UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

# COMPILATION AND ANALYSIS OF DISPLACEMENT MEASUREMENTS OBTAINED ON THE SUPERSTITION HILLS FAULT ZONE AND NEARBY FAULTS IN IMPERIAL VALLEY, CALIFORNIA, FOLLOWING THE EARTHQUAKES OF NOVEMBER 24, 1987

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# INTRODUCTION

Surface faulting associated with the M 6.2 and 6.6 earthquakes of November 24, 1987 occurred along the Superstition Hills fault zone (SHFZ) and within a 10 km by 16 km region on its northeast side in the western Imperial Valley (Figure 1). In the year following the earthquakes, over 600 measurements of offset were made on 132 left-lateral, right-lateral, or normal faults. Sharp *et al.* (1989) describe the surface faulting and these measurements. Plate 1 of that paper shows fault rupture and the locations of displacement measurement sites. In addition to the two-point measurement sites, seven quadrilateral sites are distributed along the SHFZ, four of which were emplaced before the earthquakes of November 1987 (Sharp and Saxton, 1989). A quadrilateral comprises four stakes driven into the ground to form a rectangle straddling the northwest-trending Superstition Hills fault. The corners of the quadrilateral are designated according to the corresponding cardinal point of the compass. Resurveying of the quadrilaterals gave three-dimensional records of the components of surface displacement associated with the earthquakes at millimeter or beter resolution (Sharp and Saxton, 1989). The unprecendented size of the Superstition Hills data set required that the data be stored and analyzed on a computer. This report describes the paths, computer programs, and strategies devised to compile and analyze the displacement measurements obtained following the November 1987 earthquakes. The entire Superstition Hills data set is presented along with the procedures used to reduce it.

The three aspects of the data reduction to be discussed in detail include the quadrilateral program, the spread-sheet program, and the power-law programs. The measurements made at the quadrilateral sites are reduced into components describing the three-dimensional motion by the quadrilateral program. The reduction of the displacement measurements to obtain the strike-slip and dip-slip components is carried out using a spread-sheet program. The strategy of fitting the temporal behavior of the slip at any site, devised by Sharp and Saxton (1989) and implemented by Boatwright *et al.* (1989), required that several new power-law programs be written to analyze the raw data.

The flow chart (Figure 2) depicts the paths and programs used to compile and analyze the data and to tabulate and plot the results. The solid lines show where computer files are generated by and input to the various programs, and the dotted lines indicate files where the data must be entered manually. Time histories of the displacement on the SHFZ and the northeast-trending faults were obtained from the quadrilateral measurements, and at other sites by measuring the distance between two marks on opposite sides of the fault. The displacement measurements were either transferred from field data sheets directly into the spread-sheet program in order to calculate the strike-slip and dip-slip components, and the fault dip or, in the case of measurements made at quadrilateral sites, were first reduced by a quadrilateral program (QUAD3D) and then entered into a spread-sheet compilation. The quadrilateral program described here reduces six horizontal dimensions and two elevation differences into components of the slip cell describing the relative motion of the quadrilateral corners. The strike-slip and vertical components calculated with these two programs, from sites with three or more measurements, were then entered into power-law programs (AFTER, DIFFER, and GATHER). The programs invert the slip measurements and times of measurement for three parameters, $\beta$, $c$, and $u_f$, of a simple power-law function. $\beta$ is the inverse of the duration after the earthquake during which the surface slip follows a power law, $c$ is the power-law exponent, and $u_f$ is the final displacement which the slip approaches asymptotically (Boatwright *et al.*, 1989; Sharp and Saxton, 1989). One of several power-law programs was chosen as appropriate and run on each data file and the power-law parameters were determined. Time-displacement trajectories of the power-law fittings were individually plotted. Tabulating programs (TABLE and REDUCE) then combine the resulting parameters. An additional program (SLIPPER) plots these parameters as a function of longitudinal position on the SHFZ.

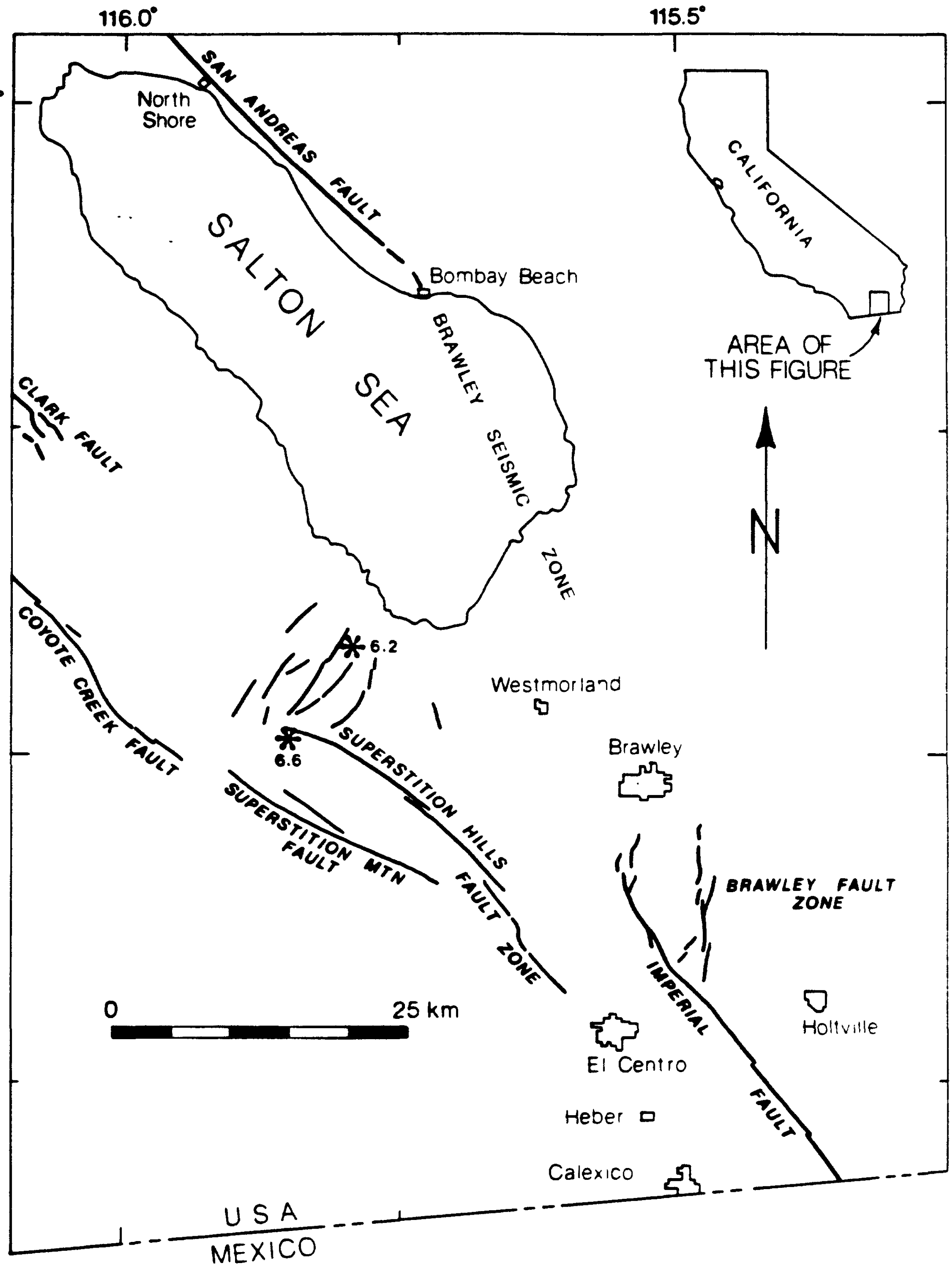


**FIGURE 1.** Index map showing the location of the SHFZ and the two epicenters of the November 1987 earthquakes. Surface rupture along the SHFZ and the northeast-trending faults are shown schematically (from Sharp *et al.* 1989).

