DEPARTMENT OF THE INTERIOR

U. S. GEOLOGICAL SURVEY

Digital Recordings of Aftershocks of the May 2, 1983 Coalinga, California Earthquake

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INTRODUCTION

Following the May 2, 1983 Coalinga, California earthquake (M_L = 6.5, 122 23:42 UTC), the U.S. Geological Survey installed portable, digital, three-component seismographs at 29 sites in the epicentral area. The primary objective was to record aftershock ground motions over a broad range of earthquake magnitudes at small source-to-station distances. We hoped to record one or more large aftershocks on-scale. During the period May 3 – May 25 (123 – 145 UTC) we made at least one recording of more than 1100 aftershocks. These events were confirmed as earthquakes by the CALNET and ranged in magitude from 1.7 < duration magnitude < 5.2 (J. Eaton, personal communication, 1983). We recorded approximately 500 aftershocks at three or more stations and 150 aftershocks at five or more stations (Appendix C).

The primary aftershock-recording network operated from 123 1000 – 139 2100 and consisted of stations SUB, SKH, OLF, ANT, LLN, MIT, VEW, JUN, YUB, ALP, TRA, SGT, and SPP (Figure 1). (The ordering of stations in the Tables and Appendices corresponds to our numbering system in the field and corresponds roughly to the chronology of station installation.) From 123 – 138 these instruments recorded seismicity in trigger mode. On 138 and 139 they operated in trigger and preset modes to record both seismicity and blasts detonated by the U.S.G.S.

In addition, several special experiments were conducted using aftershocks as ground motion sources.

(1) Stations AAW, DZN, CDF, LUC, TOT, and FRS were deployed from 139 2100 – 143 1900 to compare ground motions in downtown Coalinga (sited on Quaternary alluvium) with ground motions on sandstone outcrop 4 km to the southwest at Coalinga Baths (Figure 2).Fourteen aftershocks triggered the recorders of primary interest, AAW or DZN in Coalinga and FRS at Coalinga Baths (Appendix C).

(2) Station SUB is of special interest because it was sited near a permanent U.S.G.S. SMA-1 accelerograph at the Pleasant Valley Pumping Plant switchyard. Initial examination of the mainshock strong-motion records suggested the existence of a site effect at the switchyard site. In order to provide data concerning local site conditions at SUB, station SPP was installed 200 meters southeast of SUB (Figure 1). These two stations operated simultaneously from 130 2315 – 132 1630.

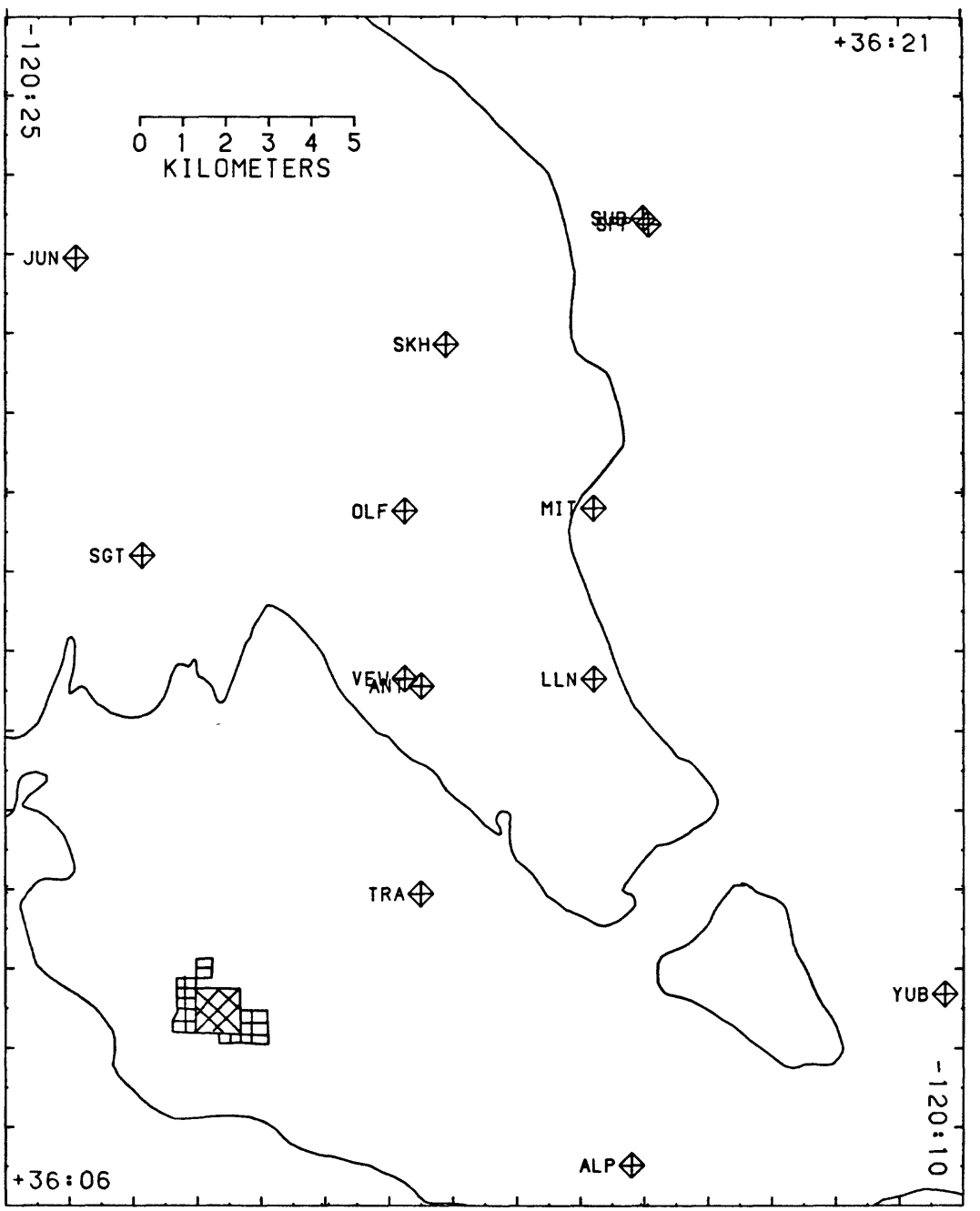

Figure 1. Map showing the primary aftershock-recording network (GEOS). Solid line approximates the bedrock-alluvium contact in the area. The town of Coalinga is represented by the cross-hatched area on the southwest side of Pleasant Valley.

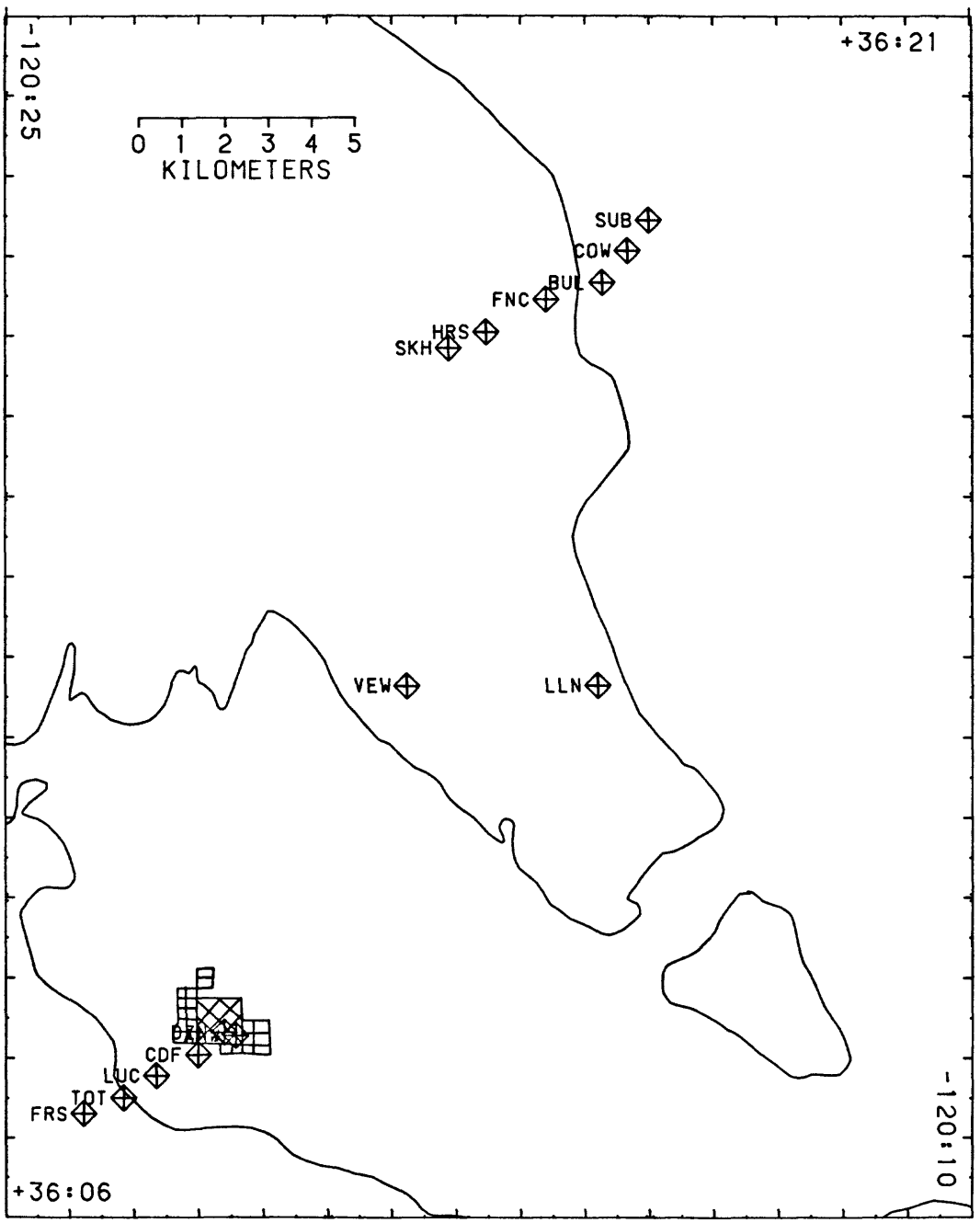

Figure 2. Map showing the two ground motion experiments (GEOS). Stations SKH, LLN, and VEW were maintained throughout both experiments. Solid line approximates the bedrock-alluvium contact in the area. The town of Coalinga is represented by the cross-hatched area on the southwest side of Pleasant Valley.

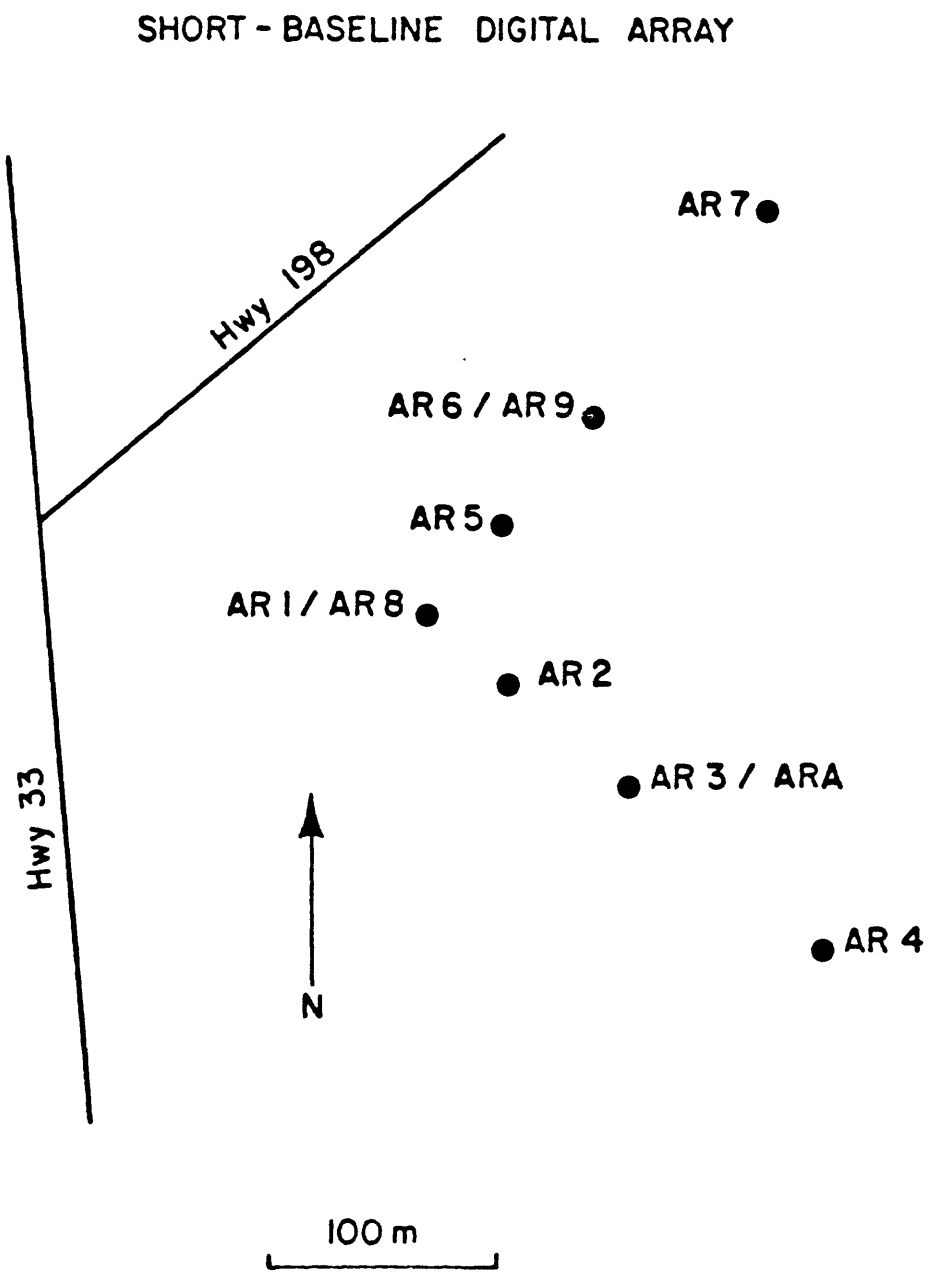

Figure 3. Map showing the L-shaped short-baseline array (DR100). Location AR1/AR8 corresponds to GEOS station OLF (Figure 1).

