rests on outside of conical lip of aluminum cup. As temperature increases, the cup expands faster than the quartz tubes but its expansion serves to decrease the overall (quartz to quartz) length, thus compensating for the thermal expansion of the quartz standard of length.

terminate in 1 instrument vault; all the instruments at RMA have individual vaults. The recorders (10- or 5-inch strip-chart type) for each instrument were put on-site and were visited normally once per week. Checking of recorders and instrument's balance were made when the sites were visited.

The character of the Colorado strainmeter network can be summarized briefly as follows. Except the 2 underground strainmeters of GOL station, all the other entrenched, surface strainmeter stations were originally constructed for purposes other than the monitoring of earth tides. When these strainmeters were built, their main objects were rather to monitor either strain-steps associated with earthquakes (Wideman, 1967) or to study secular strains associated with local earthquakes (Romig, 1969). The geometric relation of the stations to the expected source of future earthquakes, therefore, dominated the deployment of the network. Not many precautions were taken either to give these instruments perfect insulation from thermal and barometric pressure effects, or to locate the instruments on good hard base rocks of large extent, such as is normally done in the installation of earth tide stations (Melchior, 1966).

A tidal strain study was made by Suh (1971) with the data from the surface strainmeters of RMA stations for the

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time interval from July 11, 1968 through August 9, 1968. The results of this study showed, even under these rather severe circumstances for an earth tide station, that these surface strainmeters do record earth tides. This was very encouraging because a large number of such entrenched type. surface strainmeter stations were already constructed and in operation through Colorado, Nevada and Aleutian Islands to study earthquakes, nuclear blasts, and secular strains, etc.

Figs. 8 and 9 show the amplitude spectra of the strain data from RMA surface strainmeters and of the temperature and barometric pressure changes. They show that most noise from these two meteorological sources is concentrated on and near the K_1 and S_2 tidal periods. Although most of the other tidal constituents are also affected by these huge noises, the amplitude spectra of strain data still provide distinctive peaks at the M_2 tidal period, especially in the N/S component, while the two noises show very little effect on this period.

In summary, these strainmeters are capable of providing valuable information on the tidal strains in this area in spite of the fact that they were disigned to recover secular strains and strain-steps associated with local earthquakes. However, in earth tide studies using the strain data from this network, it is desirable to concentrate on the amplitudes

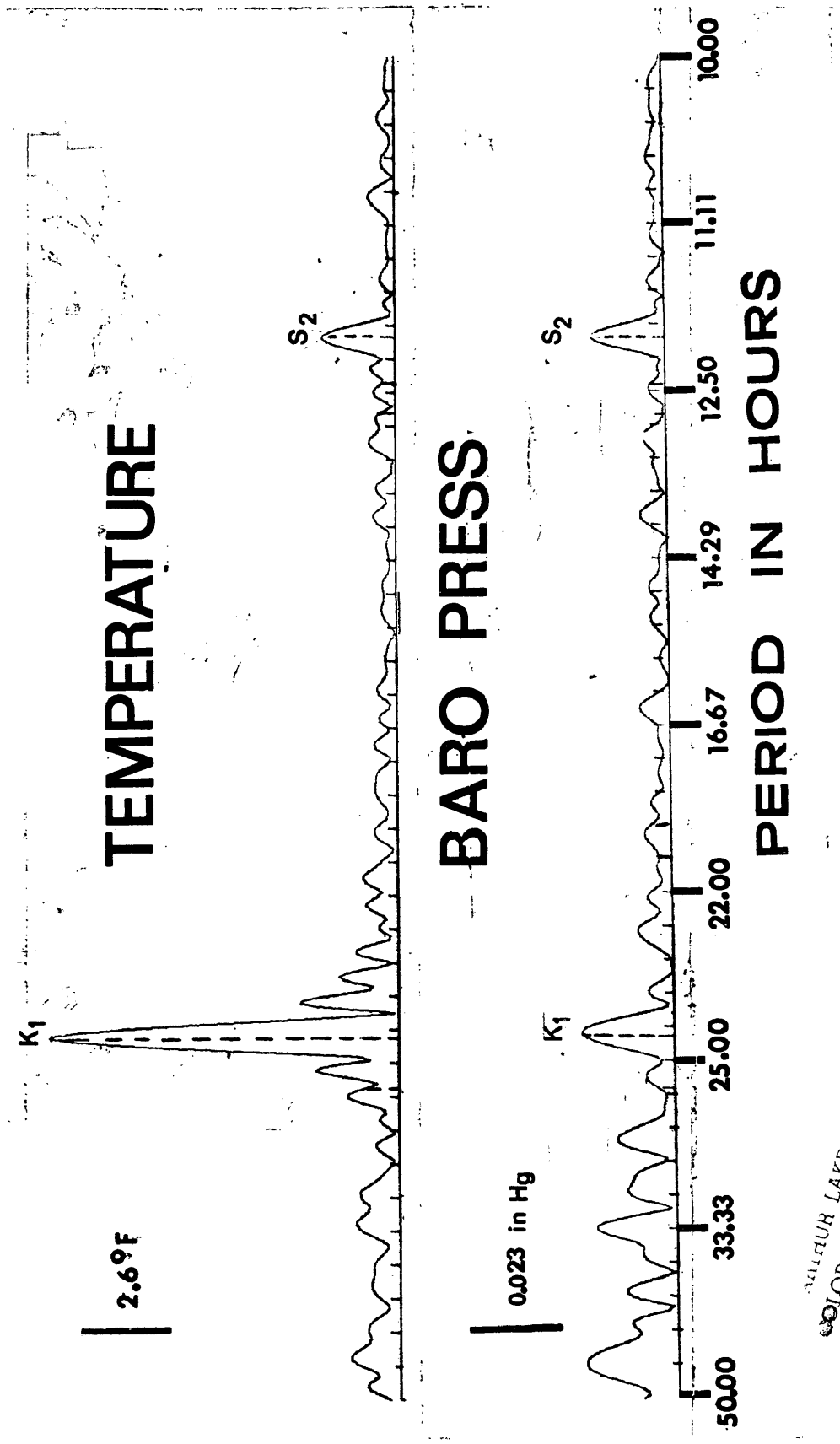

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Figure 8. Amplitude spectra of temperature and barometric pressure changes.

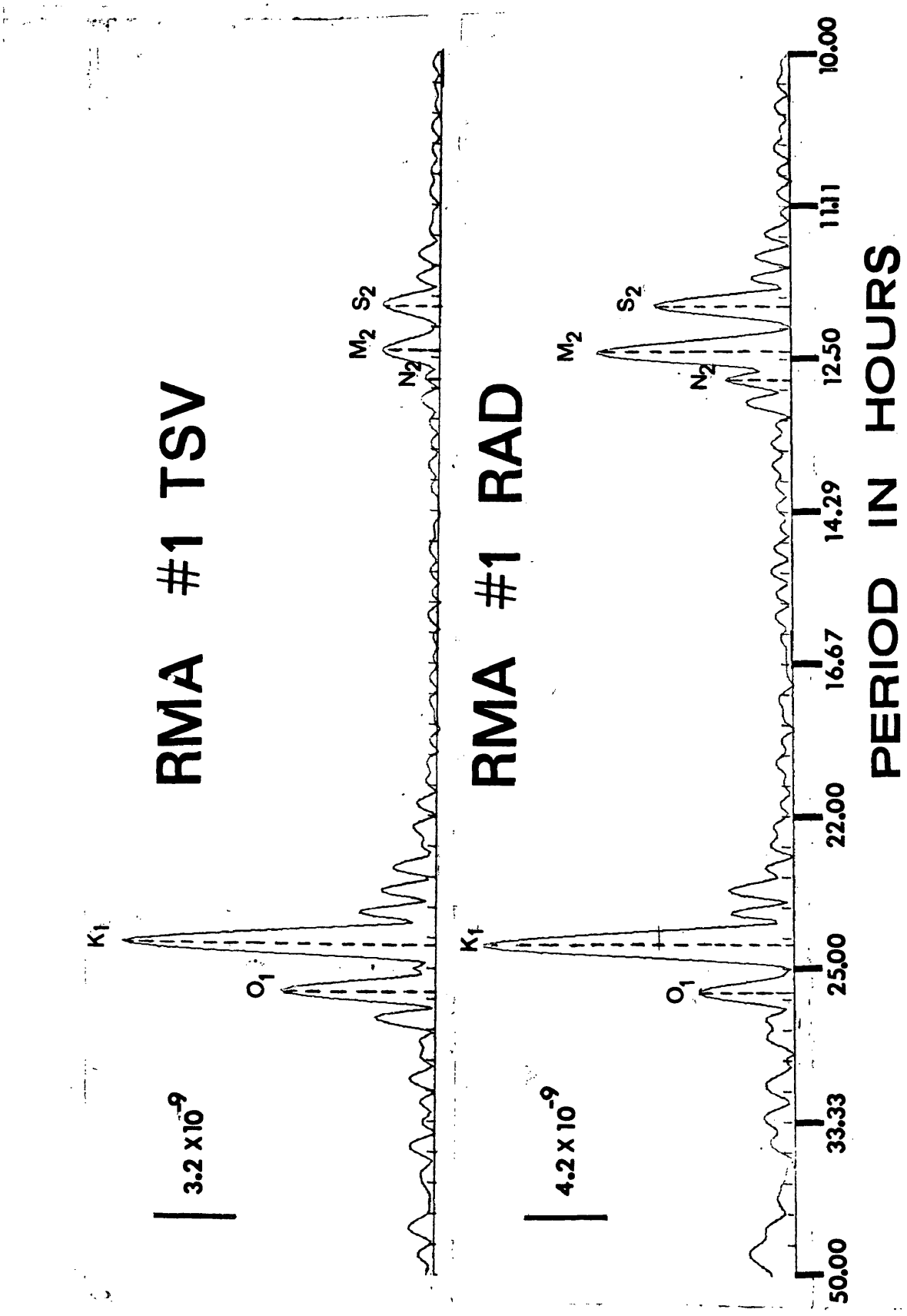

Figure 9. Amplitude spectra of RMA #1 observed strain data.

of the tidal constituent M_2, in the N/S direction only if possible, since it shows the biggest strain amplitudes and the most noise-free data after being analysed.

T 1547

DATA ANALYSIS

The raw data used in this study consist of eleven components of observed strain data and the eleven matching components of calculated theoretical tidal strain data for a period of 30 days. The data periods were August 19, 1972, through September 18, 1972, for the BDC station and August 16, 1972, through September, 15, 1972, for the rest of the network stations. Due to instrument malfunctions, data of sufficient quality for analysis were not obtained from four components of the network, GOL NW/SE and the three components of the RMA #3. Components designated RMA refer to RMA #1 components unless specifically labeled RMA #3.

In the following, the calculation of the theoretical tidal strains, the correction of the raw observed strain data, the method of harmonic analysis used in this study, and the results of that harmonic analysis are discussed.

Calculation of the theoretical tidal strains at the strainmeter stations was made by Harrison's (1971) tidal computer program. His program computes the five terms associated with the five spherical harmonic functions of 2nd degree in terrestrial colatitude and longitude and the seven terms associated with the 3rd degree spherical functions.

The expansion of the first two terms of the right hand

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side of the following equation for the tidal potential, V, on the Earth's surface due to the luni-solar attractions (Bartels, 1957) yields 12 terms employed in Harrison's program to calculate the tidal potential as a function of time:

$$V = V_2 + V_3 + V_4 + \text{------}$$

$$= \frac{GMr^2}{R^3} P_2(\cos Z) + \left(\frac{r}{R}\right) P_3(\cos Z) + \left(\frac{r}{R}\right)^2 P_4(\cos Z) \text{ ---}$$

where:

G is the Newtonian constant of gravitation

M is the mass of the Sun (Ms) or of the Moon (Mm).

($G \cdot Ms$ taken as 1.33×10^{26} gm Cm^3/sec^2)(Harrison, 1971)

($G \cdot Mm$ taken as 4.90×10^{18} gm Cm^3/sec^2)(Harrison, 1971)

r is the distance between center of Earth and the observation point.

R is the distance from Earth's center to the Sun (Rs) or the Moon (Rm),

(Average r/Rm 1.6×10^{-2}) (Harrison, 1972)

(Average r/Rs 4.3×10^{-5}) (Harrison, 1972)

Z is the zenith angle of the Sun or of the Moon,

P_2 is the 2nd degree spherical harmonic and

P_3 is the 3rd degree spherical harmonic.

Details of this expansion process and the final resulting equations of the expansion can be found in Harrison (1971) and also in Munk and Cartwright (1966).

The displacements, S, due to the potential term, V, can be written in polar coordinates as follows (Melchior, 1966):

$$S_r = \frac{H(r)}{g} V \qquad \text{along the radius, r,}$$

$$S = \frac{L(r)}{g} \frac{\partial V}{\partial \theta} \qquad \text{in the N/S direction, } \theta \text{ being the colatitude}$$

$$S = \frac{L(r)}{g \sin} \frac{\partial V}{\partial \lambda} \qquad \text{in the E/W direction, } \lambda \text{ being the East Longitude}$$

where:

g is the gravitational acceleration ($g = 980$ cm/sec^2),

$H(r)\Big|_{r=a} = \underline{h}$ = Love's number,

$L(r)\Big|_{r=a} = \underline{l}$ = Shidas's number

The Love's and Shida's numbers specify, respectively, the ratio of the height of the earth tide to the height of the corresponding static ocean tide at the surface ($\underline{h}$) and

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the ratio between the horizontal displacement and that of the corresponding static ocean tide.

The strain tensor components, e_{rr}, $e_{\theta\theta}$ and $e_{\lambda\lambda}$, using the same system of coordinates, are:

$$e_{rr} = \frac{\partial S_r}{\partial r} = 2\,\frac{H(r)}{gr}\,V + \left(\frac{1}{H(r)}\,\frac{dH(r)}{dr} - \frac{1}{g}\,\frac{dg}{dr}\right)\frac{H(r)}{g}\,V$$

$$e_{\theta\theta} = \frac{1}{r}\,\frac{\partial S_\theta}{\partial \theta} + \frac{S_r}{r} = \frac{L(r)}{gr}\,\frac{\partial^2 V}{\partial \theta^2} + \frac{H(r)}{gr}\,V$$

$$e_{\lambda\lambda} = \frac{1}{r\sin\theta}\,\frac{\partial S_\lambda}{\partial \lambda} + \cot\theta\,\frac{S_\theta}{r} + \frac{S_r}{r}$$

$$= \frac{L(r)}{gr\sin^2\theta}\,\frac{\partial^2 V}{\partial \lambda^2} + \cot\theta\,\frac{L(r)}{gr}\,\frac{\partial V}{\partial \theta} + \frac{H(r)}{gr}\,V$$

In the calculations of the theoretical tidal strains at these stations, the following numbers were assumed for Love's and Shida's numbers:

$h_2 = 0.612$ $\qquad$ $h_3 = 0.290$

$l_2 = 0.083$ $\qquad$ $l_3 = 0.014$

The calculated values for the theoretical tidal strains at all stations of this strainmeter network differ by less than 2%. Therefore, only 2 sets of the theoretical tidal strains are shown (Figs. 10 and 11) for comparison with the observed strain data.

The observed strain data from these strainmeters contain many other features in addition to tidal strains, such as zero shifts, strain-steps from earthquakes, traffic noises, secular strains, and thermal and barometric disturbances. Therefore, the following three corrections were applied to the data before harmonic analysis:

1) Step correction - The raw strain data include zero shifts caused mainly by the Automatic Recentering Device (ARD). The ARD was designed by Dr. Romig (Colorado School of Mines) to rebalance the transducer mechanically by use of motor-driven-micrometer whenever the strain signal goes beyond certain preset limits. Because of the ARD, the transducer is always in the linear range of the response curve and the pen remains on the recording chart without manual resetting. Although most zero shifts are caused by the ARD, there are also strain-steps or trace offsets associated with earthquakes and passing traffic, especially at the BDC and QBC station. These steps of natural and instrumental origin were removed from the data.

2) Drift correction - The raw strain data also contain a component of drift of significantly longer period than the tides. The drift is much larger than the

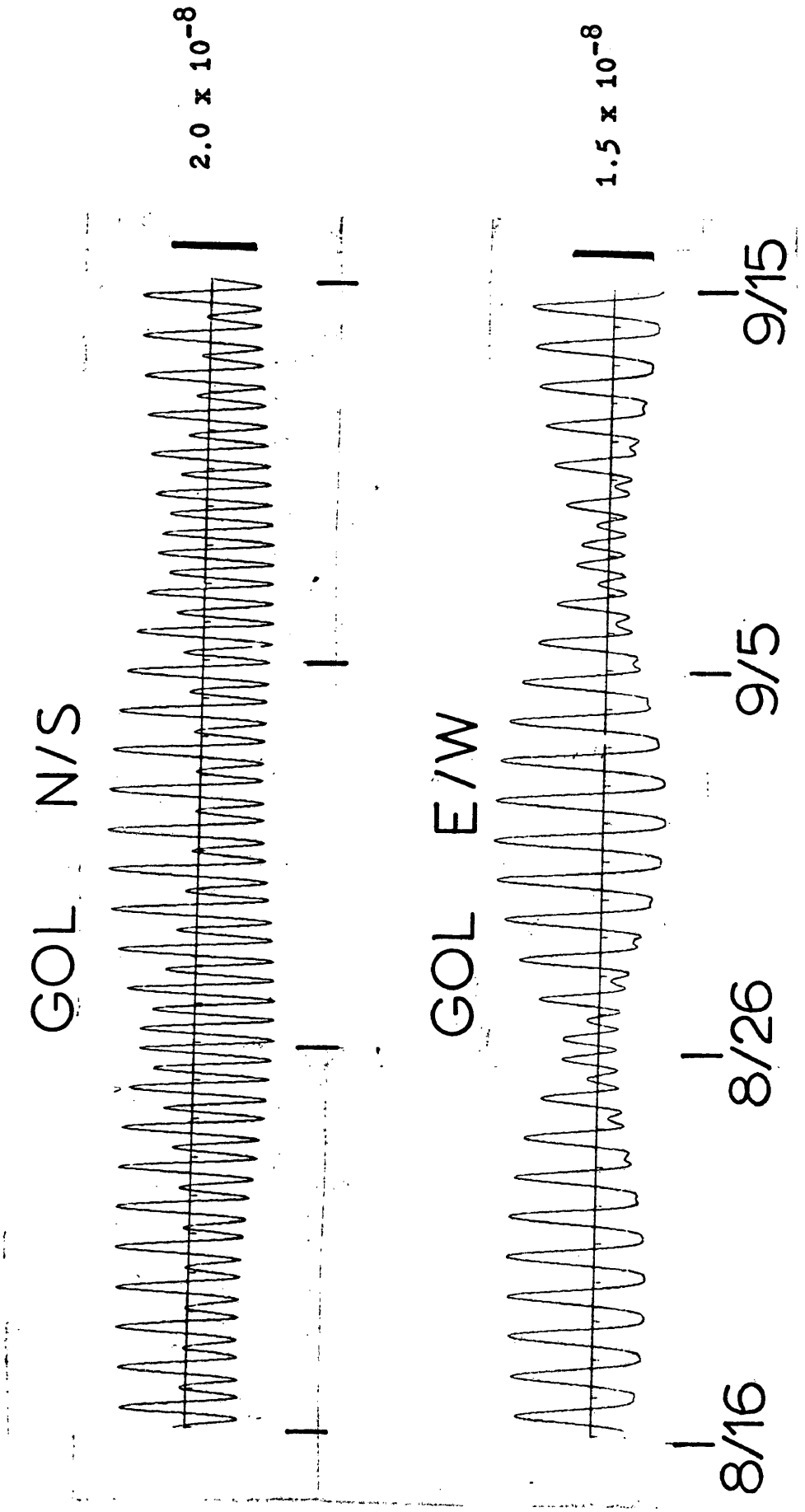

Figure 10. Theoretical Tidal Strains at GOL.
Traces of calculated theoretical strain data at GOL
for the interval Aug. 16, 1972 through Sept. 15, 1972.
Rock compression downward. Vertical scale equvalents
are shown at the right.

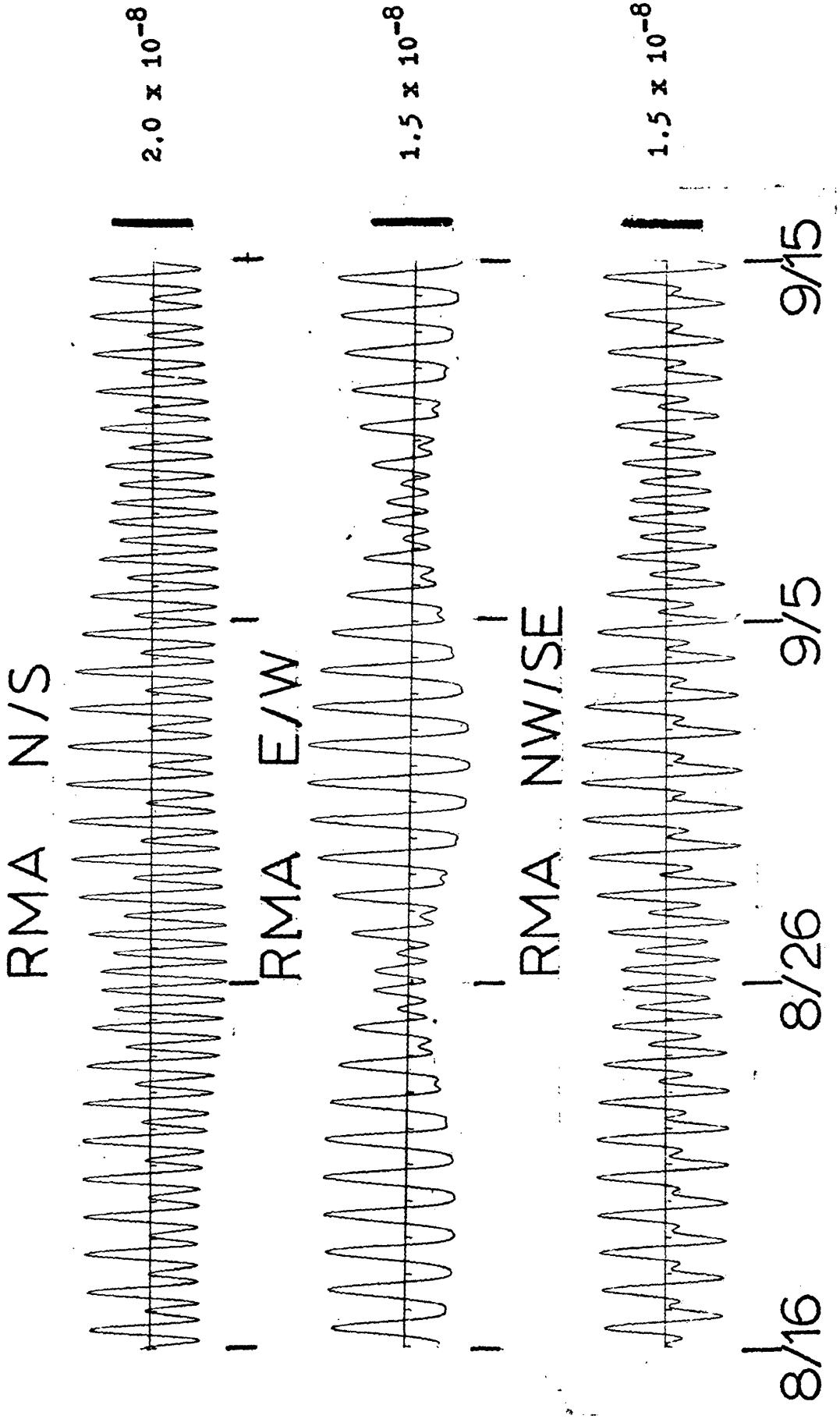

Figure 11. Theoretical Tidal Strains at RMA.
Traces of calculated theoretical strain data at RMA
for the interval Aug. 16, 1972 through Sept. 15, 1972.
Rock compression downward.

tidal signal and may be into either rock extension or rock compression. The sense may be related to transducer orientation (C. J. Wideman - personal communication) and local site characteristics. These drifts are largely due to the secular strains and the environmental effects such as seasonal temperature changes (Romig, 1969). Drifts of more than 24 hour periods were removed from the strain data by removing the average value of the top and bottom of an envelope fitted to the tidal peaks and troughs.

3) Sensitivity correction - After removing steps and large drifts, each data set was calibrated. Because of instrumental differences, each record has a different sensitivity. The raw strain data were, therefore, converted to true strain values according to the data from the ARD mechanical calibration. The final corrected data are shown as Figs. 12 to 15.

Each set of the corrected strain data was then harmonically analysed to get the amplitudes and phases of the tidal constituents. The International Commission for Earth Tides (headquartered at Brussel, Belgium) suggests Pertsev's method of analysis as one of the three recommended methods. The technique used in this study is Pertsev's

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method (1958) for 29 days of tidal observations.

The essence of this method is briefly described in the following. The observed tidal strains can be considered as a sum of individual tidal waves as:

$$Y_{tk} = \sum_n R_n \cos(\sigma_n t + \rho_n k - \delta_n)$$

$$= \sum_n R_n \left[\cos \sigma_n t(\cos \delta_n \cos \rho_n k + \sin \delta_n \sin \rho_n k) + \sin \sigma_n t(\sin \delta_n \cos \rho_n k - \cos \delta_n \sin \rho_n k)\right]$$

where:

Y_{tk} = observed total tidal strains in a hourly digitized format,

t = mean solar hour,

k = mean solar day,

n = a wave index for a certain tidal constituent,

R_n = amplitude of the nth wave,

= phase-change of the nth wave per hour,

= phase-change of the nth wave per day,

Two sets of time domain digital filters, C_{tm} and D_{kl}, were used to separate diurnal waves and semidiurnal waves and to separate the five major tidal constituents (M_2, S_2, N_2, K_1 and O_1) from each other. Subsequent computation with the

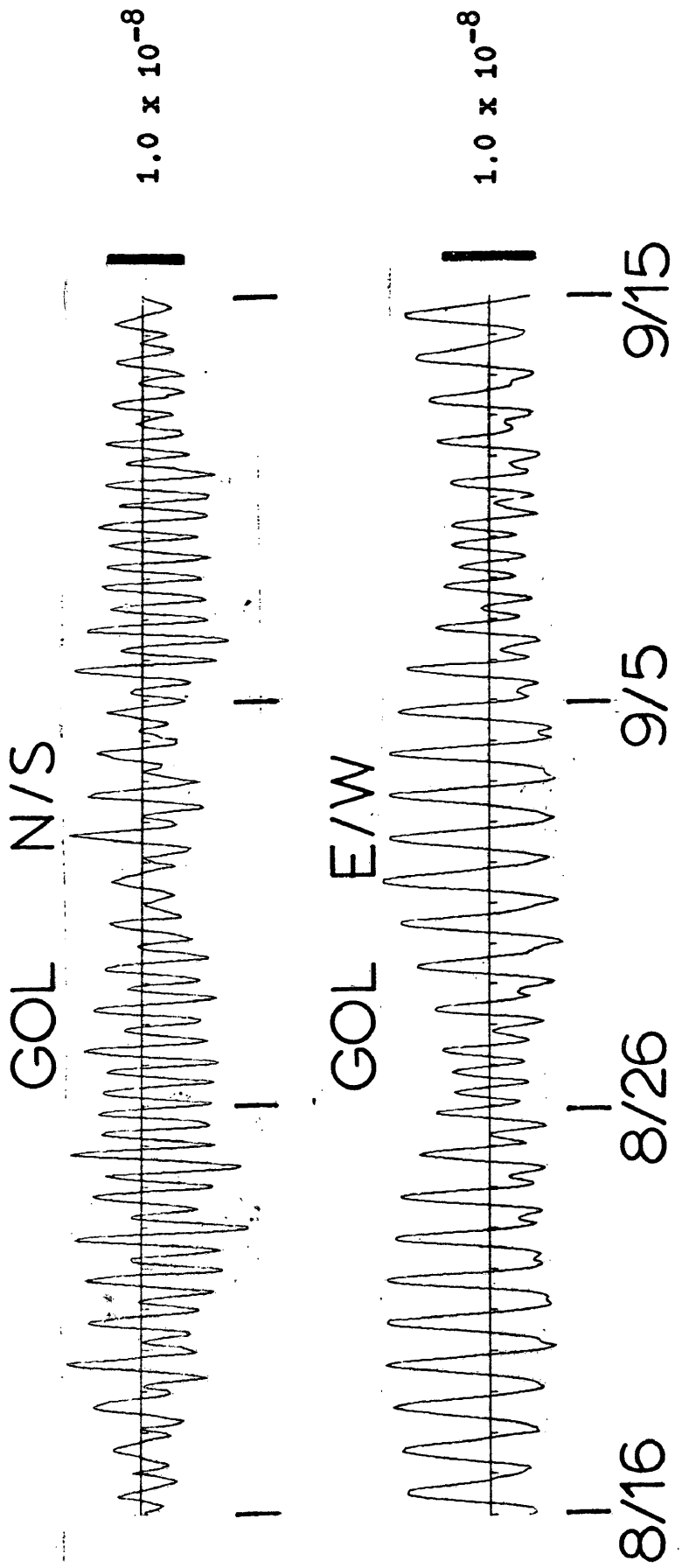

Figure 12. Observed Tidal Strains at GOL.
Traces of observed strain data at GOL after drift- and sensitivity corrected for the interval Aug. 16, 1972 through Sept. 15, 1972. Rock compression downward.