**FLOW CHART**

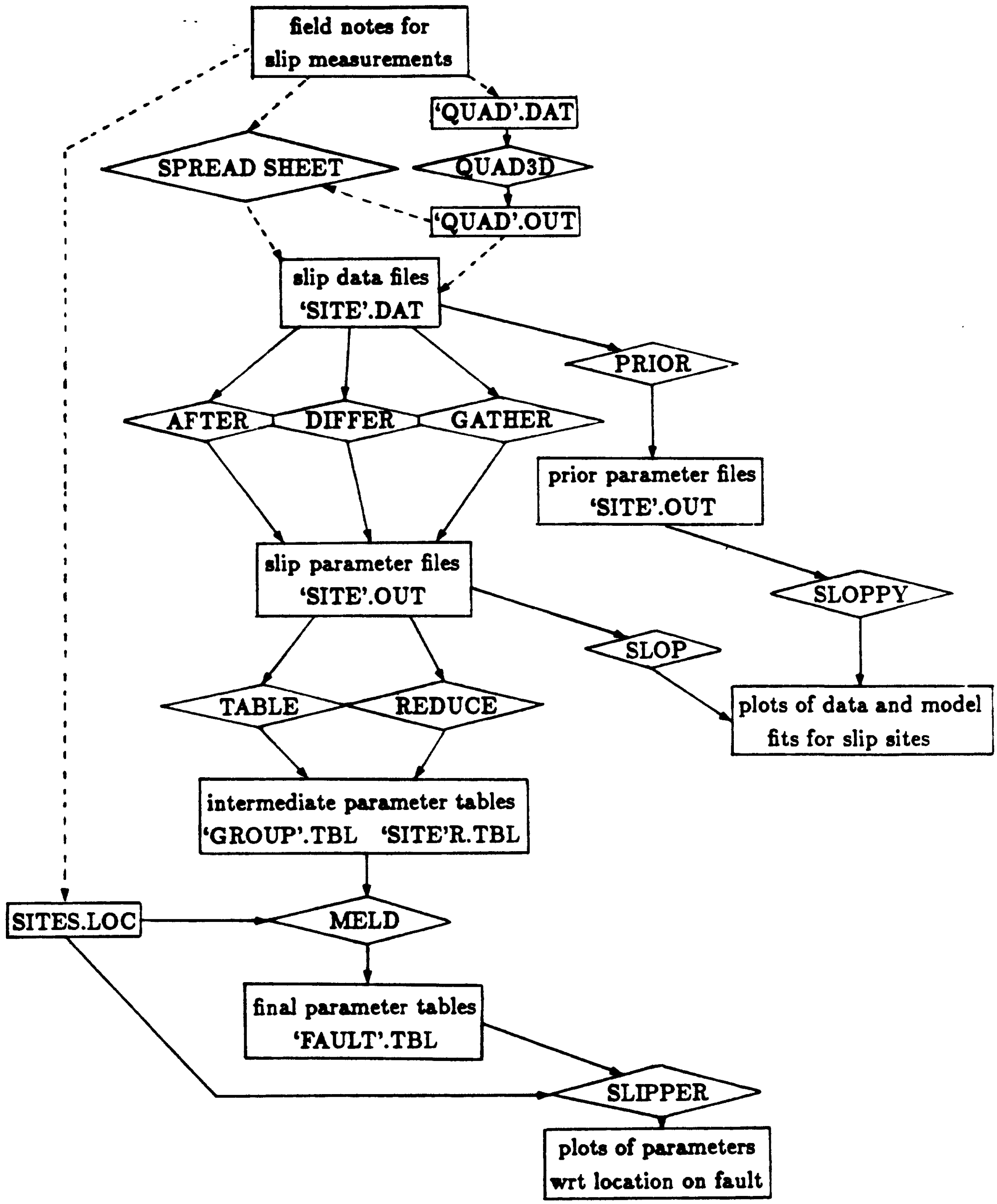


FIGURE 2. Flow chart depicting the paths and programs used to compile and analyze the data and to tabulate and plot the results.

## QUADRILATERAL PROGRAM

The quadrilateral program, QUAD3D whose FORTRAN code and executable is on the VAX 750 [BUDDING.SLIP.QUAD.PC], reduces measurements made at a quadrilateral into components describing the three-dimensional motion. The program reduces horizontal dimensions and elevation differences between the four quadrilateral corners (N, S, E, W) to cartesian coordinates. The north corner is fixed at the origin and the motion of the south, east, and west corners are determined relative to this point, using the fault strike as the X axis, the horizontal direction normal to the fault strike as the Y axis, and vertical as the Z axis. The fixed azimuth of the fault was determined indirectly by obtaining intercept distances of the fault trace from points N and E as measured along the northwest and southeast edges of the quadrilaterals and computing the azimuth from a field-measured azimuth of the northeast edge. Program KONST was written to determine certain constants (described below) that are used to obtain the changes of these intecept distances as the displacement grew.

Data files are created in the format of 'QUAD'.DAT, shown in Table 1. The azimuth of the northeast side of the quadrilateral, the azimuth of the fault (both in degrees west of north), and constants K1 and K2 are entered on the first line. K1 is the ratio of the slope distance between E and the fault to the slope distance between E and S determined in program KONST. K2 is the ratio of the slope distance between N and the fault to the slope distance between N and W. All lengths are in cm. Measurements entered for times of reoccupation of the quadrilaterals include the date, DLNW, DLSE, FE, and horizontal distances between the quadrilateral corners–NE, NS, NW, EW, SW, and SE. The horizontal distances have been corrected for differences in elevation and the temperature of the steel tape at the time of measurement. DLNW and DLSE are the elevation differences of N wrt W and S wrt E. FE is the horizontal distance from E to a line parallel to the fault, passing through N, as measured along the direction of quadrilateral edge SE. The distance FE was determined for each reoccupation by another program not described here.

In the example shown (Table 1), two sets of data are listed for each day of remeasurement between 25/11/87 and 26/10/88. The first data set is derived directly from the raw field data. The second entry in each data pair (followed by an S) is a smoothed version of the data adjusted for the difference between the measured distance versus the calculated distance of each measurement. The smoothing was done by taking advantage of the single redundancy of the raw quadrilateral data to make the data internally consistent at the level of field precision (0.1 mm). The smoothing criteria are described in Sharp and Saxton (1989). The smoothing was done with program SMTHR. The initial datum used in NQUAD.DAT is the smoothed version of the latest pre-earthquake measurement (24/10/86). The program can analyze data in either the measured or smoothed form.

The program is run as shown below.

```
$ RUN [BUDDING.SLIP.QUAD]QUAD3D
ENTER QUAD NAME
N QUAD
 WORKING...
FORTRAN STOP
```

The 'QUAD'.OUT file for NQUAD quadrilateral is shown in Table 2. Column headings are defined below and are illustrated by Figure 3. Figure 3A illustrates the relative positions of the four corners of the quadrilateral, N, S, E, and W, in a horizontal plane at surveying time I (${}_HN_I$, ${}_HW_I$, ${}_HS_I$, and ${}_HE_I$) and at surveying time II (${}_HN_{II}$, ${}_HW_{II}$, ${}_HS_{II}$, and ${}_HE_{II}$). Note the position of ${}_HW_I$ and ${}_HW_{II}$ in the horizontal plane and the vector $W_I \rightarrow W_{II}$ showing the movement of the W quadrilateral corner between times I and II. Figure 3B illustrates the cartesian axes and the components of the slip cell defined by the vector $W_I \rightarrow W_{II}$ which are calculated by the QUAD3D program. XE, YE, XS, YS, XW, and YW are X and Y coordinate pairs for the east, south, and west corners, respectively, with the X axis parallel to fault strike (positive toward SE) and the Y axis horizontal and normal to the fault strike (positive toward NE). SSS and SSW are strike-slip components for S wrt E and W wrt N. Positive strike slip is right lateral. ES and WE are extensional components of S wrt E and W wrt N. Positive extension indicates that the two points are moving apart. SLS and SLW are slip of S wrt E and W wrt N. VSE and VNW are changes in elevation differences of S wrt E and N wrt W, equal to the vertical component of slip. Positive values indicate S and W rising wrt E and N, respectively. HS and HW are horizontal components of SLS and SLW. AHS, in degrees W of N, is the azimuth of SLS. AHW, in degrees W of N, is the azimuth of SLW. DIPS and DIPW are dip-slip components of SLS and SLW. DIP<S and DIP<W are dip angles of the fault indicated by S wrt E and W wrt N. The angle is positive when extension is positive. PLNGS and PLNGW are plunges of SLS and SLW. A negative value indicates plunge to the NW and a positive value indicates plunge to the SE for a right-lateral fault striking NW.