(3) Stations SUB, COW, BUL, FNC, HRS, and SKH operated from 143 2100 – 145 1800 to compare ground motions on alluvium with ground motions on sandstone exposed at Anticline Ridge (Figure 2). This experiment was similar in intent to the ground motion experiment at Coalinga. Eleven aftershocks triggered the recorders of primary interest, SUB on alluvium and HRS on sandstone (SKH operated erratically during the experiment but HRS provided consistent sandstone ground motions).

(4) Stations AR1, AR2, AR3, AR4, AR5, AR6, AR7, AR8, AR9, and ARA operated from 123 2100 – 144 2000 as a short-baseline L-shaped array (Figure 3). The vertex of this array was located at station OLF (Figure 1). The objective of this experiment was to obtain detailed spatial and temporal information about the rupture processes of large aftershocks.

During these experiments stations SKH, LLN, and VEW were maintained to provide control on aftershock locations (Figure 2).

This report is a summary of field and data-playback information and is intended to facilitate the use of this data set. It includes station locations and times-of-operation, pertinent instrument parameters, and clock-corrections.

INSTRUMENTATION AND LOGISTICS

Instrumentation is discussed most conveniently in terms of the experiments outlined above.

GEOS data. The primary aftershock-recording network and the ground-motion-comparison experiments (Figures 1 and 2) used GEOS recorders (Borcherdt and others, 1984), each recording three components of ground acceleration with Kinemetrics FBA-13 force-balance accelerometers (fba) and three components of ground velocity with Mark Products L22 geophones. Nominal gain settings were 6 dB for acceleration and 24 dB for velocity, which provided a reasonable trade-off between the number of triggers and dynamic range. The largest events clipped the velocity records but were well-recorded in acceleration; small events were well-recorded in velocity but below the noise in acceleration. Trigger and recording parameters are given in Table 1. Location, time-of-operation, gain, and system orientation for each GEOS site are found in Appendix A. Orientation in Appendix A corresponds to the direction of ground motion giving a positive signal after tape playback. Two aspects of orientation must be considered: the physical orientation of the sensor relative to up, north, and east and the internal polarity of each system (sensor+cable+recorder). We attempted to orient each sensor Up,N,E; most discrepancies can be blamed on haste and/or darkness. If possible, orientation was double-checked when each sensor was removed from the field. Note the many cases of reversed channel polarity in Appendix A. System polarity (sensor+cable+GEOS) was checked in the field by tapping the sensor and recording the resulting signal. Independent tests made in the

TABLE 1 – Nominal GEOS parameters

Channel 1,2,3 = UP,N,E acceleration

Channel 4,5,6 = UP,N,E velocity

Digitizing constant = 3276.8 count/V

Sample rate = 200 sample/second/channel (100 s/s/c for tapes A,B,C at LLN)

Trigger channel= 4

STA/LTA = 0.5/4.0 second

Trigger ratio = 4:1

Pre-event memory $\approx$ 2.0 second

Duration = 5 second

Anti-alias corner frequency = 50 Hz

Anti-alias rolloff = 42 dB/octave

Sensor	Sensitivity	Natural Freq.	Damping
FBA-13	0.0051 V/cm/s/s	50 Hz	0.7
L22	0.5 V/cm/s	2 Hz	0.7

TABLE 2 – Nominal DR100 parameters

Channel 1,2,3 = UP,N,E acceleration or velocity

Digitizing constant = 204.8 count/V

Sample rate = 200 sample/second/channel

Trigger channel= 1

STA/LTA = 0.2/20.0 second

Trigger ratio = 2.8:1 (9dB)

Pre-event memory $\approx$ 0.7 second

Duration = 5 second

Anti-alias corner frequency = 50 Hz

Anti-alias rolloff = 30 dB/octave

Sensor	Sensitivity	Natural Freq.	Damping
SA-3000	0.0068 V/cm/s/s	50 Hz	0.7
S-6000	0.5 V/cm/s	2 Hz	0.7

lab indicated that the reversed polarity was due to the sensor in every case. It is worth noting that the Coalinga field project comprised the first comprehensive field test for most of the GEOS units and many of the sensors, accounting for the sensor polarity problems and the GEOS hardware and software problems we encountered. Many of the problems were corrected during the course of the field work.

DR100 data. The short-baseline array (Figure 3) used Sprengnether DR100 recorders, each recording three components of ground motion: ground acceleration with Sprengnether SA-3000 fbas (AR1, AR5, AR6, AR7, ARA) or ground velocity with Sprengnether S-6000 geophones (AR2, AR3, AR4, AR8, AR9). Recording and trigger parameters are listed in Table 2. Location, time-of-operation, gain, and sensor orientation for each DR100 site are found in Appendix A.

Data tapes were returned to Menlo Park for final playback after preliminary analysis in the field. The high quality of the data is evident in the seismograms plotted in Figures 4 and 5. Figure 4 shows accelerograms from the largest event we recorded, 129 0249 ($M_L = 5.2$), from seven GEOS and three DR100 (L-shaped array) stations. Figure 5 shows velocity seismograms from a small event with hypocenter near the 129 0249 hypocenter, 129 0315 ($M_L \approx 2.0$), from three GEOS stations. Comparison of these seismograms reveals the high effective dynamic range of the GEOS recording system.

TIMING

Instrument clock corrections were obtained by comparing internal clocks with WWVB radios and/or master clocks. Each GEOS unit includes a WWVB receiver and WWVB was the preferred time standard for measuring GEOS clock corrections. In case of poor radio reception, master clocks were used at GEOS sites. Master clocks were always used to obtain DR100 clock corrections. Clock corrections are given in Appendix B.

It was not our intention to resynch the clocks to a time standard at each visit (typically once per day) but to let the internal clocks drift as far as practical before resynching in order to determine a smooth clock-drift rate. Instrument malfunctions prevented this in some cases, forcing frequent resynching and a poorly-determined clock drift. In several cases of GEOS malfunction, it was clear that the unit needed to be turned off and restarted. In this situation, typically the clock was still running and it was possible to get a clock correction with a master clock, turn the unit off, turn the unit on again, and synch the internal clock to WWVB. We often obtained clock corrections relative to a master clock from GEOS units immediately after synching to WWVB. These clock corrections (Appendix B) provide checks on both the master clock drift rate and the scatter in individual WWVB synchs. These results are summarized in Figure 6. The master clock drift is apparently insignificant

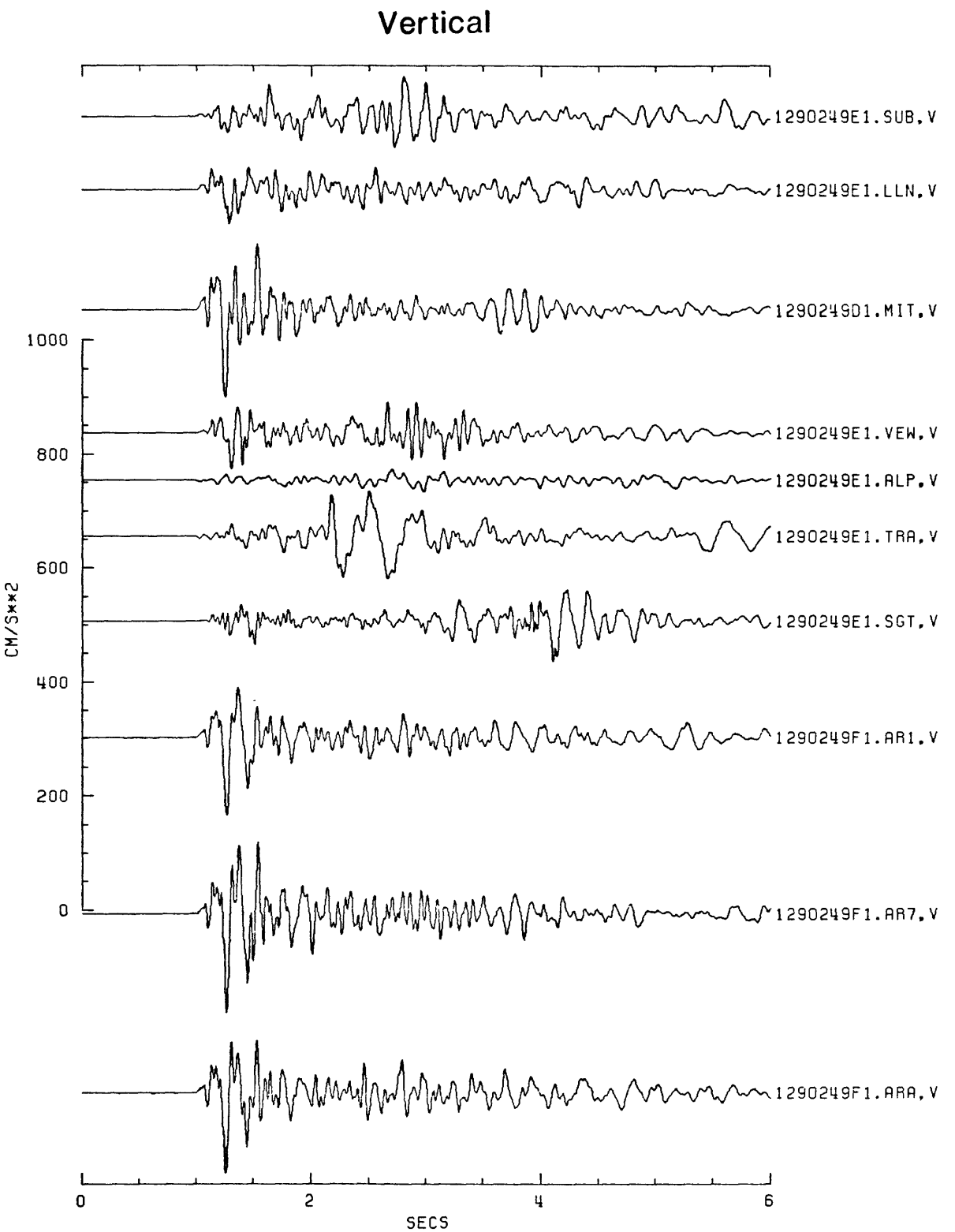

Figure 4a. Vertical acceleration from aftershock 129 0249 ($M_L = 5.2$) at seven GEOS and three DR100 (L-shaped array) stations. The hypocentral P arrival is aligned at 1.0 second.