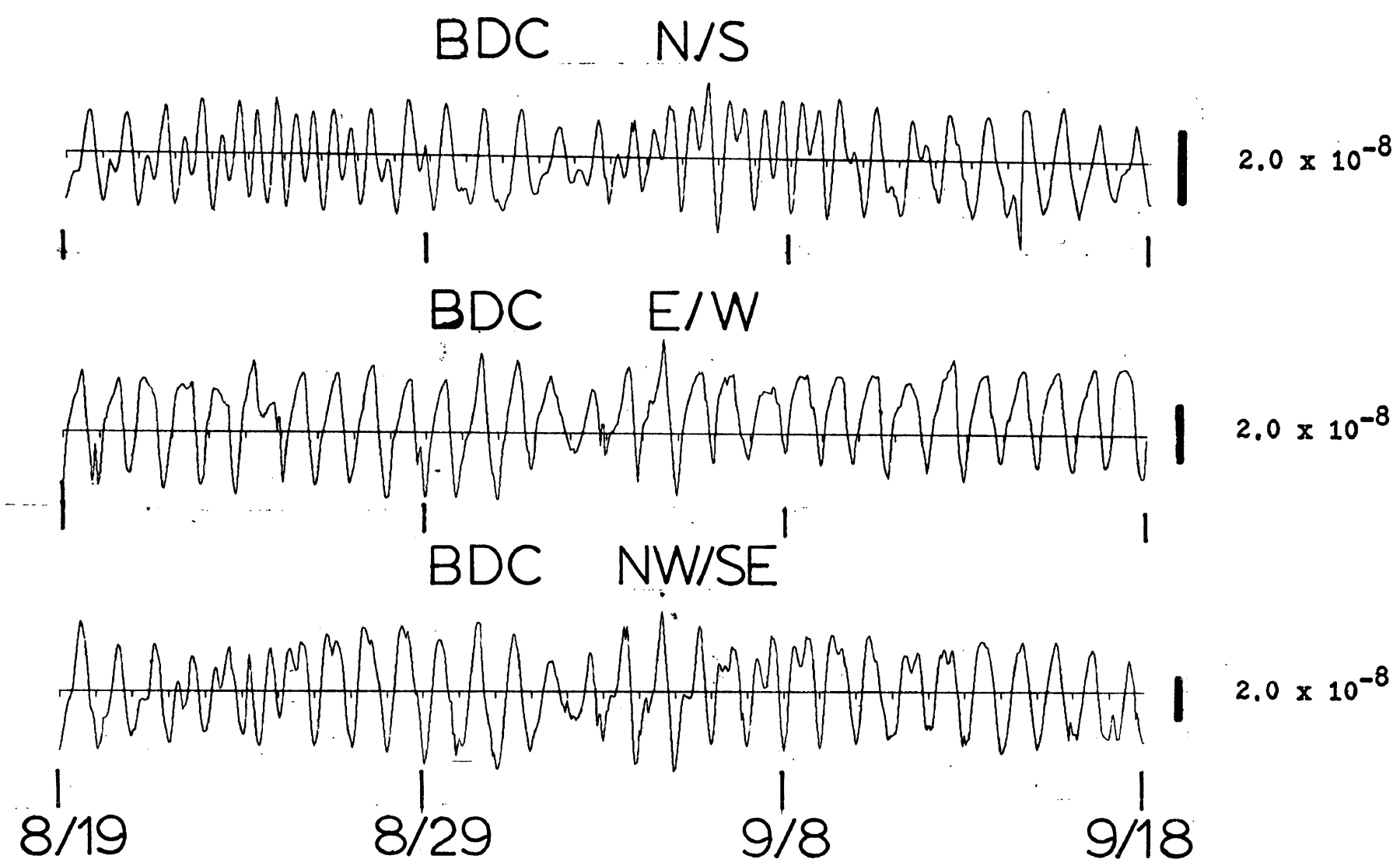

Figure 13. Observed Tidal Strains at BDC.
Traces of observed strain data at BDC after drift- and sensitivity corrected for the interval Aug. 19, 1972 through Sept. 18, 1972. Rock compression downward. Vertical scale is shown on right.

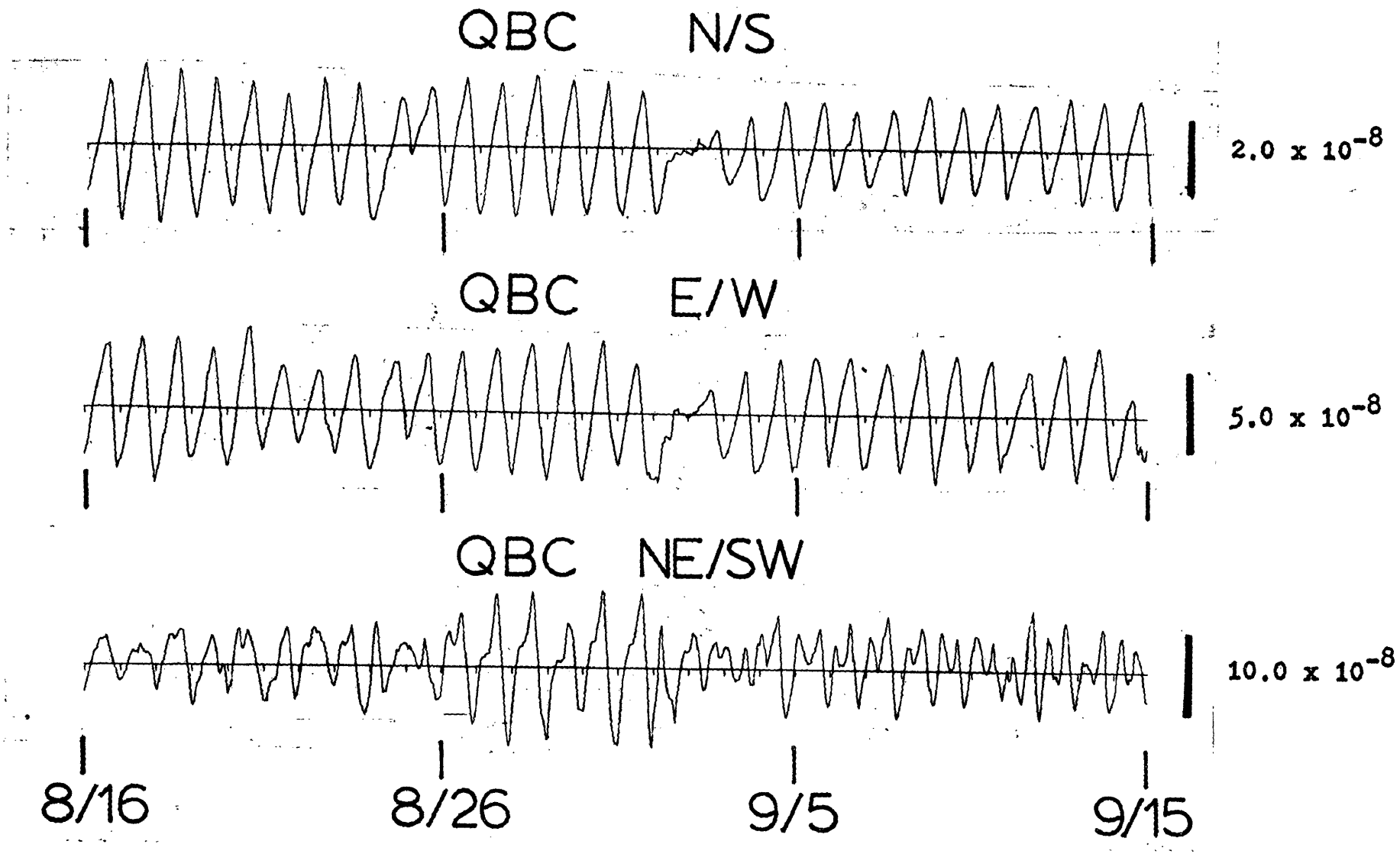

Figure 14. Observed Tidal Strains at QBC.
Traces of observed strain data at QBC after drift- and sensitivity corrected for the interval Aug. 16, 1972 through Sept. 15, 1972. Rock compression downward. Vertical scale to right.

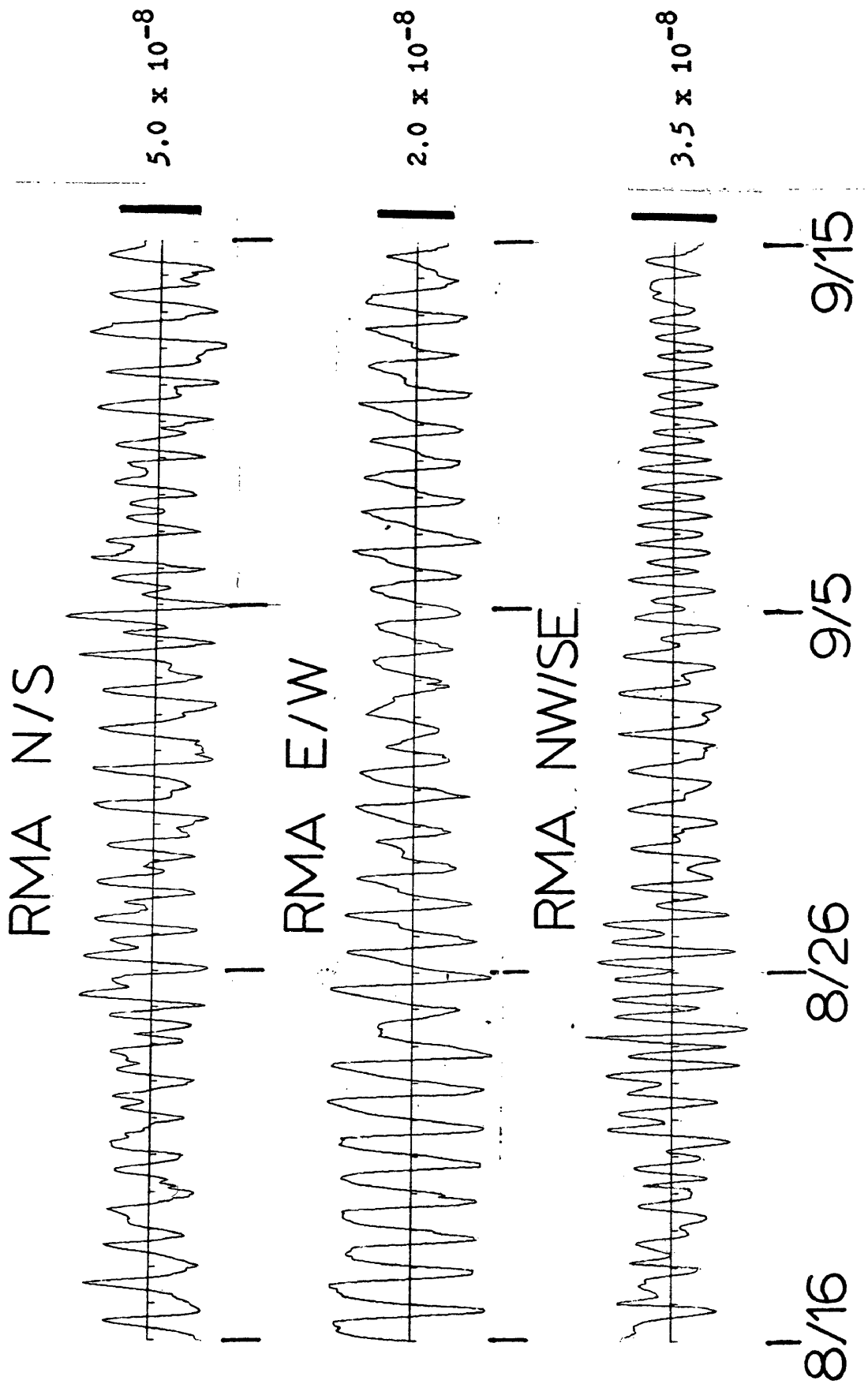

Figure 15. Observed Tidal Strains at RMA.
Traces of observed strain data at RMA after drift- and sensitivity corrected for the interval Aug. 16, 1972 through Sept. 15, 1972. Rock compression downward. Vertical scale to right.

two sets of filters were done as follows:

$$X_m^k = \sum_{t=1}^{24} Y_{tk}\, C_{tm} \qquad \begin{matrix} m = 1,2,3,4 \\ k = 1,2,3,4, \text{ ---},29 \end{matrix} \qquad (1)$$

$$X_{mq} = \sum_{k=1}^{29} X_m^k\, D_{kq} \qquad \begin{matrix} m = 1,2,3,4 \\ q = 1,2,3,4,5,6,7 \end{matrix} \qquad (2)$$

where:

C_{tm} = 4 different time domain filters,

D_{kq} = 7 different time domain filters.

1) First operation - The first operation consists of multiplying the observed value, Y_{tk}, by cos 15°t, sin 15°t, cos 30°t and sin 30°t, which are C_{t1}, C_{t2}, C_{t3} and C_{t4}, respectively. Then, the products of multiplication are summed for each day. Because of the orthogonality of the sine and cosine functions, this operation results in the separation of diurnal ($\sigma_n \approx 15^\circ$) and semidiurnal waves ($\sigma_n \approx 30^\circ$). As an example, X_1^k will be given in a general form as obtained from the first operation:

$$X_1^k = \sum_n 8 \sin 3\sigma_n \sin 6\sigma_n \cos 1.5\sigma_n (1+2\cos\sigma_n)$$

$$\left[\cos\delta_n \cos k\rho_n + \sin\delta_n \sin k\rho_n\right] R_n \,.$$

This operation singles out diurnal waves since for the semidiurnal waves $\sin 6\sigma_n \approx 0$ and so X_1^k become very small. It follows, therefore, that all diurnal waves come to have large amplification coefficients and all the semidiurnal waves have very small amplification factors compared to diurnal waves.

2) Second operation - The sine and cosine of waves with $\varsigma_n = 2\pi P$ (S_2 and K_1), $\varsigma_n = 2\pi P - 25^\circ$ (M_2 and O_1) and $\varsigma_n = 2\pi P - 36^\circ$ (N_2) where P is 1 for diurnal waves and 2 for semidiurnal waves are separated in a similar way in the second operation. The sum is over 29 days. As an example, X_{11} will be given in a general form:

$$X_{11} = \sum_n 8 \sin 3\sigma_n \sin 6\sigma_n \cos 1.5\sigma_n (1+2\cos\sigma_n)$$

$$\{1+4\cos 3.5\varsigma_n \cos 7.5\varsigma_n [1+2\cos 2\varsigma_n (1+2\cos 2\ _n)]\}$$

$$R_n \cos\delta_n$$

The factor in the braces $\{\ \}$ is equal to 29 for $\varsigma_n = 2\pi P$ and it is small for $\varsigma_n = 2\pi P - 25^\circ$ and $\varsigma_n = 2\pi P - 36^\circ$.

Thus, as a result of the above 2 operations, X_{mq} will be one of the following types:

$$X_{1q} = \Sigma_n a_n R_n \cos\delta_n, \qquad X_{2q} = \Sigma_n b_n R_n \sin\delta_n$$

for the diurnal waves and

$$X_{3q} = \Sigma_n c_n R_n \cos\delta_n, \qquad X_{4q} = \Sigma_n d_n R_n \sin\delta_n$$

for the semidiurnal waves.

The amplification coefficients, a_n, b_n, c_n, and d_n, are functions of q, the specific filter of D_{kq}. For each q, the nth coefficient will be large thus amplifying the amplitude of that nth wave and all the others will be small. As an example, the coefficients of amplification (d_n) at X_{42} will be given to show the separation of wave M_2. Since m = 4 and q = 2, this means the amplification coefficients of the semidiurnal waves in the sine part:

waves	M_2	S_2	K_2	N_2	ν_2	O_1	K_1	μ_2
b_n	494.3	0	-5.5	-55.9	39.8	-51.1	0	-43.2

3) Third operation - This operation determines linear combinations of the already found values of X_{mq} to eliminate further the contributions of the disturbing waves having relatively large amplification

coefficients and/or original amplitudes. This operation consists in finding the sums $\sum_n X_{mq} L_{mqn}$. The sums obtained at this stage of operation can be written as follows:

$$n = \sum_{const} X_{mq} L_{mqn}$$

$$= 6_n R_n \cos\delta_n + \sum_i A_i R_i \cos\delta_i + \sum_j a_j R_j \cos\delta_j$$

where $i \neq j \neq n$ and L_{mqn} are the linear combination of coefficients given by Pertsev.

The first term on the right hand side denotes the basic wave of interest, n. Its amplification, G_n, is large, about 500 for waves M_2, S_2, N_2 and K_1 and about 800 for wave O_1. The second term on the right includes waves with periods near the wave of interest. The coefficients, A_i, are relatively large. The last term on the right represents all the remaining waves, these waves have very small amplification coefficients. By dividing $\Sigma X_{mq} L_{mqn}$ by the corresponding G_n, we arrive at

$$\bar{R}_n \cos\bar{\delta}_n = \frac{\Sigma X_{mq} L_{mqn}}{G_n} \approx R_n \cos\delta_n + \sum_i \alpha_i R_i \cos\delta_i$$

where

$\alpha_i = A_i/G_n$,

$\bar{R}_n \cos \bar{\delta}_n$ is the approximation made by dropping the third term of the previous equation.

A similar expression can be written for the terms containing $\sin \bar{\delta}_n$. Now the first approximations can be made for the amplitude and phase of the basic wave n:

$$\text{amplitude} = \bar{R}_n = \sqrt{\bar{R}_n^2 \cos^2 \bar{\delta}_n + \bar{R}_n^2 \sin^2 \bar{\delta}_n}$$

$$\text{phase angle} = \tan^{-1}\left(\frac{\bar{R}_n \sin \bar{\delta}_n}{\bar{R}_n \cos \bar{\delta}_n}\right)$$

These approximations for the amplitude and phase of the M_2 tidal constituent are very good. For M_2, the α_is are very small due to lack of other disturbing waves near the M_2 frequency and $\bar{R}_n \cos \bar{\delta}_n$ is within 1% of $R_n \cos \delta_n$.

Since the M_2 tidal constituent is the only one of interest which needs a real precision, the other process of the Pertsev's method for other tidal constituents will not be discussed here. The interested reader can refer to his original paper (Pertsev, 1958).

As can be seen from inspection of Figs 12 to 15, the

observed strain data at all sites except GOL show diurnal oscillations much larger than expected from theoretical calculations (compare Fig. 11 to Figs. 13 to 15). It is probable that diurnal thermal effects have contaminated these tidal signals. The maximum magnitude of these effects may be estimated from Figs. 16 and 17.

Fig. 16 shows the comparison of the observed amplitudes of the K_1 tidal strain constituent, at various sites and azimuths, with the theoretical expected amplitudes at these sites (horizontal bars). The best insulated site, GOL, produced observed tidal strains close to theoretical tidal strains (compare Fig. 10 to Fig. 12). The BDC and RMA sites have deep trenches (BDC) or additionally insulated and buried endhouses (RMA) and these sites produced less thermally contaminated tidal strain data than at the QBC station. The QBC vault has no additional thermal insulation except the 4-inch thick concrete vault cover. The observed QBC strain data shows the greatest amplitudes of the K_1 tidal constituent. In June of 1971 the RMA sites were modified. Addition of about 1 foot of styrofoam and dry soil over the roof of the endhouse together with insulation of the hatchway at these sites noticeably reduced the daily oscillations. At that time, it was estimated that the amplitudes of these oscillations were reduced to about 20% of their previous values.

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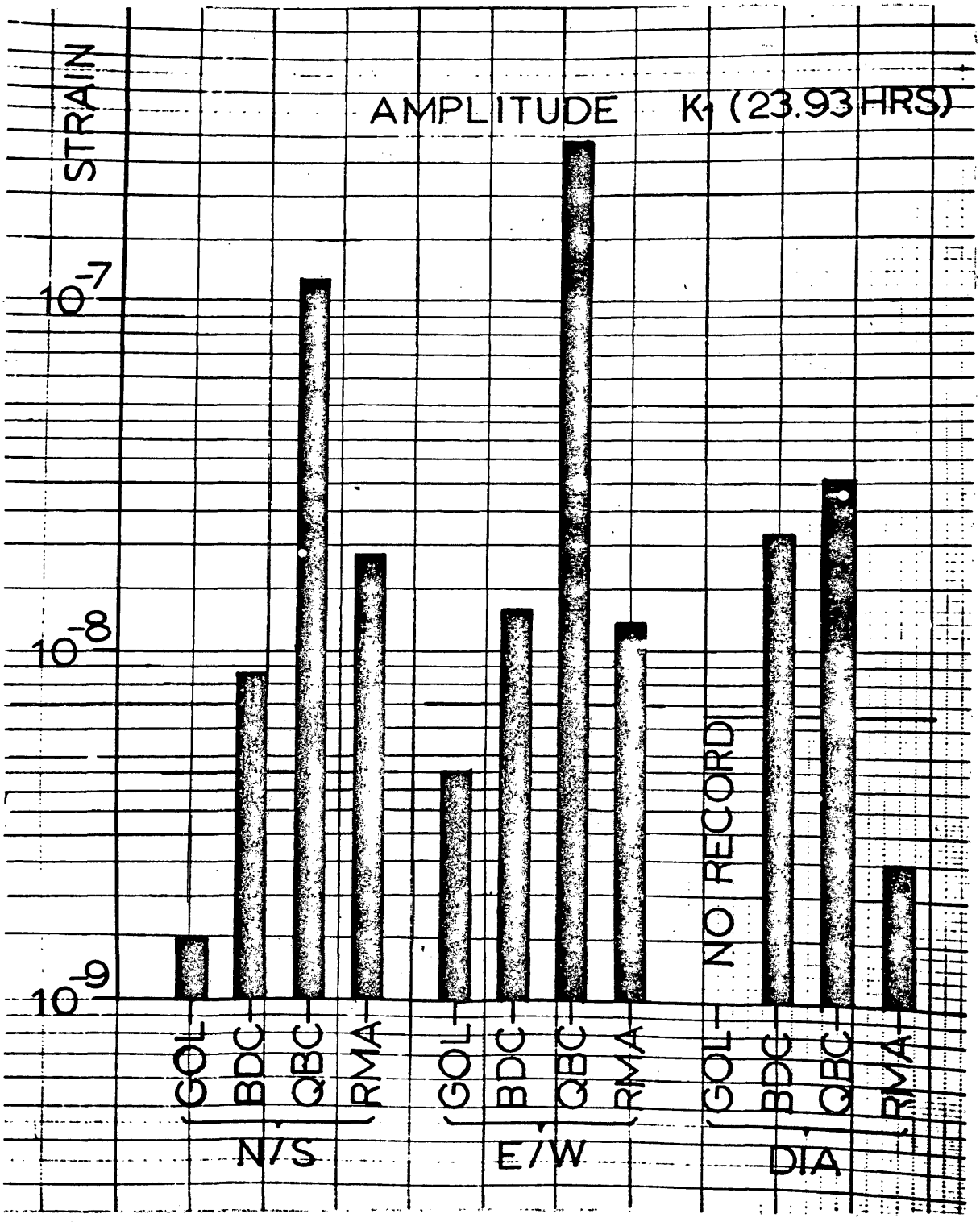

Fig. 16 Amplitudes of K_1 Tidal Constituent.

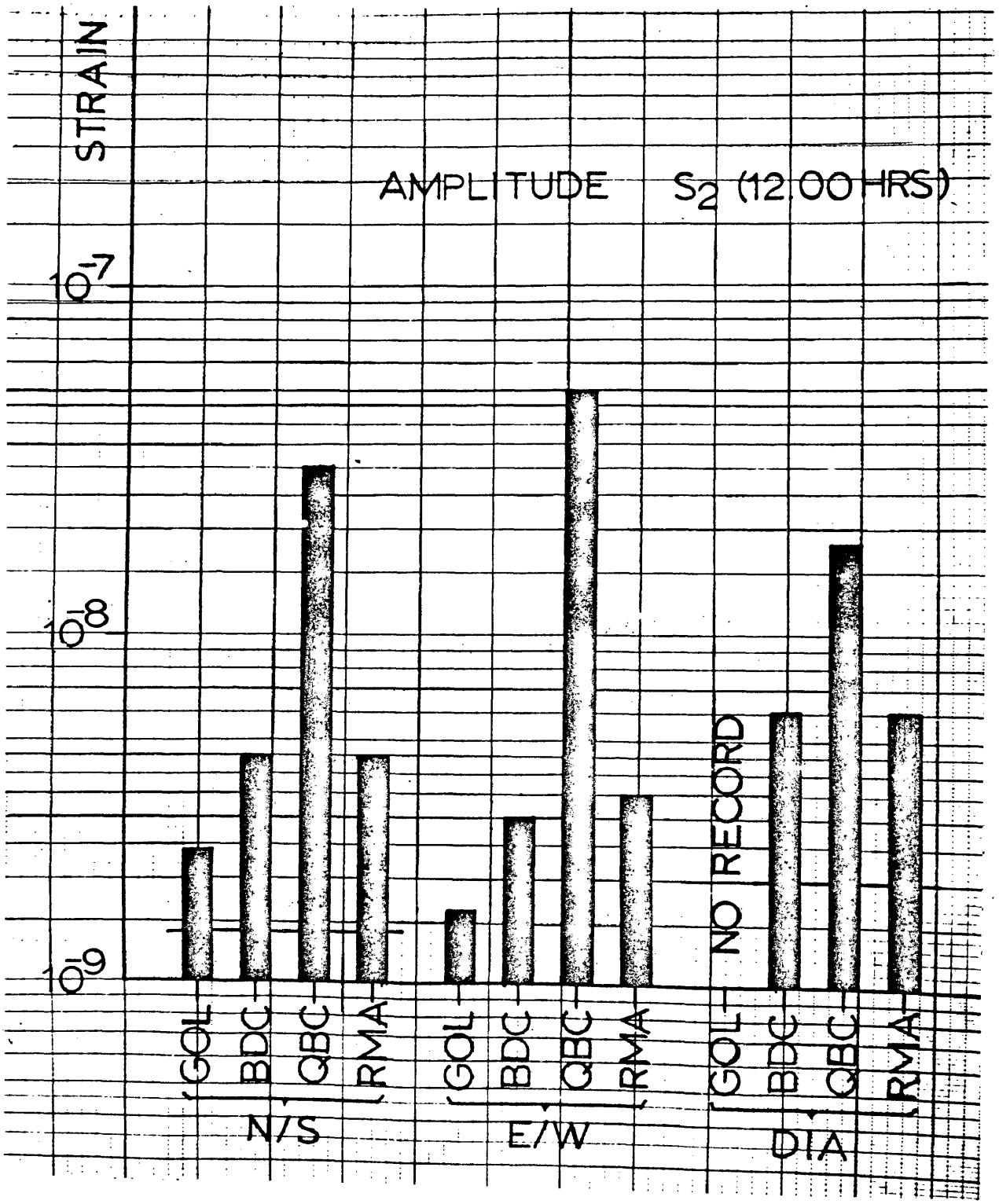

Fig. 17 Amplitudes of S_2 Tidal Constituent.