Measurements necessary in the spread-sheet reduction of each quadrilateral include AZ FLT, SLS, AHS, and PLNGS. Values evaluated separately in the power- law program are SSS, SSW, VSE, and VNW. The format used for the date of each measurement in the quadrilateral program should be changed to the date and time format required by the power-law programs, so that the data can be read directly from one program into the other. The FORTRAN code for the program is listed in Appendix 1.

TABLE 1. Format of the 'SITE'.DAT file, shown by NQUAD.DAT, required by the QUAD3D program.

```
$ TYP NQUAD.DAT
 74  75.77  .547106  .558371                                  [AZ NE, AZ FLT, K1, K2]
24/10/86-S
   0.0505   0.1540  -0.1891                                       [DLNW, DLSE, FE]
   6.1207   7.4585   4.6672   7.1241   5.3403   4.3914        [NE,NS,NW,EW,SW,SE]
25/11/87
   0.0546   0.1626  -0.1894
   6.1187   7.3664   4.6570   7.2162   5.3407   4.4001
25/11/87-S
   0.0546   0.1626  -0.1894
   6.1187   7.3664   4.6570   7.2162   5.3399   4.4001
28/11/87
   0.0557   0.1630  -0.1895
   6.1173   7.3550   4.6562   7.2275   5.3398   4.4022
28/11/87-S
   0.0557   0.1630  -0.1895
   6.1173   7.3550   4.6562   7.2275   5.3398   4.4022
6/12/87
   0.0565   0.1637  -0.1896
   6.1171   7.3438   4.6547   7.2377   5.3394   4.4031
6/12/87-S
   0.0565   0.1637  -0.1896
   6.1171   7.3438   4.6547   7.2377   5.3393   4.4030
12/12/87
   0.0568   0.1642  -0.1896
   6.1163   7.3345   4.6531   7.2456   5.3384   4.4024
12/12/87-S
   0.0568   0.1642  -0.1896
   6.1167   7.3345   4.6533   7.2456   5.3386   4.4033
21/12/87
   0.0571   0.1646  -0.1896
   6.1165   7.3285   4.6532   7.2514   5.3391   4.4040
21/12/87-S
   0.0571   0.1646  -0.1896
   6.1165   7.3285   4.6528   7.2514   5.3386   4.4037
13/1/88
   0.0580   0.1652  -0.1897
   6.1157   7.3193   4.6521   7.2602   5.3389   4.4051
13/1/88-S
   0.0580   0.1652  -0.1897
   6.1160   7.3193   4.6521   7.2602   5.3386   4.4044
24/2/88
   0.0586   0.1657  -0.1897
   6.1158   7.3118   4.6513   7.2685   5.3384   4.4068
24/2/88-S
   0.0586   0.1657  -0.1897
   6.1159   7.3118   4.6515   7.2685   5.3384   4.4068
29/4/88
   0.0592   0.1662  -0.1898
   6.1150   7.2987   4.6496   7.2803   5.3381   4.4087
29/4/88-S
   0.0592   0.1662  -0.1898
   6.1150   7.2987   4.6496   7.2803   5.3381   4.4079
26/10/88
   0.0597   0.1665  -0.1899
   6.1148   7.2863   4.6487   7.2940   5.3390   4.4106
26/10/88-S
   0.0597   0.1665  -0.1899
   6.1148   7.2863   4.6487   7.2940   5.3384   4.4106
```

**TABLE 2.** Format of the 'SITE'.OUT file, shown by NQUAD.OUT, calculated by the QUAD3D program.

$ TYP NQUAD.OUT
DATA FROM THE N          QUAD. MOVEMENT RELATIVE TO:24/10/86-S

| DATE | XE | YE | XS | YS | XW | YW |
|---|---|---|---|---|---|---|
| 24/10/86-S | 6.1178 | -0.1888 | 5.8910 | -4.5744 | 0.5511 | -4.6346 |
| 25/11/87 | 6.1158 | -0.1888 | 5.7731 | -4.5756 | 0.4334 | -4.6368 |
| 25/11/87-S | 6.1158 | -0.1888 | 5.7731 | -4.5756 | 0.4334 | -4.6368 |
| 28/11/87 | 6.1144 | -0.1889 | 5.7577 | -4.5766 | 0.4181 | -4.6374 |
| 28/11/87-S | 6.1144 | -0.1889 | 5.7577 | -4.5766 | 0.4181 | -4.6374 |
| 6/12/87 | 6.1142 | -0.1889 | 5.7435 | -4.5764 | 0.4047 | -4.6371 |
| 6/12/87-S | 6.1142 | -0.1889 | 5.7436 | -4.5763 | 0.4047 | -4.6371 |
| 12/12/87 | 6.1134 | -0.1889 | 5.7329 | -4.5748 | 0.3934 | -4.6364 |
| 12/12/87-S | 6.1138 | -0.1889 | 5.7322 | -4.5756 | 0.3939 | -4.6366 |
| 21/12/87 | 6.1136 | -0.1889 | 5.7245 | -4.5756 | 0.3868 | -4.6371 |
| 21/12/87-S | 6.1136 | -0.1889 | 5.7248 | -4.5754 | 0.3865 | -4.6367 |
| 13/1/88 | 6.1128 | -0.1889 | 5.7126 | -4.5758 | 0.3747 | -4.6370 |
| 13/1/88-S | 6.1131 | -0.1889 | 5.7132 | -4.5751 | 0.3750 | -4.6370 |
| 24/2/88 | 6.1129 | -0.1889 | 5.7024 | -4.5765 | 0.3644 | -4.6370 |
| 24/2/88-S | 6.1130 | -0.1889 | 5.7025 | -4.5765 | 0.3646 | -4.6372 |
| 29/4/88 | 6.1121 | -0.1889 | 5.6853 | -4.5769 | 0.3483 | -4.6365 |
| 29/4/88-S | 6.1121 | -0.1889 | 5.6859 | -4.5762 | 0.3483 | -4.6365 |
| 26/10/88 | 6.1119 | -0.1889 | 5.6691 | -4.5773 | 0.3310 | -4.6369 |
| 26/10/88-S | 6.1119 | -0.1889 | 5.6691 | -4.5773 | 0.3310 | -4.6369 |