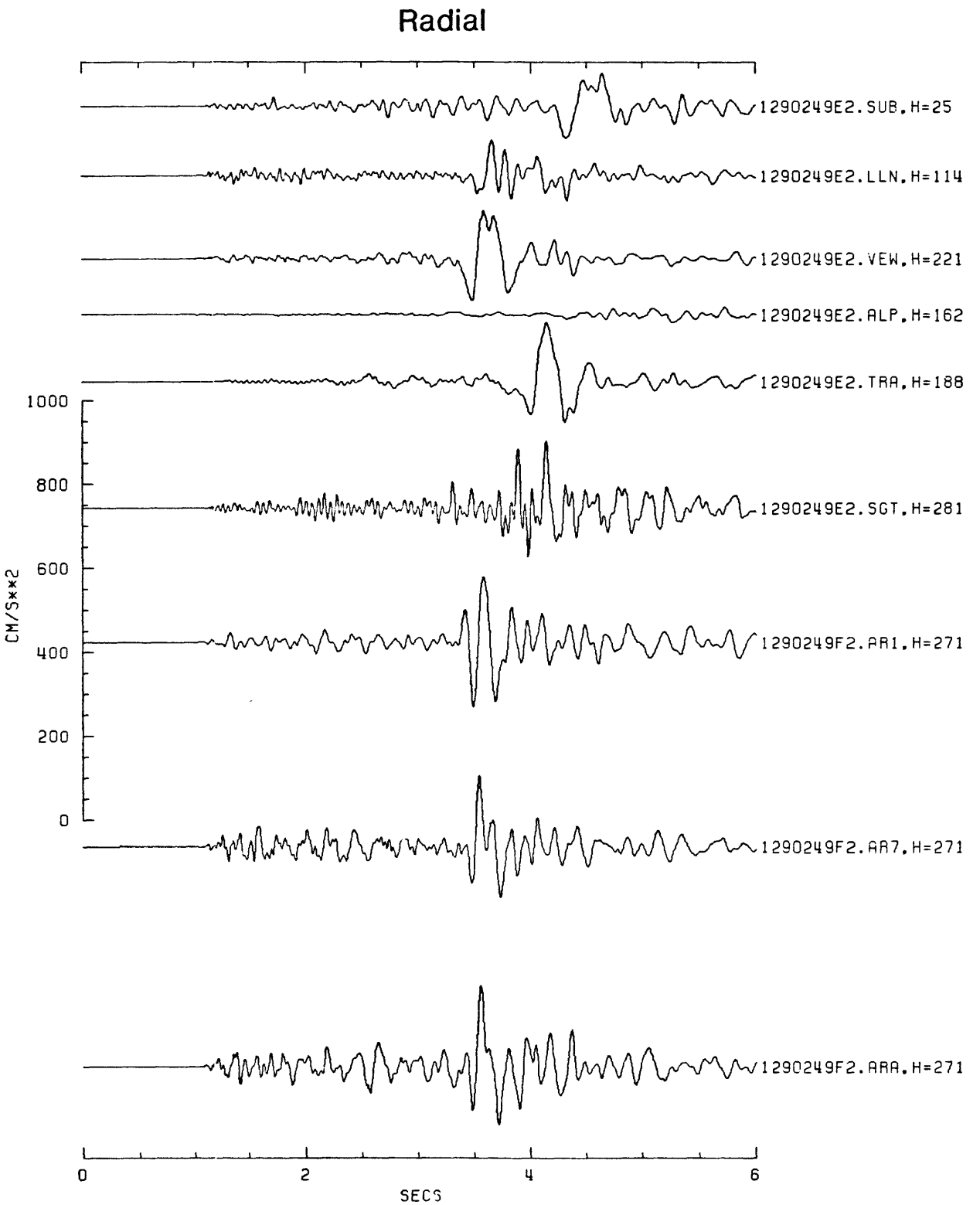

Figure 4b. Radial acceleration from aftershock 129 0249 ($M_L = 5.2$) at six GEOS and three DR100 (L-shaped array) stations. The hypocentral P arrival is aligned at 1.0 second.

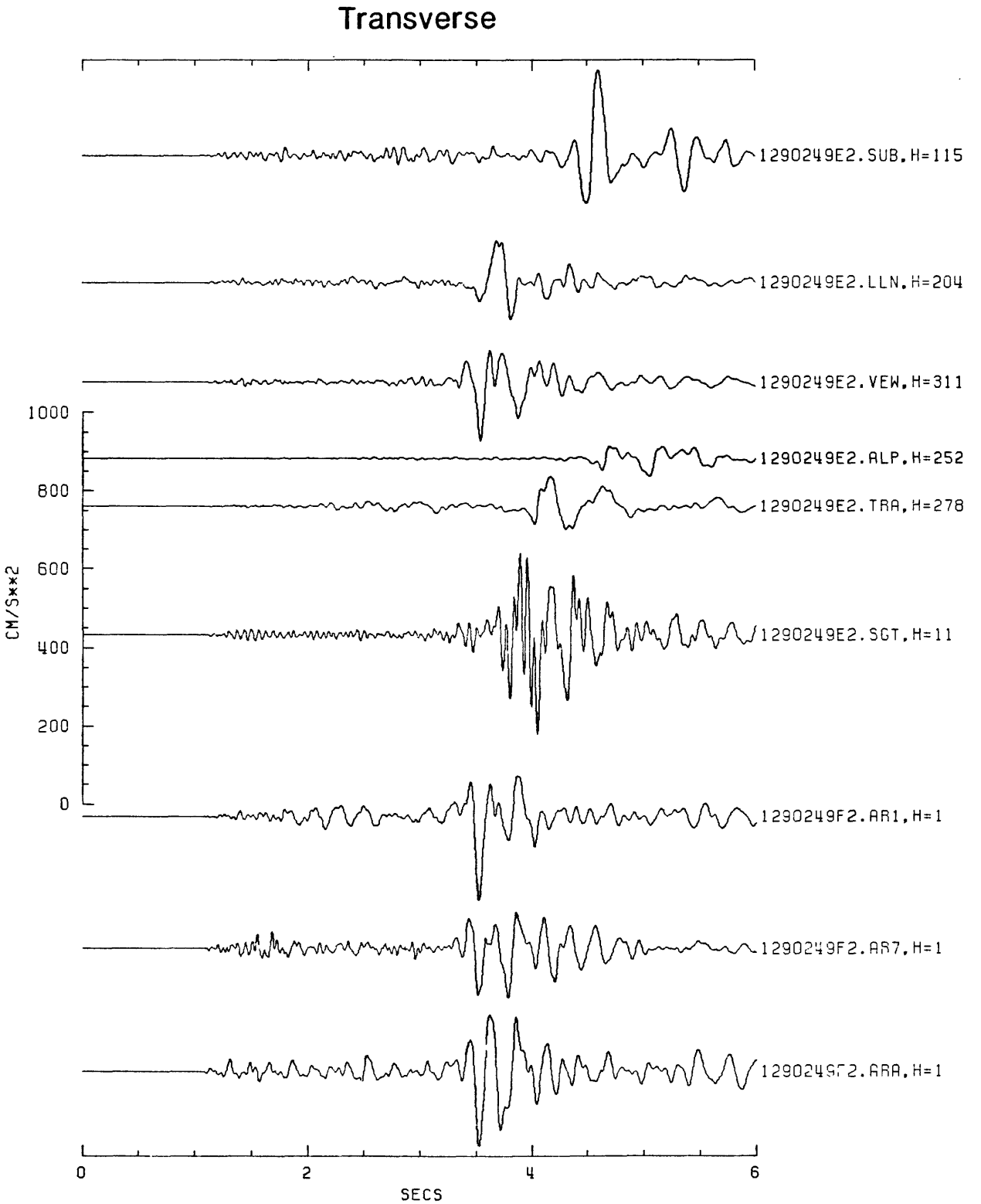

Figure 4c. Transverse acceleration from aftershock 129 0249 ($M_L = 5.2$) at six GEOS and three DR100 (L-shaped array) stations. The hypocentral P arrival is aligned at 1.0 second.

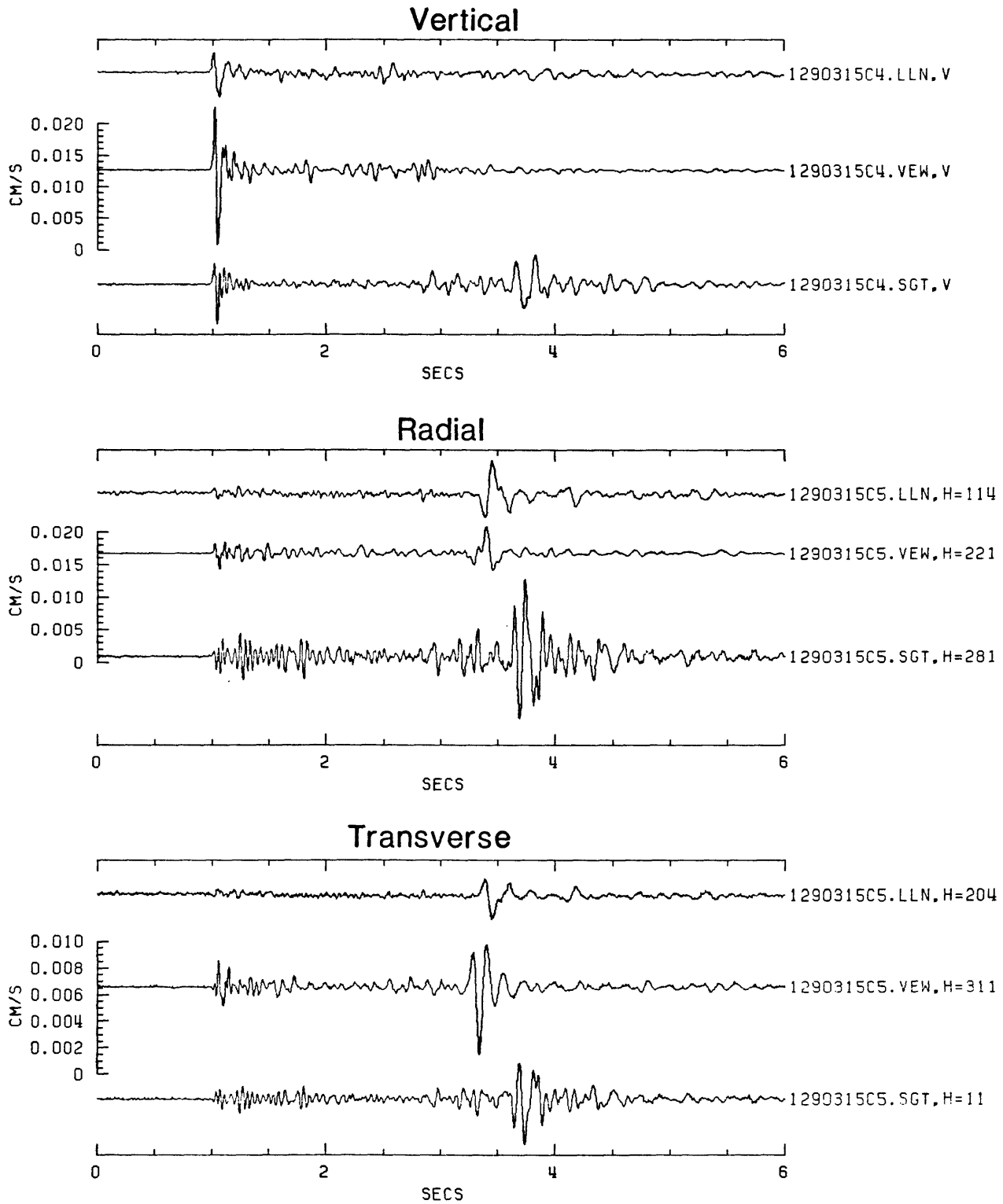

Figure 5. Vertical, radial, and transverse velocity from aftershock 129 0315 ($M_L \approx 2.0$), a small event with hypocenter near 129 0249 (Figure 4), at three GEOS stations.

relative to the scatter in individual WWVB synchs.

A problem in the GEOS software related to the periodic sampling of battery voltage caused absolute timing to be incorrect in the original playbacks. An attempt to fix this problem during subsequent playbacks required the determination of the time when the GEOS was placed in "record mode" after being programmed in "menu mode" (G. Maxwell, personal communication). Since this time was not saved by the GEOS and was not routinely recorded in the field notes, it was necessary to infer it indirectly during the playback procedure. For example, if the GEOS was calibrated at 123 12:34 ("menu mode") and a foot-stomp test was conducted at 123 12:38 ("record mode") the into-record-mode time could be usefully inferred as $\approx$ 123 12:36. If a recorder was placed into "menu mode" in the middle of a tape (for reprogramming, etc.) that tape needed to be played back twice using two different into-record-mode times. However in some cases no useful inference could be made about the into-record-mode times. Tests made at the time of this writing indicate that the timing problem has not been solved in the Coalinga GEOS data despite our best efforts to determine the correct into-record-mode times. However, relative times within a trace (S-P times, for example) are thought to be correct. The GEOS clock corrections in Appendix B are included only for completeness. We emphasize that clock corrections for the DR100 data, which will be crutial in analyzing data from the L-shaped array, are accurate.

ACKNOWLEDMENTS

We thank E. Cranswick, C. Criley, G. Maxwell, and R. McClearn for assistance at various stages of the field work and data playback. J. Coakley provided a daily seismicity summary in the form of smoked-drum records while we were in the field and J. Eaton generously provided the origin times and magnitudes used in the text and in Appendix C. E. Criley helped coordinate our efforts to record the U.S.G.S. explosions. We thank the people of the Coalinga area for providing instrument sites and for their hospitality during the field work. M. Andrews and J. Fletcher reviewed an early version of this report.

REFERENCES

Borcherdt, R. D., J. P. Fletcher, E. G. Jensen, G. L. Maxwell, J. R. VanSchaak, R. E. Warrick, E. Cranswick, and R. McClearn (1984). A General Earthquake Observation System (GEOS), submitted to *Bull. Seismol. Soc. Am.*.