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In summary, the data seem to indicate that the better the thermal insulation of a site, the more closely the amplitudes of the K_1 tidal constituent approach to the theoretical values.

Fig. 17 shows the comparisons of the observed amplitudes of the S_2 tidal strain constituent, at various sites and azimuths, with the theoretical expected values at these sites (horizontal bars). It shows very similar patterns of amplitude variations with site and is easily related to the thermal insulation at different sites.

Since it has been shown that the M_2 tidal constituent are the least affected by the thermal effects (Figs. 8 and 9). It will be quite reasonable to emphasize the amplitude of the M_2 tidal constituent in any discussion of local perturbations.

Table 3 shows the results of the harmonic analysis for the M_2 tidal constituent. Although the calculated theoretical strain data at this network are practically the same for all stations, the observed tidal strain amplitudes vary rapidly from one station to another. These variations in the amplitudes of the M_2 tidal constituent do not repeat the site to site variations shown in the amplitudes of the K_1 and S_2 tidal constituents and are, therefore, probably not due to thermal effects. The sizes of the variation in the amplitudes of the M_2 tidal constituent are also much bigger than the

anticipated error limits in either calibration of the raw strain data or in the harmonic analysis. In fact, they differ by factors of 2 in magnitudes rather than by only 10 or 20%.

Kuo (1969) showed that, at Ogdensburg, New Jersey, most of indirect effects are due to oceanic loading. By using areal strain which eliminates the oceanic loading effect, he could get values very close to the theoretical Love's and Shida's numbers. From this, it can be said that the areal strain at the stations of this network should show approximately the same values at all sites, unless there are other secondary effects beside oceanic loading effects. Table 4 shows the areal strains observed at these sites. This table indicates that there exist other sources of local perturbation besides ocean loading which cause variations of the M_2 tidal strain amplitudes at these stations.

In summary:

1) 30 days of observed strain data from 11 strainmeters of this network were acquired during August and September of 1972.
2) Raw strain data were corrected before the harmonic analysis for the zero offsets, drifts, and sensitivities.
3) Pertsev's method was used to obtain the amplitude and phase of the M_2 tidal constituent at each site.

Table 3

Observed Amplitudes and Phases of the M_2 Tidal Constituent.

Component	Amplitude(±5%)	Phase(±5)
GOL N/S	4.6	23
GOL E/W	2.5	23
BDC N/S	6.8	15
BDC E/W	1.1	17
BDC NW/SE	9.1	16
QBC N/S	9.8	15
QBC E/W	16.5	18
QBC NE/SW	7.5	20
RMA N/S	12.7	15
RMA E/W	1.5	17
RMA NW/SE	10.4	15

Note: Amplitudes are in units of 10^{-9} strain and phases are in degrees of observed minus theoretical.

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Table 4

Amplitudes and phases of areal strain of the M_2 tidal constituent.

Station	Amplitude(±5%)	Phase(±5)
GOL	7.1	23
BDC	7.9	16
QBC	26.3	17
RMA	14.2	16

Note: Amplitudes are in 10^{-9} strain and phase are in degrees of observed minus theoretical.

4) Theoretical tidal strains for the same period as the observations were calculated using Harrison's (1971) tidal computer program.

5) The result of the harmonic analysis of the observed data show large thermal effects in the trenched, near-surface insturments and only the M_2 tidal constituents provide relatively noise-free, reliable strain amaplitudes.

6) N/S strainmeters have the biggest M_2 tidal amplitude, as expected compared with the other 2 components, and therefore provide most reliable data.

7) The site to site variation of M_2 tidal amplitudes in the N/S direction does not repeat the pattern shown in the variations of the amplitudes of K_1 and S_2. Therefore, this variation of M_2 amplitudes is not due to the thermal effects.

8) The areal strains of the observed data indicate that the indirect effect at these sites are not due to the oceanic loading effects. Therefore, there must exist other sources of local perturbations which dominate the variations of M_2 tidal amplitude at this area.

DISCUSSION

The results of the harmonic analysis of the observed strains (Table 3 and 4) show that the amplitudes of the M_2 tidal constituent, as observed at different stations do not agree within the limits of errors introduced during data acquisition and the analyzing process. All observing stations are within $\pm \frac{1}{4}$ degree of a common latitude and longitude. The calculated values for the theoretical tidal strains at all stations differ by less than 2%. Therefore the observed differences in amplitude of M_2 cannot arise solely from the variation in geographic position from station to station. Some large indirect effect, whose magnitude varies rapidly with geographic position, must be present. The probable identification of this effect is the objective of the following discussion.

The present state of the art in such studies, as reflected in the G.E.O.P. Conference mentioned earlier, is only semiquantitative. Therefore much of this discussion must rest on a basis of plausibility only. Development of new quantitative arguments for each possible indirect effect lies beyond the scope of this paper.

It is customary, in tidal studies, to consider first the possibility that all anomalous observations are due to the

effect of ocean loading. It is not hypothesized here that the ocean load term is necessarily small in the vicinity of Denver. However, it does seem implausible that, given the great distance (over 1400 km) to the nearest ocean, the loading effect is both (1) large in magnitude, and (2) characterized by rapid changes in magnitude or phase angle over distances of only 25-40 km. The latter characteristic would be needed to explain the anomalies and seems particularly inappropriate to loading. Tentatively it is concluded that the ocean loading is not the probable source of the observed anamalies.

Certain alternative sources of tidal perturbations have been mentioned in the introductory section of this paper. In the following five numbered subsections we reconsider such of those, and other, possible sources as seem relevant to the Denver problem.

(1) Empirically the tidal strains correlate with distance from the Rocky Mountain front-tides are smallest in the mountains and increase eastward out into the high plains. This variation is reminiscent of Tomaschek's (1954) tidal observations in England (pp 3 herein). One might hypothesize that the Rocky Mountains provide a long rigid element, trending N/S, which acts to reduce the N/S component of tidal strain in its vicinity. Given the great length of this hypothesized element (of the order of 1000 km) it seems that

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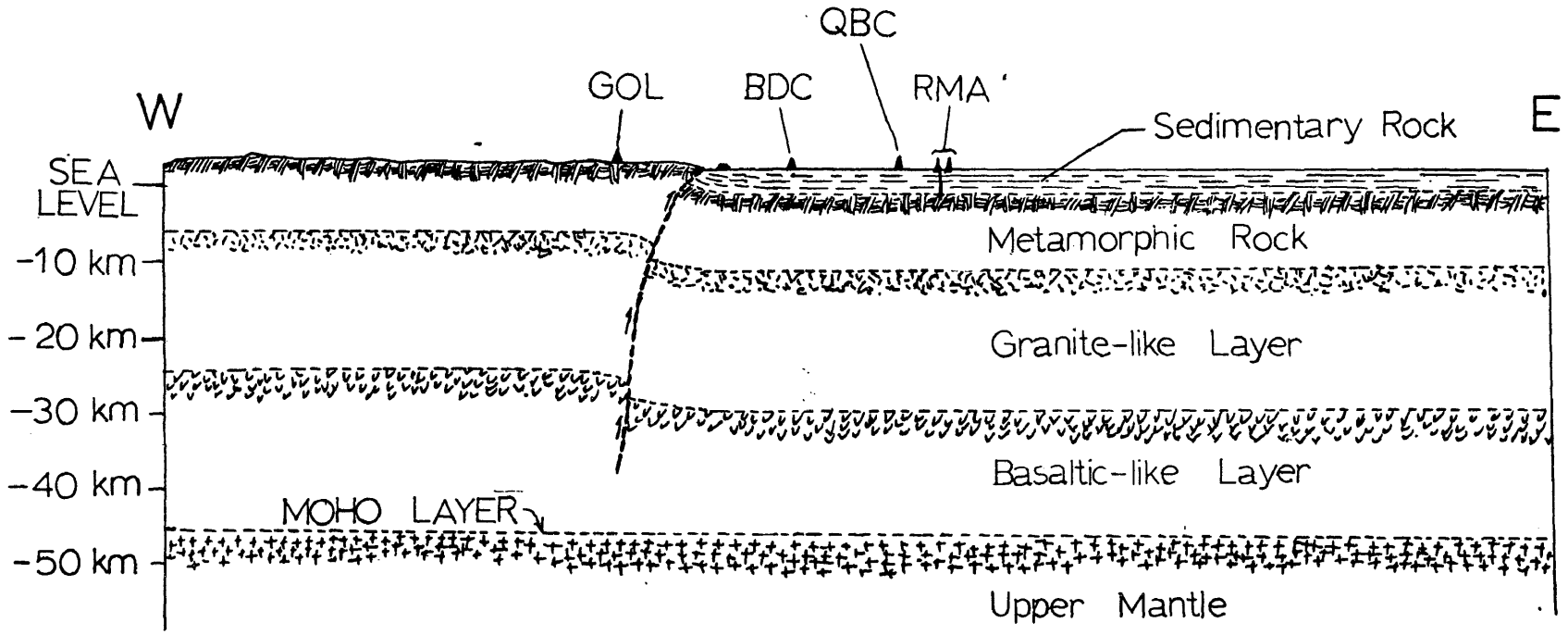
EARTHCRUST STRUCTURE OF DENVER— ROCKY MOUNTAIN AREA, COLORADO*



*WANG (1965)

Fig. 18

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near (within 25-35 km) of the edge of the element one would not expect such rapid changes in tidal amplitude as are observed between the Quimby and RMA sites (Figure 18). In any case this hypothesis implies that a change in the effective ridigity of certain geologic elements is capable of changing the tidal strain within and near those elements and we believe a more direct correlation with elastic properties can be shown later. Therefore the role of the Rocky Mountains is tentatively discounted.

(2) A variety of local and regional faults and fracture zones can be identified near Denver. The Golden Fault separates the crystalline rocks of the mountains from the sediments of the Denver basin. Certainly another important complex of faulting, not mappable on the surface, is associated with the famous N.E. Denver seismic zone which lies below the Quimby-RMA portion of this study area. The importance of these fractures is not discounted totally here but it is remarked that, in exploration seismology, one cannot hypothesize that faults are stress-free boundaries in the medium. If such were commonly the case, strong reflections from fault surfaces would be common and they are not. Nishimura (1950) may have found an exception near Beppu on Kyushu (pp 3 herein). In addition the simple spatial distribution of the observed tidal anomalies argues against

any model which adduces a multiplicity of small fractures, it being improbable that the fracture pattern changes so smoothly across a zone characterized by such dramatic tectonic and lithologic changes. In brief it is believed that an explanation in terms of large faults may be possible but would involve hypothesizing tidal displacements across them which are smooth, not stick-slip, and which only reduce the stress across the boundary without making the stress zero. This seems improbable.

(3) It is well established (Barrows, 1973) that changes in ground moisture, and in local water table elevation are capable of producing perturbations of near-surface strain records by amounts even greater than the tidal amplitude. Certainly tidal changes in fluid surface elevation in wells are relatively common though not present in most wells. These changes are usually interpreted as reflecting the flow of fluid from the well bore into, and out of, a volume of fractured rock penetrated by the well bore. Dilatation of the rock by tidal stresses leads to a drop in fluid level. In the absence of tidal stresses one would expect such a reduction in instital fluid pressure to produce a reduction in rock volume and an associated compression in areal strain observed at the surface. It seems that, in most cases, near surface tidal strains are the cause, not the effect, of

associated water table fluctuations, and that the strains due to the direct effect probably are reduced by the associated water table changes, if any. Professor Harrison has called to our attention Dr. Farrell's remark that nearly all observed strains are somewhat too small to fit the theory. This systematic perturbation might be due to water table motions. No observational data is available regarding the size of the water table tide at the various strain-meter sites being discussed here, without such data the contribution of the water table tide cannot be estimated, and further speculation seems inappropriate.

(4) All near-surface strain observations are probably perturbed by the topography near the instrument site. The theory of this effect has not been adequately developed in the literature. Mr. M. W. Lee, of this department, is investigating the effect but has not yet progressed to very realistic models. At present, therefore, the importance of this topographic correction in explaining the anomalous tidal amplitudes observed near Denver cannot be quantified at all sites. There are gross topographic differences between the steep hillside at Bergen Park and the almost flat environment of the R.M.A. site 3, but at present it is not clear whether the Bergen Park topographic correction should amplify the tidal signal or reduce it. However the BDC and RMA sites are both located in relatively flat topography. The significant

difference between the tidal signals at these two topographically similar sites is interpreted as indicating that the topographic effect is not the dominant perturbation present in this data.

(5) Empirically, the amplitudes of M_2 also correlate inversely with the competence of the rock exposed at each site. If it be plausible to hypothesize that the horizontal tidal stresses are almost constant across the subject network then an inverse relation between local rock rigidity and local strain would be expected from Hooke's Law. It will be shown that, (I) the rigidity of the local rocks does vary significantly across the net, being large at GOL where the strain is small and small at RMA where the strain is large, and (II) it is plausible that the tidal stress vary slowly, in space.

Characteristic rock specimens were not collected from each site at the time the instruments were constructed. Direct laboratory measurements of elastic parameters therefore cannot now be made without new excavations at each site. It is possible, however, to estimate the rigidity of the rocks on which the instrument piers are placed from other available information.

Table 5 is a generalized stratigraphic section of the vicinity of the network, included here to provide orientation for the following site descriptions.

TABLE 5

Generalized Stratigraphic Section of the Golden - Morrison Area*

Age	Formation	Lithology	Thickness (Ft)
Paleocene	Green Mountain-conglomerate	Pebble and boulder conglomerate, non-marine, non-glacial.	423
	---------- Disconformity ----------		
	Denver	Drab graywacke sandstone and mudstone. The base is a very widespread basalt and andesite conglomerate, non-marine.	434

Upper Cretaceous			
	---------- Disconformity ----------		
	Arapahoe	Light gray, buft, tan sandstone, shales and conglomerate, non-marine	691
	---------- Disconformity ----------		
	Laramie	Gray sandstones and claystones; some thin coals in lower part. Non-marine.	626
	---------- Transitional? ----------		
	Fox Hills	Buff, fine-grained sandstone and drab-colored silty shale. Marine.	112

	Pierre	Gray shale with some fine sandstone and siltstone. Marine.	8000

	Niobrara	Buff, foraminiferal shale, gray limestone; fossilferous. Marine	440
	----------	Disconformity ----------	
	Benton	Gray-black, fissle shale. Marine.	480
	----------	----------	
	Dakota	Sandstone with some black carbonaceous claystone; predominantly continental.	277
----------		Disconformity ----------	
Upper Jurassic	Morrison	Sandstone with variegated shales; continental.	297
----------		Disconformity ----------	
Lower Jurassic	Ralston	Mudstone, malstone, gypsum and yellow sandstone; continental	54 - 83
----------		----------	
Triassic-Permian	Lykins	Red, sandy shale and mudstone with laminated limestone.	410 - 463
----------		Disconformity ----------	
Permian	Lyons	Gray sandstone; continental.	132
----------		Disconformity ----------	
Upper	Fountain	Red, arkosic, conglomeratic sandstones, and arenaceous mudstone; non-marine.	1001
----------		Nonconformity ----------	
Pre-Cambrian		Gneiss and schist	

* After Reichert (1954)

At the GOL station, the rocks surrounding the station are Precambrian, metamorphic crystallines, mostly schist and gneiss. The principal rock types found in the tunnels are hornblende-andesine gneiss and biotite-amphibolite with quartz zones of lit-par-lit injection of granitic material. These rocks show a foliation with a general northwest strike (Klugman, 1964). By comparison with other sites, these rocks are the most competent rocks. Their rigidity is estimated to be between 0.45 and 0.60 megrabars (10^{12} dynes/cm^2) (Birch, 1965).

At the BDC station, the bed rocks are the Cretaceous Fox Hills Formation, mainly consisted of sandstones of fine-to medium-grained, friable and massive-to well-bedded (Reichert, 1954). A thin core sample from this formation, perhaps not characteristic of the gross properties, shows V_s=3710 ft/sec and ρ = 2.65 grams/cm^3 (John Bedwell-personnal communication). The observation implys μ= 0.028 megabars, which seems low. By comparison with other sites, these rocks are less competent than those of GOL but clearly more competent than those under the RMA sites. The rigidity is estimated to be between 0.35 and 0.50 megabars (Birch, 1965).

At the QBC station, the bed rocks are Cretaceous Laramie Formation which is made up almost entirely of a series of interbedded sandstones, clays and carbonaceous claystones

(Reichert, 1954). The strainmeters were installed on the horizontal bedding surface of poorly cemented sandstones (Major-personnal communication). By comparison with other sites, these rocks are less competent than those of GOL and BDC, but clearly more competent than those of RMA. The rigidity is estimated to be between 0.30 to 0.45 megabars (Birch, 1965).

At the RMA stations, the underlying rocks are of the Paleocene Denver Formation which mainly consists of graywacke sandstones and mudstones (Reichert, 1954). The strainmeters were installed on a weathered mudstone or shale (similar to Pierre shale?) because no more competent rocks were found near the surface. A field determination of seismic velocities in the Pierre shale indicates $\mu = 0.007$ megabars (Hollister et al, 1966). RMA #3 rocks were more weathered than the RMA #1 rocks (Romig, 1969). By comparison with other sites, these rocks were the least competent rocks. The rigidity is estimated to be between 0.05 and 0.20 megabars at RMA #1 and between 0.01 and 0.15 megabars at RMA #3 (Birch, 1965).

Figure 19 shows the relation between the amplitude of the M_2 constituent of the observed tidal strain and the rigidity of the base rocks, using the preceeding estimates for the rock rigidity characteristic of each site. It is not appropriate to consider this display to be more than

semi-quantitative. It is considered significant that the act of arranging the sites in order of increasing rock rigidity also arranges the sites in order of decreasing strain amplitude.

Now consider the plausibility of the hypothesis that the tidal stress varies slowly in space, i.e. that the stress is almost constant across the network. It is conventional to approximate the vertical, or "lithostatic", component, P_{xx}, of the stress at depth "X" in the earth by asuming that $P_{xx} = \rho g X$ wherin "ρ" is the density and "g" is the acceleration of gravity. Note that the Hookian coefficients which specify the elastic characteristics of the rock are not included. In such a model $(\Delta P_{xx})(\Delta X)^{-1} = \rho g$. Let us rotate the model and estimate the space rate of change of the horizontal component of the tidal stress in a similar manner, using the horizontal component of the tidal acceleration in place of g. The amplitude of this tidal acceleration is about 35 microgals or 35×10^{-6} cm/sec^2. Assume that ρ is about 3.0 gm/cm^3. Therefore $P_{xx} \approx (3.0 \text{ gm/cm}^3)(35 \times 10^{-6} \text{ cm/sec}^2)X$ or $P_{xx} = (1 \times 10^{-4} \text{ gm/sec}^2 \cdot 1/\text{cm}^2)X = (1 \times 10^{-4} \text{ dynes/cm}^3)X$ wherein X is the length of the horizontal element being subjected to the tidal acceleration. Now in order to make P_{xx} large enough to produce tidal strains of the order of 2×10^{-8} in rock of Youngs Modulus near 10^{12} dynes/cm^2 one needs $P_{xx} = (2 \times 10^{-8})(10^{12} \text{ dynes/cm}^2) = 2 \times 10^4$ dynes/cm^2.

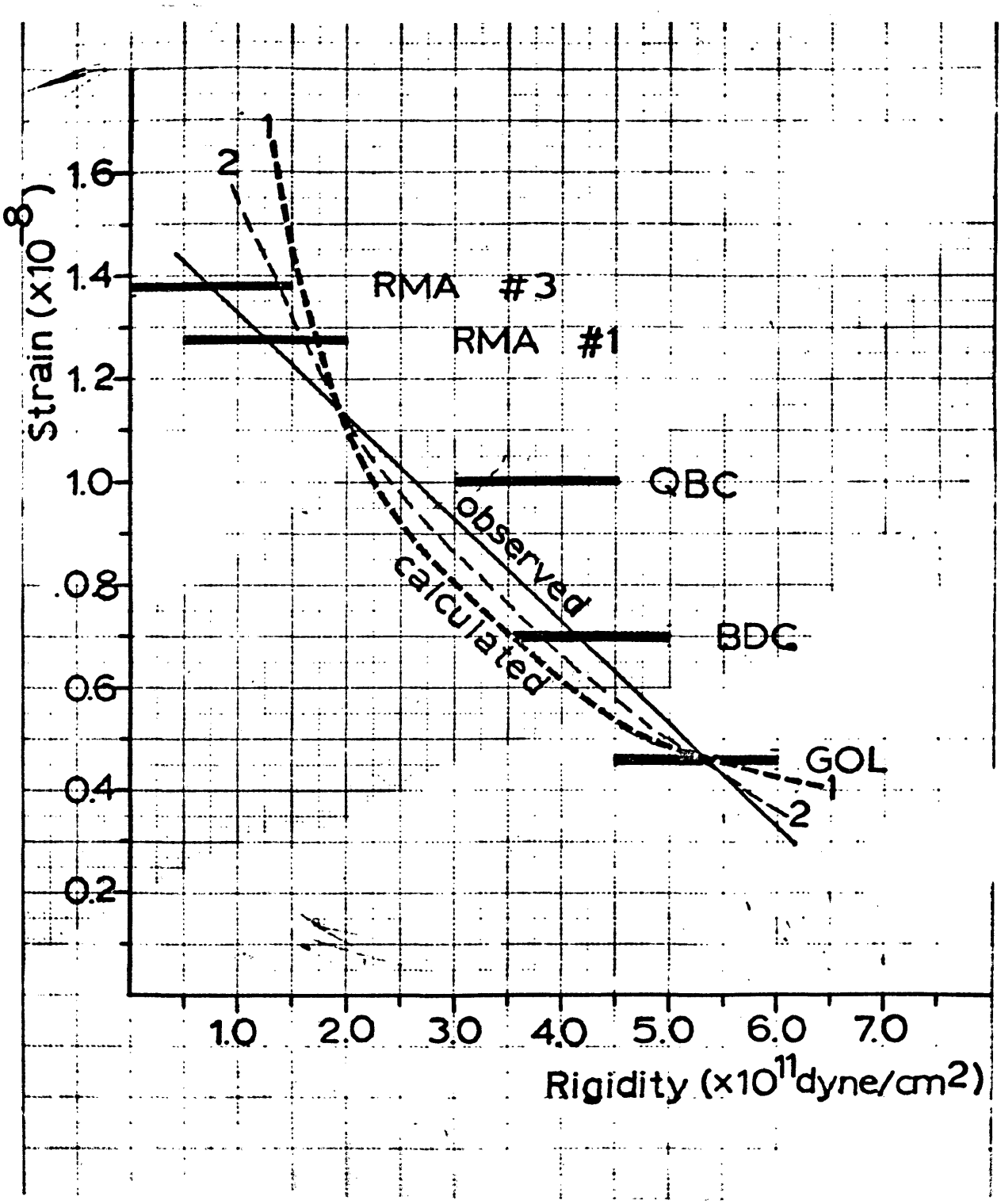

Fig. 19 Strain Amplitudes vs Approximate Rigidity of Base Rocks.

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Therefore 2×10^4 dynes/cm$^2 \approx (1 \times 10^{-4}$ dynes/cm$^3)X$, or $X \approx 10^8$ cm $\simeq$ 1000 km. That is to say the body force due to the moon needs to build up over distances of the order of 1000 km in order to produce stresses of a magnitude comparable to those associated with the tides. Two features of this argument are relevant; (1) the locally generated stress, due to tidal body forces acting within a few tens of kilometers of the observing site, produces very little of the tidal stress present, and (2) to a first approximation, the elastic constants of the rock element upon which the tidal forces act do not influence the stress. It is plausible, therefore, to assume the tidal stresses are almost the same throughout the network even though the local rock types vary.

On the basis of this assumption and the observed correlation with local rock rigidity (Figure 19) it is tentatively concluded that the dominant indirect effect, perturbing the observations, is the site-to-site variation in the rigidity of the rock on which the instruments are placed.

The size of this "site effect" on tidal measurements is comparable to that of the "station-correction" conventionally applied in earthquake magnitude studies (Richter, 1958, pp 343) The Richter Magnitude $M = \log_{10} A - \log_{10} A_0$. Wherein A is a measure of the ground motion at the observing station and A_0 is a function of distance. It is common to find that, in

a network of seismograph stations, one particular station always produces records such that M is larger, or smaller, than the network average by as much as 0.3. This corresponds to real changes in A, or ground motion, by a factor of 2 ($\log_{10} 2 = 0.3$) associated with some local effect. The GOL seismograph records, compared with world-wide observations, lead to small values of M, ie the station-correction is positive (Ruth Simon - personnal communication). The facts that (1) local effects of comparable magnitude are used in short-period work, and (2) GOL exhibits small ground motions at short-periods, are interpreted as contributing to the plausibility of the conclusion that changes in rock rigidity in the vicinity of the observing station influence the local tidal strain.

Further support for this conclusion arises from the fact that certain anomalous strain observations, previously reported, now seem interpretable in light of this conclusion. These anomalous observations are (A) Nishimura's tidal study near Makimine, and (B) the anomalously large strain-steps observed at Semisopochnoi associated with an underground explosion. We now discuss these two observations.