| DATE | SSS | SSW | ES | WE | SLS | SLW | VSE | VNW | HS | HW | AHS | AHW |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 25/11/87 | 11.60 | 11.76 | 0.12 | 0.22 | 11.63 | 11.77 | 0.86 | 0.41 | 11.60 | 11.76 | 75.2 | 74.7 |
| 25/11/87-S | 11.60 | 11.76 | 0.12 | 0.22 | 11.63 | 11.77 | 0.86 | 0.41 | 11.60 | 11.76 | 75.2 | 74.7 |
| 28/11/87 | 13.00 | 13.29 | 0.22 | 0.28 | 13.03 | 13.31 | 0.90 | 0.52 | 13.00 | 13.30 | 74.8 | 74.5 |
| 28/11/87-S | 13.00 | 13.29 | 0.22 | 0.28 | 13.03 | 13.31 | 0.90 | 0.52 | 13.00 | 13.30 | 74.8 | 74.5 |
| 6/12/87 | 14.39 | 14.64 | 0.19 | 0.25 | 14.42 | 14.65 | 0.97 | 0.60 | 14.39 | 14.64 | 75.0 | 74.8 |
| 6/12/87-S | 14.38 | 14.64 | 0.18 | 0.25 | 14.42 | 14.65 | 0.97 | 0.60 | 14.38 | 14.64 | 75.0 | 74.8 |
| 12/12/87 | 15.37 | 15.76 | 0.04 | 0.19 | 15.41 | 15.78 | 1.02 | 0.63 | 15.37 | 15.77 | 75.6 | 75.1 |
| 12/12/87-S | 15.48 | 15.71 | 0.12 | 0.20 | 15.51 | 15.73 | 1.02 | 0.63 | 15.48 | 15.71 | 75.3 | 75.0 |
| 21/12/87 | 16.23 | 16.43 | 0.12 | 0.25 | 16.26 | 16.44 | 1.06 | 0.66 | 16.23 | 16.43 | 75.3 | 74.9 |
| 21/12/87-S | 16.21 | 16.45 | 0.10 | 0.22 | 16.24 | 16.47 | 1.06 | 0.66 | 16.21 | 16.46 | 75.4 | 75.0 |
| 13/1/88 | 17.34 | 17.63 | 0.13 | 0.24 | 17.38 | 17.65 | 1.12 | 0.75 | 17.34 | 17.63 | 75.3 | 75.0 |
| 13/1/88-S | 17.31 | 17.60 | 0.07 | 0.24 | 17.35 | 17.62 | 1.12 | 0.75 | 17.31 | 17.61 | 75.5 | 75.0 |
| 24/2/88 | 18.37 | 18.67 | 0.21 | 0.25 | 18.41 | 18.69 | 1.17 | 0.81 | 18.37 | 18.67 | 75.1 | 75.0 |
| 24/2/88-S | 18.38 | 18.64 | 0.21 | 0.26 | 18.42 | 18.66 | 1.17 | 0.81 | 18.38 | 18.64 | 75.1 | 75.0 |
| 29/4/88 | 20.00 | 20.28 | 0.25 | 0.20 | 20.04 | 20.30 | 1.22 | 0.87 | 20.00 | 20.28 | 75.1 | 75.2 |
| 29/4/88-S | 19.94 | 20.28 | 0.17 | 0.20 | 19.98 | 20.30 | 1.22 | 0.87 | 19.94 | 20.28 | 75.3 | 75.2 |
| 26/10/88 | 21.60 | 22.00 | 0.28 | 0.23 | 21.64 | 22.02 | 1.25 | 0.92 | 21.60 | 22.00 | 75.0 | 75.2 |
| 26/10/88-S | 21.60 | 22.00 | 0.28 | 0.23 | 21.64 | 22.02 | 1.25 | 0.92 | 21.60 | 22.00 | 75.0 | 75.2 |

| DATE | DIPS | DIPW | DIP<S | DIP<W | PLNGS | PLNGW |
|---|---|---|---|---|---|---|
| 25/11/87 | 0.9 | 0.5 | 82.1 | 61.4 | 4.2 | 2.0 |
| 25/11/87-S | 0.9 | 0.5 | 82.1 | 61.4 | 4.2 | 2.0 |
| 28/11/87 | 0.9 | 0.6 | 76.4 | 61.4 | 4.0 | 2.2 |
| 28/11/87-S | 0.9 | 0.6 | 76.4 | 61.4 | 4.0 | 2.2 |
| 6/12/87 | 1.0 | 0.7 | 78.7 | 67.2 | 3.9 | 2.3 |
| 6/12/87-S | 1.0 | 0.7 | 79.3 | 67.2 | 3.9 | 2.3 |
| 12/12/87 | 1.0 | 0.7 | 87.8 | 73.3 | 3.8 | 2.3 |
| 12/12/87-S | 1.0 | 0.7 | 83.3 | 72.1 | 3.8 | 2.3 |
| 21/12/87 | 1.1 | 0.7 | 83.3 | 68.9 | 3.7 | 2.3 |
| 21/12/87-S | 1.1 | 0.7 | 84.8 | 71.8 | 3.7 | 2.3 |
| 13/1/88 | 1.1 | 0.8 | 83.1 | 72.1 | 3.7 | 2.4 |
| 13/1/88-S | 1.1 | 0.8 | 86.6 | 72.2 | 3.7 | 2.4 |
| 24/2/88 | 1.2 | 0.8 | 79.8 | 73.2 | 3.6 | 2.5 |
| 24/2/88-S | 1.2 | 0.9 | 79.8 | 72.0 | 3.6 | 2.5 |
| 29/4/88 | 1.2 | 0.9 | 78.6 | 77.2 | 3.5 | 2.5 |
| 29/4/88-S | 1.2 | 0.9 | 82.0 | 77.2 | 3.5 | 2.5 |
| 26/10/88 | 1.3 | 0.9 | 77.5 | 75.7 | 3.3 | 2.4 |
| 26/10/88-S | 1.3 | 0.9 | 77.5 | 75.7 | 3.3 | 2.4 |