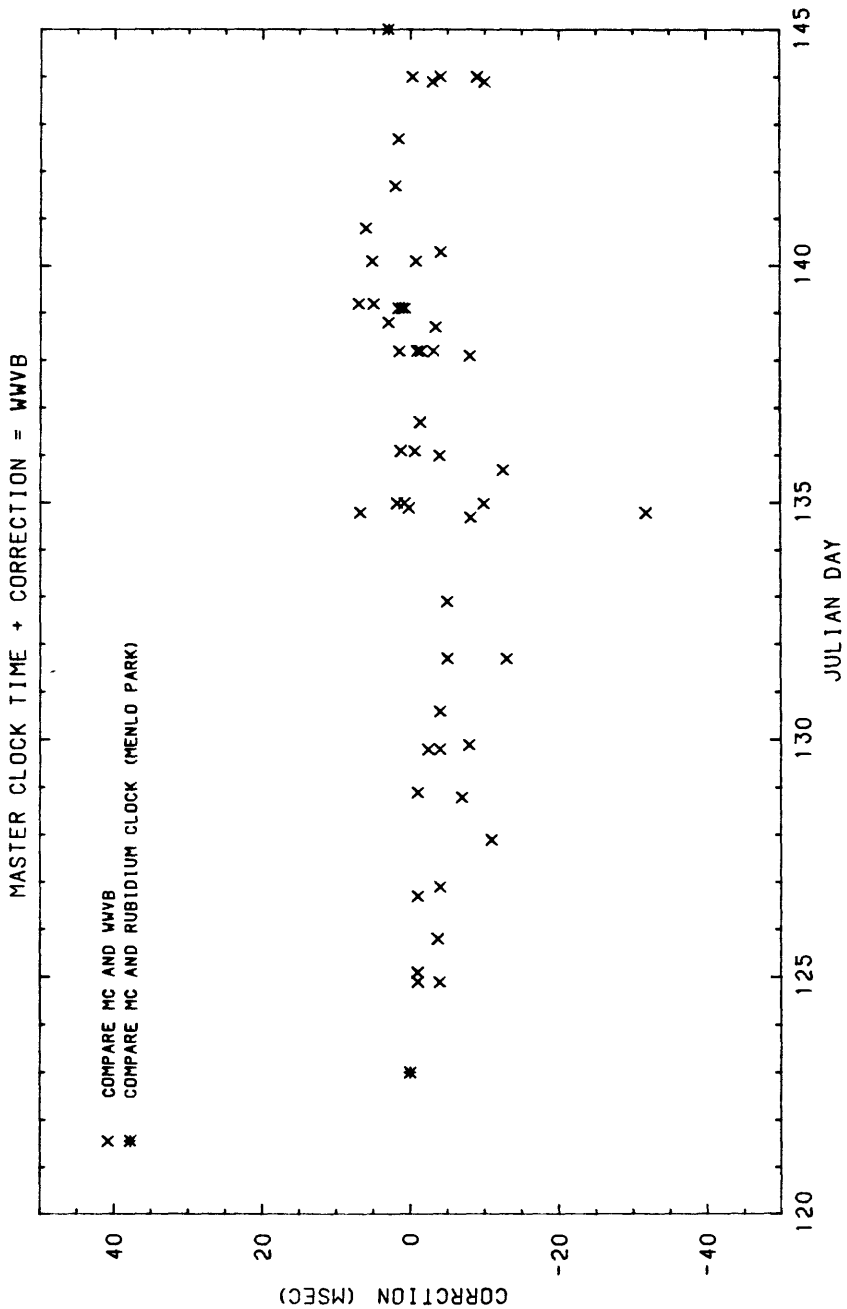

Figure 6. Comparison of master clock and WWVB.

Appendix A – Station locations and instrument parameters.

SUB

Lat.=36°18.45′, Long.=-120°15.02′, Elev.=120 m

East corner of Pleasant Valley Pumping Plant switchyard. 10 m from permanent USGS SMA-1.

		FBA-13			L22			
Time (UTC)	GEOS	No.	Gain	Orientation	No.	Gain	Orientation	Tapes
123 1020 – 135 0550* down	2	34	6dB	(UP,000,090)	161	24dB	(UP,000,270)	A–H
138 0400 – 139 1950 down	12	33	12dB	(UP,170,080)	190	36dB	(UP,350,080)	I–J
143 2045 – 145 1630	5	31	12dB	(UP,180,090)	185	36dB	(UP,000,090)	K

SKH

Lat.=36°16.85′, Long.=-120°18.12′, Elev.=240 m

100 meters west of Hwy 33.

		FBA-13			L22			
Time (UTC)	GEOS	No.	Gain	Orientation	No.	Gain	Orientation	Tapes
123 1056 – 127 0030	9	30	6dB	(UP,355,085)	160	24dB	(UP,180,270)	A–C
127 0030 – 128 2330	14	"	"	"	"	"	"	D–F
129 0015 – 130 1740	7	"	"	"	"	"	"	G–H
130 1740 – 131 2305 down	15	"	"	"	"	"	"	I
133 0150 – 133 1840 down	15	"	"	"	"	"	"	J
134 0500 – 134 2330 down	7	"	"	"	"	"	"	K
135 1810 – 136 0125 down	7	"	"	"	"	"	"	L
136 0255 – 138 0550	7	"	"	"	"	"	"	M
138 0550 – 140 0715	7	"	12dB	"	"	36dB	"	N–O
140 0715 – 144 1725	7	"	6dB	"	"	24dB	"	P–Q
144 1725 – 144 2315	7	"	12dB	"	"	36dB	"	R

OLF

Lat.=36°14.76′, Long.=-120°18.76′, Elev.=280 m

150 meters east of Hwy 33 and 150 meters south of Hwy 198.

		FBA-13			L22			
Time (UTC)	GEOS	No.	Gain	Orientation	No.	Gain	Orientation	Tapes
123 1110 - 123 1615	5	33	6dB	(UP,000,090)	162	24dB	(UP,180,090)	A
123 1640 - 125 0000	4	"	"	"	"	"	"	B–D
125 0000 - 125 2030	4	23	"	"	156	"	(UP,000,090)	E

ANT

Lat.=36°12.56′, Long.=-120°18.50′, Elev.=290 m

20 meters south of Palmer Ave.

		FBA-13			L22			
Time (UTC)	GEOS	No.	Gain	Orientation	No.	Gain	Orientation	Tapes
123 1150 - 123 2000	7	17	6dB	(UP,000,090)	185	24dB	(UP,180,090)	A

LLN

Lat.=36°12.65′, Long.=-120°15.80′, Elev.=200 m

100 meters north of Palmer Ave.

		FBA-13			L22			
Time (UTC)	GEOS	No.	Gain	Orientation	No.	Gain	Orientation	Tapes
123 1220 - 138 0510	1	28	6dB	(UP,000,090)	183	24dB	(UP,185,095)	A–N
138 0515 - 138 1815	1	"	12dB	"	"	36dB	"	O
138 1820 - 139 0220	1	"	6dB	"	"	24dB	"	P
139 0220 - 140 0740	1	"	12dB	"	"	36dB	"	P
140 0740 - 145 1700	1	"	6dB	"	"	24dB	"	Q–S

MIT

Lat.=36°14.80′, Long.=-120°15.80′, Elev.=180 m

Intersection of dirt roads.

		FBA-13			L22			
Time (UTC)	GEOS	No.	Gain	Orientation	No.	Gain	Orientation	Tapes
123 1300 - 127 1715	10	27	6dB	(UP,000,090)	184	24dB	(UP,195,105)	A-E
127 1715 - 138 0445	10	23	"	(UP,010,100)	"	"	"	F-M
138 0445 - 138 1745	10	"	12dB	"	"	36dB	"	N
138 1745 - 139 0156	10	"	6dB	"	"	24dB	"	O
139 0156 - 139 1910	10	"	12dB	"	"	36dB	"	O

VEW

Lat.=36°12.65′, Long.=-120°18.76′, Elev.=300 m

300 meters from Hwy 33.

		FBA-13			L22			
Time (UTC)	GEOS	No.	Gain	Orientation	No.	Gain	Orientation	Tapes
123 2043 - 124 1915	8	16	6dB	(UP,005,095)	156	24dB	(UP,000,090)	A
124 1915 - 138 0530	8	"	"	"	"	"	(UP,030,120)	B-G
138 0530 - 140 1745	8	"	12dB	"	"	36dB	"	H-I
140 1745 - 145 1730	8	"	6dB	"	"	24dB	"	J

JUN

Lat.=36°17.95′, Long.=-120°23.91′, Elev.=1070 m

0.53 miles southeast on road from point where it turns right at top of Black Mountain.

		FBA-13			L22			
Time (UTC)	GEOS	No.	Gain	Orientation	No.	Gain	Orientation	Tapes
125 0130 - 130 1900	5	17	6dB	(UP,000,090)	185	24dB	(UP,190,100)	A-F
130 1920 - 138 0345	5	31	"	"	"	"	"	G-I
138 0345 - 139 2230	5	"	12dB	"	"	36dB	"	J-K

YUB

Lat.=36°08.68′, Long.=-120°10.29′, Elev.=150 m

Dirt road, irrigation ditch.

		FBA-13			L22			
Time (UTC)	GEOS	No.	Gain	Orientation	No.	Gain	Orientation	Tapes
124 0300 - 127 2040 down	12	5	6dB	(UP,350,080)	193	24dB	(UP,180,090)	A-D
128 1945 - 138 0515	9	"	"	"	"	"	"	E-G
138 0515 - 139 2030	9	"	12dB	"	"	36dB	"	H-I

ALP

Lat.=36°06.52′, Long.=-120°15.19′, Elev.=180 m

Intersection of dirt roads.

		FBA-13			L22			
Time (UTC)	GEOS	No.	Gain	Orientation	No.	Gain	Orientation	Tapes
124 0650 - 125 1600 down	13	32	6dB	(UP,355,085)	191	24dB	(UP,180,090)	A-B
126 1615 - 138 0500	13	"	"	"	"	"	"	C-L
138 0500 - 139 2105	13	"	12dB	"	"	36dB	"	M-N

TRA

Lat.=36°09.94′, Long.=-120°18.51′, Elev.=190 m

Intersection of dirt roads.

		FBA-13			L22			
Time (UTC)	GEOS	No.	Gain	Orientation	No.	Gain	Orientation	Tapes
124 0730 - 138 0430	11	11	6dB	(UP,000,090)	197	24dB	(UP,190,100)	A-K
138 0430 - 139 2135	11	"	12dB	"	"	36dB	"	L-M

SGT

Lat.=36°14.20′, Long.=-120°22.87′, Elev.=380 m

50 meters on dirt road turning north off gravel road.

		FBA-13			L22			
Time (UTC)	GEOS	No.	Gain	Orientation	No.	Gain	Orientation	Tapes
125 2300 – 126 2355 down	4	2	6dB	(UP,350,080)	154	24dB	(UP,175,085)	A–B
127 2245 – 130 2200 down	4	"	"	"	"	"	"	C–E
134 1815 – 135 1845 down	15	"	"	"	"	"	"	F
138 0300 – 139 0145	15	"	12dB	"	"	36dB	"	G

AAW

Lat.=36°08.29′, Long.=-120°21.42′, Elev.=200 m

Burnett Construction Co. garage, 5th and Glenn Streets. Co-sited with temporary USGS SMA-1.

		FBA-13			L22			
Time (UTC)	GEOS	No.	Gain	Orientation	No.	Gain	Orientation	Tapes
139 2100 – 140 1800	12	33	12dB	(UP,000,090)	190	24dB	(UP,180,090)	A
140 1800 – 143 1820	12	"	"	"	"	30dB	"	B–C

SPP

Lat.=36°18.38′, Long.=-120°14.94′, Elev.=120 m

200 meters southeast of SUB.

		FBA-13			L22			
Time (UTC)	GEOS	No.	Gain	Orientation	No.	Gain	Orientation	Tapes
130 2315 – 132 1630 down	16	33	6dB	(UP,000,090)	190	24dB	(UP,180,090)	A–B
134 0520 – 135 0020	4	"	"	"	"	"	"	C
135 0030 – 138 0400	12	"	"	"	"	"	"	D

FRS

Lat.=36°07.31′, Long.=-120°23.78′, Elev.=320 m

Coalinga Baths. North of old swimming pool at sandstone outcrop.
Approximately 50 meters north of temporary CDMG SMA-1.

		FBA-13			L22			
Time (UTC)	GEOS	No.	Gain	Orientation	No.	Gain	Orientation	Tapes
140 0100 - 143 1830	13	32	12dB	(UP,000,090)	191	36dB	(UP,180,090)	A–B

TOT

Lat.=36°07.51′, Long.=-120°23.16′, Elev.=260 m

Near two oil tanks.

		FBA-13			L22			
Time (UTC)	GEOS	No.	Gain	Orientation	No.	Gain	Orientation	Tapes
140 0150 - 143 1900	11	11	12dB	(UP,000,090)	197	36dB	(UP,180,090)	A–B

LUC

Lat.=36°07.79′, Long.=-120°22.65′, Elev.=230 m

Approximately 30 meters north of Lucille Ave., 5 meters east of cross-street.

		FBA-13			L22			
Time (UTC)	GEOS	No.	Gain	Orientation	No.	Gain	Orientation	Tapes
140 0215 - 143 1900	5	31	12dB	(UP,000,090)	185	36dB	(UP,180,090)	A–B

CDF

Lat.=36°08.05′, Long.=-120°22.00′, Elev.=210 m

Fire control station.

		FBA-13			L22			
Time (UTC)	GEOS	No.	Gain	Orientation	No.	Gain	Orientation	Tapes
140 1815 - 143 1845	10	23	12dB	(UP,000,090)	184	30dB	(UP,180,090)	A–C

DZN

Lat.=36°08.33′, Long.=-120°21.60′, Elev.=200 m

Abandoned building, corner of 6th and Elm Streets.