Nishimura's conclusion for his observation of anomalous fluctuation of the tidal constituent M_2 was as follows:

"In summary, a very unusual result was obtained from the

analyzed data of tiltmetric observation at Makimine. The earth tide amplitude observed at Makimine showed a notable fluctuation with time. This phenomenon is considered to be peculiar to the Makimine station. As a result of the various examinations, we can state that this fluctuation is not introduced by error in the analysis, but is intinately related to the bending motion of the Earth's crust by tidal load of sea water in Hyuganada region (where is 28 km away from Makimine and one of the active centers of large sea earthquakes). As a natural consequence of the results, the state of matter in the crust near Makimine is considered to vary with time to a considerable extent, and though the nature of this variation is beyond our comprehension, we can at any rate watch the change of state of the crust continuously by such a method of tiltmetric observation. (Nishimura, 1950, p. 372)

Moreover, the special observation for the same purpose of study on the amplitude fluctuation of componental tide of earth tides have been made at some stations besides Makimine during the course of I.G.Y. It is provisionally reported that this phenomena is certainly a real, natural one, and not apparently introduced by any cause of error by the analysis method, the

instrumental or artificial, or meteorological and other errors, at least in case of Makimine. It has a certain connection with the change of elastic property of crustal underground and moreover with the seismic activity of the neighboring area" (Nishimura, 1958).

According to Birch (1965), the elastic constants are functions of temperature and pressure (or more generally of stress) and the elastic constants of rocks may vary with stress, particularly at low stresses where the relationship between stress and strain often departs markedly from linearity. This behavior is caused by porosity or intercrystalline spaces which may be changed by stress; thus the effective constants of a rock are determined, not only by the constants of the solid components, but also by the shape and distribution of the spaces between them. These spaces may be greatly reduced by the application of pressure to the solid components, and are often virtually eliminated by pressures of the order of 1 kilobar (= 10^9 dynes/cm^2).

Simon (1964) and Tomaschevskays (1961) showed that the shear modulus changes about 5 to 20%, depending on rock types, when the confining pressure of the sample increases from 0 to 1 kilobar. In such experiments 70% of the change occurs within the first few hundred bars. The reported stress-drops (or the confining pressure changes) associated with earthquakes are about the order of 10 to 400 bars depending

on the characteristics of the earthquake sources such as fault width, rigidity and maximum displacements along rupture (Wyss, 1970; Brune et al, 1967; Wyss et al, 1972). Assuming a stress-drop of a few hundred bars associated with an earthquake occurance, it is quite conceivable to expect to see changes of the near surface shear modulus of about 10 to 30% in the source region. This much change in shear modulus would, in turn, quite easily causes a 50% change in the tidal response (or strain amplitude) according to the graph of Fig. 19.

In view of this relationship, it is quite probable that the observation of tidal amplitude fluctuation in time at Makimine is indeed a real effect caused by seismic activity near the observation point.

The CANNIKIN underground nuclear test ($m_b \approx 7$) was detonated at 51° 28'18.0" N., 179° 06'24.0" E., at 22^h00^m GMT on November 6, 1971. Prior to this time, a network of strain observatories, designed to monitor the very long period earth deformations associated with the shot, had been deployed in the Aleutian Islands. Permanent strain steps were observed at all stations (Romig et. al., 1972).

Anomalously large residual strains were observed at the Semisopochnoi site. The principal compressions at Rat Island (66.6 km from ground zero) and at Semisopochnoi (57 km from

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ground zero) were 2.3×10^{-8} and 16×10^{-8} respectively. It was not anticipated that the amplitude of the residual strain should be equal at these two sites, the source probably being azimuthally assymetric. However various attempts to fit the observed strain with simple source models lead repeatedly do prediction of Semisopochnoi strains smaller than those observed. By comparison with all other sites involved in the Aleutian experiment Semisopochnoi is unique with respect to the rock type on which the instruments are emplaced. At all other sites the instruments are emplaced on bedded lavas, fractured but exhibiting only minor porosity other than that associated with the thin fractures. The Semisopochnoi site, by contrast, is underlain by a thick bed of glassey, vesicular, agglomerate, the minimum "grain" size being of the order of one foot. A shovel handle could be inserted into the rock mass to a depth of 4' in many places. This material might be approximately modeled by a slightly welded sphere-pack. Extensive analysis of such models, leading to estimates of their effective rigidity, are available in the literature (e.g. White, 1965) and will not be reproduced here. It is well established that, in the absence of interstitial fluids as at Semisopochnoi, the effective rigidity of such sphere-packs is <u>much</u> less than the rigidity of the material of which the spheres are made. For example, in the limit, perfect spheres just touching

with no loading, the shear modulus approaches zero. A detailed quantitative analysis of the Semisopochnoi material is not possible because of our failure to make suitable detailed field studies of grain size distributions, packing character determinations, etc. However the gross difference in porosity between the Semisopochnoi instrument footing and that at all other sites is not in doubt. From the viewpoint of the hypothesis discussed above, the importance of local rock type, one would expect abnormally large strains to be recorded by sites located on material of abnormally low rigidity and that is what occurred at Semisopochnoi at the time of the CANNIKIN event, This observation supports the hypothesis.

In summary:

1) Empirically, it is found that the observed tidal strain amplitude correlates with distance from the Rocky Mountain Front-tides are smallest in the mountains and gradually increase out to the plains.

2) The amplitude differences are due to some local effects rather due to either the geographic differences in the station location or the oceanic loading effect.

3) It seems probable that the major portion of the local effect is due to differences in the effective rigidity of the base rocks in the vicinity of the instrumental sites.

4) Any time variation in the effective rigidity in the vicinity of an instrumental site may also cause fluctuations in the amplitude of the tidal constituents.

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CONCLUSIONS

A network of strainmeters installed in central Colorado has provided a unique opportunity to study local perturbations of tidal strains in a relatively small area about 25 km in radius. Analysis of data collected from this network during August and September of 1972 has resulted in some general conclusions concerning tidal strain measurements:

1) The observed tidal strains in this network due to the luni-solar attractions are considerably smaller than the theoretically calculated tidal strains assuming $\underline{h} = 0.612$ and $\underline{L} = 0.083$.
2) Local effects are as big as the direct effects.
3) The oceanic loading effects at this network are not the dominant factor in the local perturbations of the tidal strain amplitude.
4) The dominant part of the local effects probably comes from the local variations of effective elastic properties in the vicinity of each strainmeter installation.
5) The "vicinity of the site" means a three miles or less, perhaps much less.

If these results characterize other regions, the following applications might be made:

1) One month's observation of tidal strains at strainmeter sites located close to each other will be enough to see the differences in overall elastic properties in that area and provide site calibration.
2) Any time variation of effective elasticity at one site should cause detectable fluctuations in the amplitude of the tidal constituents. Such fluctuations could indicate changes in stress near the site and be useful in prediction of rock failure.
3) Tidal strain measurements at different sites having distinctive differences in their geologic or geophysical environments can not be compared directly to each other without having been corrected for their characteristics.
4) It is probable that similar site corrections will be necessary in the interpretations of all other strain data.
5) Strainmeters will be generally much more useful to study the local perturbations of earth tides than gravity or tilt measurements because of their greater sensitivities to local environments.

DATA APPENDIX

Theoretical Tidal Strain Data for GOL N/S

All data are in 10^{-9} strain. Data period is from 00^h 00^m (GMT), August 16 through September 15, 1972.

2.38	0.99	-2.26	-6.40	-10.20	-12.44	-12.27	-9.45
-4.39	1.93	8.17	13.01	15.38	14.77	11.33	5.83
-0.53	-6.37	-10.54	-12.30	-11.54	-8.76	-4.97	-1.35
0.98	1.34	-0.36	-3.61	-7.44	-10.63	-12.11	-11.18
-7.74	-2.33	4.01	9.97	14.30	16.06	14.86	11.00
5.29	-1.03	-6.65	-10.50	-11.94	-10.97	-8.17	-4.55
-1.28	0.64	0.63	-1.30	-4.57	-8.17	-10.94	-11.87
-10.38	-6.48	-0.81	5.57	11.33	15.27	16.54	14.87
10.62	4.69	-1.65	-7.14	-10.74	-11.89	-10.69	-7.78
-4.20	-1.10	0.55	0.25	-1.91	-5.25	-8.82	-11.35
-11.92	-10.01	-5.73	0.21	6.69	12.36	16.02	16.90
14.78	10.12	3.91	-2.56	-7.99	-11.37	-12.21	-10.68
-7.50	-3.78	-0.70	0.78	0.20	-2.26	-5.08	-9.54
-12.02	-12.38	-10.14	-5.49	0.80	7.46	13.14	16.61
17.10	14.50	9.35	2.75	-3.93	-9.33	-12.45	-12.86
-10.82	-7.16	-3.12	0.07	1.41	0.51	-2.39	-6.44
-10.41	-13.02	-13.27	-10.73	-5.66	1.02	7.96	13.69
16.95	17.01	13.83	8.09	1.01	-5.90	-11.21	-13.92
-13.69	-10.89	-6.54	-2.00	1.37	2.56	1.29	-2.32
-7.01	-11.47	-14.32	-14.51	-11.66	-6.15	0.97	8.20
13.94	16.91	16.41	12.53	6.11	-1.45	-8.48	-13.52
-15.56	-14.39	-10.56	-5.31	-0.18	3.39	4.26	2.27
-2.07	-7.57	-12.65	-15.78	-15.92	-12.75	-6.79	0.73
8.14	13.75	16.26	15.96	10.40	3.32	-4.57	-11.50
-15.93	-16.96	-14.54	-9.47	-3.21	2.48	6.04	6.48
3.67	-1.66	-8.06	-13.77	-17.19	-17.26	-13.78	-7.45
0.30	7.69	12.94	14.81	12.81	7.41	-0.14	-8.07
-14.52	-17.94	-17.63	-13.74	-7.36	-0.18	5.89	9.27
9.04	5.26	-1.09	-8.35	-14.63	-18.25	-18.24	-14.55
-8.04	-0.30	6.78	11.44	12.54	9.79	3.84	-3.85
-11.39	-16.91	-19.03	-17.19	-11.83	-4.29	3.56	9.73
12.67	11.63	6.88	-0.38	-8.33	-14.98	-18.71	-18.65
-14.90	-8.48	-1.07	5.43	9.34	9.68	6.36	0.20
-7.21	-13.96	-18.26	-18.91	-15.61	-9.01	-0.65	7.50
13.47	15.81	13.97	8.41	0.50	-7.86	-14.70	-18.47
-18.45	-14.85	-8.80	-1.97	3.78	6.94	6.68	3.08
-2.91	-9.69	-15.40	-18.41	-17.73	-13.25	-5.83	2.92
11.01	16.57	18.31	15.84	9.77	1.53	-6.97	-13.83
-17.63	-17.74	-14.49	-8.99	-2.89	2.11	4.63	4.01
0.43	-5.13	-11.10	-15.76	-17.65	-15.96	-10.75	-2.95
5.81	13.62	18.74	20.01	17.18	10.91	2.64	-5.78
-12.57	-16.42	-16.78	-13.98	-9.11	-3.73	0.67	2.76
2.02	-1.35	-6.36	-11.58	-15.39	-16.51	-14.23	-8.70
-0.87	7.69	15.17	19.93	20.95	18.02	11.80	3.69

-4.57	-11.28	-15.20	-15.63	-13.48	-9.16	-4.29	-0.35
1.53	3.61	-2.28	-6.83	-11.50	-14.73	-15.49	-12.99
-7.44	0.23	8.53	15.74	20.31	21.26	18.38	12.34
4.43	-3.66	-10.30	-14.30	-15.15	-13.11	-9.14	-4.59
-0.86	0.95	0.72	-2.56	-6.84	-11.23	-14.37	-14.91
-12.43	-7.02	-0.46	8.56	15.60	20.39	21.05	18.27
12.36	4.61	-3.56	-9.95	-13.96	-14.66	-12.91	-9.03
-4.54	-1.82	1.01	0.43	-2.39	-6.63	-11.01	-14.14
-14.84	-12.49	-7.22	0.12	8.09	15.34	19.47	20.39
17.60	11.70	3.98	-3.91	-10.38	-14.23	-14.94	-12.78
-8.69	-4.02	-0.19	1.67	1.03	-1.93	-6.36	-12.96
-14.29	-15.15	-12.93	-7.74	-0.46	7.43	14.27	18.52
19.24	16.24	10.10	2.43	-5.36	-11.56	-14.98	-15.16
-12.45	-7.68	-2.57	1.10	2.90	2.02	-1.30	-6.13
-11.08	-14.66	-15.66	-13.47	-8.26	-1.41	6.77	13.36
17.24	17.52	14.11	7.78	-0.02	-7.56	-13.19	-15.84
-15.15	-11.02	-6.37	-0.99	3.02	4.57	3.22	-0.66
-6.01	-11.34	-15.38	-16.11	-13.82	-8.53	-1.32	6.22
12.34	15.58	15.18	11.21	4.60	-3.29	-10.76	-14.62
-16.33	-14.47	-9.93	-4.03	1.58	5.41	6.44	4.42
-0.17	-6.15	-11.67	-15.47	-16.31	-13.32	-8.43	-1.35
5.73	11.12	13.49	12.26	7.71	0.76	-6.34	-12.44
-15.93	-16.63	-12.87	-7.37	-0.98	4.67	7.95	8.22
5.34	3.06	-6.26	-11.98	-15.60	-16.13	-13.36	-7.94
-1.17	5.23	9.67	11.02	8.94	3.96	-2.67	-9.25
-14.15	-16.14	-14.75	-10.36	-4.10	2.40	7.68	10.27
9.60	5.86	-0.63	-6.58	-12.17	-16.42	-15.53	-12.51
-7.17	-0.91	4.63	8.00	8.33	5.54	0.36	-5.83
-11.42	-14.91	-15.35	-12.57	-7.21	-2.53	5.86	10.43
12.08	10.45	5.94	-0.35	-6.91	-12.16	-14.92	-14.60
-11.42	-6.31	-0.70	3.89	6.21	5.66	2.38	-2.72
-8.24	-12.66	-14.71	-13.73	-9.82	-3.51	2.94	8.87
12.61	13.29	10.78	5.69	-0.79	-7.15	-11.96	-14.19
-13.50	-10.26	-5.52	-0.59	3.06	4.46	3.22	-0.30
-5.09	-9.87	-13.74	-13.79	-11.64	-6.91	-0.57	5.98
11.29	14.13	13.93	10.71	5.23	-1.26	-7.32	-11.62
-13.37	-12.36	-9.18	-4.81	-0.60	2.24	2.89	1.19
-2.37	-6.75	-10.64	-12.82	-12.49	-9.44	-4.19	2.23
8.44	13.46	15.14	14.16	10.39	4.66	-1.71	-7.41
-11.26	-12.60	-11.40	-8.27	-4.28	-0.66	1.53	1.62
-0.38	-3.88	-7.83	-11.00	-12.31	-11.14	-7.46	-1.88
4.49	10.32	14.36	15.73	14.14	9.96	4.10	-2.17
-7.56	-11.02	-12.32	-13.65	-7.58	-3.86	-0.68	1.31
0.70	-1.51	-4.94	-8.55	-11.17	-11.82	-10.72	-5.87
-0.08	6.23	11.73	15.27	16.08	13.99	9.46	3.46
-2.73	-7.68	-11.92	-11.72	-10.16	-7.96	-3.49	-0.60

Theoretical Tidal Strain Data for GOL E/W

All data are in 10^{-9} strain. Data period is from 00^h 00^m (GMT), August 16 through September 15, 1972.

-6.63	-6.77	-6.54	-6.90	-6.34	-5.03	-2.84	0.17
3.74	7.43	10.73	13.17	14.34	14.07	12.41	9.61
6.12	2.38	-1.28	-3.92	-5.96	-7.21	-7.81	-8.02
-8.07	-8.11	-8.17	-8.10	-7.70	-6.69	-4.87	-2.20
1.21	5.03	8.83	12.09	14.35	15.25	14.67	12.69
9.61	5.88	1.99	-1.59	-4.53	-6.66	-7.99	-8.69
-8.98	-9.08	-9.11	-9.06	-8.81	-8.13	-6.78	-4.61
-1.61	2.87	6.87	9.92	13.12	15.22	15.87	15.02
12.77	9.46	5.55	1.54	-2.11	-5.07	-7.21	-8.54
-9.24	-9.54	-9.63	-9.63	-9.52	-9.15	-8.29	-6.73
-4.33	-1.10	2.75	6.86	10.74	13.87	15.80	16.26
15.17	12.68	9.17	5.11	1.33	-2.63	-5.54	-7.58
-8.81	-9.42	-9.64	-9.69	-9.66	-9.53	-9.12	-8.21
-6.56	-4.75	-2.70	3.25	7.43	11.3	14.35	16.13
16.38	15.25	12.34	8.64	4.48	1.46	-3.16	-5.89
-7.71	-8.70	-9.29	-9.16	-9.12	-9.39	-9.00	-8.67
-7.83	-6.24	-3.75	-0.40	3.56	7.72	11.53	14.45
16.04	16.25	14.47	11.55	7.73	3.56	-0.41	-3.69
-6.05	-7.44	-8.22	-8.06	-7.89	-7.75	-7.77	-7.83
-7.71	-7.11	-5.73	-3.43	-0.23	3.61	7.62	11.26
13.96	15.29	15.02	13.20	10.11	6.27	2.25	-1.35
-4.13	-5.65	-6.58	-6.54	-6.13	-5.64	-5.43	-5.56
-5.91	-6.18	-6.21	-5.56	-3.14	-0.28	3.24	6.94
10.25	12.60	13.59	13.01	10.99	7.87	4.20	0.61
-2.35	-4.29	-5.16	-4.91	-4.27	-3.76	-2.30	-2.09
-2.48	-3.28	-4.15	-4.62	-4.31	-3.73	-0.71	2.28
5.46	8.28	10.16	10.75	9.91	7.81	4.85	1.65
-1.19	-3.16	-3.96	-3.58	-2.30	-0.59	1.00	1.98
2.07	1.25	-0.19	-1.83	-3.14	-3.67	-3.16	-1.65
0.60	3.10	5.28	6.64	6.85	5.83	3.87	1.37
-1.07	-2.85	-3.54	-2.98	-1.30	1.11	3.65	5.70
6.76	6.58	5.22	3.00	0.47	-1.79	-3.27	-3.71
-3.09	-1.70	0.41	1.51	2.36	2.29	1.31	-0.32
-2.13	-3.55	-4.26	-3.40	-1.46	1.44	4.87	8.27
10.41	11.41	10.35	8.86	5.87	2.45	-0.74	-3.18
-4.56	-4.87	-4.35	-3.42	-2.54	-2.10	-2.31	-3.10
-4.21	-5.18	-5.51	-4.82	-2.83	0.32	4.26	8.43
12.02	14.47	15.40	14.35	11.81	8.13	3.96	-0.02
-3.29	-5.51	-6.65	-6.90	-6.63	-6.25	-6.68	-6.29
-6.80	-7.33	-7.49	-6.65	-5.09	-2.11	1.92	6.55
11.14	14.98	17.44	18.09	16.83	13.87	9.72	5.22
0.45	-3.44	-6.31	-8.09	-8.94	-9.17	-9.14	-9.12
-9.26	-9.47	-9.51	-9.02	-7.66	-5.13	-1.54	3.02
8.03	12.85	16.77	19.19	19.72	18.29	15.12	10.71

5.72	0.81	-3.47	-6.76	-8.97	-10.21	-10.76	-10.94
-10.99	-11.05	-11.03	-10.74	-9.86	-8.09	-5.22	-1.26
3.53	8.68	13.56	17.49	19.88	20.36	18.90	15.68
11.20	6.11	1.07	-3.38	-6.86	-9.27	-10.7[illegible]	-11.39
-11.65	-11.71	-11.70	-11.57	-11.13	-10.[illegible]	-8.19	-5.23
-1.22	3.57	8.69	13.52	17.41	19.77	20.26	18.80
15.61	11.18	6.14	1.14	-3.27	-6.72	-9.1[illegible]	-10.49
-11.14	-11.35	-11.37	-11.32	-11.18	-10.76	-9.77	-7.95
-5.12	-1.27	3.36	8.32	12.99	16.75	19.03	19.47
18.01	14.88	10.56	5.68	0.89	-3.27	-6.46	-8.55
-9.68	-10.11	-10.14	-10.06	-10.00	-9.93	-9.65	-8.89
-7.33	-4.80	-1.26	3.05	7.71	12.1[illegible]	15.61	17.69
17.99	16.48	13.39	9.23	4.63	0.23	-3.45	-6.10
-7.66	-8.32	-8.32	-8.08	-7.87	-7.83	-7.92	-7.92
-7.50	-6.36	-4.26	-1.18	2.68	6.88	10.85	13.96
15.69	15.75	14.12	11.09	7.18	3.03	-0.76	-3.70
-5.55	-6.34	-6.30	-5.81	-5.25	-4.94	-5.00	-5.35
-5.74	-5.80	-5.19	-3.64	-1.13	2.15	5.77	9.16
11.73	13.00	12.75	11.00	8.10	4.59	1.09	-1.83
-3.78	-4.63	-4.49	-3.69	-2.67	-1.85	-1.53	-1.80
-2.53	-3.42	-4.06	-4.04	-3.13	-1.26	1.35	4.28
6.99	8.94	9.71	9.15	7.37	4.75	1.83	-0.81
-2.66	-3.47	-3.21	-2.11	-0.60	0.85	1.80	1.98
1.37	0.15	-1.30	-2.55	-3.16	-2.89	-1.70	0.21
2.42	4.43	5.75	6.06	5.29	3.61	1.44	-0.71
-2.31	-3.00	-2.42	-1.28	0.66	2.73	4.41	5.31
5.21	4.15	2.39	0.35	-1.48	-2.69	-3.03	-2.47
-1.24	0.28	1.64	2.42	2.39	1.55	0.14	-1.43
-2.69	-3.21	-2.74	-1.26	0.98	3.56	5.96	7.67
8.35	7.85	6.29	3.98	1.41	-0.94	-2.65	-3.51
-3.51	-2.87	-1.95	-1.13	-0.76	-0.98	-1.73	-2.74
-3.62	-3.97	-3.45	-1.95	0.42	3.33	6.31	8.81
10.38	10.72	9.77	7.72	4.93	1.91	-0.25	-2.97
-4.24	-4.69	-4.53	-4.07	-3.66	-3.54	-3.81	-4.35
-4.89	-5.08	-4.57	-3.17	-0.84	2.19	5.54	8.69
11.12	12.43	12.38	10.99	8.50	5.32	1.97	-1.10
-3.50	-5.38	-5.86	-6.05	-5.92	-5.77	-5.79	-6.00
-6.27	-6.34	-5.90	-4.66	-2.56	0.37	3.85	7.43
10.60	12.86	13.86	13.44	11.65	8.80	5.33	1.73
-1.53	-4.13	-5.91	-6.91	-7.33	-7.41	-7.41	-7.46
-7.56	-7.56	-7.21	-6.25	-4.47	-1.83	1.53	5.27
8.95	12.05	14.12	14.80	14.03	11.93	8.79	5.10
1.33	-2.15	-4.76	-6.64	-7.77	-8.31	-8.50	-8.56
-8.60	-8.55	-8.35	-7.67	-6.31	-4.13	-1.12	2.52
6.43	10.13	13.12	14.96	15.39	14.33	11.95	8.59
4.73	0.86	-2.59	-5.32	-7.24	-8.39	-8.96	-9.19

Theoretical Tidal Strain Data for RMA N/S

All data are in 10^{-9} strain. Data period is from 00^h 00^m (GMT), August 16 through September 15, 1972.

2.33	0.86	-2.44	-6.58	-10.33	-12.48	-12.20	-9.29
-4.17	2.17	8.37	13.12	15.38	14.65	11.12	5.58
-0.77	-6.57	-10.65	-12.31	-11.46	-8.63	-4.84	-1.26
0.99	1.28	-2.49	-3.78	-7.59	-10.73	-12.11	-11.08
-7.56	-2.10	4.24	10.16	14.40	16.34	14.74	10.78
5.04	-1.27	-6.83	-10.59	-11.94	-10.89	-8.85	-4.44
-1.21	3.64	8.55	-1.44	-4.73	-8.31	-11.01	-11.85
-10.26	-6.26	-0.57	5.80	11.51	15.35	16.50	14.72
10.40	4.44	-1.69	-7.31	-10.82	-11.68	-10.61	-7.66
-4.09	-1.04	0.53	2.16	-2.05	-5.44	-8.95	-11.41
-11.88	-9.85	-5.52	2.46	6.92	12.53	16.09	16.84
14.62	9.89	3.65	-2.79	-8.15	-11.44	-12.19	-10.58
-7.37	-3.66	-0.65	3.75	8.10	-2.42	-6.05	-9.67
-12.08	-12.33	-9.99	-5.26	1.05	7.73	13.30	16.66
17.03	14.32	9.10	2.48	-4.16	-9.49	-12.50	-12.82
-10.70	-7.03	-3.00	0.12	1.38	0.39	-2.56	-6.62
-10.55	-13.17	-13.21	-10.56	-5.42	1.29	8.20	13.85
16.99	16.92	13.63	7.82	0.72	-6.13	-11.36	-13.96
-13.62	-10.75	-6.38	-1.87	1.41	2.50	1.05	-2.53
-7.22	-11.63	-14.37	-14.44	-11.48	-5.89	1.25	8.44
14.08	16.92	16.29	12.29	5.81	-1.74	-8.72	-13.64
-15.56	-14.28	-10.39	-5.13	-0.05	3.38	4.18	2.09
-2.31	-7.61	-12.82	-15.84	-15.85	-12.56	-6.52	1.01
8.37	13.87	16.24	14.90	10.13	3.36	-4.88	-11.72
-16.03	-16.52	-14.39	-9.26	-3.01	2.61	6.25	6.37
3.44	-1.94	-8.53	-13.96	-17.25	-17.18	-13.58	-7.18
0.58	7.90	13.83	14.75	12.61	7.11	-0.48	-8.37
-14.70	-17.99	-17.54	-13.55	-7.11	0.34	6.02	9.26
8.89	4.99	-1.41	-8.65	-14.83	-18.31	-18.16	-14.34
-7.77	-0.03	6.97	11.50	12.45	9.56	3.52	-4.18
-11.66	-17.36	-19.23	-17.64	-11.59	-4.01	3.79	9.85
12.64	11.45	6.58	-0.73	-8.64	-15.19	-18.78	-18.57
-14.70	-8.22	-0.83	5.58	9.37	9.56	6.11	-0.11
-7.51	-14.19	-18.36	-18.86	-15.41	-8.72	-0.35	7.73
13.57	15.75	13.75	8.09	0.14	-8.18	-14.92	-18.54
-18.37	-14.66	-8.56	-1.76	3.90	6.93	6.54	2.83
-3.21	-9.96	-15.58	-18.46	-17.62	-13.01	-5.52	3.23
11.24	16.66	18.23	15.61	9.44	1.17	-7.29	-14.04
-17.69	-17.67	-14.32	-8.78	-2.70	2.21	4.61	3.87
0.19	-5.39	-11.33	-15.90	-17.65	-15.92	-11.43	-2.63
6.12	13.64	18.82	19.93	16.95	10.58	2.29	-6.09
-12.78	-16.49	-16.72	-13.83	-8.92	-3.54	0.75	2.74
1.88	-1.56	-6.60	-11.78	-15.49	-16.46	-14.06	-8.42
-0.55	7.99	15.38	20.01	20.87	17.80	11.49	3.35

-4.87	-11.48	-15.28	-15.79	-13.35	-8.99	-4.15	-0.27
1.50	0.68	-2.48	-7.05	-11.67	-14.86	-15.44	-12.82
-7.17	0.55	8.83	15.95	20.39	21.18	18.17	12.03
4.10	-3.95	-10.50	-14.38	-15.11	-12.99	-8.98	-4.45
-0.79	0.93	0.20	-2.74	-7.04	-11.39	-14.38	-14.86
-12.26	-6.75	0.78	8.65	15.81	20.17	20.98	18.07
12.07	4.28	-3.65	-10.15	-14.04	-14.83	-12.80	-8.86
-4.40	-0.76	0.98	0.31	-2.57	-6.83	-11.18	-14.21
-14.79	-12.32	-6.96	0.43	8.38	15.25	19.54	20.32
17.39	11.41	3.66	-4.19	-10.58	-14.31	-14.90	-12.66
-8.53	-3.88	-0.12	1.64	0.91	-2.12	-6.58	-11.13
-14.37	-15.12	-12.76	-7.48	-0.16	7.71	14.46	18.59
19.16	16.03	9.90	2.11	-5.64	-11.74	-15.04	-15.11
-12.31	-7.71	-2.73	1.16	2.86	1.58	-1.51	-6.36
-11.27	-14.75	-15.62	-13.31	-8.01	-0.72	7.34	13.54
17.29	17.42	13.88	7.48	-0.34	-7.81	-13.35	-15.87
-15.06	-11.43	-6.18	-0.85	3.08	4.51	3.76	-0.89
-6.25	-11.33	-15.20	-16.06	-13.67	-8.28	-1.34	6.47
12.48	15.59	15.04	10.96	4.29	-3.39	-10.32	-14.94
-16.32	-14.34	-9.73	-3.84	1.72	5.45	6.36	4.21
-0.42	-6.31	-11.07	-15.56	-16.27	-13.66	-8.18	-1.09
5.95	11 23	13.46	12.09	7.44	2.65	-6.62	-12.64
-15.99	-15.97	-12.71	-7.15	-2.78	4.73	7.96	8.10
5.12	-0.72	-6.53	-12.18	-15.68	-16.08	-13.20	-7.70
-0.94	5.41	9.74	10.96	8.75	3.69	-2.95	-9.49
-14.28	-16.14	-14.63	-10.16	-3.87	2.65	7.78	12.25
9.46	5.62	-0.31	-6.84	-12.35	-15.48	-15.47	-12.35
-6.96	-0.71	4.76	8.02	8.23	5.34	0.10	-6.09
-11.61	-14.98	-15.30	-12.41	-6.98	-2.29	6.34	10.53
12.23	10.28	5.69	-0.63	-7.15	-12.33	-14.97	-14.53
-11.26	-6.12	-0.53	3.98	6.19	5.53	2.17	-2.96
-8.45	-12.79	-14.73	-13.63	-9.63	-3.57	3.17	9.02
12.65	13.21	10.59	5.43	-1.07	-7.38	-12.10	-14.22
-13.42	-10.12	-5.32	-0.46	3.12	4.41	3.08	-0.50
-5.31	-9.97	-13.12	-13.76	-11.50	-6.69	-0.33	6.19
11.41	14.16	13.82	10.50	4.97	-1.52	-7.51	-11.74
-13.38	-12.30	-9.23	-4.66	-0.49	2.27	2.83	1.24
-2.56	-6.93	-10.77	-12.86	-12.41	-9.27	-3.96	2.47
8.63	13.18	15.12	14.03	10.18	4.42	-1.96	-7.60
-11.35	-12.60	-11.32	-8.14	-4.15	-0.57	1.53	1.54
-0.52	-4.06	-7.99	-11.09	-12.31	-11.04	-7.27	-1.64
4.73	10.52	14.44	15.69	14.02	9.74	3.85	-2.40
-7.73	-11.10	-12.00	-10.56	-7.45	-3.75	-0.62	0.99
0.61	-1.45	-5.11	-8.69	-11.23	-11.79	-9.89	-5.67
0.16	6.45	11.89	15.33	16.02	13.83	9.23	3.21
-2.96	-8.24	-11.49	-11.69	-10.06	-6.93	-3.39	-0.55

Theoretical Tidal Strain Data for RMA E/W

All data are in 10^{-9} strain. Data period is from 00^h 00^m (GMT), August 16 through September 15, 1972.