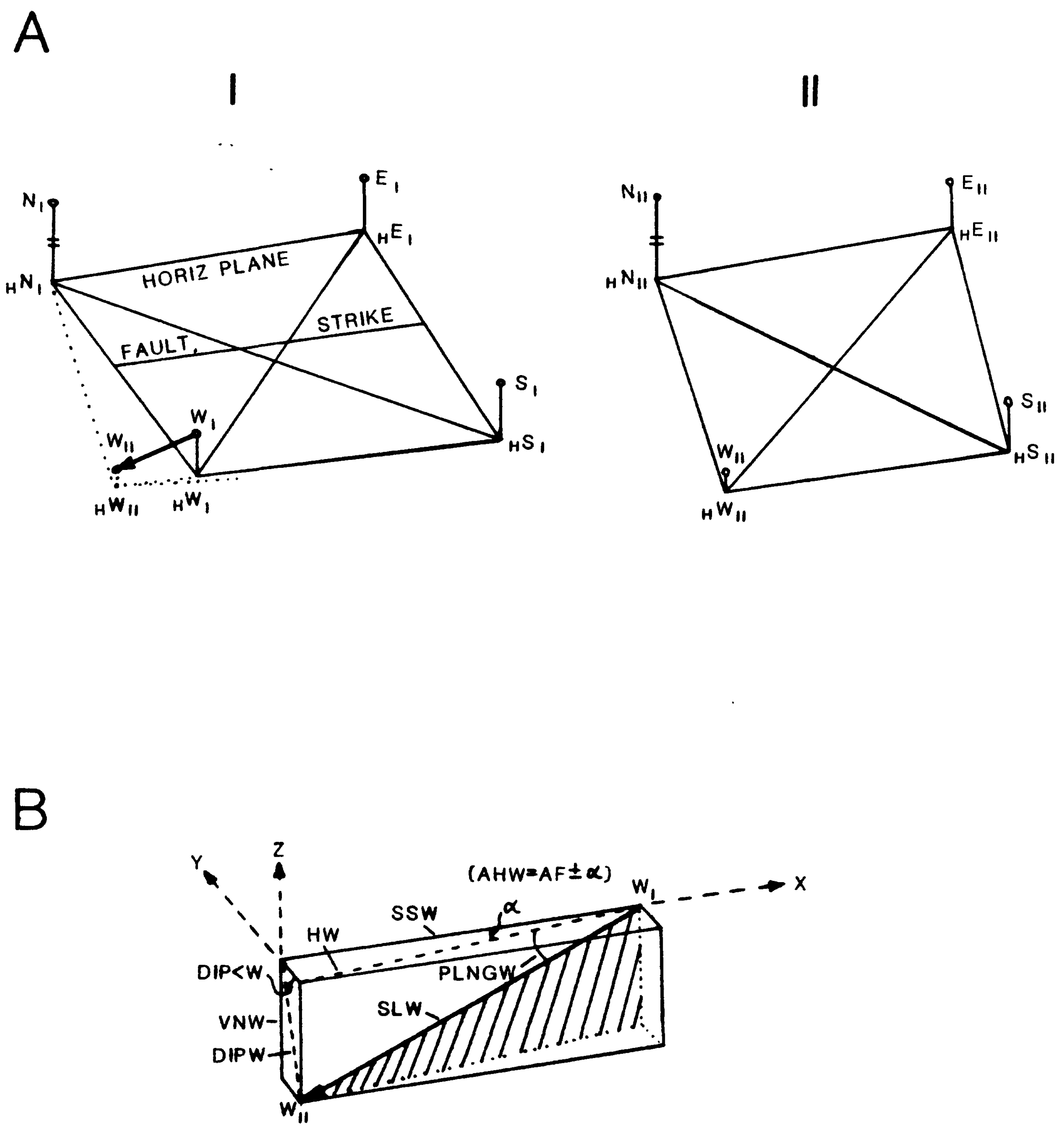


**FIGURE 3.** Figure 3A illustrates the relative positions of the four corners of the quadrilateral, N, S, E, and W, in a horizontal plane at surveying time I (${}_{H}N_{I}$, ${}_{H}W_{I}$, ${}_{H}S_{I}$, and ${}_{H}E_{I}$) and at surveying time II (${}_{H}N_{II}$, ${}_{H}W_{II}$, ${}_{H}S_{II}$, and ${}_{H}E_{II}$). Note the position of ${}_{H}W_{I}$ and ${}_{H}W_{II}$ in the horizontal plane and the vector $W_{I} \rightarrow W_{II}$ showing the movement of the W quadrilateral corner between times I and II. Figure 3B illustrates the cartesian axes and the components of the slip cell defined by the vector $W_{I} \rightarrow W_{II}$ which are calculated by the QUAD3D program. AF = fault azimuth.

## SPREAD-SHEET PROGRAM

425 measurements of displacement obtained at 296 sites following the Superstition Hills earthquakes are listed in Appendix 2. Locations of these sites are shown in Plates 1A and 1B in Sharp *et al.* (1989). The spread-sheet program calculates strike-slip and dip-slip components and dip from field measurements usually comprising length of slip vector, azimuth of slip vector, plunge angle and quadrant of downward inclination of the slip vector, and local azimuth of the fault.

Calculations were carried out on a PC with a Symphony spread-sheet program developed by Lotus Corp. Unfortunately, due to the cost of the appropriate software, the VAX 750 and 785 have no spread-sheet capabilities at present, so the displacement data were entered manually into both the PC to be analyzed by the spread-sheet program and into the VAX to be analyzed by the power-law programs. The spread-sheet data on the PC can be written into an ASCII file, however, and thereby transferred to the VAX using KERMIT. If this file transfer is reasonably convenient, it would be useful to write a program to extract 'SITE'.DAT files from the transferred spread-sheet files.

## POWER-LAW PROGRAMS

Three versions of the power-law program, AFTER, GATHER, and DIFFER, are available to accommodate different measurement strategies. Three related programs PRIOR, PRIOR_S, and PRIOR_T are available to analyze different power-law functions. All of these programs (codes and executables) are located in [BUDDING.SLIP]. The AFTER, GATHER, and DIFFER programs invert the slip measurements to fit the power-law function

$$u(t) = u_f \left[ \frac{\beta t}{\beta t + 1} \right]^c$$

where $u(t)$ is the displacement at post-earthquake time $t$, $u_f$ is the final displacement, $\beta$ is the inverse of the "duration" of the afterslip and $c$ is the power-law exponent (Boatwright *et al.*, 1989; Sharp and Saxton, 1989). The "duration" ($T = 1/\beta$) is the time during which the displacement rises steeply in log-log and log-linear plots of displacement versus time. At times longer than the duration, the displacement increases asymptotically to the final slip.

The program AFTER is used to reduce a discretely sampled record of displacement measured on a natural feature. The data is entered as shown below in the file RS-K.DAT, following the format (6X,F12.4,10X,F8.3,10X,F8.3). Date and post-earthquake time are entered in decimal days in the first column, cumulative displacement in centimeters in the second column, and uncertainty associated with each measurement, in centimeters, in the third column. Commonly the uncertainty increases with time as the natural feature degrades. The program AFTER was used to obtain the power-law trajectories shown in Figure 4.

```
$ TYP RS-K.DAT
                 5.44                48.0                0.5
                14.42                52.0                0.5
                24.114               55.0                1.0
                84.26                61.0                1.0
               175.56                62.0                1.0
```

At many sites nails were emplaced as semi-permanent markers to increase the precision of the displacement measurement. The program GATHER is used to analyze a record of slip measurements obtained in this fashion (see JL-14.DAT on the following page). This program searches for a decrease in the measured slip value in the data file, i.e. 3.58 cm at 4.343 days, which signals a change to the differential measurements made on nails. Displacements measured after the nails were installed are reported as differential values (cumulative displacement less displacement at time of nail installation), i.e. 3.58 cm, rather than 25.08 cm, with an uncertainty of $\pm 0.1$ cm. The program calculates the uncertainty $\sigma_s$ of a displacement "measurement" as

$$\sigma_s^2 = \sigma_i^2 + \sigma_d^2$$

where $\sigma_i$ is the uncertainty associated with the initial measurement and $\sigma_d$ is the uncertainty associated with a subsequent measurement of differential slip. The GATHER program uses both the initial slip measurements and the differential slip measurements to invert for the best power-law fit to the data. This program was used to obtain the trajectories shown in Figure 5. A change of data-point symbol from a circle to a diamond indicates a measurement made on nails rather than on natural features. Note that overall displacement, not the differential slip, is plotted.

```
$ TYP JL-14.DAT
          1.302          21.50          0.5
          4.343           3.58          0.2
         16.215           8.08          0.2
         19.135           8.60          0.2
         21.368           8.80          0.2
         23.212           9.42          0.2
         94.260          14.33          0.2
        154.460          16.64          0.2
```

At some sites, the offset feature was destroyed prior to reoccupation of the site, so that the overall displacement at the site cannot be measured. The program DIFFER is used to analyze data where there were only one or two measurements of displacement made before the feature was lost. The program searches for a displacement measurement of 0 cm (see RS-BETA.DAT) which gives the time the nails were emplaced. Subsequent nail measurements are reported as differential values with an uncertainty of ±0.2 cm. The program DIFFER was used to obtain the trajectories shown in Figure 6. The estimates of overall displacement which are derived from measurements of the differential slip and the derived estimate of the "lost" slip are plotted using diamonds.

```
$ TYP RS-BETA.DAT
          1.168          39.5           0.5
          6.265          49.5           0.5
         14.472          56.0           0.5
         71.280          65.0           1.0
         97.201           0.0           0.0
        156.167           2.99          0.2
```

The AFTER, GATHER, and DIFFER programs can be initiated in [BUDDING...] by simply entering the program name. An example of how these programs are run follows, where GATHER is used to invert the displacement measurements at site JL-14. The screen output shows both cumulative slip with calculated uncertainty and differential slip with measured uncertainty. The program searches for the best $\beta$ in the range $0.0005 \leq \beta \leq 0.5$. The inversion iteratively searches for a best fit of the model to the data (Boatwright *et al.*, 1989). Once this minimum has been located, the programs perform a Monte Carlo permutation of the data to quantify the uncertainty of the derived parameters. The fit for each seventh Monte Carlo permutation is output to the screen.