		FBA-13			L22			
Time (UTC)	GEOS	No.	Gain	Orientation	No.	Gain	Orientation	Tapes
140 1730 – 143 1830	9	5	12dB	(UP,000,090)	193	30dB	(UP,180,090)	A–B

COW

Lat.=36°18.07′, Long.=-120°15.35′, Elev.=130 m

Between SUB and BUL.

		FBA-13			L22			
Time (UTC)	GEOS	No.	Gain	Orientation	No.	Gain	Orientation	Tapes
143 2115 – 145 1700	11	11	12dB	(UP,000,090)	197	36dB	(UP,180,090)	A

BUL

Lat.=36°17.67′, Long.=-120°15.74′, Elev.=150 m

50 north of end of canal.

		FBA-13			L22			
Time (UTC)	GEOS	No.	Gain	Orientation	No.	Gain	Orientation	Tapes
143 2345 – 145 1715	13	32	12dB	(UP,000,090)	191	36dB	(UP,180,090)	A

FNC

Lat.=36°17.46′, Long.=-120°16.61′, Elev.=180 m

50 meters north of Hwy 145 along fence.

		FBA-13			L22			
Time (UTC)	GEOS	No.	Gain	Orientation	No.	Gain	Orientation	Tapes
144 0000 – 145 1800	9	5	12dB	(UP,000,090)	193	36dB	(UP,180,090)	A

HRS

Lat.=36°17.05′, Long.=-120°17.54′, Elev.=240 m

30 meters north of Hwy 145.

		FBA-13			L22			
Time (UTC)	GEOS	No.	Gain	Orientation	No.	Gain	Orientation	Tapes
144 0030 - 144 1810	12	33	12dB	(UP,000,090)	190	36dB	(UP,180,090)	A-B

AR1

Lat.=36°14.76′, Long.=-120°18.76′, Elev.=280 m

Co-sited with GEOS OLF.

		SA-3000		
Time (UTC)	DR100	No.	Gain	Orientation
123 2110 - 124 2000	214	104	12dB	(UP,000,090)
124 2000 - 125 0000	"	"	18dB	"
125 0000 - 126 1700	211	"	18dB	"
126 1700 - 132 1730	"	"	12dB	"

AR2

Azimuth from AR1/AR8 to AR2: 128°.

Distance from AR1/AR8 to AR2: 48 m.

		S-6000		
Time (UTC)	DR100	No.	Gain	Orientation
124 1900 - 126 1635	216	6725	18dB	(UP,000,090)
126 1635 - 138 0300	"	"	12dB	"
138 0300 - 138 2330	"	"	30dB	"
138 2330 - 144 1945	"	"	18dB	"

AR3

Azimuth from AR1/AR8 to AR3: 126°.

Distance from AR1/AR8 to AR3: 117 m.

		S-6000		
Time (UTC)	DR100	No.	Gain	Orientation
124 1900 - 126 1630	212	6726	18dB	(UP,000,090)
126 1630 - 126 2325	"	"	12dB	"

AR4

Azimuth from AR1/AR8 to AR4: 125°.

Distance from AR1/AR8 to AR4: 226 m.

		S-6000		
Time (UTC)	DR100	No.	Gain	Orientation
124 1855 - 126 1620	223	6724	18dB	(UP,000,090)
126 1620 - 138 0300	"	"	12dB	"
138 0300 - 138 2315	"	"	30dB	"
138 2315 - 144 2000	"	"	18dB	"

AR5

Azimuth from AR1/AR8 to AR5: 38°.

Distance from AR1/AR8 to AR5: 52 m.

		SA-3000		
Time (UTC)	DR100	No.	Gain	Orientation
125 2025 - 126 1655	219	?	18dB	(UP,000,090)
126 1655 - 138 0300	"	"	12dB	"
138 0300 - 138 2340	"	"	30dB	"
138 2340 - 144 2045	"	"	18dB	"

AR6

Azimuth from AR1/AR8 to AR6: 38°.

Distance from AR1/AR8 to AR6: 114 m.

		SA-3000		
Time (UTC)	DR100	No.	Gain	Orientation
125 2015 - 126 1650	222	?	18dB	(UP,000,090)
126 1650 - 126 2320	"	"	12dB	"

AR7

Azimuth from AR1/AR8 to AR7: 39°.

Distance from AR1/AR8 to AR7: 233 m.

		SA-3000		
Time (UTC)	DR100	No.	Gain	Orientation
124 1915 - 126 1640	218	107	18dB	(UP,000,090)
126 1640 - 134 2300	"	"	12dB	"
134 2300 - 138 0300	211	"	"	"
138 0300 - 138 2300	"	"	30dB	"
138 2300 - 144 2030	"	"	18dB	"

AR8

Co-sited with AR1.

		S-6000		
Time (UTC)	DR100	No.	Gain	Orientation
125 2050 - 126 1700	217	?	18dB	(UP,000,090)
126 1700 - 138 0300	"	"	12dB	"
138 0300 - 138 2300	"	"	30dB	"
138 2300 - 144 1900	"	"	18dB	"

AR9

Azimuth from AR1/AR8 to AR9: 38°.

Distance from AR1/AR8 to AR7: 114 m.

		S-6000		
Time (UTC)	DR100	No.	Gain	Orientation
126 2320 - 138 0300	222	6726	12dB	(UP,000,090)
138 0300 - 138 2350	"	"	30dB	"
138 2350 - 144 2035	"	"	18dB	"

ARA

Azimuth from AR1/AR8 to ARA: 126°.

Distance from AR1/AR8 to ARA: 117 m.

		SA-3000		
Time (UTC)	DR100	No.	Gain	Orientation
126 2325 - 138 0300	212	?	12dB	(UP,000,090)
138 0300 - 138 2320	"	"	30dB	"
138 2320 - 144 1930	"	"	18dB	"

Appendix B – Clock corrections.

SUB

Convention: GEOS time + clock correction (sec) = time standard.

Comment: Bad BNC on unit 2 prevented reading clock error.

Time (UTC)	GEOS	Clock Correction	Time Standard	Comment
123 1010	02	0.000	WWVB	Install unit. WWVB synch.
127 1545		?		Crashed, no error measured.
1545		0.000	WWVB	WWVB synch. (Not in LOG)
128 1955		+0.014	MC	Calculated from LOG.
1955		0.000	MC	MC synch.
130 2330		+0.603	WWVB	(?)Calculated from LOG.
2330		0.000	WWVB	WWVB synch.
135 0550	02	?		Unit vandalized.
138 0420	12	0.000	WWVB	Install unit. WWVB synch.
0420		-0.0059	MC	
139 0315		+0.0237	MC	Crashed, clock running.
0315		0.000	WWVB	WWVB synch.
0315		-0.0016	MC	
139 1950	12	+0.0104	MC	
143 2045	05	0.000	WWVB	Install unit. WWVB synch.
2045		+0.010	MC	
145 1630	05	-0.029	MC	

SKH

Convention: GEOS time + clock correction (sec) = time standard.

Time (UTC)	GEOS	Clock Correction	Time Standard	Comment
123 1050	09	0.000	WWVB	Install unit. WWVB synch.
123 1700		?		Crashed, no error measured.
1700		0.000	MC	MC synch.
124 1745		-0.009	MC	
125 1820		-0.011	MC	
127 0030	09	-0.015	MC	
127 0040	14	0.000	MC	Install unit. MC synch.
127 1630		-0.102	MC	?
128 2030		+0.0246	MC	Crashed, clock running.
2030		0.000	MC	MC synch.
128 2330	14	?		No error measured.
129 0015	07	0.000	WWVB	Install unit. WWVB synch.
130 1800	07	+0.0430	MC	
130 1800	15	0.000	MC	Install unit. MC synch.
131 2305	15	-0.0088	MC	
133 0145	16	0.000	WWVB	Install unit. WWVB synch.
133 1840	16	+0.0059	MC	
134 0500	07	0.000	WWVB	Install unit. WWVB synch.
134 2330	07	+0.0200	MC	Crashed, clock running.
135 1805	07	0.000	WWVB	Install unit. WWVB synch.
1805		-0.0035	MC	
136 0125	07	+0.0074	MC	Crashed, clock running.
136 0300	07	0.000	WWVB	Install unit. WWVB synch.
0300		+0.0006	MC	
136 2335		+0.0169	MC	
138 0600		+0.0493	MC	
0600		0.000	WWVB	WWVB synch.
0600		+0.0031	MC	

continued

SKH (continued)

Time (UTC)	GEOS	Clock Correction	Time Standard	Comment
139 0240		+0.0341	MC	
140 0715		+0.0553	MC	
140 1810		+0.0610	MC	
141 1530		+0.082	MC	
142 0405		?		Crashed, no error measured.
0405		0.000	WWVB	WWVB synch.
143 0245		?		Crashed, no error measured.
0245		0.000	WWVB	WWVB synch.
143 2140		+0.0144	MC	
144 1725		+0.031	MC	
144 2315	07	?		No error measured.

OLF

Convention: GEOS time + clock correction (sec) = time standard.

Time (UTC)	GEOS	Clock Correction	Time Standard	Comment
123 1110	05	0.000	WWVB	Install unit. WWVB synch. (Not in LOG)
123 1640	05	?		No error measured.
123 1640	04	0.000	MC	Install unit. MC synch.
123 1805		+0.001	WWVB	Calculated from LOG.
1805		0.000	WWVB	WWVB auto-synch.
125 2030	04	?		No error measured.

ANT

Convention: GEOS time + clock correction (sec) = time standard.

Time (UTC)	GEOS	Clock Correction	Time Standard	Comment
123 1150	07	0.000	WWVB	Install unit. WWVB synch.
123 2000	07	?		Crashed, no error measured.

LLN

Convention: GEOS time + clock correction (sec) = time standard.

Time (UTC)	GEOS	Clock Correction	Time Standard	Comment
123 1225	01	0.000	WWVB	Install unit. WWVB synch.
124 1840		-0.005	MC	
125 1845		?		Crashed, no error measured.
1845		0.000	WWVB	WWVB synch.
1845		+0.0037	MC	
127 0120		?		Crashed(?), no error measured.
0120		0.000	WWVB	WWVB synch.
128 2310		?		No error measured.
2310		0.000	WWVB	Crashed in menu. WWVB synch.
130 1710		-0.0032	MC	
132 0030		-0.0081	MC	
0030		0.000	WWVB	Crashed in menu. WWVB synch.
0030		+0.0006	MC	
132 1800		?		Crashed, no error measured.
1800		0.000	WWVB	WWVB synch.
133 1820		-0.0041	MC	
134 1710		-0.0097	MC	Crashed, clock running.
1710		0.000	WWVB	WWVB synch.
135 1740		-0.0072	MC	
136 1745		-0.0134	MC	
138 0520		-0.0263	MC	
0520		-0.027	WWVB	Calculated from LOG.
0520		0.000	WWVB	WWVB synch.
0520		+0.0009	MC	
138 1815		-0.0008	MC	
139 0215		-0.0054	MC	
0215		0.000	WWVB	Crashed in menu. WWVB synch.
0215		-0.0007	MC	
140 0750		-0.0127	MC	
0750		0.000	WWVB	Crashed in menu. WWVB synch.
0750		+0.0041	MC	
140 1730		+0.0026	MC	
143 2110		-0.0241	MC	
144 1900		-0.034	MC	
145 1700	01	-0.0431	MC	

MIT

Convention: GEOS time + clock correction (sec) = time standard.

Time (UTC)	GEOS	Clock Correction	Time Standard	Comment
123 1305	10	0.000	WWVB	Install unit. WWVB synch.
124 1820		+0.084	MC	
125 1830		+0.1436	MC	
127 0030		?		Crashed(?), no error measured.
0030		0.000	WWVB	WWVB synch.
127 1720		?		Crashed, no error measured.
1720		0.000	WWVB	WWVB synch.
130 1500		+0.192	MC	Crashed, clock running.
1500		0.000	WWVB	WWVB synch. (not in LOG)
1500		+0.004	MC	
132 0050		+0.0895	MC	
132 1820		+0.1355	MC	Crashed, clock running.
1820		0.000	WWVB	WWVB synch.
133 1800		+0.0637	MC	Crashed, clock running.
1800		0.000	WWVB	WWVB synch.
134 1640		+0.0613	MC	Crashed, clock running.
1640		0.000	WWVB	WWVB synch.
135 1720		+0.0669	MC	Crashed, clock running.
1720		0.000	WWVB	WWVB synch.
1720		+0.0024	MC	
135 2350		+0.0185	MC	
2350		0.000	WWVB	Crashed in status. WWVB synch.
136 1730		+0.0515	MC	Crashed, clock running.
1730		0.000	WWVB	WWVB synch.
1730		+0.0013	MC	
138 0450		+0.0869	MC	Crashed, clock running.
0450		0.000	WWVB	WWVB synch.
0450		+0.0014	MC	
138 1755		+0.0331	MC	Crashed, clock running.
1755		0.000	WWVB	WWVB synch.
1755		+0.0034	MC	
139 0150		+0.0255	MC	
0150		+0.027	WWVB	Calculated from LOG.
0150		0.000	WWVB	WWVB synch.
0150		-0.0011	MC	
139 1910	10	?		No error measured.