-6.70	-6.84	-6.99	-6.91	-6.32	-4.96	-2.73	0.31
3.88	7.55	10.82	13.19	14.31	13.99	12.28	9.46
5.95	2.24	-1.19	-4.01	-6.03	-7.26	-7.86	-8.07
-8.13	-8.16	-8.22	-8.13	-7.69	-6.63	-4.78	-2.07
1.36	5.18	8.96	12.17	14.37	15.21	14.58	12.56
9.46	5.73	1.65	-1.71	-4.62	-6.72	-8.04	-8.74
-9.03	-9.13	-9.16	-9.11	-8.83	-8.11	-6.71	-4.50
-1.46	2.23	6.22	10.05	13.20	15.22	15.83	14.92
12.64	9.31	5.40	1.40	-2.22	-5.16	-7.28	-8.60
-9.30	-9.60	-9.69	-9.69	-9.56	-9.16	-8.26	-6.65
-4.21	-0.95	2.92	7.02	10.86	13.94	15.81	16.21
15.06	12.54	9.21	4.96	2.69	-2.74	-5.62	-7.65
-8.87	-9.46	-9.70	-9.75	-9.72	-9.56	-9.13	-8.17
-6.48	-3.92	-2.54	3.42	7.56	11.41	14.41	16.13
16.31	14.93	12.19	8.48	4.33	1.26	-3.27	-5.97
-7.77	-8.75	-9.15	-9.22	-9.19	-9.15	-9.05	-8.68
-7.80	-6.16	-3.62	-0.24	3.73	7.87	11.63	14.58
16.02	15.97	14.34	11.39	7.56	3.42	-0.53	-3.79
-6.12	-7.50	-8.26	-8.12	-7.96	-7.54	-7.54	-7.89
-7.74	-7.29	-5.66	-3.31	-0.08	3.76	7.76	11.35
13.99	15.25	14.92	13.05	9.94	6.18	2.11	-1.47
-4.21	-5.91	-6.52	-6.58	-6.15	-5.71	-5.52	-5.65
-5.99	-6.23	-6.21	-5.80	-3.84	-0.15	3.37	7.05
10.31	12.62	13.52	12.69	10.83	7.69	4.04	0.48
-2.44	-4.34	-5.12	-4.92	-4.18	-3.11	-2.36	-2.19
-2.59	-3.39	-4.22	-4.65	-4.28	-2.92	-0.61	2.38
5.54	8.31	10.13	10.66	9.77	7.64	4.69	1.51
-1.29	-3.21	-3.97	-3.56	-2.28	-0.63	0.95	1.89
1.95	1.13	-0.32	-1.93	-3.19	-3.67	-3.12	-1.58
0.67	3.15	5.28	6.58	6.74	5.71	3.71	1.23
-1.17	-2.90	-3.55	-2.95	-1.24	1.15	3.66	5.66
6.67	6.44	5.06	2.64	0.34	-1.87	-3.31	-3.78
-3.06	-1.67	0.42	1.48	2.28	2.17	1.17	-0.46
-2.24	-3.61	-4.08	-3.34	-1.37	1.58	4.95	8.10
10.38	11.31	12.70	12.69	5.69	2.29	-0.86	-3.25
-4.59	-4.88	-4.36	-3.44	-2.59	-2.19	-2.41	-3.22
-4.31	-5.24	-5.52	-4.74	-2.72	0.45	4.47	8.53
12.07	14.45	15.21	14.20	11.62	7.93	3.78	-0.17
-3.39	-5.58	-6.69	-6.94	-6.68	-6.32	-6.18	-6.39
-6.89	-7.48	-7.51	-6.81	-4.99	-1.96	2.09	6.71
11.27	15.05	17.43	18.60	16.68	13.68	9.52	4.83
0.29	-3.55	-6.39	-8.15	-8.99	-9.23	-9.21	-9.21
-9.34	-9.54	-9.65	-9.71	-7.59	-5.45	-1.37	3.21
8.21	12.99	16.84	19.19	19.64	18.15	14.93	10.51

5.52	0.64	-3.60	-6.86	-9.04	-10.28	-10.83	-11.01
-11.07	-11.12	-11.39	-10.76	-9.83	-7.99	-5.07	-1.07
3.74	8.88	13.71	17.57	19.89	20.31	18.76	15.49
11.00	5.91	0.90	-3.51	-6.97	-9.35	-10.77	-11.46
-11.72	-11.79	-11.77	-11.62	-11.15	-10.06	-8.09	-5.07
-1.03	3.78	8.39	13.68	17.49	19.78	20.19	18.66
15.43	10.99	5.95	0.97	-3.40	-6.82	-9.18	-10.56
-11.21	-11.42	-11.45	-11.39	-11.23	-10.77	-9.74	-7.86
-4.97	-1.08	3.56	8.51	13.14	16.83	19.23	19.40
17.88	14.71	10.37	5.50	0.73	-3.40	-6.55	-8.63
-9.74	-10.17	-10.21	-10.14	-10.08	-9.99	-9.68	-8.86
-7.25	-4.66	-1.09	3.24	7.88	12.23	15.68	17.68
17.91	16.34	13.21	9.04	4.45	0.08	-3.56	-6.18
-7.72	-8.35	-8.38	-8.15	-7.95	-7.92	-7.99	-7.96
-7.50	-6.30	-4.15	-1.04	2.84	7.03	10.95	14.00
15.66	15.65	13.97	10.91	7.00	2.87	-0.88	-3.78
-5.60	-6.37	-6.53	-5.86	-5.32	-5.13	-5.09	-5.43
-5.79	-5.82	-5.15	-3.56	-1.01	2.28	5.88	9.23
11.74	12.95	12.64	10.85	7.94	4.43	0.96	-1.92
-3.83	-4.65	-4.50	-3.71	-2.71	-1.92	-1.62	-1.91
-2.64	-3.50	-4.09	-4.03	-3.07	-1.17	1.45	4.36
7.03	8.92	9.64	9.03	7.22	4.60	1.70	-0.90
-2.71	-3.48	-3.19	-2.09	-0.60	0.82	1.73	1.88
1.25	0.04	-1.40	-2.60	-3.17	-2.86	-1.64	0.27
2.46	4.43	5.70	5.97	5.17	3.40	1.31	-0.80
-2.36	-3.30	-2.59	-1.24	0.70	2.74	4.38	5.24
5.10	4.02	2.26	0.24	-1.56	-2.72	-3.02	-2.44
-1.21	0.29	1.51	2.35	2.29	1.44	0.03	-1.52
-2.74	-3.21	-2.70	-1.20	1.05	3.62	5.96	7.64
8.27	7.74	6.15	3.85	1.29	-1.42	-2.70	-3.53
-3.51	-2.87	-1.96	-1.10	-0.84	-1.09	-1.83	-2.82
-3.67	-3.97	-3.41	-1.88	0.51	3.43	6.37	8.83
10.35	10.64	9.65	7.57	4.79	1.79	-0.94	-3.23
-4.28	-4.71	-4.55	-4.10	-3.71	-3.62	-3.90	-4.43
-4.95	-5.39	-4.54	-3.09	-0.74	2.31	5.64	8.76
11.14	12.39	12.29	10.87	8.36	5.16	1.84	-1.20
-3.57	-5.13	-5.90	-6.08	-5.97	-5.83	-5.86	-6.07
-6.33	-6.36	-5.88	-4.61	-2.45	0.58	3.98	7.54
10.67	12.88	13.82	13.34	11.52	8.66	5.18	1.60
-1.64	-4.21	-5.97	-6.96	-7.37	-7.46	-7.47	-7.53
-7.62	-7.59	-7.21	-6.20	-4.38	-1.74	1.67	5.42
9.07	12.12	14.11	14.75	13.94	11.79	8.64	4.95
1.20	-2.16	-4.64	-6.78	-7.82	-8.36	-8.56	-8.62
-8.65	-8.62	-8.36	-7.65	-6.24	-4.01	-0.97	2.68
6.58	10.25	13.18	14.97	15.34	14.23	11.81	8.44
4.58	0.73	-2.70	-5.41	-7.30	-8.44	-9.02	-9.24

Theoretical Tidal Strain Data for RMA NW/SE

All data are in 10^{-9} strain. Data period is from 00^h 00^m (GMT), August 16 through September 15, 1972.

-1.85	-0.28	-0.15	-1.19	-2.76	-4.04	-4.29	-3.01
-0.17	3.86	8.30	12.20	14.63	14.93	12.86	8.67
3.05	-3.00	-8.42	-12.36	-14.10	-13.73	-11.60	-8.44
-5.17	-2.57	-1.16	-1.04	-1.88	-3.34	-3.77	-3.41
-1.58	1.65	5.82	10.15	13.69	15.59	15.29	12.65
8.02	2.15	-3.96	-9.27	-12.93	-14.42	-13.93	-11.71
-8.58	-5.41	-2.96	-1.67	-1.56	-2.28	-3.10	-3.53
-2.75	-0.54	2.97	7.25	11.48	14.74	16.24	15.47
12.39	7.40	1.31	-4.86	-10.03	-13.55	-14.86	-14.08
-11.71	-8.52	-5.38	-3.02	-1.83	-1.80	-2.51	-3.30
-3.46	-2.42	0.05	3.78	8.17	12.38	15.48	16.69
15.56	12.09	6.76	0.45	-5.80	-10.05	-14.21	-15.24
-14.15	-11.51	-8.16	-4.97	-2.68	-1.65	-1.87	-2.67
-3.54	-3.68	-2.52	0.15	4.08	8.64	12.91	15.95
16.95	15.51	11.67	6.21	-2.55	-6.88	-11.03	-14.91
-15.54	-14.20	-10.95	-7.32	-4.34	-1.85	-1.48	-1.56
-2.82	-3.08	-4.27	-3.10	-0.33	3.86	8.63	13.04
16.07	16.92	15.17	10.90	4.97	-1.81	-8.15	-12.97
-15.51	-15.53	-13.35	-9.75	-5.76	-2.41	-0.42	-0.10
-1.19	-3.03	-4.70	-5.30	-4.23	-1.32	3.06	8.08
12.65	15.70	16.38	14.35	9.81	3.52	-3.35	-9.53
-13.88	-15.72	-14.89	-11.87	-7.61	-3.26	0.36	1.64
1.26	-0.70	-3.39	-5.76	-6.81	-5.91	-2.93	1.65
6.89	11.61	14.54	15.16	12.85	8.36	1.67	-5.06
-10.76	-14.33	-15.15	-13.23	-9.25	-4.32	0.25	3.33
4.21	2.84	-0.24	-3.99	-7.19	-8.73	-8.10	-5.10
-0.38	5.02	9.80	12.77	13.12	10.65	5.79	-0.43
-6.64	-11.50	-13.93	-13.47	-10.34	-5.43	0.03	4.58
7.11	7.01	4.41	0.65	-4.84	-8.92	-11.05	-10.62
-7.68	-2.90	2.53	7.28	10.14	10.39	7.90	3.27
-2.41	-7.73	-11.38	-12.43	-10.60	-6.31	-0.63	5.02
9.23	10.91	9.64	5.71	0.08	-5.88	-11.73	-13.36
-13.19	-10.38	-5.69	-0.36	4.26	7.41	7.26	5.00
0.90	-3.90	-8.74	-10.30	-9.93	-6.84	-1.66	4.43
9.96	13.54	14.23	11.77	6.63	-0.47	-6.88	-12.35
-15.38	-15.48	-12.88	-8.41	-3.31	1.12	3.80	4.18
2.36	-0.98	-4.71	-7.56	-8.48	-6.83	-2.36	2.85
9.00	14.14	16.98	16.72	13.27	7.21	-0.24	-7.61
-13.49	-16.82	-17.21	-14.90	-10.74	-5.94	-1.72	0.94
1.57	3.29	-2.21	-4.86	-6.59	-6.41	-3.93	0.65
6.53	12.48	17.13	19.30	18.32	14.19	7.59	-0.26
-7.92	-14.32	-17.60	-18.26	-16.29	-12.50	-8.09	-3.96
-1.27	-0.36	-1.10	-2.86	-4.67	-5.52	-4.63	-1.65
3.16	8.99	14.65	18.87	20.57	19.16	14.71	7.91

-0.07	-7.62	-14.03	-17.78	-18.70	-17.05	-13.58	-9.34
-5.44	-2.70	-1.56	-1.89	-3.12	-4.38	-4.73	-3.47
-0.30	4.51	10.18	15.60	19.54	21.70	19.45	14.94
8.14	0.21	-7.50	-13.73	-17.59	-18.68	-17.25	-13.99
-9.93	-6.10	-3.33	-2.05	-2.17	-3.16	-4.19	-4.38
-3.04	0.10	4.80	10.32	15.58	19.41	20.82	19.28
14.84	8.17	0.56	-7.25	-13.42	-17.25	-18.36	-16.97
-13.75	-9.72	-5.92	-3.16	-1.88	-2.22	-3.05	-4.16
-4.46	-3.26	-3.27	4.29	9.70	14.89	18.68	20.11
18.63	14.30	7.75	0.11	-7.32	-13.29	-16.89	-17.78
-16.17	-12.79	-8.67	-4.85	-2.19	-1.10	-1.50	-2.86
-4.31	-4.93	-4.20	-1.21	3.22	8.54	13.69	17.46
18.88	17.42	13.14	6.72	-0.71	-7.81	-13.33	-16.43
-16.79	-14.71	-10.98	-6.68	-2.89	-0.47	2.20	-0.74
-2.67	-4.66	-5.72	-5.12	-2.54	1.76	7.02	12.10
15.78	17.10	15.56	11.29	5.02	-2.05	-8.59	-13.38
-15.65	-15.19	-12.42	-8.24	-3.79	-0.10	1.77	1.77
0.05	-2.63	-5.26	-6.80	-6.50	-4.28	0.12	5.29
10.21	13.69	14.79	13.10	8.84	2.84	-3.67	-9.37
-13.11	-14.26	-12.78	-9.24	-4.65	-0.21	2.97	4.19
3.27	0.61	-2.90	-6.16	-8.11	-8.02	-5.69	-1.56
3.44	8.12	11.28	12.08	10.21	6.05	0.49	-5.21
-9.78	-12.22	-12.29	-9.55	-5.32	-0.52	3.63	6.12
6.36	4.37	0.73	-3.56	-7.32	-9.51	-9.50	-7.20
-3.16	1.63	5.96	8.71	9.17	7.19	3.26	-1.65
-6.30	-9.54	-10.59	-9.19	-5.71	-1.03	3.68	7.25
8.80	7.93	4.86	0.33	-4.56	-8.62	-10.87	-10.80
-8.48	-4.55	-0.04	3.87	6.18	6.33	4.35	0.92
-3.26	-6.72	-8.50	-8.29	-5.79	-1.65	3.17	7.49
10.24	10.73	8.75	4.72	-0.51	-5.75	-9.99	-12.03
-11.83	-9.47	-5.68	-1.56	1.96	3.97	3.81	1.95
-1.04	-4.19	-6.47	-7.06	-5.61	-2.29	2.20	6.86
10.57	12.41	11.84	8.88	4.08	-1.58	-6.97	-11.00
-12.93	-12.55	-12.16	-6.54	-2.70	0.35	1.92	1.76
0.13	-2.26	-4.52	-5.69	-5.20	-2.87	0.96	5.54
9.84	12.84	13.75	12.25	8.50	3.17	-2.73	-8.08
-11.89	-13.56	-12.99	-10.59	-7.15	-3.62	-0.91	0.42
0.24	-1.11	-2.93	-4.36	-4.64	-3.32	-0.38	3.73
8.20	12.05	14.35	14.45	12.18	7.83	2.16	-3.82
-9.02	-12.57	-13.96	-13.24	-10.83	-7.52	-4.26	-1.81
-0.64	-0.60	-1.98	-3.21	-3.99	-3.58	-1.66	1.68
5.91	10.20	13.66	15.29	14.73	11.86	7.07	1.18
-4.79	-9.83	-13.12	-14.28	-13.37	-10.92	-7.71	-4.61
-2.35	-1.31	-1.44	-2.32	-3.29	-3.65	-2.79	-0.35
3.25	7.53	11.64	14.67	15.86	14.77	11.43	6.31
0.25	-5.71	-10.58	-13.63	-14.53	-13.42	-10.87	-7.67*

Observed Tidal Strain Data for GOL N/S

All data are in 10^{-9} strain. Data period is from 00^h 00^m (GMT), August 16 through September 15, 1972.

1.00	-0.06	-1.07	-2.22	-2.66	-3.11	-2.16	-1.31
-0.36	1.20	2.72	3.45	2.62	1.74	0.42	-0.96
-2.06	-2.82	-3.83	-4.73	-5.05	-4.00	-2.84	-1.91
1.31	0.21	-1.35	-2.94	-3.09	-4.31	-3.82	-2.60
-1.43	-0.45	0.17	1.28	2.56	3.69	4.06	3.66
2.59	1.87	0.60	-0.23	-1.27	-2.74	-4.18	-3.87
-3.47	-1.92	-0.24	0.07	-3.01	-4.61	-5.51	-6.23
-4.54	-2.92	-1.90	-0.10	3.17	5.16	6.36	6.94
6.40	5.43	4.39	2.57	1.05	-1.50	-2.93	-4.13
-3.97	-3.49	-0.97	-0.19	-2.64	-2.76	-4.98	-7.15
-9.33	-7.68	-6.26	-3.14	-0.16	3.64	7.27	9.40
10.34	10.79	6.40	2.52	0.48	-1.04	-5.70	-7.85
-7.19	-6.36	-5.70	-1.85	-0.79	2.01	-1.16	-2.36
-4.25	-6.14	-6.76	-6.76	-4.18	-0.36	4.88	6.50
7.64	7.46	5.36	3.57	2.49	-3.56	-6.31	-7.81
-8.03	-6.36	-4.64	-2.54	-0.38	2.58	-0.31	-2.37
-4.99	-7.25	-9.73	-10.27	-6.33	-2.99	0.12	3.26
6.46	8.17	6.83	4.92	2.48	-3.37	-8.40	-11.20
-11.42	-9.70	-5.42	-1.66	1.26	1.51	1.55	-0.77
-4.23	-7.14	-9.06	-11.21	-9.93	-6.44	-1.39	3.44
8.61	9.59	8.94	7.32	2.91	-3.35	-8.80	-13.29
-15.27	-15.24	-13.92	-8.47	-3.24	0.30	1.67	1.49
-0.85	-3.25	-6.23	-6.60	-7.48	-6.16	-3.28	-0.52
2.77	4.89	6.48	6.98	5.23	1.18	-1.84	-7.54
-9.81	-10.06	-7.28	-3.41	2.43	2.75	4.96	5.34
1.11	-4.10	-7.88	-12.21	-13.59	-14.34	-13.56	-7.65
-3.80	1.96	7.65	10.26	8.80	6.30	1.71	-3.92
-7.62	-10.40	-9.26	-6.71	-3.25	1.11	3.93	5.71
5.48	4.71	-0.53	-5.33	-9.16	-9.50	-9.04	-8.07
-4.17	0.65	5.43	6.23	5.53	4.78	1.58	-1.67
-5.91	-9.36	-9.95	-6.20	-2.46	1.28	4.02	5.32
5.66	4.52	2.43	-1.31	-4.16	-8.57	-12.27	-9.30
-5.65	-3.17	0.16	3.11	5.10	4.54	2.53	-2.37
-6.82	-10.31	-10.97	-9.27	-4.74	0.23	4.22	6.31
8.34	7.52	5.69	1.97	-1.76	-6.48	-8.36	-9.32
-7.46	-5.00	-1.59	0.89	2.43	2.54	1.73	-0.96
-3.63	-7.25	-8.03	-8.34	-6.65	-2.62	0.45	4.46
6.61	6.98	6.26	3.76	0.37	-3.52	-6.85	-9.28
-10.69	-9.25	-5.53	-1.71	0.29	2.32	1.69	0.11
-3.18	-5.54	-7.87	-8.27	-6.82	-4.83	-1.45	1.50
4.99	5.35	4.86	3.53	0.45	-2.54	-5.49	-9.27
-9.34	-7.59	-6.64	-4.29	-1.89	-0.36	0.38	0.70
-1.15	-2.94	-6.21	-7.23	-6.18	-5.32	-4.51	-2.36
0.18	2.25	3.39	4.89	4.72	3.88	1.41	-2.51

-5.55	-5.49	-4.58	-3.69	-2.80	-1.93	-1.12	-0.30
-0.41	-1.68	-2.09	-2.92	-3.74	-4.54	-3.56	-3.01
-1.57	-3.56	1.32	2.35	3.39	4.42	3.71	3.02
2.36	0.82	0.17	-2.89	-1.77	-2.70	-4.79	-4.04
-1.85	-1.32	-2.62	-0.26	-1.92	-3.02	-4.40	-6.10
-6.39	-6.87	-5.06	-2.30	1.01	3.57	5.84	8.12
10.53	8.00	5.60	2.46	-2.51	-3.37	-4.37	-4.81
-4.30	-4.08	-1.99	-0.22	-2.03	-0.99	-3.09	-4.62
-7.76	-8.62	-8.26	-5.25	-2.35	0.46	5.38	7.78
7.21	6.65	5.28	2.63	0.02	-3.47	-5.24	-6.14
-8.18	-6.20	-4.89	-3.45	-2.29	-0.96	-0.35	-1.01
-2.40	-2.58	-2.80	-1.01	0.85	2.44	3.98	4.55
4.95	6.67	5.64	2.53	0.08	-1.74	-4.26	-4.31
-4.75	-4.71	-2.74	-2.12	-1.56	0.18	0.56	0.32
-1.29	-2.28	-3.27	-3.63	-2.73	-0.52	0.99	2.07
3.91	5.17	3.51	2.30	0.44	-1.44	-4.32	-5.30
-5.97	-4.54	-2.43	-0.36	1.07	1.38	1.42	0.99
-1.34	-3.14	-6.19	-6.76	-6.07	-4.20	0.58	3.27
6.93	9.33	9.79	8.37	5.03	1.15	-3.99	-7.88
-10.55	-9.52	-6.65	-2.59	0.07	2.34	3.20	2.21
0.20	-2.30	-7.05	-11.81	-12.29	-10.98	-7.88	-1.76
3.12	7.95	7.88	6.56	4.04	1.56	-3.49	-7.26
-9.27	-8.30	-7.33	-3.42	1.45	3.15	4.65	3.76
2.29	-1.02	-4.30	-7.58	-9.22	-8.62	-7.62	-5.38
-1.97	1.47	4.92	5.41	5.93	3.51	-1.25	-3.62
-8.31	-8.26	-7.25	-4.66	-1.09	2.40	3.72	4.98
5.07	2.47	-1.28	-5.57	-7.57	-9.56	-8.18	-4.56
-2.08	0.38	2.27	3.59	4.88	3.41	0.31	-3.31
-6.36	-7.79	-7.59	-4.12	-1.77	2.72	5.09	6.36
5.51	4.19	0.27	-3.12	-7.03	-8.86	-9.12	-8.41
-6.64	-3.40	-0.71	3.47	3.08	3.68	-2.22	-5.12
-8.99	-9.13	-9.34	-7.66	-4.09	0.36	3.73	5.25
5.38	3.67	0.98	-2.73	-6.47	-9.37	-10.32	-9.51
-7.34	-5.26	-4.64	-5.41	2.37	2.44	1.18	-1.23
-2.67	-5.08	-6.61	-5.52	-2.22	-0.81	2.81	4.13
5.40	4.49	1.80	-0.84	-2.78	-4.64	-5.73	-5.52
-5.33	-2.37	-0.33	0.00	1.15	0.14	-0.44	-1.48
-2.49	-4.36	-4.14	-2.25	0.02	2.29	3.68	4.26
4.33	3.28	1.25	-1.54	-3.52	-3.36	-4.82	-5.86
-5.28	-4.32	-1.72	0.66	2.64	2.86	-0.97	-1.95
-2.92	-5.84	-5.21	-4.57	-3.36	-2.98	1.36	2.97
3.78	3.72	2.21	1.12	-0.78	-2.44	-3.37	-4.22
-4.29	-2.82	-1.28	-0.46	0.42	-0.16	-0.91	-1.56
-2.66	-3.39	-2.91	-1.16	0.80	2.29	3.36	4.05
3.27	2.44	1.35	0.67	-0.24	-1.07	-2.14	-2.74
-3.49	-4.10	-3.72	-3.05	-2.08	-1.36	-0.53	0.03

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Observed Tidal Strain Data for GOL E/W

All data are in 10^{-9} strain. Data period is from 00^h 00^m (GMT), August 16 through September 15, 1972.