The program then writes out the final parameter estimates and their uncertainties, as well as the slip predicted by the model. Initial slip is defined as the displacement one day after the earthquake. Afterslip ratio is the ratio of the final slip to the initial slip. The FORTRAN codes for programs AFTER and GATHER are listed in Appendix 1. The codes and executables are located in [BUDDING.SLIP].

```
$ [BUDDING.SLIP]GATHER
enter name of input file: JL-14

                            site JL-14

                 1.3020                21.500                 0.500
                 4.3430                25.080                 0.539
                                        3.5800                0.2000
                16.2150                29.580                 0.539
                                        8.0800                0.2000
                19.1350                30.100                 0.539
                                        8.6000                0.2000
                21.3680                30.300                 0.539
                                        8.8000                0.2000
                23.2120                30.920                 0.539
                                        9.4200                0.2000
                94.2600                35.830                 0.539
                                       14.3300                0.2000
               154.4600                38.140                 0.539
                                       16.6400                0.2000

 #itr  initial  final  missing      C        beta       duration         X2

  50    20.82   45.14   21.50     0.126     0.0022       456.13      0.5350E+01

   sampled Monte Carlo inversions

  48    20.91   44.96   21.57     0.125     0.0022       458.61      0.1266E+02
  47    20.46   45.18   21.14     0.128     0.0021       483.63      0.8094E+01
  42    20.48   43.62   21.16     0.130     0.0030       337.50      0.9076E+01
  44    21.18   45.04   21.86     0.124     0.0023       429.17      0.9404E+01
  52    20.01   43.05   20.68     0.131     0.0029       345.76      0.1040E+02
  46    21.11   45.99   21.78     0.124     0.0019       537.22      0.6959E+01
  54    21.25   46.98   21.93     0.123     0.0016       632.42      0.9899E+01
  53    20.96   44.71   21.66     0.127     0.0026       386.85      0.2530E+01
  53    20.85   44.25   21.52     0.126     0.0026       391.09      0.1317E+02
  41    21.52   46.48   22.20     0.124     0.0020       508.99      0.6236E+01
  52    20.59   45.38   21.23     0.126     0.0019       523.05      0.2286E+02
  47    21.04   46.42   21.71     0.123     0.0016       607.35      0.8421E+01
  51    19.99   44.11   20.66     0.131     0.0024       424.12      0.1056E+02
  49    20.45   46.09   21.12     0.128     0.0018       570.39      0.6767E+01
```

```
beta = 0.00219 +/- 0.00066      (range covers 99% of beta)

    Monte Carlo range is 0.00070 to 0.00418

slip duration = 456.1 days      (interval 350.0 to  663.8 days)

C = 0.1264 +/- 0.0029

initial slip =  20.82 +/-  0.53

final slip =  45.14 +/-  1.80

afterslip ratio = 2.17 +/- 0.08

    time          measured slip      model slip        uncertainty

     1.30             21.50            21.52              0.50

    time         cumulative slip     model slip        uncertainty

     4.34             25.08            25.04              0.54
    16.21             29.58            29.48              0.54
    19.13             30.10            30.08              0.54
    21.37             30.30            30.48              0.54
    23.21             30.92            30.79              0.54
    94.26             35.83            36.12              0.54
   154.46             38.14            37.94              0.54

    time        differential slip    model diff        uncertainty

     4.34              3.58             3.52              0.20
    16.21              8.08             7.96              0.20
    19.13              8.60             8.56              0.20
    21.37              8.80             8.96              0.20
    23.21              9.42             9.27              0.20
    94.26             14.33            14.60              0.20
   154.46             16.64            16.42              0.20
FORTRAN STOP
```

The program SLOP plots the model fit to the measured displacements. Running the plotting program, as shown on the following page, is self-explantory. The example shown creates a linear-log plot using the file JL-14.OUT. Once the type of plot is decided, SLOP will cycle over an entire set of sites. Entering a <CR> at the prompt for the site name exits the program. We present four plots of this kind per page in Figures 4 - 6. The related program SLOPS generates plots of only the data points and the fitted curve without printing the fitted parameter values. The program also requests the X and Y limits for each plot as input.

```
$ RUN [BUDDING.SLIP]SLOP

[plotting package prompts]

1 = linear vs. linear
2 = log vs. log
3 = linear vs. log
4 = log vs. linear
Choose plot type (I1): 3  (CR = 2)
type station name (A/cr=stop): JL-14

Save this plot [Y/N]? Y
type station name (A/cr=stop): CR exits SLOP
FORTRAN STOP
```

The PRIOR program, and its two variations PRIOR_S and PRIOR_T, were written as alternative methods for fitting the data near the northwest end of the SHFZ. Power-law fits to the measured displacement at sites on this portion of the fault resulted in $\beta$ approaching a negative value (that is, fixed at the lower limit of the allowed range). Sharp and Saxton (1989) suggest that these negative $\beta$ values reflect displacement that may have occurred prior to the second mainshock (**M** 6.6) of November 24, 1987. They used the PRIOR program to analyze the data from N-QUAD and NC-QUAD.

The program PRIOR inverts the displacement measurements to fit the power-law function

$$u(t) = u_o + u_1 t^c$$

where $u(t)$ is the displacement at post-earthquake time $t$, $u_o$ is the initial displacement prior to the earthquake, $u_1$ is the displacement one day after the earthquake, and $c$ is the power-law exponent at post-earthquake time $t$. 'SITE'.DAT files of the form required for AFTER are used in the PRIOR program. An example of a PRIOR run is shown on the following page on NCQUAD-VSE.DAT. A lower limit $< 0$ for prior slip can be used, if desired. This value is then added to the first measured displacement, halved, and used as a starting point for the iterations. The iterations are output to the screen. Once the minimum has been located, the power-law exponent, initial slip, minimum prior slip, and the fits of measured to model slip (less the minimum prior slip) are printed. In the example, 0.87 cm of vertical displacement is estimated to have occurred at NCQUAD before the **M** 6.6 earthquake.

The program SLOPPY is used to plot the power-law trajectories of data analyzed by PRIOR. To accomodate the prior displacement, limits for the axis of abscissas must

```
$ RUN [BUDDING.SLIP]PRIOR
enter name of input file:  NCQUAD-VSE


               station NCQUAD-VSE

          1.3000           -0.5200           0.0200
          5.2700           -0.4800           0.0200
         12.2600           -0.4500           0.0200
         18.2500           -0.4300           0.0200
         27.2400           -0.4100           0.0200
         50.2200           -0.3900           0.0200
         92.3300           -0.3700           0.0200
        157.2000           -0.3400           0.0200

set lower limit for prior slip:  -2.0 (CR = 0)

  prior   initial    C         X2

  -1.26    0.73    0.046      0.29
  -1.62    1.09    0.032      0.34
  -1.44    0.91    0.038      0.32
  -1.26    0.73    0.046      0.29
  -1.08    0.55    0.059      0.26
  -0.90    0.37    0.082      0.23
  -0.72    0.19    0.133      0.31
  -0.81    0.28    0.101      0.24
  -0.90    0.37    0.082      0.23
  -0.99    0.46    0.068      0.24
  -0.94    0.41    0.074      0.24
  -0.90    0.37    0.082      0.23
  -0.85    0.32    0.090      0.23
  -0.81    0.28    0.101      0.24
  -0.83    0.30    0.095      0.23
  -0.85    0.32    0.090      0.23
  -0.88    0.35    0.086      0.23
  -0.90    0.37    0.082      0.23
  -0.89    0.36    0.084      0.23
  -0.88    0.35    0.086      0.23
    .        .       .          .
    .        .       .          .
    .        .       .          .

C = 0.0861 +/- 0.0114

initial slip =   0.35 +/-  0.04

minimum prior slip =  -0.87

     time      measured slip     model slip      uncertainty

     1.30          0.35            0.35            0.02
     5.27          0.39            0.40            0.02
    12.26          0.42            0.43            0.02
    18.25          0.44            0.44            0.02
    27.24          0.46            0.46            0.02
    50.22          0.48            0.48            0.02
    92.33          0.50            0.51            0.02
   157.20          0.53            0.53            0.02
FORTRAN STOP
```

be set after the prompt in the plotting routine. An example of the output from SLOPPY is plotted in Figure 7 for site NCQUAD-VSE.