VEW

Convention: GEOS time + clock correction (sec) = time standard.

Time (UTC)	GEOS	Clock Correction	Time Standard	Comment
123 2045	08	0.000	WWVB	Install unit. WWVB synch.
124 1915		-0.005	MC	
125 1910		-0.010	MC	
129 1820		-0.0448	MC	
132 0000		-0.0616	MC	
134 1720		-0.0043	MC	?
135 1750		-0.0921	MC	
136 0000		-0.0949	MC	
136 1800		-0.1009	MC	
138 0540		-0.1132	MC	
0540		-0.111	WWVB	Calculated from LOG.
0540		0.000	WWVB	WWVB synch.
0540		-0.0015	MC	WWVB synch.
138 1855		-0.0046	MC	Crashed, clock running.
1855		0.000	WWVB	WWVB synch.
1855		-0.0030	MC	
141 1545		-0.025	MC	
143 2125		-0.0334	MC	
145 1730	08	-0.0470	MC	

JUN

Convention: GEOS time + clock correction (sec) = time standard.

Time (UTC)	GEOS	Clock Correction	Time Standard	Comment
125 0130	05	0.000	WWVB	Install unit. WWVB synch.
0130		+0.001	MC	
125 2145		-0.001	MC	
126 2230		?		Crashed, no error measured.
2230		0.000	WWVB	WWVB synch.
2230		+0.004	MC	
127 2315		+0.004	MC	
128 2245		+0.003	MC	
130 1915		-0.005	MC	
131 2115		-0.006	MC	
132 1915		-0.007	MC	
133 1630		-0.007	MC	
134 1900		+0.3783	MC	?
1900		0.000	WWVB	WWVB synch.
1900		-0.0068	MC	
136 1845		-0.0273	MC	
138 0345		-0.039	MC	
139 0230		-0.051	MC	
139 2230	05	-0.0545	MC	

YUB

Convention: GEOS time + clock correction (sec) = time standard.

Time (UTC)	GEOS	Clock Correction	Time Standard	Comment
124 0535	12	0.000	WWVB	Install unit. WWVB synch.
124 2055		?		No error measured.
2055		0.000	WWVB	WWVB synch.
2055		+0.004	MC	
126 1540		+0.049	MC	
127 2100	12	+0.077	MC	
128 1945	9	0.000	WWVB	Install unit. WWVB synch.
1945		+0.007	MC	
129 2025		?		Crashed, no error measured.
2025		0.000	WWVB	WWVB synch.
2025		+0.008	MC	
131 0115		+0.003	MC	
131 1615		+0.002	MC	
132 2100		+0.001	MC	
133 1530		-0.004	MC	
134 2145		-0.0062	MC	Crashed, clock running.
2145		0.000	WWVB	WWVB synch.
2145		-0.0002	MC	
135 1720		-0.0019	MC	
136 2210		-0.0045	MC	
138 0515		-0.009	MC	
139 0445		-0.010	MC	Crashed, clock running.
0445		0.000	WWVB	WWVB synch.
0445		-0.005	MC	
139 2025	9	-0.0062	MC	

ALP

Convention: GEOS time + clock correction (sec) = time standard.

Time (UTC)	GEOS	Clock Correction	Time Standard	Comment
124 0625	13	0.000	WWVB	Install unit. WWVB synch.
124 2035		?		Crashed, no error measured.
2035		0.000	WWVB	WWVB synch.
2035		+0.001	MC	
125 1600	13	?		Crashed, no error measured.
126 1615	13	0.000	WWVB	Install unit. WWVB synch
1615		+0.001	MC	
127 2130		?		Crashed, no error measured.
2130		0.000	WWVB	WWVB synch.
2130		+0.009	MC	
128 2000		+0.029	MC	
129 2000		+0.049	MC	
2000		0.000	WWVB	Crashed in menu, WWVB synch.
2000		+0.004	MC	
131 0100		+0.026	MC	
131 1650		+0.042	MC	Crashed, clock runnning.
1650		0.000	WWVB	WWVB synch.
1650		+0.005	MC	
132 2035		?		Crashed, no error measured.
2035		0.000	WWVB	WWVB synch.
2035		+0.005	MC	
133 1545		+0.021	MC	
134 2205		+0.0435	MC	
135 1800		+0.0606	MC	
1800		0.000	WWVB	Crashed in menu. WWVB synch.
1800		+0.0125	MC	
136 2240		+0.0362	MC	
138 0500		+0.059	MC	
139 0415		+0.079	MC	
0415		0.000	WWVB	WWVB synch.
139 2105	13	+0.0102	MC	

TRA

Convention: GEOS time + clock correction (sec) = time standard.

Time (UTC)	GEOS	Clock Correction	Time Standard	Comment
124 0730	11	?		Install unit. No time synch (001 0000).
124 2010		?		Crashed. No error measured.
2010		0.000	MC	MC synch.
125 1930		+0.012	MC	
126 1645		+0.026	MC	
127 2210		+0.039	MC	Crashed, clock running.
2210		0.000	MC	MC synch.
128 2050		+0.011	MC	Crashed, clock running.
2050		0.000	MC	MC synch.
129 1930		?		Crashed, no error measured.
1930		0.000	MC	MC synch.
131 0030		+0.015	MC	
0030		0.000	MC	MC synch. Clock set to wrong day!
131 1715		+0.012	MC	
132 2010		+0.026	MC	
2010		0.000	MC	MC synch. Reset clock to correct day.
133 1600		+0.010	MC	
134 2230		+0.0223	MC	
135 1820		+0.0312	MC	
136 2300		+0.0419	MC	
138 0430		+0.051	MC	
139 0350		?		Crashed, no error measured.
0350		0.000	MC	MC synch.
139 2135	11	+0.0056	MC	

SGT

Convention: GEOS time + clock correction (sec) = time standard.

Time (UTC)	GEOS	Clock Correction	Time Standard	Comment
125 2310	04	0.000	MC	Install unit. MC synch.
126 2150		?		No error measured.
2150		0.000	MC	MC synch.
126 2355	04	?		Crashed, no error measured.
127 2240	04	0.000	WWVB	Install unit. WWVB synch.
2240		+0.011	MC	
128 2205		?		No error measured.
2205		0.000	WWVB	Crashed in status. WWVB synch.
2205		+0.001	MC	
129 1805		+0.016	MC	
1805		0.000	WWVB	Crashed in menu. WWVB synch.
1805		+0.0024	MC	
130 2200	04	+0.016	MC	
134 1825	15	0.000	MC	Install unit. MC synch.
135 1845	15	?		Crashed, no error measured.
138 0300	15	0.000	WWVB	Install unit. WWVB synch.
0300		+0.008	MC	
139 0145	15	?		Crashed, no error measured.

AAW

Convention: GEOS time + clock correction (sec) = time standard.

Time (UTC)	GEOS	Clock Correction	Time Standard	Comment
139 2000	12	?		Install site. No time synch (001 0001).
139 2140		?		Time set by wristwatch.
139 2340		0.000	MC	MC synch.
140 1800		+0.014	MC	
141 1615		+0.021	MC	
142 1835		+0.0326	MC	
143 1820	12	+0.0526	MC	

SPP

Convention: GEOS time + clock correction (sec) = time standard.

Time (UTC)	GEOS	Clock Correction	Time Standard	Comment
130 2315	16	0.000	WWVB	Install unit. WWVB synch.
131 2240		-0.0052	MC	Crashed, clock running.
2240		0.000	WWVB	WWVB synch.
2240		-0.0016	MC	
132 1640	16	?		Crashed, no error measured.
134 0520	04	0.000	WWVB	Install unit. WWVB synch.
135 0035	04	+0.0202	MC	Crashed, clock running.
135 0035	12	0.000	WWVB	Install unit. WWVB synch.
0035		+0.0099	MC	
136 2350		+0.0568	MC	
138 0400	12	+0.0829	MC	

FRS

Convention: GEOS time + clock correction (sec) = time standard.

Time (UTC)	GEOS	Clock Correction	Time Standard	Comment
140 0105	13	0.000	WWVB	Install site. WWVB synch.
0105		-0.0052	MC	
140 1850		+0.005	MC	
141 2000		+0.018	MC	
142 1750		+0.0318	MC	
143 1830	13	+0.056	MC	

TOT

Convention: GEOS time + clock correction (sec) = time standard.

Time (UTC)	GEOS	Clock Correction	Time Standard	Comment
140 0200	11	0.000	WWVB	Install site. WWVB synch.
0200		+0.0007	MC	
140 1845		-0.004	MC	
141 1930		-0.002	MC	
142 1730		-0.001	MC	
143 1900	11	+0.008	MC	

LUC

Convention: GEOS time + clock correction (sec) = time standard.

Time (UTC)	GEOS	Clock Correction	Time Standard	Comment
140 0240	05	0.000	MC	Install site. MC synch.
140 1830		-0.011	MC	
141 1915		-0.037	MC	
142 1715		-0.0574	MC	
143 1900	05	-0.0726	MC	

CDF

Convention: GEOS time + clock correction (sec) = time standard.

Time (UTC)	GEOS	Clock Correction	Time Standard	Comment
140 1815	10	0.000	WWVB	Install site. WWVB synch.
1815		-0.006	MC	
141 1855		+0.041	MC	Crashed, clock running.
1855		-0.002	MC	WWVB synch.
142 1705		?		Crashed, no error measured.
1705		-0.0016	MC	WWVB synch.
143 1830	10	?		Crashed, no error measured.

DZN

Convention: GEOS time + clock correction (sec) = time standard.

Time (UTC)	GEOS	Clock Correction	Time Standard	Comment
140 1740	09	0.000	MC	Install unit. MC synch.
141 1630		-0.007	MC	
143 1830	09	-0.0059	MC	

COW

Convention: GEOS time + clock correction (sec) = time standard.

Time (UTC)	GEOS	Clock Correction	Time Standard	Comment
143 2120	11	0.000	WWVB	Install unit. WWVB synch.
2120		+0.003	MC	
145 1700	11	+0.004	MC	

BUL

Convention: GEOS time + clock correction (sec) = time standard.

Time (UTC)	GEOS	Clock Correction	Time Standard	Comment
143 2340	13	0.000	WWVB	Install unit. WWVB synch.
2340		+0.0041	MC	
145 1715	13	+0.037	MC	

FNC

Convention: GEOS time + clock correction (sec) = time standard.

Time (UTC)	GEOS	Clock Correction	Time Standard	Comment
144 0010	09	0.000	WWVB	Install unit. WWVB synch.
0010		+0.009	MC	
145 1800	09	+0.006	MC	

HRS

Convention: GEOS time + clock correction (sec) = time standard.

Time (UTC)	GEOS	Clock Correction	Time Standard	Comment
144 0050	12	0.000	WWVB	Install unit. WWVB synch.
0050		+0.0003	MC	
144 2305		?		Crashed, no error measured.
2305		?		Set by wristwatch.
144 2310		-5.989	WWVB	Calculated from LOG.
2310		0.000	WWVB	WWVB auto-synch.
145 1810	12	+0.0092	MC	

AR1

Convention: DR100 time + clock correction (sec) = time standard.

Time (UTC)	DR100	Clock Correction	Time Standard	Comment
123 2110	214	0.000	MC	Install unit. MC synch.
125 0000	214	?		No error measured.
125 0000	211	-0.036	MC	Install unit. MC synch.*
125 1940		-0.0408	MC	
1940		0.000	MC	MC synch.
126 1700		-0.0064	MC	
127 1630		-0.0193	MC	
129 1730		-0.0402	MC	
130 1830		-0.0505	MC	†
131 1740		-0.0574	MC	†
132 1730	211	-0.0679	MC	

AR2

Convention: DR100 time + clock correction (sec) = time standard.

Time (UTC)	DR100	Clock Correction	Time Standard	Comment
124 1900	216	-0.036	MC	Install unit. MC synch.*
125 1940		-0.0246	MC	
1940		0.000	MC	MC synch.
126 1635		+0.0083	MC	
127 1630		+0.0119	MC	
129 1720		+0.0261	MC	
130 1835		+0.0313	MC	
131 1740		+0.0402	MC	†
132 1715		+0.0471	MC	
134 2300		+0.0743	MC	†
135 1615		+0.0831	MC	
136 1600		+0.0904	MC	†
138 2330		+0.1205	MC	
140 2120		+0.1482		
144 1945	216	+0.2150	MC	

AR3

Convention: DR100 time + clock correction (sec) = time standard.

Time (UTC)	DR100	Clock Correction	Time Standard	Comment
124 1900	212	-0.036	MC	Install unit. MC synch.*
125 1930		-0.0265	MC	
1930		0.000	MC	MC synch.
126 1630		+0.0079	MC	
126 2325	212	?		No error measured(?)

AR4

Convention: DR100 time + clock correction (sec) = time standard.