-4.76	-5.35	-5.51	-5.26	-5.00	-3.47	-1.95	1.27
3.63	6.00	7.51	8.61	9.70	9.97	9.79	9.18
7.73	5.44	3.57	2.12	0.25	-0.35	-0.96	-2.82
-3.43	-4.04	-4.23	-4.84	-4.61	-3.56	-2.49	0.23
2.11	4.41	6.28	8.15	9.19	10.64	10.42	10.20
9.17	7.72	5.44	2.70	1.30	-0.14	-1.59	-3.03
-4.48	-5.92	-5.74	-5.58	-5.00	-4.43	-3.45	-2.06
-0.28	1.92	4.10	6.27	7.62	9.79	10.72	11.65
11.06	9.64	8.22	6.38	4.13	1.47	-0.38	-2.25
-3.71	-5.17	-6.25	-6.51	-5.97	-5.86	-5.34	-4.42
-3.12	-1.41	0.69	3.57	5.64	8.14	10.15	11.78
12.60	11.81	10.21	7.81	4.60	2.59	-0.22	-3.04
-5.46	-6.70	-7.54	-7.99	-6.69	-6.19	-6.09	-5.59
-4.70	-3.42	-1.74	0.72	2.79	6.33	8.87	11.32
12.19	12.34	12.11	9.13	6.56	3.21	0.27	-2.25
-4.39	-5.73	-7.25	-7.19	-7.31	-7.34	-6.77	-6.87
-6.97	-6.56	-5.57	-4.08	-1.41	2.34	5.88	8.95
11.25	12.38	12.36	10.79	8.08	5.31	1.57	-1.10
-3.36	-5.24	-5.56	-6.27	-6.22	-5.45	-5.34	-5.67
-5.98	-6.30	-5.46	-4.62	-2.62	2.13	3.66	7.19
9.96	10.66	11.39	11.16	9.79	6.52	3.65	0.02
-2.45	-4.15	-5.09	-5.64	-4.30	-3.70	-3.48	-4.02
-4.54	-5.82	-6.34	-6.09	-4.71	-2.17	0.75	4.42
7.32	9.18	10.50	10.77	9.16	6.05	3.32	-0.17
-3.26	-4.49	-5.33	-5.16	-4.24	-2.96	-2.42	-2.27
-3.24	-4.56	-5.88	-6.46	-6.66	-5.74	-3.71	-0.19
2.59	4.92	7.25	8.46	7.80	6.44	3.86	0.99
-1.18	-2.97	-4.40	-3.99	-2.46	-1.39	-0.31	0.04
-0.33	-1.81	-3.64	-5.45	-6.89	-6.46	-5.65	-3.35
-1.05	1.28	4.34	6.32	6.45	5.87	3.82	1.42
-0.97	-2.72	-3.36	-3.64	-1.32	0.64	2.58	3.79
4.25	3.26	1.52	-0.57	-2.67	-4.39	-4.63	-3.78
-2.19	0.48	2.44	3.67	4.52	3.79	2.32	0.49
-1.70	-3.53	-4.26	-3.88	-2.05	0.15	2.71	4.54
5.65	5.67	4.23	2.07	-0.46	-2.61	-4.05	-4.74
-4.34	-3.16	-2.36	-0.81	-0.36	-0.62	-1.62	-3.33
-4.33	-5.67	-6.64	-5.79	-4.56	-1.55	1.11	4.14
6.08	6.58	6.35	5.42	3.41	1.24	-1.33	-2.97
-3.88	-4.81	-3.92	-3.39	-3.58	-3.77	-4.32	-5.95
-6.49	-7.40	-7.94	-7.84	-5.42	-3.49	-0.04	3.22
5.71	7.73	8.66	8.54	7.34	5.78	3.50	1.58
-0.33	-2.24	-4.50	-4.62	-5.09	-5.21	-6.24	-6.50
-7.33	-8.86	-8.68	-8.00	-6.67	-4.64	-1.89	1.56
4.30	7.41	9.44	10.41	10.67	10.21	8.32	6.09

4.21	1.63	-0.95	-2.11	-3.61	-4.41	-5.20	-5.63
-6.77	-7.54	-8.31	-8.62	-6.31	-4.61	-2.55	0.20
3.31	6.42	9.16	11.20	12.53	12.78	12.7[illegible]	11.55
9.68	7.12	4.91	2.69	1.15	-0.31	-2.85	-4.69
-5.11	-5.95	-6.79	-7.28	-6.72	-5.1[illegible]	-4.18	-1.85
0.12	2.45	5.12	6.15	9.77	11.40	11.99	11.88
10.27	7.97	5.68	3.38	1.10	-1.54	-3.81	-5.05
-6.27	-6.80	-7.32	-7.84	-6.97	-6.44	-5.91	-4.67
-3.09	-1.16	0.42	3.41	6.04	9.01	10.61	11.85
12.05	10.66	7.94	5.72	3.50	-0.10	-2.67	-4.53
-6.73	-7.37	-8.01	-7.77	-7.14	-6.85	-6.57	-6.62
-5.65	-4.68	-3.23	-1.02	2.35	5.04	8.[illegible]7	10.40
12.04	11.94	11.12	7.60	4.75	1.54	-1.66	-4.17
-5.31	-6.79	-7.59	-6.31	-6.08	-5.84	-6.65	-7.44
-7.56	-6.98	-5.73	-3.78	-1.50	1.47	5.12	8.08
10.35	10.91	10.44	9.28	7.10	4.57	1.36	-1.51
-3.35	-4.25	-4.80	-4.17	-3.88	-3.25	-3.31	-3.70
-4.10	-4.83	-5.92	-5.29	-3.64	-1.32	2.[illegible]3	5.04
6.69	8.45	[illegible].86	9.90	7.54	4.48	1.[illegible]7	-1.64
-3.34	-4.37	-4.70	-3.35	-2.68	-1.66	-1.33	-2.03
-2.71	-3.74	-5.10	-6.12	-5.79	-5.46	-2.78	-0.08
1.93	3.91	5.87	6.48	5.74	3.63	1.53	-0.93
-2.72	-3.50	-3.61	-2.11	-0.62	0.53	1.[illegible]	0.79
-0.11	-1.68	-2.93	-4.52	-5.10	-5.33	-3.27	-1.20
0.53	2.32	4.43	5.52	5.27	4.34	1.72	-0.56
-2.18	-3.13	-2.75	-1.71	[illegible].02	2.05	3.39	3.73
3.06	1.72	[illegible].24	-2.30	-3.65	-4.34	-4.[illegible]2	-2.37
-0.72	1.27	3.25	4.23	4.54	3.52	1.[illegible]2	-0.21
-1.89	-2.92	-3.28	-2.15	-[illegible].03	1.74	3.5[illegible]	4.60
4.36	3.44	1.53	-0.90	-3.00	-4.44	-5.87	-4.98
-3.77	-2.23	-1.67	-1.12	-[illegible].56	-0.67	-1.44	-3.20
-4.30	-5.41	-4.87	-3.65	-1.45	1.[illegible]8	3.25	4.15
4.70	4.59	3.[illegible]3	1.09	-1.33	-3.4[illegible]	-4.4[illegible]	-4.57
-4.67	-3.45	-2.[illegible]8	-2.64	-2.40	-3.14	-3.89	-4.96
-5.70	-6.11	-5.93	-4.43	-2.27	0.23	3.[illegible]5	5.23
6.08	6.29	5.51	4.07	1.65	-0.4[illegible]	-1.53	-2.29
-2.73	-2.84	-2.60	-2.05	-1.82	-1.91	-2.66	-4.05
-4.78	-4.87	-5.26	-4.38	-2.17	0.33	2.24	5.10
6.66	7.24	7.18	6.46	4.46	2.78	1.11	0.42
-0.91	-1.92	-2.62	-2.63	-2.65	-3.00	-3.99	-4.65
-4.99	-5.32	-5.32	-4.05	-1.54	0.31	2.49	5.63
7.49	8.61	8.76	8.59	8.43	6.31	5.17	3.71
2.57	1.43	0.30	0.13	-0.68	-1.5[illegible]	-2.63	-3.44
-3.93	-4.13	-4.26	-3.46	-2.34	-0.9[illegible]	1.93	4.23
6.63	8.38	9.[illegible]2	9.96	10.12	8.9[illegible]	7.87	6.40
4.95	3.18	1.73	0.28	-1.17	-2.29	-3.43	-4.87

Observed Tidal Strain Data for BDC N/S

All data are in 10^{-9} strain. Data period is from 00^h 00^m (GMT), August 19 through September 18, 1972.

-14.65	-13.32	-10.85	-8.69	-7.18	-6.15	-6.26	-6.19
-5.97	-4.76	-2.40	0.61	4.93	9.39	12.11	13.35
12.97	13.48	6.69	2.41	-2.67	-5.78	-9.21	-12.80
-15.23	-15.21	-12.74	-8.79	-5.33	-2.34	-3.25	-4.47
-5.53	-6.25	-4.84	-2.62	0.76	5.77	9.98	11.63
12.47	11.03	7.30	2.91	-1.97	-8.70	-13.06	-16.01
-16.69	-15.43	-12.38	-8.37	-4.36	-1.58	-0.92	-2.15
-4.51	-7.06	-8.63	-7.60	-3.66	1.12	5.08	8.38
12.32	14.96	14.01	10.29	4.77	-2.54	-8.78	-13.61
-15.90	-14.94	-11.38	-6.27	-1.16	3.20	4.79	4.01
0.61	-4.25	-6.52	-7.17	-5.56	-1.50	4.17	9.35
13.71	16.93	16.88	13.73	7.49	0.91	-7.62	-13.24
-17.39	-17.49	-14.49	-9.07	-3.81	1.63	5.27	5.33
3.11	-1.73	-5.43	-8.32	-8.62	-6.31	-3.03	2.35
8.71	13.77	16.53	13.93	8.22	2.02	-4.51	-9.74
-13.67	-13.33	-9.75	-3.20	2.84	13.09	13.54	9.25
4.94	-1.48	-8.28	-12.42	-15.17	-15.48	-11.59	-4.79
3.12	10.04	17.59	15.51	12.93	7.96	1.85	-6.06
-13.17	-16.37	-14.05	-8.31	-0.63	5.41	9.99	12.60
12.12	9.02	3.96	-2.07	-7.31	-8.96	-6.73	-3.51
1.97	7.75	12.23	13.44	10.92	5.38	-3.09	-9.53
-15.32	-17.53	-17.63	-13.17	-7.08	1.31	8.40	12.90
14.02	12.17	8.24	2.03	-3.16	-6.58	-8.18	-7.19
-4.08	0.33	4.91	8.18	7.87	3.97	-1.05	-5.27
-10.47	-14.85	-15.65	-14.58	-9.60	-3.57	4.25	10.29
13.55	14.26	12.20	6.90	1.61	-2.21	-4.89	-7.39
-8.59	-7.01	-3.95	-1.87	-1.41	-2.56	-6.15	-10.38
-14.12	-16.87	-18.64	-16.76	-12.28	-5.94	0.88	7.85
13.52	17.22	17.17	14.73	10.64	7.19	4.04	0.23
-3.92	-5.32	-4.14	-1.18	1.28	3.27	-0.37	-5.62
-10.39	-12.54	-17.73	-17.18	-13.80	-9.02	-2.66	4.29
9.57	13.81	16.20	15.44	12.35	8.88	4.38	0.31
-3.32	-6.04	-9.78	-11.14	-11.26	-9.77	-11.23	-10.44
-10.31	-12.47	-14.50	-15.23	-14.20	-11.71	-7.92	-2.69
3.01	8.54	11.78	14.19	14.47	13.67	9.78	1.48
-4.87	-8.78	-12.33	-13.80	-14.42	-13.44	-14.81	-15.88
-17.11	-17.01	-14.79	-13.38	-12.28	-11.65	-9.38	-4.83
-1.24	4.32	8.59	12.21	14.23	14.42	12.65	7.47
3.25	-1.62	-5.52	-8.77	-10.89	-11.87	-12.04	-11.73
-9.64	-8.36	-6.92	-6.12	-5.48	-5.34	-5.02	-4.06
-2.44	-0.14	2.66	6.10	7.75	8.76	9.11	8.66
5.91	3.34	0.27	-2.64	-5.38	-7.48	-8.28	-8.10
-7.44	-6.64	-4.49	-4.16	-3.99	-4.65	-5.76	-7.17
-8.38	-8.75	-6.96	-4.50	-0.86	3.30	6.84	9.60

11.73	10.32	6.99	0.92	-6.09	-6.39	-8.94	-14.72
-12.81	-8.28	-3.93	-1.51	0.13	1.16	-0.38	-2.53
-4.65	-5.41	-6.18	-3.96	-2.07	4.83	10.90	8.03
11.77	7.47	4.23	-1.10	-6.84	-10.67	-9.03	-6.63
-4.95	-3.24	0.14	3.71	6.83	9.30	7.97	5.82
3.38	0.82	-0.57	-0.29	2.94	8.50	13.92	16.29
15.11	15.12	13.11	7.77	1.39	-7.41	-13.05	-16.71
-16.53	-12.67	-4.01	2.89	9.51	14.54	16.04	15.14
12.66	8.75	5.05	2.54	3.81	8.34	12.41	17.36
22.77	23.43	18.73	12.44	4.05	-4.53	-12.33	-19.68
-22.99	-18.68	-12.61	-5.27	4.16	11.44	16.40	18.08
16.79	13.79	9.93	6.51	5.01	7.29	7.72	9.35
14.01	15.87	15.08	11.16	5.08	-2.72	-9.17	-14.57
-16.10	-13.61	-7.58	-1.49	4.92	11.17	14.67	15.28
12.65	8.10	2.62	-2.63	-5.55	-5.81	-2.76	3.60
8.71	15.19	17.97	17.86	12.31	3.59	-4.67	-12.84
-17.04	-16.51	-13.62	-6.66	0.87	8.62	14.14	17.92
17.21	14.43	9.59	5.13	2.02	1.58	4.12	7.03
9.36	12.38	15.30	15.18	11.86	5.95	-1.52	-9.92
-16.80	-18.42	-14.78	-9.12	-2.80	5.35	11.90	17.01
19.06	17.76	14.02	9.30	4.25	1.32	3.34	-0.49
-0.98	0.25	2.61	2.37	2.02	-2.67	-5.84	-11.13
-15.61	-17.65	-16.44	-13.11	-7.50	-2.10	7.29	13.54
15.89	16.45	13.58	9.41	5.24	2.21	-0.99	-6.30
-9.34	-9.77	-9.37	-8.04	-8.48	-11.19	-11.15	-12.73
-15.61	-17.36	-17.00	-15.41	-10.71	-3.86	2.70	7.98
11.67	12.56	11.23	8.28	4.88	1.98	0.73	0.48
2.37	4.93	4.91	3.77	1.84	-1.85	-5.85	-8.20
-8.58	-10.72	-12.35	-12.99	-9.90	-4.24	1.10	6.76
12.42	14.17	14.30	12.57	10.15	6.95	5.05	5.25
3.35	-0.36	-4.71	-5.49	-6.44	-9.34	-12.57	-14.50
-15.79	-18.07	-16.93	-14.97	-11.56	-6.84	-1.30	3.91
8.63	12.21	13.51	13.67	12.70	11.23	8.30	6.51
2.12	-0.49	-2.60	-4.39	-6.67	-7.33	-13.32	-16.34
-17.38	-15.93	-14.28	-12.44	-10.06	-11.27	-15.79	-20.14
-24.29	-27.43	14.56	15.89	15.96	16.06	15.55	12.97
8.79	4.43	0.88	-2.51	-5.57	-8.79	-12.17	-14.75
-16.18	-15.17	-13.83	-12.17	-9.86	-6.41	-2.96	1.14
4.26	7.06	9.86	12.99	15.95	16.98	14.92	9.77
5.26	0.91	-3.76	-6.15	-8.55	-12.95	-14.98	-16.72
-17.83	-15.35	-12.71	-10.72	-8.74	-6.75	-4.93	-2.96
-0.81	2.31	4.95	7.26	10.06	11.88	9.80	5.60
2.21	-3.68	-3.42	-5.53	-8.24	-9.99	-11.16	-11.56
-12.01	-9.86	-7.55	-5.57	-3.74	-3.39	-2.86	-2.02
-1.66	-0.65	0.85	3.65	8.77	11.85	11.72	8.33
5.60	2.86	-0.26	-3.42	-6.64	-10.35	-12.76	-12.89*

Observed Tidal Strain Data for BDC E/W

All data are in 10^{-9} strain. Data period is from 00^h 00^m (GMT), August 19 through September 18, 1972.

-19.92	-11.06	-3.5[illegible]	[illegible].87	3.40	6.35	8.93	10.86
12.15	13.19	14.8[illegible]	16.69	19.41	21.1[illegible]	13.35	5.28
-0.03	-6.07	-1[illegible].56	-17.91	-15.69	-4.9[illegible]	-12.57	-19.33
-16.77	-10.11	-2.14	3.88	3.96	5.57	8.07	9.48
10.59	11.93	12.96	15.34	17.66	18.4[illegible]	14.47	3.61
-0.46	-11.31	-13.[illegible]9	-14.54	-14.79	-11.79	-7.33	-4.25
-1.20	3.68	1[illegible].67	16.81	17.72	[illegible].56	18.35	17.01
16.03	15.29	14.64	13.09	11.93	9.97	8.92	-8.94
-12.26	-19.06	-2[illegible].4[illegible]	-19.20	-16.27	-11.35	-7.10	-3.26
-0.23	6.40	11.69	13.77	15.04	15.76	16.[illegible]8	16.26
15.36	14.49	14.6[illegible]	15.38	16.62	17.4[illegible]	11.46	[illegible].80
-2.53	-14.28	-18.3[illegible]	-18.84	-17.26	-15.[illegible]2	-3.10	3.01
4.38	7.42	12.54	15.19	14.58	14.[illegible]1	13.91	13.16
12.34	11.05	1[illegible].24	9.37	8.84	9.34	-2.53	-11.58
-17.44	-20.77	-22.1[illegible]	-18.5[illegible]	-9.31	-2.79	5.[illegible]5	9.41
10.69	13.[illegible]8	17.19	19.5[illegible]	20.45	22.4[illegible]	25.[illegible]7	20.53
11.36	7.39	6.35	5.44	4.91	6.11	6.37	7.95
8.86	9.35	9.97	10.04	5.3[illegible]	[illegible].21	4.73	5.16
-10.04	-18.[illegible]4	-13.89	-6.63	-2.18	1.87	4.[illegible]6	7.04
9.49	12.[illegible]8	14.79	16.42	18.11	19.4[illegible]	20.66	20.30
13.47	7.53	1.52	-4.15	-10.15	-14.7[illegible]	-18.74	-18.65
-15.55	-8.[illegible]7	-3.53	-1.02	1.03	3.15	5.27	8.8[illegible]
11.53	14.33	17.[illegible]8	17.88	19.43	20.67	20.52	14.15
8.67	3.12	-2.49	-8.83	-14.16	-18.22	-16.56	-14.40
-12.00	-8.69	-3.4[illegible]	1.06	4.16	6.3[illegible]	7.88	12.23
15.09	18.28	20.52	21.94	22.68	23.37	19.12	11.26
2.59	-4.35	-10.[illegible]9	-14.76	-20.25	-23.33	-22.95	-22.23
-15.78	-7.66	-3.[illegible]2	-2.13	[illegible].37	2.67	4.29	7.63
10.68	12.79	15.27	16.54	17.80	18.5[illegible]	18.11	8.50
1.81	-5.31	-11.77	-7.69	-5.24	-8.14	-14.54	-22.41
-22.70	-16.[illegible]1	-8.46	-4.54	-[illegible].76	3.16	6.28	8.73
11.05	13.5[illegible]	15.16	16.55	17.67	18.3[illegible]	14.18	5.33
-0.53	-6.09	-13.21	-20.[illegible]2	-23.04	-20.[illegible]7	-16.91	-12.23
-10.17	-8.[illegible]5	-3.46	-1.93	-1.26	[illegible].4[illegible]	3.[illegible]4	6.14
9.16	13.43	17.22	21.73	25.[illegible]8	27.83	25.15	15.44
8.73	1.23	-5.16	-1[illegible].83	-14.06	-15.6[illegible]	-20.[illegible]0	-23.64
-23.64	-18.25	-1[illegible].05	-4.65	-2.18	1.7[illegible]	5.47	8.24
10.75	14.47	17.[illegible]0	20.48	23.42	25.45	22.79	18.75
14.13	4.91	-1.54	-6.04	-[illegible].44	-11.7[illegible]	-13.13	-1[illegible].61
-5.59	-0.[illegible]9	4.33	6.09	7.45	8.49	1[illegible].15	12.56
14.93	16.85	18.32	19.87	16.85	14.43	13.13	12.41
8.79	7.12	5.54	3.52	2.11	-[illegible].[illegible]	-1.91	-3.86
-5.99	-5.94	-5.78	-7.[illegible]9	-6.67	-5.6[illegible]	-4.21	-2.15
-0.17	2.33	4.96	7.31	9.65	12.51	14.27	15.41

14.78	12.68	9.22	3.66	-4.48	3.73	3.12	-7.76
-7.09	-4.31	-1.24	-0.00	3.60	1.52	2.42	2.72
5.57	7.13	8.42	12.47	16.79	22.34	21.78	23.39
21.42	13.74	5.42	-2.73	-9.78	-17.23	-8.51	-4.63
1.40	3.57	4.80	5.10	6.87	11.59	11.58	10.35
11.21	13.40	16.10	18.74	22.56	26.91	33.27	27.11
18.24	11.47	6.26	-0.45	-7.62	-14.38	-19.33	-21.91
-18.78	-12.49	-4.76	0.53	4.05	7.66	9.91	11.98
13.76	15.89	17.59	18.59	20.22	20.98	20.93	21.29
21.48	16.68	12.11	10.97	5.52	-1.95	-5.36	-9.89
-10.17	2.07	8.95	13.39	14.33	16.71	18.26	19.92
17.01	18.92	20.40	20.26	22.23	22.93	12.47	9.02
6.90	1.57	-1.24	-1.52	-3.94	-6.24	-8.02	-9.01
-6.26	-2.46	1.87	5.39	8.23	11.19	13.61	13.62
14.28	14.94	15.25	14.89	14.45	14.43	14.34	16.67
16.19	11.97	11.20	10.43	5.23	-1.57	-4.11	-6.92
-5.45	1.35	6.78	9.80	12.39	14.72	16.31	18.17
19.74	20.36	22.29	19.79	19.27	20.21	20.98	16.83
10.11	9.66	8.64	4.93	0.53	-5.63	-7.54	-11.08
-9.96	-3.52	3.56	7.81	12.04	12.65	15.36	17.12
18.33	19.78	20.13	22.20	20.11	19.09	13.12	6.35
0.69	-0.62	-4.34	-7.21	-10.37	-9.95	-3.78	-1.20
0.72	5.19	8.39	11.19	12.72	15.30	17.25	18.78
19.65	20.92	20.58	20.25	22.18	22.47	13.42	0.47
-6.10	-10.42	-12.30	-14.21	-15.41	-7.82	0.41	5.27
7.04	8.64	9.55	10.93	11.16	13.59	15.33	16.77
17.92	18.22	18.11	17.40	16.23	14.79	13.95	11.91
7.86	2.21	-3.70	-5.66	-8.86	-13.31	-11.22	-6.30
-1.81	1.66	4.08	7.29	8.52	11.47	13.76	16.22
19.63	19.59	20.23	22.11	22.67	23.85	24.65	26.47
20.96	5.44	-5.55	-9.07	-11.12	-14.24	-16.43	-13.94
-7.19	-1.08	3.90	6.43	8.77	11.46	14.39	15.99
18.39	19.65	22.20	20.69	20.86	21.24	17.56	14.36
6.17	7.01	3.91	0.50	-3.78	-8.53	-9.99	-9.70
-6.11	-3.68	3.66	5.44	5.45	8.23	10.19	12.25
15.08	17.36	19.47	20.80	21.73	22.42	22.42	21.64
14.58	6.43	5.75	0.25	-5.26	-9.31	-11.64	-11.58
-8.59	-0.27	6.43	9.52	11.93	14.33	15.91	16.95
17.84	19.12	20.56	21.25	22.09	22.11	19.42	11.09
5.92	2.04	-2.94	-7.02	-10.34	-12.24	-12.83	-11.77
-7.67	-1.34	4.14	7.64	8.70	11.65	13.22	13.95
16.38	18.51	19.69	21.52	23.20	23.13	19.85	8.92
3.94	-2.61	-7.87	-10.18	-11.72	-11.04	-9.20	-6.21
-1.12	9.53	16.40	19.61	20.92	22.51	22.72	23.15
23.41	23.35	22.72	21.91	20.92	19.40	17.41	12.01
0.99	-6.69	-11.43	-14.17	-15.84	-14.97	-13.23	-1.46*

Observed Tidal Strain Data for BDC NW/SE

All data are in 10^{-9} strain. Data period is from 00^h 00^m (GMT), August 19 through September 18, 1972.