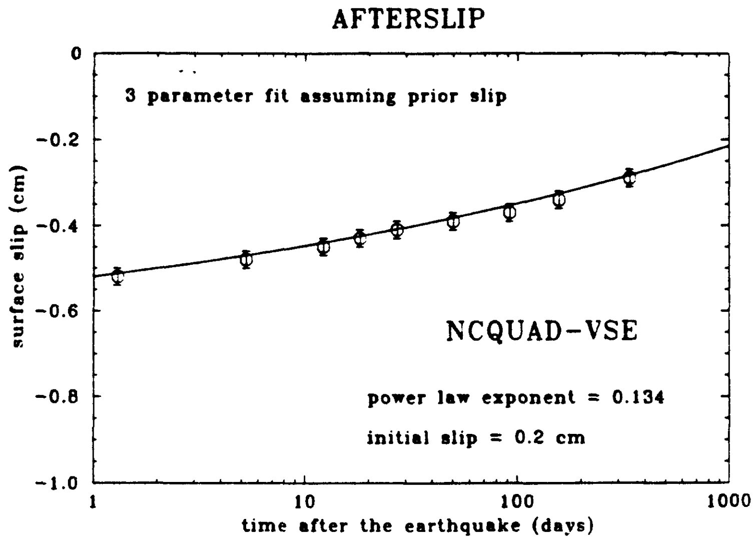


**FIGURE 7.** Model fit of afterslip with calculated error bars and parameters determined for site NCQUAD-VSE analyzed by the program PRIOR.

The program PRIOR_S (which calculates a displacement present prior to the eatrthquake) inverts displacement measurements to fit the power law function

$$u(t) = u_o + u_f \left[ \frac{\beta t}{\beta t + 1} \right]^c$$

where $u(t)$ is the displacement at post-earthquake time $t$, $u_o$ is the initial displacement prior to the power-law slip, $u_o + u_f$ is the final displacement, $\beta$ is the duration after the earthquake during which the surface slip follows a power law, and $c$ is the power-law exponent.

The program PRIOR_T (which calculates the time of the displacement present prior to the earthquake) inverts displacement measurements to fit the power law function

$$u(t) = u_f \left[ \frac{\beta(t + t_o)}{\beta(t + t_o) + 1} \right]^c$$

where $u(t)$ is the displacement at post-earthquake time $t$, $u_f$ is the final displacement, $\beta$ is the duration after the earthquake during which the surface slip follows a power law, $t_o$ is the time when the pre-earthquake displacement occurred, and $c$ is the power-law exponent.

Both the PRIOR_S and PRIOR_T programs require data files ('SITE'.DAT) in the format used to run AFTER. The PRIOR_S program prompts for a lower limit for the range of prior slip to be searched, similiar to the PRIOR program. The range of prior time which is searched in PRIOR_T is hard-wired into the program. The iterative search that both programs follow is output to the screen in the same format as in the AFTER, GATHER, and DIFFER programs. The 'SITE'.OUT files generated by PRIOR_S AND PRIOR_T are plotted using SLOP, not SLOPPY. An example of the PRIOR_S output for site NCQUAD-VSE is shown in Figure 8.

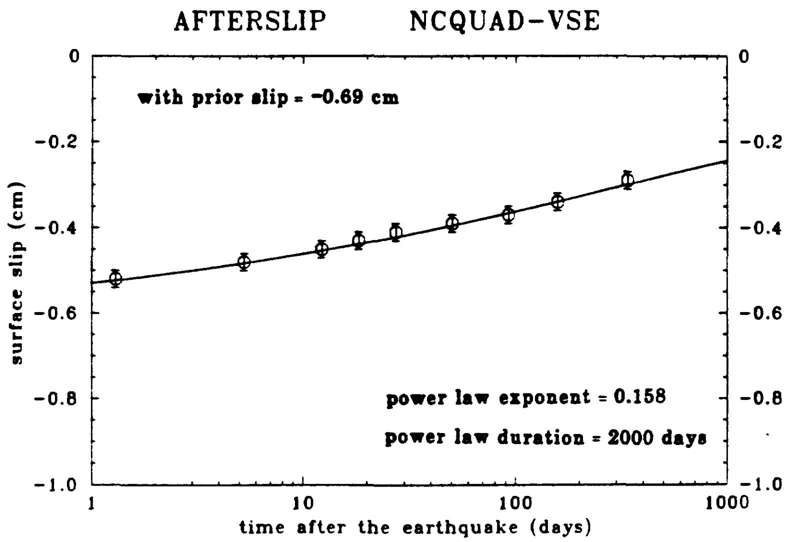


**FIGURE 8.** Model fit of afterslip with calculated error bars and parameters determined for site NCQUAD-VSE analyzed by the program PRIOR_S.

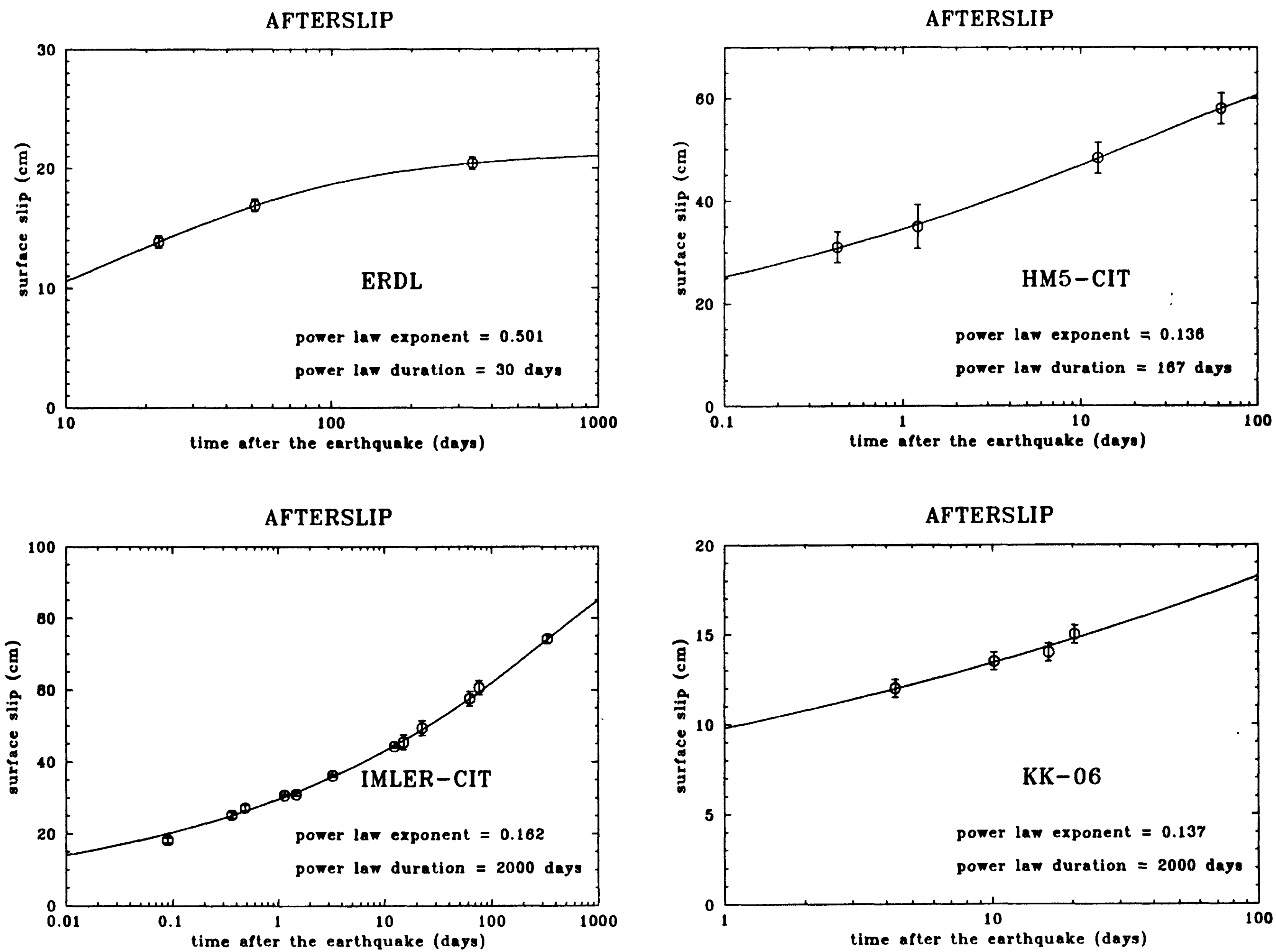


**FIGURE 4.** Model fits of afterslip with calculated error bars and parameters determined for those sites analyzed by the program AFTER.