Time (UTC)	DR100	Clock Correction	Time Standard	Comment
124 1855	223	-0.036	MC	Install unit. MC synch.*
125 1920		-0.0297	MC	
1920		0.000	MC	MC synch.
126 1620		+0.0030	MC	
127 1550		+0.0023	MC	
129 1635		+0.0061	MC	
130 1830		+0.0067	MC	
131 1720		+0.0071	MC	
132 1650		+0.0098	MC	
134 2300		+0.0172	MC	†
135 1535		+0.0202	MC	
136 1600		+0.0199	MC	†
138 2315		+0.0269	MC	
140 2055		+0.0969	MC	
144 2000	223	+0.0302	MC	

AR5

Convention: DR100 time + clock correction (sec) = time standard.

Time (UTC)	DR100	Clock Correction	Time Standard	Comment
125 2025	219	0.000	MC	Install unit. MC synch.
126 1655		-0.0063	MC	
127 1630		-0.0209	MC	
129 1730		-0.0433	MC	
130 1830		-0.0554	MC	†
131 1740		-0.0626	MC	†
132 1725		-0.0726	MC	
134 2300		-0.0905	MC	†
135 1620		-0.0961	MC	
136 1600		-0.1070	MC	†
138 2340		-0.1181	MC	
140 2140		-0.1256	MC	
?		?		Resynch?
144 2045	219	-0.0462	MC	

AR6

Convention: DR100 time + clock correction (sec) = time standard.

Time (UTC)	DR100	Clock Correction	Time Standard	Comment
125 2015	222	0.000	MC	Install unit. MC synch.
126 1650		-0.0159	MC	
126 2320	222	?		No error measured.

AR7

Convention: DR100 time + clock correction (sec) = time standard.

Time (UTC)	DR100	Clock Correction	Time Standard	Comment
124 1915	218	-0.036	MC	Install unit. MC synch.*
125 1950		-0.0430	MC	
1950		0.000	MC	MC synch.
126 1640		-0.0068	MC	
127 1610		-0.0201	MC	
129 1705		-0.0402	MC	
130 1830		-0.0514	MC	†
131 1740		-0.0596	MC	†
132 1705		-0.0707	MC	
134 2300	218	-0.1005	MC	
134 2300	211	0.000	MC	Install unit. MC synch.
135 0235		?	?	?
135 1555		-0.0042	MC	
136 1600		-0.0170	MC	†
138 2300		-0.0370	MC	
2300		0.000	MC	MC synch.
139 0100		?		?
144 2030	211	?		Crashed, no error measured.

AR8

Convention: DR100 time + clock correction (sec) = time standard.

Time (UTC)	DR100	Clock Correction	Time Standard	Comment
125 2050	217	0.000	MC	Install unit. MC synch.
126 1600		-0.0083	MC	
127 1640		-0.0328	MC	
129 1735		-0.0492	MC	
130 1830		-0.0626	MC	†
131 1740		-0.0733	MC	†
132 1735		-0.0851	MC	
135 0000		-0.1124	MC	†
0000		0.000	MC	MC synch.
135 1645		-0.0078	MC	
136 1600		-0.0229	MC	†
138 2300		-0.0399	MC	
140 2140		-0.0630	MC	
144 1900	217	-0.1142	MC	

AR9

Convention: DR100 time + clock correction (sec) = time standard.

Time (UTC)	DR100	Clock Correction	Time Standard	Comment
125 2015	222	0.000	MC	Install unit (AR6). MC synch.
126 1650		-0.0159	MC	(AR6).
126 2320		?		Becomes AR9. No error measured.
127 1620		-0.0362	MC	
129 1710		-0.0665	MC	
130 1830		-0.0843	MC	†
131 1740		-0.0963	MC	
132 1710		-0.1113	MC	
134 2300		-0.1342	MC	†
135 1600		-0.1435	MC	
1600		0.000	MC	
136 1600		-0.0132	MC	†
138 2350		-0.0252	MC	
2350		0.000	MC	MC synch.
140 2110		-0.0072	MC	
144 2035	222	-0.0058	MC	

ARA

Convention: DR100 time + clock correction (sec) = time standard.

Time (UTC)	DR100	Clock Correction	Time Standard	Comment
124 1900	212	-0.036	MC	Install unit (AR3). MC synch.
125 1930		-0.0265	MC	(AR3).
1930		0.000	MC	MC synch (AR3).
126 1630		+0.0079	MC	(AR3).
126 2325		?		Becomes ARA. No error measured,
127 1600		+0.0095	MC	
128 2130		+0.0163	MC	
129 1700		+0.0198	MC	
130 1830		+0.0236	MC	†
131 1740		+0.0299	MC	†
132 1700		+0.0343	MC	
133 1710		+0.0329	MC	
134 2300		+0.0402	MC	†
135 1540		+0.0447	MC	
136 1600		+0.0481	MC	†
138 2320		+0.0700	MC	
140 2100		+0.0794	MC	
144 1930	212	+0.2437	MC	

* Master clock mis-set 36 msec.

† Time approximate (+/ −1 hour).

Appendix C – Events recorded by three or more GEOS

Times given in the Appendix correspond to the first sample in the record and are specified by Julian day, hour, minute and a letter code corresponding to seconds: A = 0–3, B = 3–6, . . ., T = 57–60. A magnitude entry in the "NET" column indicates that the event was also reported as an event by the CALNET. Magnitudes were provided by J. Eaton (personal comm., 1983) and should be considered preliminary.

WHERE OUTPUT, TBACK= 5.0, TAHEAD= 15.0. 3 RECORDS TO DECLARE AN EVENT.

	NET	SUB	SKH	OLF	ANT	LLN	MIT	VEW	JUN	YUB	ALP	TRA	SGT	AAW	SPP	FRS	TOT	LUC	CDF	DZN	COW	BUL	FNC	HRS
12311557	3.1	T	T	A																				
12312220	2.3	S	G	Q																				
12312370	2.9	H	G	G			H																	
12312540	2.8		E	E			F																	
12312570	3.5		B	B			C																	
12313000	1.9		O	M			C																	
12313050	2.8	M	M	K			M																	
12313090	3.7	F		E			F		F															
12313100	2.6			O			U		P															
12313201	3.1	J		I			J		K															
12313220	2.5			F			G		G															
12313370	2.4	O		U					O															
12313440	2.5			M			J		M															
12313470	3.1	K		K			H		K															
12313480	3.5	K		K			O		R															
12313510				G			N																	
12313570				E			C		E															
12314090	2.7	H		G			E		F															
12314150	3.0	O		N			L		M															
12314140		K		U			F		Q															
12314200	3.3	I		G			F																	
12314260	3.7	S		K			O		K															
12314280		I		G			F		G															
12314290	2.8	S		K			F		Q															
12314300		H		H			K																	
12314370				B			T		A															
12314400				O			K		S															
12314500	3.6	Q		P			N		O															
12314550	2.3			K			L																	
12314560	2.5			O			L		N															
12315000	2.2			O			M		N															
12315030	3.5	B		A			S		T															
12315100	3.8	M					J		M															
12315140	2.5			L			I		L															
12315270	3.2	S					G		S															
12315410	4.6	O			O		D		N															
12316110	3.1	G					D		G															
12316160	3.6	B					S		B															
12316220	3.3	N					J		M															
12316510	2.3	G		Q			U																	
12316550	3.1			E			C		E															
12317010	3.7	K		J			H		K															
12317040	2.9	P	P				N		P															
12317090	3.2		M				J		M															
12317160	2.9	S		R			P																	
12317350	3.2			T			K		T															
12317440	3.1	M		M			K																	
12317510	2.5	I		H			G		I															
12318250	2.8			L			I		K															
12318290	2.2			H			G		I															
12318420	2.6	S		S			Q		S															
12318540	2.3			C			A		C															
12319310	2.0			P			P		O															
12319480	3.0	L		L					L															
12320360	3.0	N		L			N		N															
12320390	2.6			L			K		J															
12320401	2.5	I		J			J																	
12320500	3.3			S			P		R															
12321360	3.7	A					K		T		T													

NET SUB SKH OLF ANT LLN MIT VEW JUN YUB ALP TRA SGT AAW SPP FRS TOT LUC CDF DZN COW BUL FNC HRS

	NET	SUB	SKH	OLF	ANT	LLN	MIT	VEW	JUN	YUB	ALP	TRA	SGT	AAW	SPP	FRS	TOT	LUC	CDF	DZN	COW	BUL	FNC	HRS
12321368M						M	U	O																
1232147E	2.7					E	H	G																
12322220F	2.4			H		F	H	G																
12322222H	2.3			I			I	H																
12322223P	2.7			P			P	K																
12322229M	3.5	P		P		M	P	N																
12322257K	2.4			L		K	M	N																
12323225L	2.6	N		M		L	N	C																
12323455S	3.7	C		S		T	C																	
12323491I	2.5	I		I				B																
12323501R	2.6			A		R		I																
12323571E	3.1	E		E				A																
12400101B		E		D		B	D	E																
12400301C				E		C	E	D																
12400326G		G		G				G																
12400360D		GR		R		O	K	R																
12401271I	3.0	R		M		I	M	K																
12401541J	2.9			M		J		M																
12402011H	2.4			D		H		J																
12402401A	3.0	E		D		A	D	A																
12402511T	2.4			B		T		K																
12404031J	2.6	J		B				B																
12404071B	2.2			B		B		I																
12404211I	2.5			I		I	I	P																
12404241P	2.7			P		P	P	G																
12404481F	2.4			G		L	O	A																
12405411L	3.0			A		S	A	L																
12405581S				J		H		P		P		P												
12406081H						L		U																
12406501L	2.4					L	O	N																
12407261L		N	N			L	N	B		M		N												
12407341T	2.8	NC	C			I	B	C		A		B												
12407391A	3.2	C	A			A	C	A		C		D												
12407451A	2.5	A					A	S		T		R												
12407541G	2.9	AT				G	S	N		D		C												
12408161L						L	N	C																
12408181A	3.4					A	C	K		P		O												
12408181P						P	M	P		M		S												
12408191J						J	P	M																
12408251N	3.0	Q				N	M	S		A		A												
12408461J	2.9	MS	S			J	S	B		N		F												
12408481P	3.3	S				P				K		K												
12408581S	3.2					S	M	C				B												
12409071M	2.7					M	C	E																
12409091C	1.9					C	I	J																
12409101I	2.7					I	H																	
12409531H	2.5					H	T																	
12410021T	2.5					T	H	J																
12411101G	2.9	HG	G			H	F	H																
12411401F	2.7	G	F			F	E	E																
12411441E	2.8					E	D	E																
12412201C	3.2	CF	C			D	E	D																
12412531E	2.5	F	F			E	I	F																
12413181I	2.5	C	L			I	A	K																
12413251A	3.0		B			A	D	B																
12413291D	3.4		F			D	G	F																
12414041G	2.7		E			G	C	S																
12415591C	3.6	E	H			C	E	G																
12416111E	4.0	H	H			E	G																	
	NET	SUB	SKH	OLF	ANT	LLN	MIT	VEW	JUN	YUB	ALP	TRA	SGT	AAW	SPP	FRS	TOT	LUC	CDF	DZN	COW	BUL	FNC	HRS

	NET	SUB	SKH	OLF	ANT	LLN	MIT	VEW	JUN	YUB	ALP	TRA	SGT	AAW	SPP	FRS	TOT	LUC	CDF	DZN	COW	BUL	FNC	HRS
1241617N	2.9		Q			N	Q				M	M												
1242047J	2.5					J																		
1242051H	2.9			K		H					K	K												
1242054Q	2.1			S		Q						S												
1242057B	2.1					B					D	D												
1242113P		Q		P								R												
1242119S	3.1	A		S							A	S												
1242147G	2.9	I										H												
1242149H	2.5			I		H				K	J	I												
1242203L	3.1			N		L				O	N	N												
1242210F				H		F						H												
1242247E	2.4			H		E					H	E												
1250022B	2.9	E				B						E												
1250027O	3.5	E								K		K												
1250032B	3.3					G				E		E												
1250156N	3.4					N			O	O		O												
1250205M	2.9					M				M		M												
1250252K	2.9					K			K	L		L												
1250331C	3.0					G			C	O		H												
1250437O	3.7					O			K	O		O												
1250438I						I			L			L												
1250439B						B			E			D												
1250452J	2.9					J				L		M												
1250522I	2.9					N						K												
1250806I	3.6								K	I		J												
1250857K	2.5								K	K		K												
1251944A	2.8		A					B	A			C												
1252148G	2.3					G		G				G												
1252157J	1.9					U			J			O												
1252221S	2.8					I	T			S		T												
1252240E	3.2		E			E		E	G			F												
1252347D	2.4					D		D				D	D											
1260019H	2.7					H		H				H												
1260021G	2.3					G		G	J			H	G											
1260027A	2.1					A	A	A																
1260105O	2.2					A	O	O				O												
1260129N	2.2					N		N				N												
1260144O	2.2					U		O				P	P											
1260204O	2.9					T				T		T												
1260313G	2.8					H				G		H	I											
1260431H	3.0		I					H				J	I											
1260457C	3.3		D			D	D	C	E	D		C	D											
1260535L	2.9					D		D		M		L	E											
1260707D	2.2		D			D	D	D				E	E											
1260708I	2.1		T						B				I											
1260743I	2.3		J			J	J	J	I				K											
1260756C	2.5		C			C			D				C											
1260804M	2.3		M			M		M				M	M											
1260941E	2.1		E						E				E											
1260943N	3.6		N			N	N	N	N	N		N	N											
1260945B			B									C	B											
1260946L									L				L											
1261013T	2.0		A			T						T												
1261021E	2.1		E						E				E											
1261129J	2.7		J					K	K				K											
1261148A	2.2		A			A		A				A	B											
1261151O	3.3		O			O	O	P	O	O		P	P											
1261204I	2.3					I		J	K															
1261326N	2.5		P			O				O		N	P											
1261329L	1.9		M			M						L	N											
	NET	SUB	SKH	OLF	ANT	LLN	MIT	VEW	JUN	YUB	ALP	TRA	SGT	AAW	SPP	FRS	TOT	LUC	CDF	DZN	COW	BUL	FNC	HRS