-31.01	-27.74	-22.39	-18.10	-12.25	-8.32	-5.10	-3.27
-0.41	4.34	10.48	17.12	24.45	31.78	36.31	34.41
29.20	24.33	16.15	6.40	-7.53	-9.84	-11.11	-15.18
-24.28	-30.62	-29.11	-26.87	-21.10	-13.91	-13.97	-13.28
-12.03	-8.49	-3.43	2.04	9.19	16.90	23.44	23.78
21.37	12.75	5.22	-2.27	-9.36	-16.07	-20.46	-23.61
-22.36	-19.86	-20.26	-15.58	-10.17	-5.57	-4.41	-4.06
-5.06	-4.98	-4.67	-1.37	8.22	18.73	24.77	24.08
20.31	17.98	13.43	4.42	-7.15	-15.39	-18.19	-23.20
-27.13	-26.85	-20.76	-12.09	-3.39	2.38	5.22	2.85
-3.31	-9.63	-8.70	-6.95	-4.20	4.12	14.36	17.51
18.06	15.62	12.15	4.19	-3.92	-13.58	-18.35	-21.20
-21.07	-19.71	-15.65	-8.76	-0.22	7.30	11.37	11.99
7.42	3.39	1.46	2.16	6.35	12.13	17.40	21.31
23.50	11.99	10.92	7.18	1.21	-6.05	-15.02	-18.77
-21.97	-22.55	-18.06	-8.13	7.74	19.14	13.56	1.09
-6.48	-16.78	-25.14	-27.69	-28.17	-24.24	-14.71	-3.05
5.52	14.51	20.41	22.59	15.78	10.59	8.06	-4.65
-9.32	-13.93	-12.23	-5.97	3.66	12.48	19.44	21.60
22.25	19.32	15.58	12.41	9.83	12.16	23.06	25.86
24.12	24.01	22.31	17.37	7.27	-4.52	-18.33	-24.97
-28.79	-27.25	-21.87	-12.29	-1.30	10.59	20.26	26.31
29.78	29.12	24.56	22.32	18.45	21.93	25.62	26.39
23.63	22.11	18.27	13.07	2.67	-11.39	-19.38	-22.50
-25.28	-29.63	-25.82	-18.37	-3.80	7.65	18.91	26.01
32.75	33.25	32.71	29.38	26.41	24.31	27.07	22.18
15.57	11.39	7.43	2.85	-5.16	-13.33	-22.20	-29.85
-31.94	-28.36	-24.94	-16.24	-7.69	-0.91	11.76	21.79
29.37	32.24	34.21	32.68	29.22	27.64	31.42	25.90
18.94	8.63	2.79	-2.05	-0.86	-5.62	-11.47	-22.23
-31.47	-37.63	-34.85	-29.66	-18.60	-9.58	-0.61	9.98
18.78	23.21	26.38	26.91	26.01	23.15	19.56	13.50
5.14	0.39	-5.48	-5.52	-22.45	-22.23	-33.79	-29.15
-24.53	-26.72	-28.59	-27.71	-22.69	-15.62	-7.18	2.78
10.46	18.63	24.51	31.58	35.15	36.26	35.26	19.07
7.34	-1.63	-7.51	-12.93	-17.35	-20.95	-33.62	-31.76
-36.19	-40.58	-39.32	-36.06	-29.74	-22.78	-15.17	-6.04
2.69	11.90	19.15	24.27	29.00	29.98	25.32	21.79
15.22	4.41	-4.76	-11.93	-17.10	-22.36	-27.53	-31.22
-29.28	-26.01	-22.10	-20.33	-18.44	-15.91	-10.66	-5.80
0.21	3.63	8.40	13.73	15.73	15.29	16.05	13.68
9.03	7.26	3.44	-0.14	-3.35	-6.18	-7.57	-10.83
-4.51	-9.60	-11.70	-14.11	-12.31	-12.66	-14.86	-13.71
-11.82	-10.57	-6.67	-3.41	3.55	8.47	15.70	20.55

20.41	17.55	6.23	2.61	-17.99	-12.49	-11.62	-21.99
-25.54	-18.57	-13.17	-10.09	-5.30	-1.86	-2.05	-2.56
-0.61	0.84	4.75	12.32	20.27	26.17	34.17	27.62
33.94	20.25	7.14	-1.12	-29.93	-37.49	-37.58	-34.32
-19.90	-22.28	-11.93	-7.79	-4.82	-2.34	-13.72	-8.30
-4.45	-1.77	4.61	7.20	16.62	24.35	35.43	42.33
32.71	22.48	13.20	3.64	-8.79	-21.57	-33.17	-41.13
-40.28	-34.52	-26.46	-18.35	-8.63	-3.28	-1.32	-1.92
-2.59	-3.39	-2.92	-1.82	4.58	12.48	22.17	29.82
34.40	32.33	24.51	13.87	4.93	-8.91	-17.91	-24.34
-27.34	-24.99	-15.91	-3.24	7.36	15.31	14.18	10.42
11.62	13.90	12.99	10.65	12.27	18.54	23.56	22.65
22.22	18.81	12.40	4.58	-14.56	-18.83	-19.97	-26.89
-28.26	-23.58	-15.11	-4.57	6.98	14.34	17.68	17.36
15.62	10.90	6.84	2.79	1.99	2.74	13.23	20.99
29.65	28.29	26.65	24.81	12.57	-1.77	-16.24	-24.92
-30.59	-25.25	-20.61	-10.68	2.77	12.98	23.11	24.34
23.94	20.46	16.20	13.50	13.48	16.63	24.72	29.17
28.49	27.69	26.24	20.33	9.61	-1.22	-13.75	-21.70
-29.61	-28.40	-20.07	-9.63	2.90	13.52	22.43	27.17
29.67	29.58	26.93	21.87	20.11	19.68	21.96	22.99
17.82	14.15	12.60	6.36	-1.59	-12.55	-15.72	-20.25
-27.18	-26.36	-20.53	-12.65	-1.67	10.50	19.17	26.76
28.60	29.54	26.64	22.15	19.01	16.54	16.30	10.31
2.20	-3.34	-7.16	-10.15	-15.25	-24.02	-24.49	-23.06
-22.82	-21.85	-21.39	-19.16	-10.31	0.83	8.52	15.19
18.42	19.22	18.53	15.95	11.86	10.29	12.70	15.72
17.68	20.93	20.20	12.22	1.99	-9.77	-17.87	-19.69
-17.33	-17.55	-19.31	-18.79	-11.83	-1.19	7.27	15.43
19.66	17.26	21.85	21.99	17.84	14.88	15.26	19.90
21.97	14.38	6.67	0.58	-4.07	-11.96	-21.52	-28.08
-22.26	-27.46	-25.38	-24.51	-13.56	-5.77	3.26	11.77
18.54	23.06	25.14	25.83	26.18	25.93	23.23	23.75
22.01	17.85	13.51	7.60	0.31	-9.49	-17.65	-25.42
-31.62	-31.91	-29.95	-27.81	-23.42	-16.41	-10.45	-0.67
6.34	12.48	13.76	19.91	20.85	22.14	24.64	26.10
21.15	16.35	10.08	3.22	-5.47	-13.18	-19.25	-24.70
-29.71	-28.55	-24.86	-20.56	-14.78	-9.42	-4.32	1.57
7.38	12.42	16.51	21.34	23.58	26.12	24.34	16.14
7.78	0.99	-4.43	-11.18	-17.60	-24.71	-14.90	-17.64
-21.08	-22.07	-21.67	-24.45	-17.60	-11.79	-7.53	-1.18
5.35	9.70	14.33	19.57	19.72	22.71	20.95	13.56
2.80	-5.61	-12.36	-19.12	-21.58	-22.83	-23.74	-24.69
-24.60	-20.43	-12.34	-11.16	-17.40	-24.16	-24.33	-22.75
-16.82	-10.54	-2.69	3.78	11.30	16.57	16.11	11.50
7.06	3.16	-13.87	-16.19	-18.07	-22.12	-25.30	-26.04*

Observed Tidal Strain Data for QBC N/S

All data are in 1.25×10^{-9} strain. Data period is from $00^h\ 00^m$ (GMT), August 16 through September 15, 1972.

-10.14	-9.71	-7.24	-5.87	-4.11	-2.82	-1.29	0.55
2.16	3.60	4.74	6.89	8.67	10.62	12.90	14.57
13.27	9.65	4.94	-0.84	-6.45	-12.00	-15.81	-16.78
-14.21	-11.38	-9.81	-6.77	-4.59	-2.32	0.05	2.13
4.30	6.80	9.81	11.03	13.33	14.89	17.57	18.15
15.30	11.84	7.15	2.16	-1.71	-5.95	-9.47	-13.13
-16.53	-17.49	-15.39	-12.88	-10.28	-7.75	-5.36	-2.49
0.39	2.97	5.25	7.55	9.77	13.22	17.15	16.35
12.65	9.09	4.81	0.05	-4.10	-7.56	-10.40	-12.94
-14.40	-16.41	-15.20	-12.58	-10.41	-8.25	-6.26	-3.97
-1.77	1.00	3.75	6.25	8.88	12.19	15.17	15.00
12.61	9.11	4.64	1.10	-2.39	-5.90	-8.10	-10.08
-12.08	-13.56	-13.18	-10.65	-6.10	-3.43	-0.82	0.78
2.01	3.49	4.83	5.79	7.86	10.34	12.68	14.32
12.60	9.17	5.52	2.05	-1.79	-5.23	-8.10	-10.64
-12.92	-14.88	-15.42	-12.99	-10.00	-7.64	-5.98	-4.40
-2.81	-1.22	0.93	3.38	5.93	8.78	11.25	11.29
8.75	5.91	3.53	-1.90	-6.22	-9.69	-13.00	-14.66
-15.53	-15.45	-13.52	-10.80	-8.23	-5.81	-4.08	-2.43
-0.77	0.82	2.18	3.78	5.86	8.80	12.77	15.27
13.63	11.40	8.38	2.23	-2.80	-5.37	-8.57	-11.44
-12.50	-13.42	-12.55	-10.39	-7.32	-4.95	-2.66	-0.68
1.14	2.64	3.91	5.56	7.61	10.29	14.27	12.58
8.92	5.61	1.42	-3.66	-9.78	-13.96	-15.77	-16.48
-16.53	-15.69	-14.11	-12.98	-11.38	-10.39	-9.94	-8.07
-5.33	-3.96	-2.89	-2.13	-0.88	0.61	2.04	4.18
6.02	8.35	10.13	10.89	10.55	9.65	7.27	5.19
2.79	-1.09	-1.93	-0.89	0.53	1.80	3.13	4.47
5.17	5.87	6.49	7.34	8.41	10.74	12.28	13.19
12.84	11.31	8.45	4.88	0.68	-4.24	-8.13	-11.57
-13.44	-12.78	-11.11	-8.81	-5.79	-3.00	-0.59	1.75
3.78	5.51	6.93	8.28	9.72	11.79	14.19	15.49
13.90	11.27	7.77	3.08	-2.32	-6.99	-11.56	-14.01
-15.10	-14.53	-13.08	-10.52	-7.95	-5.28	-2.51	-0.04
2.14	4.41	6.07	7.66	9.04	11.07	13.73	14.38
12.15	8.94	4.63	0.34	-3.56	-7.22	-10.79	-14.43
-15.79	-15.04	-12.86	-10.30	-7.19	-3.92	-1.04	1.67
4.00	6.09	8.26	10.04	11.58	13.48	15.86	16.05
13.04	8.93	4.83	0.22	-4.63	-8.57	-10.71	-12.38
-14.68	-15.32	-13.78	-11.44	-9.03	-6.30	-3.34	-0.45
1.73	3.93	6.21	7.95	9.54	11.67	13.74	15.10
13.09	9.91	5.72	0.36	-4.53	-7.93	-11.09	-13.38
-14.03	-14.99	-13.46	-11.08	-8.46	-6.32	-4.24	-2.01
0.38	2.86	5.34	7.43	9.76	11.85	14.97	14.27

10.41	6.30	0.84	-2.84	-7.63	-10.65	-12.81	-13.91
-14.55	-15.01	-13.46	-10.77	-8.34	-5.78	-3.57	-1.30
0.78	2.75	4.77	6.69	8.42	10.75	12.74	11.80
9.89	6.00	2.47	-2.42	-6.48	-9.68	-12.28	-14.62
-14.56	-13.79	-12.57	-10.91	-9.03	-7.46	-4.41	-3.01
-2.95	-2.89	-2.68	-2.40	-1.25	-0.98	-1.32	-1.23
-1.20	-0.69	-0.34	-0.49	-0.74	-0.94	-1.11	-1.22
-1.20	-0.59	-0.15	0.23	2.24	1.32	1.01	0.74
0.44	0.18	0.21	0.37	1.05	2.24	2.78	3.60
4.23	3.62	2.51	0.86	-2.07	-4.09	-5.44	-6.42
-7.51	-8.09	-7.91	-7.33	-6.64	-6.07	-5.47	-4.69
-4.02	-3.32	-2.12	-1.05	0.45	2.30	4.41	6.08
7.32	6.32	3.70	-0.45	-3.64	-7.73	-10.77	-11.28
-11.44	-11.18	-10.34	-9.39	-8.41	-7.55	-6.51	-5.13
-3.71	-2.34	-0.63	1.35	3.44	5.71	8.33	10.59
10.14	8.54	6.20	3.02	-0.13	-3.41	-6.41	-9.70
-12.02	-13.34	-12.52	-11.01	-9.35	-7.61	-6.01	-4.96
-3.67	-2.45	-0.91	0.55	2.10	4.43	6.78	8.89
9.93	10.62	9.71	7.76	4.44	0.63	-2.12	-4.73
-7.14	-9.19	-8.30	-6.96	-5.50	-3.99	-2.50	-1.21
0.53	1.16	1.25	1.95	3.41	5.39	7.58	8.48
7.62	6.41	4.08	1.16	-1.63	-3.74	-6.35	-7.98
-8.30	-8.03	-7.32	-6.15	-4.76	-3.69	-2.47	-1.50
-0.76	-0.12	0.51	1.61	2.70	4.01	5.31	7.39
9.15	8.34	7.71	5.84	3.22	-0.64	-4.00	-7.03
-9.25	-10.05	-9.40	-7.57	-5.55	-4.14	-2.55	-1.41
-0.08	1.12	2.16	3.46	4.64	6.46	8.39	10.33
11.91	12.22	11.21	8.16	4.58	0.39	-3.70	-7.06
-10.08	-11.63	-11.21	-9.53	-8.00	-6.14	-4.59	-3.10
-1.45	-0.16	1.11	2.48	4.10	5.73	8.31	9.96
9.03	7.70	5.34	2.19	-0.99	-3.86	-7.14	-9.25
-9.89	-9.23	-8.11	-6.84	-4.96	-3.09	-0.91	0.86
2.70	3.98	5.32	5.97	7.06	8.22	10.00	10.83
9.68	7.56	3.77	-1.01	-5.41	-10.30	-10.58	-8.29
-6.85	-5.79	-4.54	-3.25	-1.84	-0.74	0.14	1.18
2.40	3.31	4.39	5.42	6.35	7.61	8.66	9.56
10.15	10.11	8.61	5.43	2.04	-1.93	-5.40	-7.74
-8.79	-9.18	-8.66	-7.41	-5.89	-4.64	-3.29	-2.21
-0.70	0.77	2.11	3.34	4.91	6.65	8.51	10.24
12.01	10.76	8.36	5.00	1.82	-0.53	-4.19	-7.26
-10.45	-11.97	-11.64	-10.03	-8.25	-6.42	-4.54	-2.44
-0.42	1.38	3.46	4.48	6.25	8.37	10.09	11.14
10.19	7.58	4.67	2.96	-2.78	-6.39	-9.19	-11.70
-12.76	-12.68	-10.44	-10.74	-8.41	-6.48	-2.60	-0.91
0.78	2.47	4.41	5.47	6.92	8.38	9.45	10.52
11.51	10.70	8.25	4.86	1.39	-2.94	-7.66	-11.36

Observed Tidal Strain Data for QBC E/W

All data are in 1.25×10^{-9} strain. Data period is from $00^h\ 00^m$ (GMT), August 16 through September 15, 1972.

-25.14	-21.73	-19.30	-12.89	-5.94	-1.06	2.49	6.26
9.85	12.98	15.96	18.60	23.01	26.35	28.79	29.24
29.95	20.73	7.61	-5.21	-16.98	-26.52	-31.41	-27.87
-27.26	-25.04	-21.95	-16.89	-12.47	-7.20	-3.35	1.36
6.93	12.22	17.23	21.95	26.78	28.67	34.08	31.63
24.35	16.11	5.29	-4.30	-13.44	-22.11	-28.05	-32.76
-37.76	-33.98	-30.29	-26.17	-20.10	-13.96	-12.32	-7.58
-0.52	5.46	12.26	19.50	26.79	32.11	34.46	32.54
27.56	19.14	9.91	0.64	-7.14	-10.82	-20.55	-24.28
-24.64	-24.66	-22.44	-19.13	-14.33	-11.10	-6.76	-4.36
-0.47	4.28	16.94	17.44	22.05	25.48	30.01	28.43
23.39	17.17	9.02	1.20	-11.61	-19.51	-21.42	-24.12
-28.00	-28.51	-23.90	-21.60	-17.05	-10.04	-2.58	6.07
11.76	16.36	19.52	25.01	30.95	37.33	39.61	40.42
32.88	25.04	14.62	3.15	-6.72	-10.06	-13.72	-16.54
-20.40	-18.25	-13.11	-10.31	-7.93	-4.47	-1.05	2.68
5.99	10.01	12.83	15.99	19.85	21.76	21.36	19.01
15.46	11.11	6.33	1.88	-2.24	-5.40	-8.93	-12.45
-15.97	-16.44	-13.59	-11.48	-8.61	-5.73	-2.08	1.58
3.73	6.66	10.36	13.68	17.01	19.23	19.17	18.08
15.47	10.48	0.18	-7.11	-6.84	-10.38	-11.66	-14.48
-18.44	-21.67	-19.99	-14.92	-11.01	-5.63	-0.96	0.63
4.48	9.06	13.25	17.80	21.20	24.64	27.66	26.17
22.36	13.63	4.49	-3.89	-9.27	-15.41	-18.91	-25.84
-28.99	-28.77	-26.63	-24.06	-19.94	-16.92	-14.23	-8.10
-2.69	5.64	7.42	10.64	12.62	15.27	16.31	19.53
23.03	24.55	23.70	24.92	21.92	12.83	8.62	1.71
-7.13	-13.74	-12.83	-12.33	-9.99	-5.27	-0.43	2.62
5.02	7.90	10.89	13.62	16.45	19.77	26.98	28.63
28.48	21.63	9.95	1.42	-8.52	-14.18	-20.50	-24.81
-26.36	-25.51	-22.33	-17.62	-14.00	-9.58	-4.77	-0.67
3.09	7.64	11.84	17.21	21.86	24.66	29.76	29.83
26.50	18.64	10.43	1.42	-7.17	-14.96	-21.51	-25.95
-29.14	-29.28	-25.61	-21.92	-16.32	-10.30	-4.28	1.77
7.46	12.42	16.64	20.50	24.38	27.15	31.83	30.86
26.87	17.01	7.89	-0.12	-3.62	-10.17	-18.25	-25.22
-29.19	-30.53	-22.75	-17.28	-11.85	-5.74	0.42	6.11
12.53	17.39	22.22	26.63	29.86	32.53	34.45	31.33
25.19	13.76	3.10	-7.18	-6.84	-20.51	-25.45	-30.01
-33.42	-30.38	-25.81	-21.62	-15.14	-9.24	-3.30	1.69
8.96	14.73	20.13	24.01	28.30	32.20	34.99	32.48
26.19	18.39	7.56	-4.74	-10.99	-19.13	-26.12	-29.69
-32.87	-33.01	-26.80	-22.48	-17.79	-12.34	-5.39	1.19
6.62	12.62	18.23	23.26	28.68	33.33	36.08	32.03

23.72	14.20	4.59	-4.34	-10.32	-12.60	-17.61	-19.67
-24.08	-25.17	-21.24	-16.61	-11.51	-6.86	-2.32	1.42
5.44	9.00	12.66	17.01	22.21	24.69	23.67	17.64
8.13	-2.23	-11.53	-20.15	-26.21	-32.52	-28.40	-32.33
-31.73	-32.39	-31.44	-31.14	-34.14	-30.98	-22.42	-14.88
-14.06	-10.86	-10.98	-12.11	-12.39	-9.92	-0.14	2.55
2.30	3.22	0.37	2.54	0.86	2.22	0.28	-1.04
-0.10	-0.69	-0.23	0.24	1.04	1.23	1.96	3.61
4.27	4.70	5.57	6.41	7.31	8.36	10.33	12.45
11.69	9.57	5.33	0.87	-7.23	-13.65	-14.62	-18.84
-21.39	-21.14	-19.88	-18.14	-15.57	-12.89	-10.14	-7.28
-4.33	-0.92	2.59	5.80	9.11	12.14	16.76	21.48
21.85	14.33	2.33	-6.95	-16.91	-25.28	-28.66	-27.80
-27.24	-25.86	-24.22	-22.88	-19.01	-16.20	-12.18	-8.86
-5.45	-2.36	1.19	5.94	11.52	16.42	25.17	27.56
23.96	15.51	4.56	-3.45	-9.80	-16.07	-21.89	-28.01
-25.36	-25.29	-25.14	-22.26	-17.80	-12.19	-6.19	-1.32
3.95	8.46	11.85	16.38	21.30	25.56	27.86	28.33
27.19	24.85	20.55	16.19	7.21	-0.74	-12.38	-17.84
-24.81	-20.10	-16.59	-12.01	-7.13	-1.55	3.21	7.52
11.39	14.44	17.42	20.70	23.93	26.71	28.67	25.63
21.01	18.08	13.45	2.96	-7.20	-17.45	-22.45	-26.43
-25.48	-25.39	-21.56	-17.37	-13.20	-8.26	-3.37	0.20
3.74	6.71	9.67	13.36	16.29	18.83	22.12	26.56
24.47	21.35	17.13	11.43	0.48	-12.06	-18.67	-26.09
-27.80	-24.54	-21.23	-16.38	-12.61	-8.81	-4.97	-0.71
3.59	7.93	11.94	15.23	18.93	23.25	28.36	33.33
31.89	25.70	18.15	9.27	-1.17	-11.80	-20.57	-28.92
-33.81	-29.34	-24.83	-20.67	-15.72	-10.36	-4.96	0.47
6.30	11.42	16.18	20.23	23.16	26.51	29.89	28.66
24.36	13.98	5.88	-1.20	-7.52	-14.62	-12.66	-27.22
-25.50	-22.88	-18.77	-13.56	-8.38	-3.23	2.27	6.98
10.89	15.17	18.64	22.89	25.13	26.62	28.28	24.21
14.62	1.60	-11.46	-18.11	-26.69	-23.17	-18.70	-18.39
-17.32	-15.48	-12.89	-9.92	-6.92	-3.17	0.20	3.28
5.44	8.07	9.94	12.20	13.70	14.45	18.99	22.41
22.04	20.90	13.43	6.05	-1.98	-10.34	-17.75	-23.59
-25.17	-24.76	-20.28	-16.06	-11.95	-7.35	-3.93	1.02
5.52	9.74	13.32	16.61	19.62	22.73	26.70	31.14
28.11	23.62	18.21	-2.48	-9.94	-17.79	-24.77	-29.77
-32.01	-25.78	-21.78	-16.61	-11.79	-6.55	-1.28	4.41
10.12	14.72	13.26	20.81	23.49	28.57	33.96	34.07
29.58	25.05	14.49	6.68	-5.58	-15.12	-23.01	-27.41
-30.20	-28.73	-26.80	-22.86	-19.62	-19.33	-13.92	-9.15
-4.07	1.05	3.89	5.59	7.30	9.32	9.57	7.48
-10.51	-16.36	-16.95	-12.59	-18.08	-27.55	-19.98	-15.24

Observed Tidal Strain Data for QBC NE/SW

All data are in 1.25 x 10^{-9} strain. Data period is from 00^h 00^m (GMT), August 16 through September 15, 1972.

-2.73	-1.98	-1.41	-0.58	-0.12	0.60	1.14	1.34
1.52	2.05	2.39	2.56	2.55	2.78	2.68	2.99
2.27	1.71	1.15	0.58	-0.17	-0.47	-1.09	-1.51
-1.58	-1.45	-1.13	-0.80	-0.61	0.11	0.51	0.93
1.20	1.49	1.29	1.28	1.12	1.83	2.06	1.62
1.37	1.15	1.27	1.06	0.85	0.30	-0.59	-1.81
-2.35	-2.54	-1.71	-0.70	0.14	0.48	1.15	1.84
2.35	3.04	3.05	3.06	2.56	2.74	3.07	3.39
3.52	3.63	3.55	2.78	1.47	0.14	-0.51	-2.04
-3.76	-4.13	-3.65	-2.18	-1.74	-1.58	-1.09	0.15
0.68	0.99	1.30	1.78	2.25	2.90	3.04	2.66
2.12	1.06	-0.51	-0.89	-0.24	0.07	-0.14	-1.54
-2.94	-2.12	-2.15	-0.31	1.02	2.05	3.07	3.76
3.76	2.39	1.71	1.71	2.39	3.07	3.59	3.07
2.56	2.05	1.37	0.51	-0.34	-1.02	-1.88	-2.73
-3.59	-3.52	-3.64	-2.97	-2.30	-1.79	-1.62	-1.44
-1.42	-1.23	0.00	1.06	2.13	2.52	2.92	3.50
3.91	3.48	1.66	-0.27	-1.71	-2.78	-3.48	-2.95
-2.05	-1.11	0.55	1.55	1.91	2.13	2.22	1.83
2.15	3.36	3.93	3.84	3.28	3.43	3.28	2.65
2.34	2.41	1.95	1.15	0.03	-0.92	-1.30	-1.85
-2.05	-1.55	-0.85	1.05	1.78	2.15	2.42	2.01
2.29	2.59	3.07	3.58	4.10	2.76	1.22	-0.33
-1.56	-2.99	-3.75	-4.19	-4.65	-4.96	-4.27	-3.60
-2.60	-0.43	1.99	3.67	4.58	3.60	1.91	0.88
-0.68	-2.57	-2.61	-2.56	-1.66	-0.94	-0.57	-0.03
0.16	0.55	1.71	1.53	1.86	2.19	2.17	2.31
2.27	2.05	1.66	2.11	1.71	1.40	1.11	0.65
0.19	-0.26	-0.18	0.24	1.35	2.80	2.95	0.62
-0.46	-1.37	-1.58	-1.96	-2.68	-3.38	-3.40	-3.24
-3.07	-1.45	0.50	1.93	2.85	3.24	3.63	2.82
2.34	2.20	2.39	2.92	4.12	5.31	5.48	4.27
2.88	1.32	-0.78	-1.83	-3.93	-5.26	-5.90	-5.52
-4.45	-2.69	-0.93	0.67	0.89	0.96	1.20	1.26
1.34	1.58	2.52	3.46	4.74	7.05	7.49	5.87
3.59	1.05	-0.68	-3.16	-5.46	-7.43	-8.03	-7.43
-5.46	-3.33	-1.20	0.26	1.54	1.96	2.05	2.13
2.39	2.48	3.07	3.67	5.12	6.60	7.76	6.55
4.33	2.48	0.30	-2.71	-4.50	-5.08	-5.64	-7.20
-7.37	-5.99	-3.20	-1.79	-1.03	-0.42	0.21	0.69
0.68	0.53	0.12	1.92	1.80	3.55	4.60	4.30
4.00	3.53	1.71	-0.63	-1.60	-3.59	-4.38	-4.31
-4.41	-4.17	-2.74	-0.59	0.68	1.71	2.49	2.67
2.67	2.69	4.31	4.93	6.21	7.98	7.68	5.83

3.44	3.69	-1.73	-4.01	-5.63	-6.75	-7.73	-7.69
-7.86	-6.31	-3.76	-1.39	-0.41	0.39	1.16	1.58
2.32	2.36	2.39	2.74	3.24	4.59	5.74	6.53
7.65	6.70	4.20	1.34	-0.34	-3.95	-6.78	-8.14
-5.83	-4.27	-2.96	-1.04	1.32	3.64	4.44	1.45
-0.25	-1.52	-2.34	-2.90	-3.03	-3.22	-4.01	-5.55
-2.90	-2.12	-0.48	0.50	1.33	1.84	1.67	1.70
1.74	1.97	2.56	3.68	3.45	3.23	2.36	1.15
-0.03	-1.55	-2.39	-2.12	-1.54	0.17	1.45	1.81
2.10	2.48	2.61	2.67	1.28	1.19	1.20	1.47
2.02	2.29	2.17	1.96	1.17	0.14	-0.63	-0.96
-1.20	-1.10	-0.99	-0.69	-0.03	0.64	2.01	2.21
1.23	-0.42	-1.54	-1.44	-1.50	0.16	1.53	2.69
2.53	3.38	3.62	2.49	2.05	0.40	0.67	1.60
2.23	2.61	3.74	4.09	4.70	5.55	3.37	0.16
-2.51	-3.02	-4.70	-4.91	-4.19	-2.88	-2.17	-0.87
1.37	2.11	3.44	3.73	3.22	2.61	2.06	1.40
0.98	0.43	0.66	0.80	1.50	1.75	2.06	2.61
3.56	4.13	2.76	0.66	-1.02	-2.89	-3.11	-3.76
-3.44	-2.35	0.55	2.02	2.55	1.31	0.51	0.66
0.57	0.58	0.56	1.41	2.74	4.65	4.16	1.00
1.02	-0.11	-1.51	-3.22	-3.83	-2.44	-1.43	-0.66
0.07	1.09	2.56	3.48	2.97	2.76	1.61	0.98
-0.07	0.54	1.26	2.96	3.42	3.62	4.58	5.60
4.30	2.39	1.23	-1.74	-3.45	-4.92	-4.61	-3.89
-3.11	-1.74	-0.14	1.37	2.42	2.36	2.36	1.57
0.85	0.80	1.35	1.83	2.40	3.42	4.35	4.02
3.44	1.58	-0.31	-1.83	-1.86	-3.33	-3.50	-3.07
-1.52	0.12	1.52	3.36	3.93	3.16	2.27	1.58
0.77	0.34	0.12	0.29	0.66	2.45	3.42	1.52
0.01	-1.45	-3.15	-3.59	-3.22	-2.82	-1.52	0.33
2.05	2.24	3.44	3.62	3.29	2.95	2.26	1.06
0.37	0.21	-0.17	0.15	0.81	2.32	2.98	1.58
0.52	0.31	-0.59	-1.31	-2.22	-2.83	-1.67	-0.47
0.27	-0.98	-0.82	1.62	1.54	0.49	-0.68	-1.97
-2.53	-3.33	-3.31	-2.01	-0.31	1.79	3.93	4.93
5.12	6.26	3.76	-0.33	-2.77	-4.25	-4.92	-3.44
-1.15	-0.12	1.88	3.65	2.81	3.10	1.46	-0.58
-0.45	-0.38	-0.88	-1.10	0.00	2.13	4.39	5.05
4.46	2.63	0.74	-0.52	-1.66	-2.85	-3.76	-3.18
-2.31	-1.32	-0.56	1.17	0.81	0.99	0.94	0.58
0.51	0.31	-0.53	-1.03	-2.25	-0.88	2.18	3.47
4.43	4.01	1.37	-0.94	-2.73	-3.67	-3.93	-3.50
-2.92	-2.43	-1.72	0.72	2.66	3.32	3.55	1.47
0.33	-0.72	-1.11	-0.52	-0.64	0.36	2.12	2.43
2.14	1.60	1.31	0.77	-0.55	-1.61	-2.75	-2.95

Observed Tidal Strain Data for RMA N/S

All data are in 10^{-9} strain. Data period is from 00^h 00^m (GMT), August 16 through September 15, 1972.