	NET	SUB	SKH	OLF	ANT	LLN	MIT	VEW	JUN	YUB	ALP	TRA	SGT	AAW	SPP	FRS	TOT	LUC	CDF	DZN	COW	BUL	FNC	HRS
12613346	2.2		L						L				L											
12613430	2.5		E			D		D				D	D											
12616426	2.9						H	I	I			I	G											
12617376	2.8					K		R			R		S											
12618316	3.2					K	D	D	D	E	E	C	S											
12620576	2.5					B	C				B	B												
12622241	2.2					I	I					I												
12622256	2.7					S				S		S												
12623286	3.3					P	P	P				H												
12700176	3.7					F		F	E	S		H												
12700376	2.4						C	C	B	D		C												
12701216	2.5		M						M	J		M												
12704276	2.8					I	J	J																
12704426	2.1					I	D	J																
12705436	3.5		T			T		T	T	T														
12705456			B			A		A	B	B														
12705466			J			J		J																
12706056			K			K		K																
12706186	2.7		L			L		L	L	K														
12707286	3.0		L			L			M															
12707326	3.1		L			L		L	L															
12712426	3.5		K			K		K	K															
12714016	2.8		M			N		K	N															
12715196	2.8		E			E		E	D															
12720006	2.8					D	D	U		E														
12721486	2.8					C	C	U	U															
12722206	2.2					J		J				J												
12600336	2.1					N		N				N	M											
12600376	2.5					M					K	M												
12601116	2.6					B		B				B	B											
12601206	3.5					F	F	F	F		D	F	F											
12601236	3.0					B	D	E			D	D												
12601456	2.7					M			M				M											
12601476	3.0					I	I	I			J	I	J											
12602066	2.7					K	K	K	L		L	K	L											
12603046	2.4					S	S	K	L			T	S											
12603456	3.4					M		K	L		M		L											
12604066	2.5					P		P				P	G											
12605026	2.8	R				K	G	K			S	R	K											
12605246	2.6					B		B				B	B											
12605416	2.2					U		U				O	P											
12605416	1.8					I		I					J											
12606126	2.1					O		P					O											
12606156	2.1					O		O				O	O											
12607386	3.3	D				D	D	D	E		D	D	E											
12607466	2.6					G		G			Q	U												
12610176	2.8					N		N			N	N	N											
12610376	3.3					H	G	H	H		H	H	H											
12610506	2.7					L	L	L			M	M	M											
12611146	2.1					C						U	D											
12611156	2.8					E	E	E				F	F											
12611306	2.1					S					A		A											
12615236	3.3					L	L	K	L		K	J	L											
12615246						L	D	D				C												
12615266						K		R				S	K											
12615426	3.3					E	E	E				G	E											
12615426	3.1					K	K	K			K	N	K											
12615456	2.6					K	K	K																
12616086	1.8					S		S				S												
12616196	2.7					U		U			E	U												
	NET	SUB	SKH	OLF	ANT	LLN	MIT	VEW	JUN	YUB	ALP	TRA	SGT	AAW	SPP	FRS	TOT	LUC	CDF	DZN	COW	BUL	FNC	HRS

	NET	SUB	SKH	OLF	ANT	LLN	MIT	VEW	JUN	YUB	ALP	TRA	SGT	AAW	SPP	FRS	TOT	LUC	CDF	DZN	COW	BUL	FNC	HRS
1281821L	2.3					L		L				L	L											
1281846F	2.6					F	F	F				H	H											
1281918H	3.5	J				I		H	I		J	J	I											
1282025N	3.5	N				N	N	N			N	N	N											
1282307D	2.6							D				E	F											
1290136L	2.2					L		L					L											
1290145H	2.3					I				H	I													
1290249D	5.2	E	E			E	D	E	D	E	E	E	E											
12902521						J	I	A				J	J											
12902525						A	S	A																
1290256M						N		M					N											
12903120	3.3	P				P	O	P	O		Q	P	P											
1290314A	2.6	B				B		B	A			B	B											
1290315C	1.9					C		C					C											
12903190	3.3	E				E	C	E	D	E		E	E											
12903200						E	O	Q				P												
1290324S						S	S	S	S		T	S	S											
1290326M	4.1	M	M			M	M	M	M		N	M	M											
12903300	3.2	O				N	N	N	N	O	O	O	O											
1290332B	2.6					B	B	B				B	B											
1290338D	2.1					D	D					E												
1290341A	1.9					A		A					A											
1290346A	2.1					A		A					A											
1290350P	2.0					P	P	Q																
12904501	2.6						T	T	T		A	T	T											
12904590								O	P			P	O											
1290513H	2.8							I	I		H	I	H											
1290536S	2.8	S						I	T			T	T											
1290552L	2.4						L	L					L											
1290706A	2.7										A	A	A											
12907111	2.4							I					K											
1290758H	2.6						H	H			I	H	H											
1291034B	2.7						B	H			C	H	C											
1291118H	3.0						H	H	H		I	H	I											
1291141N							N	N			O	N	P											
1291324K	3.2	K					L	L	M		K	L	L											
1291349I	1.9							I				I	I											
1291513B	2.6										B	C	C											
1291701A	2.3					A	A	A				A												
1291815N	3.0	P				N	O	O			P	O	P											
1291827A	2.5					A		D			B	B												
1291910E	2.7					J	E	E					E											
1291938I	2.4					J	J	I				J												
1292014L	3.0					L	L	N			M	M												
13000050						C					C	C												
1300028B	2.4					C	B					B												
1300310S	2.2					S		S				S												
1300353K	2.6					S				K	K													
1300445D	2.3					E					E	D												
1300645D	2.1	D				D					E													
1300738R						R				K	R													
1300818F	2.7					F		F	F			F												
1300915B	2.8	C				B		C	C			C												
1300938R	2.6					R				S	R													
1301326I	3.9	K	I			K		K	K	L	K	J												
1301345G	3.0	G							G			G												
1301417H						I		I		H	I	I												
1301420C	2.9	C				D					E	D												
1301504O	3.3					O		O		O	O	O												
1301505K						K				K	K													
	NET	SUB	SKH	OLF	ANT	LLN	MIT	VEW	JUN	YUB	ALP	TRA	SGT	AAW	SPP	FRS	TOT	LUC	CDF	DZN	COW	BUL	FNC	HRS

	NET	SUB	SKH	OLF	ANT	LLN	MIT	VEW	JUN	YUB	ALP	TRA	SGT	AAW	SPP	FRS	TOT	LUC	CDF	DZN	COW	BUL	FNC	HRS
1380714Q		Q	Q			Q	Q	Q	R	Q	Q													
1380729Q		Q	Q			Q	Q	Q	R	Q	Q													
1380744Q		Q	Q			Q	Q	Q	R	Q	Q													
1380759Q		R	Q			Q	Q	Q	R	Q	R													
1380814Q		R	Q			Q	R	Q	R	Q	Q													
1380829Q		R	Q			R	Q	Q	R	R	Q													
1380844Q		R	Q			R	Q	Q	R	R	R													
1380859Q		R	Q			R	Q		R	Q	R													
1380939D	2.3		E			D	E																	
1380949A			B			A	A																	
1381033M						M				M	M													
1381806R	2.5		R			R	R		S															
1382039J	3.3					L	L	J			M													
1390302B	2.6		C			C	B																	
1390312F	2.4					G	F	H																
1390421P	1.8		P			P	Q	S																
1390454R	2.4		R			S		R			S	R												
1390519S	1.8		S			S	S	S																
1390523Q	2.0		R			R	R	R				Q												
1390610E	2.1					F		F		E	E	F												
1390629Q	1.7	Q	Q			R		R	Q	Q	Q	Q												
1390643E	2.4		E			E		E				E												
1390644Q	2.0	Q	R			R		R	Q	Q	Q	Q												
1390659Q		R	R			R		R	R	S	Q	Q												
1390714Q		R	R			R		R	R		Q	Q												
1390723N	3.1	N	N			N		N	N			N												
1390724B		B	B			B		B	B			B												
1390729Q		R	R			R		R	R		Q	Q												
1390838R	2.5	R	R			R		R	R			R												
1390841R			S			R		S				S												
1390849N	2.4	O	U			N		O			O	U												
1390915T	2.0		T			T						T												
1390919I	2.1	J	I					J																
1391105K	3.5	K	K			K		K	K		K	K												
1391122I	1.8		J			I		J																
1391557N	2.2		O								N	N												
1391653N	2.2		U			N		N	P			O												
1391714J	2.2		J						K			K												
1391741O	1.8		U						U			P												
1391846A	2.1		B			B		B			B	A												
1391858H						H		H				H												
1391856S	2.0		S					S	S			S												
1391952M	2.5		N			M		N			N	N												
1391954M	2.5		N			M		N	M			N												
1392006H			H					H				J												
1400741E	2.9		E													F	F	F						
1400851T	2.3		T			A								T		A	A							
1401101N	3.3		O			N								O		N		O						
1401102I	2.5					T										T	T							
1401130L	2.2					M										M	L							
1401150E	2.3		F			F											E							
1401222K	3.0					L								L		M	M	K						
1401305N	2.4		N													O	O							
1401604I	2.1					I										J	I							
1401655T	2.1		T			T										B	B							
1410227J	2.0		J			J		J												J				
1411005O	3.2		O			O		O						O		O	O	O		O				
1411246B	1.8					B								B			B			B				
1411629H	2.5					H		H						H		H	H							
1411659P						P										Q	Q	Q						

NET SUB SKH OLF ANT LLN MIT VEW JUN YUB ALP TRA SGT AAW SPP FRS TOT LUC CDF DZN COW BUL FNC HRS

	NET	SUB	SKH	OLF	ANT	LLN	MIT	VEW	JUN	YUB	ALP	TRA	SGT	AAW	SPP	FRS	TOT	LUC	CDF	DZN	COW	BUL	FNC	HRS
1411732N	2.2					N								O		O	O			O				
14112000H	3.0		1			I		I						I		I	HN	H	H	H				
1412055N	1.8		N			O											A							
1412111A	2.3		A			B											P							
1420000N	1.8		O			N										O	T							
1420147K	2.1					R										T	K							
1420326R	2.2		R			S								R			K			R				
1420508J	1.9		L			J											I							
14208394	4.2		I			H		H						H		I	I	I		I				
1420950L	2.2		M			L		L						L		L	M	L		L				
1421055S	2.0					T								S		T	T							
1421741M																	A							
1421946P	2.6		G			P										P	G							
1422103L	2.7					L		M								M	M	M	M	M				
1422106I	2.4															I	I			I				
1430657M	2.5					M		M								I	M							
1430727P	2.4					M		P								G	G							
1430925K	2.3		R			K		R						R		K	K							
1431327C	3.1		D			C		D						D		C	D	E		D				
1431726B	2.8		B			B		B						B		C				B				
1440256M			M																				M	M
1440328D	2.0		D																				D	D
1440640D	1.8	D	D																		D	E	E	E
1440706I	1.7		I																			B	B	B
1440730U	1.7		U																			P	P	
1440845J	1.8																					J	J	
1440902F	4.6	G				G		F													K	F	K	K
1440903S		GI				I		I													I	S	G	S
1440905H		I																			I	H	I	I
1440934L																						L	L	M
1441046E	2.0	G						F													G	G	G	E
1441054A	2.6	GK				K		FK													GK	I	K	K
1441146H	2.4	KI				I		H													KI	N	I	I
1441147M	3.3	IO				N		M													IO	F	O	O
1441202E	2.3					E																U	F	F
1441226C	3.2	D				C		C													D	C	D	D
1441657U	2.3	DP				P															DP	U	P	P
1441846O		GP	O																			C	P	O
1442154B	2.7	B				D															C	C	C	
1450327U																						E		
1451334H	2.4					H		H														H	H	E
1451355O	2.5					O		O														P	P	H
1451406R	2.3					R		R														S	S	P
1451645E	3.3					F		F													F	F	F	S
1451650D	2.5					E																E	E	D
	NET	SUB	SKH	OLF	ANT	LLN	MIT	VEW	JUN	YUB	ALP	TRA	SGT	AAW	SPP	FRS	TOT	LUC	CDF	DZN	COW	BUL	FNC	HRS