-31.57	-27.90	-27.40	-26.96	-23.30	-19.63	-15.97	-9.15
0.88	7.70	13.26	21.34	25.06	28.39	19.76	7.70
-10.73	-22.79	-28.53	-31.19	-30.62	-28.91	-27.21	-25.76
-24.43	-22.92	-21.46	-17.30	-15.53	-14.96	-14.33	-7.83
-4.48	4.67	13.38	22.10	33.40	39.96	30.05	20.33
4.92	-5.37	-13.27	-14.39	-18.18	-21.97	-22.41	-24.12
-27.02	-29.80	-25.88	-22.60	-20.93	-15.15	-13.26	-8.71
-5.37	3.57	5.87	15.15	20.58	25.00	27.65	15.15
1.45	-7.13	-10.67	-14.71	-21.21	-20.14	-15.85	-12.25
-7.32	2.02	5.68	10.67	12.50	13.13	13.13	11.87
13.19	15.40	16.98	19.76	22.54	25.95	20.52	15.03
4.48	-3.60	-5.93	-13.38	-13.89	-23.38	-23.86	-26.33
-26.26	-23.74	-13.64	-11.11	-16.22	-10.81	-5.43	-8.14
-10.92	-8.59	-4.36	1.14	9.79	17.38	20.96	21.40
17.42	10.23	1.27	-4.42	-9.85	-16.10	-17.30	-17.93
-19.89	-13.57	-2.40	9.97	14.65	21.72	23.61	22.85
23.23	24.75	18.56	13.57	12.82	15.15	15.40	6.75
3.66	4.23	0.25	0.57	-1.14	-2.71	-8.84	-15.21
-20.39	-19.57	-11.24	-5.68	2.27	8.71	15.09	18.06
13.26	7.64	4.48	4.80	8.84	16.35	23.17	21.59
15.34	6.19	2.88	-2.71	-6.88	-13.64	-21.65	-21.09
-24.24	-26.01	-17.41	-7.89	0.06	10.61	16.86	20.64
20.71	16.41	12.25	7.58	6.69	12.25	15.40	13.51
14.96	16.41	19.89	24.68	24.56	19.38	9.34	0.57
-6.82	-17.87	-18.51	-17.74	-10.23	-2.02	6.25	10.80
-2.21	-6.31	-12.18	-18.62	-23.11	-24.31	-19.76	-11.36
1.58	14.96	24.68	25.69	23.11	8.36	-3.09	-7.70
-21.02	-31.69	-32.07	-21.78	-6.94	7.32	24.31	35.61
43.88	42.04	37.82	28.60	19.44	13.45	15.21	18.88
21.40	23.30	23.99	18.50	16.86	15.91	-0.76	-18.69
-26.96	-30.37	-33.77	-32.07	-22.66	-7.51	10.29	26.26
35.92	40.66	41.33	34.09	26.39	16.29	9.79	8.40
11.99	14.33	20.39	22.73	25.57	22.60	13.95	1.52
-9.72	-20.96	-25.05	-26.89	-20.26	-6.69	6.94	18.62
31.57	33.84	34.78	32.01	26.70	17.61	8.46	8.27
2.97	3.98	4.99	6.06	14.65	16.98	10.48	2.65
-7.01	-14.77	-25.06	-24.56	-22.22	-17.99	-1.70	11.99
24.49	31.31	33.71	33.02	26.64	20.28	14.96	-0.38
-4.36	-7.07	-6.76	-0.57	6.12	3.35	3.09	-0.95
-8.84	-13.51	-16.35	-25.32	-22.85	-11.62	-5.37	8.46
19.76	25.76	28.63	27.08	18.56	12.56	5.37	-13.26
-21.72	-24.83	-19.82	-16.35	-15.34	-15.66	-13.45	-18.81
-22.85	-23.60	-24.58	-28.85	-32.89	-33.74	-19.13	-5.49
4.36	17.99	28.63	31.69	34.15	34.36	29.67	28.09

0.00	-6.57	-13.61	-9.66	-11.11	-9.47	-10.35	-15.53
-18.88	-21.84	-18.50	-18.62	-16.41	-13.07	-8.65	-1.83
6.06	15.03	23.60	30.62	35.98	36.80	15.91	3.16
-14.27	-28.13	-32.45	-35.16	-33.65	-28.47	-23.48	-29.36
-29.10	-27.71	-29.04	-28.03	-27.08	-23.86	-24.56	-26.70
-15.72	-7.45	2.59	11.17	22.26	27.27	29.67	33.84
26.64	15.33	8.40	-3.35	-7.51	-11.74	-14.77	-16.60
-18.31	-15.24	-17.50	-25.50	-29.73	-33.38	-34.93	-35.61
-35.98	-25.67	-14.71	-3.22	8.43	18.94	25.88	31.75
31.44	25.40	18.69	6.25	-2.84	-8.65	-17.42	-19.76
-23.23	-29.28	-29.54	-13.45	-11.17	-8.08	-7.32	-8.96
-9.15	-9.17	-7.13	-1.45	11.93	26.23	34.22	46.21
38.45	26.96	11.74	2.90	-7.13	-22.10	-24.37	-35.42
-31.82	-22.92	-17.23	-9.25	13.29	17.05	20.01	8.96
0.32	-7.13	-5.24	-2.15	4.61	15.66	31.69	45.08
54.61	51.39	42.42	25.76	3.91	-12.94	-30.49	-39.39
-43.88	-37.75	-26.31	-16.29	-5.37	2.96	6.06	9.15
5.81	-3.19	-4.56	-8.59	-7.26	0.32	5.24	17.68
23.04	27.59	23.93	20.27	8.27	-5.18	-18.56	-24.49
-28.60	-14.77	-5.87	-3.91	13.26	26.73	37.75	39.90
23.30	24.37	19.89	19.19	15.47	15.53	13.83	15.28
21.91	28.98	31.10	27.23	19.89	8.65	-1.33	-14.39
-25.63	-22.92	-17.25	-13.70	-6.57	1.83	7.77	13.64
15.78	19.19	17.55	6.31	-1.07	-3.28	-4.23	-1.96
6.57	11.99	17.42	16.54	12.50	8.59	-0.51	-15.85
-22.98	-21.27	-20.77	-14.84	-8.96	3.29	15.15	22.10
26.39	25.88	21.59	18.43	11.43	8.38	7.26	6.31
7.83	7.95	11.67	16.92	16.86	19.25	8.27	-6.57
-19.57	-28.72	-25.57	-21.15	-13.64	-1.91	13.66	17.49
24.12	26.14	23.61	15.66	7.07	0.86	-5.37	-11.62
-15.47	-15.59	-10.73	-2.71	-1.14	-7.83	-14.52	-15.03
-20.58	-28.53	-32.70	-23.86	-13.76	-2.34	12.88	25.63
32.76	37.31	34.97	30.18	22.85	16.86	7.07	-2.65
-8.65	-11.99	-12.88	-9.85	-9.97	-12.29	-8.71	-8.96
-23.80	-33.59	-35.73	-34.15	-18.69	-4.48	12.25	24.56
32.45	28.35	23.61	14.77	0.88	-11.62	-19.07	-21.27
-24.12	-23.67	-21.34	-22.10	-23.99	-25.88	-26.45	-27.02
-32.58	-39.33	-39.65	-39.33	-35.61	-22.28	-8.78	11.17
25.00	32.64	39.20	42.11	37.69	35.61	29.86	28.85
29.23	13.32	3.98	-11.49	-14.20	-14.71	-18.94	-23.55
-31.82	-34.15	-31.31	-27.59	-22.41	-15.85	-8.46	6.75
15.78	21.84	26.39	29.67	31.12	24.37	11.30	4.55
-6.00	-20.39	-22.10	-22.60	-16.73	-14.28	-11.43	-16.98
-19.38	-21.76	-17.87	-26.64	-31.57	-30.11	-27.34	-20.83
-6.75	3.69	15.19	21.59	28.09	32.91	31.57	28.53
25.57	20.01	15.29	11.43	10.29	10.42	10.54	9.34

Observed Tidal Strain Data for RMA E/W

All data are in 10^{-9} strain. Data period is from 00^h 00^m (GMT), August 16 through September 15, 1972.

-1.56	5.99	10.16	14.32	15.89	17.45	19.01	19.79
19.01	18.49	19.79	20.31	20.57	20.57	16.41	11.72
0.26	-3.15	-13.02	-19.27	-20.31	-20.08	-15.60	-6.38
1.30	5.89	9.97	13.05	15.36	17.19	18.25	18.33
19.45	19.56	19.69	21.43	21.64	21.85	18.46	13.02
3.67	-5.60	-10.99	-15.08	-16.59	-16.74	-16.95	-13.25
-10.31	-2.45	4.37	9.11	11.51	14.92	15.60	15.75
17.16	17.53	16.87	16.15	15.96	14.79	8.15	-1.07
-8.72	-13.75	-17.76	-17.58	-17.16	-14.37	-9.01	-6.48
-6.07	0.10	5.23	10.62	13.18	15.10	15.91	17.45
18.18	18.41	18.39	17.84	18.59	16.77	11.02	5.29
-4.35	-12.71	-14.53	-17.63	-17.63	-13.46	-7.45	-9.27
-8.20	-5.60	-0.36	4.35	7.24	11.20	14.61	16.20
16.98	17.53	19.09	18.57	17.53	15.44	11.80	3.96
-3.59	-10.65	-18.46	-16.75	-18.78	-16.98	-12.16	-9.43
-6.72	-4.01	2.84	6.82	10.26	13.67	15.75	17.84
19.40	18.85	18.54	17.94	18.91	13.10	4.64	-5.39
-12.29	-16.87	-18.88	-19.58	-19.01	-15.47	-12.19	-8.41
-5.18	0.13	3.88	8.10	11.28	12.89	14.48	16.54
17.55	19.09	20.57	22.06	22.76	21.07	17.29	6.98
-2.06	-11.15	-15.05	-16.35	-18.96	-19.50	-16.72	-10.83
-8.62	-6.43	-0.60	2.58	6.28	8.91	10.99	13.57
15.60	18.15	20.16	21.59	21.20	21.25	15.31	5.65
-2.99	-12.71	-21.41	-21.56	-19.66	-18.07	-16.48	-13.41
-11.87	-9.90	-4.06	0.73	2.86	4.97	6.77	9.06
8.52	7.99	8.26	7.94	8.67	9.35	8.98	8.31
6.59	2.99	-1.12	-3.72	-5.03	-7.94	-9.11	-11.20
-13.02	-11.72	-6.02	-2.11	1.25	3.46	6.20	8.41
11.17	13.39	16.15	18.39	20.62	21.82	21.98	16.93
7.45	-2.23	-7.58	-13.12	-18.67	-20.57	-21.43	-19.19
-15.34	-10.52	-6.77	-3.62	-1.54	0.52	3.02	4.32
6.35	8.59	10.26	12.16	15.86	17.66	17.34	13.10
3.57	-1.82	-6.98	-12.19	-15.36	-17.32	-14.77	-12.99
-12.79	-10.18	-6.02	-2.06	0.10	2.27	3.67	3.80
3.96	5.96	9.56	11.61	13.93	16.30	18.41	16.93
8.67	2.37	-3.96	-9.45	-11.33	-16.07	-15.60	-12.53
-9.95	-5.29	-2.21	0.36	1.90	3.44	4.26	3.88
4.48	6.38	7.47	9.11	11.25	13.78	15.23	14.09
8.75	1.85	-7.66	-9.37	-11.09	-11.51	-9.84	-9.77
-7.66	-4.22	-1.30	1.12	2.79	2.99	2.86	2.34
2.60	2.97	3.93	4.92	5.91	7.99	10.28	9.56
4.90	0.81	-5.91	-7.37	-8.83	-10.26	-7.76	-7.86
-4.04	-3.31	0.29	2.37	4.19	5.36	7.06	8.26
10.00	11.20	12.94	13.91	14.87	15.62	13.20	4.58

1.15	-2.27	-5.65	-9.58	-15.05	-11.93	-10.28	-8.49
-7.68	-5.52	0.47	3.28	5.76	7.66	9.51	10.73
11.46	11.98	13.02	13.80	14.45	12.19	8.83	4.35
-1.74	-5.81	-7.37	-9.48	-9.56	-9.10	-7.56	-8.10
-3.75	-0.29	3.65	5.16	7.11	7.45	5.68	3.88
3.59	2.27	0.89	-1.04	-2.50	-4.24	-6.28	-6.48
-6.77	-5.94	-4.64	-2.50	-0.34	1.87	2.60	4.92
8.33	10.42	12.97	12.11	11.15	10.26	9.43	8.28
7.50	6.64	5.65	5.23	5.65	5.47	3.78	1.09
-1.02	-3.59	-5.60	-5.70	-9.43	-9.45	-3.41	-6.46
-7.37	-6.38	-3.54	-0.62	0.78	2.99	5.03	6.95
8.65	9.01	9.90	10.57	10.76	11.22	9.90	9.37
5.49	0.34	-2.19	-5.96	-9.74	-10.34	-7.68	-6.54
-6.46	-3.76	-2.63	0.60	1.22	2.81	4.40	5.47
6.51	8.10	9.64	9.64	10.13	10.69	8.52	7.16
-0.96	-5.18	-9.43	-11.07	-12.19	-11.77	-10.83	-9.90
-8.96	-6.74	-3.23	-1.04	0.39	1.80	3.70	6.56
7.86	8.39	10.23	11.56	12.14	11.93	10.44	6.61
5.16	3.96	-5.81	-10.89	-11.51	-12.53	-10.26	-9.53
-8.26	-4.37	-0.23	1.85	4.71	6.04	7.37	7.66
8.49	9.35	12.01	15.49	15.31	17.24	11.12	1.61
-3.96	-9.45	-13.57	-17.71	-16.64	-15.57	-13.10	-10.76
-9.64	-8.02	-4.01	-2.34	-0.68	0.47	1.90	2.76
4.11	7.53	9.14	9.92	11.22	12.01	12.76	14.82
12.47	8.49	1.46	-5.62	-10.10	-11.90	-12.55	-13.12
-9.90	-6.67	-3.93	-2.81	-0.60	-0.23	0.13	1.82
5.05	6.22	7.32	8.96	11.93	13.83	13.88	10.57
9.87	8.36	1.12	-4.71	-9.43	-10.16	-11.69	-11.64
-11.87	-8.70	-5.29	-4.32	-1.85	-1.12	-0.39	0.49
1.64	3.57	6.02	8.23	9.87	12.55	12.14	9.61
3.96	-3.26	-7.86	-11.43	-11.87	-12.60	-11.22	-10.16
-7.53	-2.76	-0.60	1.56	2.92	3.75	4.58	5.42
6.22	7.81	9.92	11.25	12.81	14.92	15.70	8.65
2.14	-5.44	-12.50	-14.35	-14.11	-14.95	-9.53	-4.11
-3.39	0.44	2.45	3.15	2.94	3.23	2.73	3.80
4.09	5.16	6.98	8.60	9.58	11.15	12.68	12.94
11.87	10.86	4.61	-1.64	-6.61	-9.81	-11.41	-8.23
-5.05	-1.87	-0.26	1.33	1.38	1.43	0.94	2.53
4.14	5.21	6.28	8.39	9.97	10.36	11.95	13.98
9.95	1.43	-1.74	-8.62	-11.67	-11.41	-13.07	-13.49
-12.19	-9.11	-2.24	0.13	2.68	5.94	8.85	11.48
13.80	13.57	13.31	12.55	12.32	11.56	7.50	3.70
-0.10	-3.68	-7.16	-7.55	-7.76	-8.62	-9.79	-11.22
-8.75	-7.32	-5.89	-5.47	-5.34	-4.97	-4.35	-2.16
-1.28	-0.65	-0.03	2.16	4.09	5.49	7.68	8.31
5.81	2.01	-0.49	-4.82	-5.21	-7.19	-8.39	-8.28

Observed Tidal Strain Data for RMA NW/SE

All data are in 10^{-9} strain. Data period is from 00^h 00^m (GMT), August 16 through September 15, 1972.

20.49	20.41	19.91	17.28	16.80	15.06	14.62	15.47
15.06	15.59	15.03	13.88	12.67	11.20	7.27	3.30
-2.83	-7.31	-11.85	-15.81	-18.03	-15.59	-12.74	2.29
22.15	22.38	16.48	12.21	9.07	5.98	5.52	6.11
7.12	8.71	10.67	12.53	13.76	12.65	10.57	10.60
10.69	8.71	3.83	-1.25	-5.82	-8.71	-9.77	-10.45
-10.48	-1.62	9.90	17.37	14.21	9.03	4.12	1.49
0.46	0.36	3.07	4.99	7.68	10.28	12.48	14.81
13.99	11.24	6.22	0.97	-3.30	-5.75	-6.90	-6.27
-5.53	-4.11	-3.26	-3.42	-5.36	-7.89	-11.34	-12.98
-13.49	-13.01	-11.46	-7.74	-2.41	3.47	7.19	12.33
13.93	13.18	8.06	3.48	-2.73	-6.69	-7.36	-7.45
-8.01	-7.84	-6.57	-6.98	1.40	11.94	6.27	0.60
-4.90	-12.15	-13.83	-12.65	-8.06	-0.39	5.93	11.90
14.63	15.33	11.08	4.10	-1.84	-7.80	-10.67	-11.32
-10.59	-7.62	-1.93	1.45	2.27	-0.34	-5.02	-11.08
-16.80	-21.16	-22.98	-20.70	-15.56	-7.99	2.63	12.53
20.06	25.84	25.82	20.00	12.09	7.55	2.85	3.12
4.97	8.21	15.23	19.48	21.70	21.40	16.17	9.78
0.53	-7.17	-12.26	-18.36	-17.74	-11.99	-4.49	4.59
12.65	17.33	17.86	15.35	12.84	11.18	6.98	4.92
4.42	7.42	14.72	21.04	25.53	26.83	23.39	14.87
2.65	-9.61	-19.90	-25.19	-26.96	-23.50	-14.91	-2.61
8.93	17.06	18.13	13.70	8.04	-2.08	-9.19	-17.20
-21.46	-12.17	0.50	12.47	18.97	26.74	35.30	18.12
-0.84	-14.94	-23.89	-28.65	-29.95	-25.55	-18.36	-7.34
1.67	9.73	17.84	23.63	21.81	16.62	7.38	-4.94
-8.20	-10.96	-8.95	0.24	8.56	17.83	23.02	24.32
20.01	12.50	-0.29	-8.44	-13.83	-17.32	-20.42	-14.79
-3.16	6.97	16.60	23.36	22.81	20.41	14.72	8.97
3.47	1.74	-1.04	5.40	13.37	21.67	27.73	30.38
25.84	16.98	4.10	-5.93	-15.98	-21.76	-24.98	-21.74
-11.83	0.67	12.47	20.54	24.50	23.80	19.69	12.52
7.22	4.40	3.33	5.24	9.92	15.93	23.34	27.00
28.28	22.92	14.65	4.17	-6.13	-14.36	-22.59	-21.41
-13.39	-5.80	3.67	4.34	6.28	6.56	4.18	-0.58
-5.19	-10.31	-13.88	-11.83	-6.86	0.14	6.81	13.46
16.38	16.55	12.89	3.38	-6.18	-12.72	-15.86	-15.61
-13.66	-11.37	-9.44	-7.86	-5.94	-5.75	-7.63	-9.55
-12.31	-16.79	-19.01	-17.83	-15.45	-9.31	-1.61	7.10
13.11	16.59	16.99	13.87	9.21	1.59	-2.08	-3.01
-2.51	-1.96	-2.03	-0.79	-2.51	-4.54	-3.60	-4.68
-9.51	-14.49	-17.11	-17.47	-16.12	-12.84	-7.56	-1.30
6.27	12.90	16.65	18.44	16.94	14.02	11.37	9.72

4.94	0.10	-4.80	-4.61	-4.47	-4.39	-4.70	-7.36
-8.69	-10.71	-12.77	-14.27	-14.53	-15.40	-12.76	-6.92
-0.77	5.31	9.63	13.37	17.23	18.31	15.74	13.30
9.58	4.12	-2.89	-3.69	-4.92	-12.00	-12.02	-12.36
-12.47	-12.53	-13.64	-13.03	-12.14	-14.43	-16.80	-13.13
-9.56	-3.71	4.47	12.19	19.14	22.25	17.45	10.40
3.12	-2.56	-8.21	-13.43	-12.62	-13.08	-14.19	-14.45
-13.79	-12.60	-11.34	-11.97	-14.99	-16.82	-17.81	-18.80
-18.10	-13.99	-7.33	-2.15	8.21	14.55	19.50	21.55
21.89	18.82	14.72	8.88	0.99	-2.13	-5.81	-6.59
-6.37	-4.97	-4.41	-3.36	-3.35	-6.23	-9.14	-13.75
-16.67	-16.44	-14.86	-9.92	-3.92	6.34	13.56	18.70
20.20	19.12	14.72	9.78	3.96	0.67	-3.44	-2.61
-1.79	2.20	3.86	5.07	4.88	2.78	-0.85	-6.11
-12.72	-16.60	-18.43	-17.69	-13.20	-5.12	3.24	7.48
13.34	15.80	15.69	12.13	9.87	0.91	-3.47	-4.41
-3.65	-1.12	2.51	6.44	8.13	9.14	7.07	1.57
-4.25	-9.94	-14.42	-16.68	-15.37	-10.14	-2.87	5.26
12.53	16.38	18.51	15.51	9.94	2.83	-2.73	-6.34
-9.92	-8.25	-7.48	2.25	6.81	9.97	11.27	7.41
2.70	-3.91	-9.18	-13.66	-14.58	-12.52	-6.04	2.99
8.26	13.46	15.64	11.07	6.52	3.34	-6.10	-9.92
-11.48	-11.42	-7.39	-1.61	5.94	12.29	15.03	11.87
5.98	-1.55	-7.33	-11.34	-15.28	-14.45	-10.18	-5.94
2.72	11.54	13.52	14.31	9.96	2.51	-4.27	-9.67
-12.35	-11.50	-6.51	-2.10	4.00	9.22	12.70	13.59
10.04	4.70	-3.46	-10.47	-15.69	-19.21	-16.79	-10.26
-2.56	7.10	12.94	14.79	12.84	6.63	-0.61	-7.50
-11.97	-14.57	-12.31	-7.84	-2.66	5.53	10.84	13.97
13.22	9.06	3.79	-2.13	-7.89	-12.24	-10.88	-5.91
0.27	5.50	8.80	8.66	5.26	1.24	-7.05	-12.72
-17.30	-15.89	-14.89	-10.60	-5.75	0.50	5.64	8.25
9.90	8.23	3.47	-3.89	-7.70	-10.89	-11.13	-7.05
-1.20	3.16	-5.53	6.61	5.33	1.36	-3.45	-8.01
-12.57	-16.79	-17.21	-12.53	-7.84	-1.11	4.97	9.68
12.67	11.41	7.89	1.57	-4.29	-8.44	-13.06	-14.82
-14.31	-9.49	-3.24	3.68	6.28	6.57	2.01	-1.57
-11.73	-14.26	-15.15	-14.69	-10.79	-5.72	-0.55	4.22
6.71	7.92	6.52	2.15	-1.93	-4.51	-7.38	-10.04
-8.91	0.10	7.12	9.56	10.33	8.40	4.87	1.23
-2.32	-5.28	-6.76	-6.81	-7.62	-5.09	-1.61	-1.11
1.88	5.41	7.27	9.00	9.02	7.21	5.38	7.96
9.67	10.31	9.73	9.97	9.51	9.51	8.47	5.86
-0.02	-4.13	-10.45	-9.44	-5.98	-3.63	-1.31	0.61
5.93	8.49	11.10	11.78	10.48	7.79	2.83	-0.77
-4.06	-4.56	-6.49	-7.77	-8.71	-9.14	-10.59	-11.36

T 1547

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