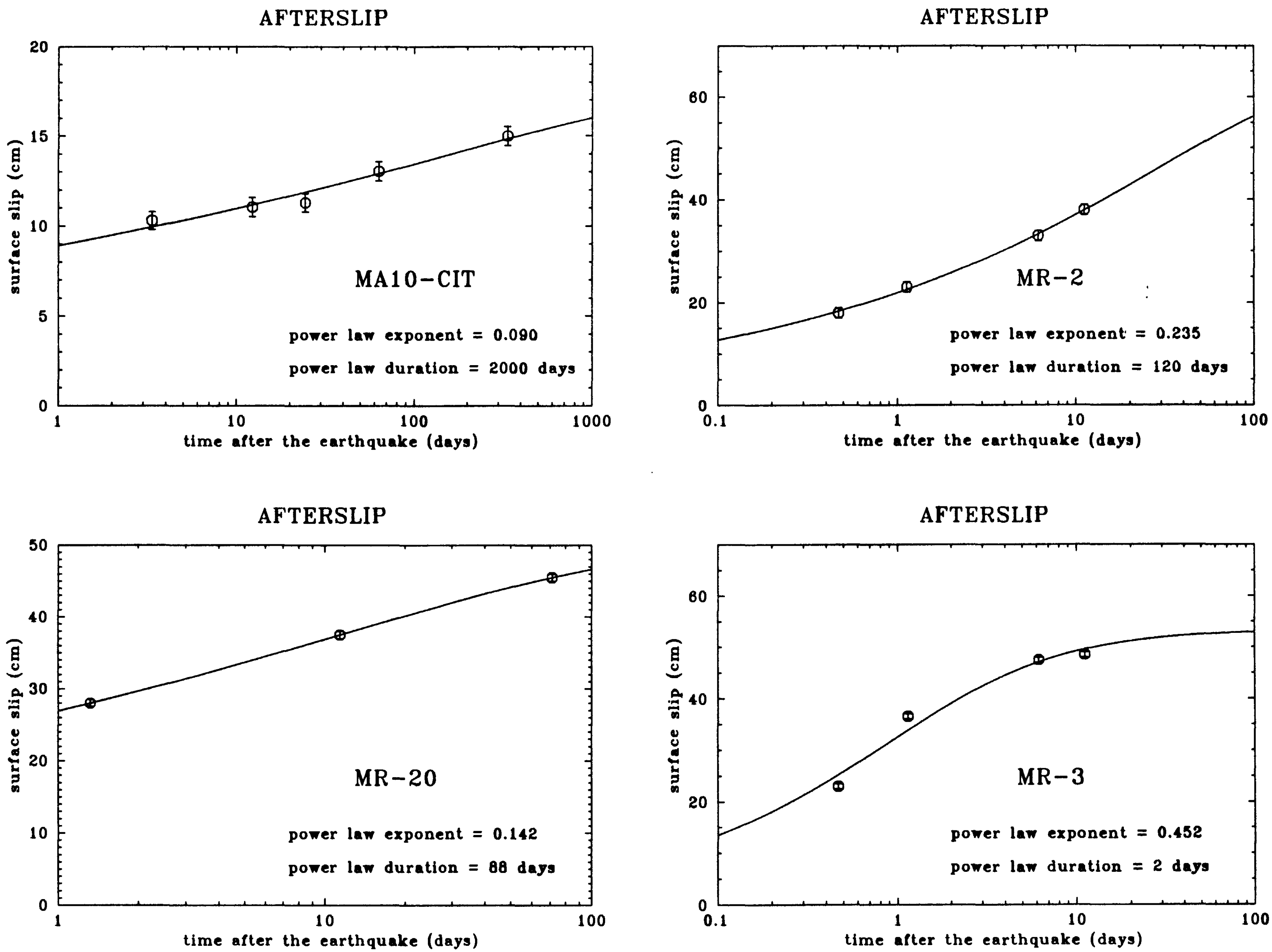


Figure 4. continued

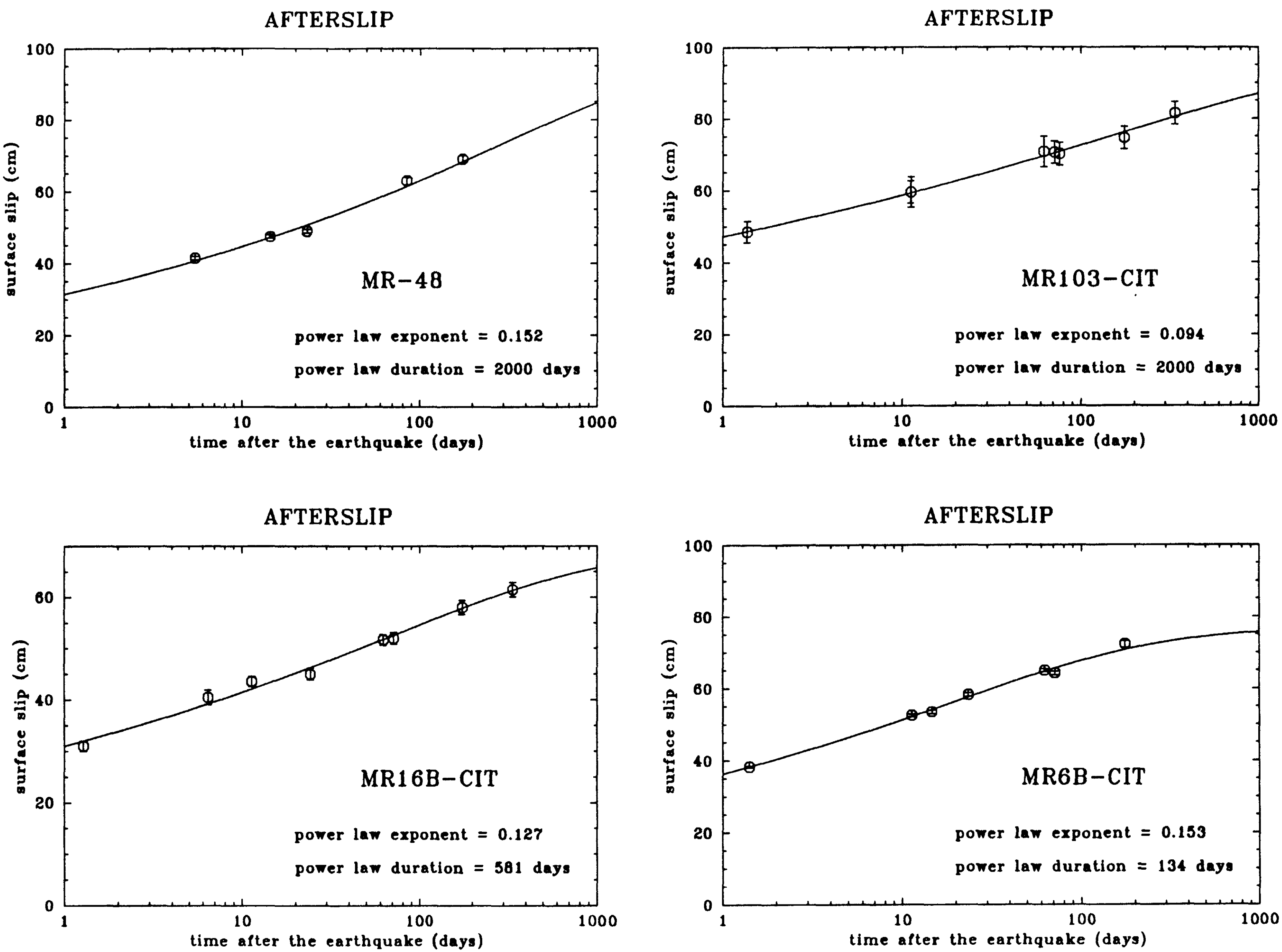


Figure 4. continued

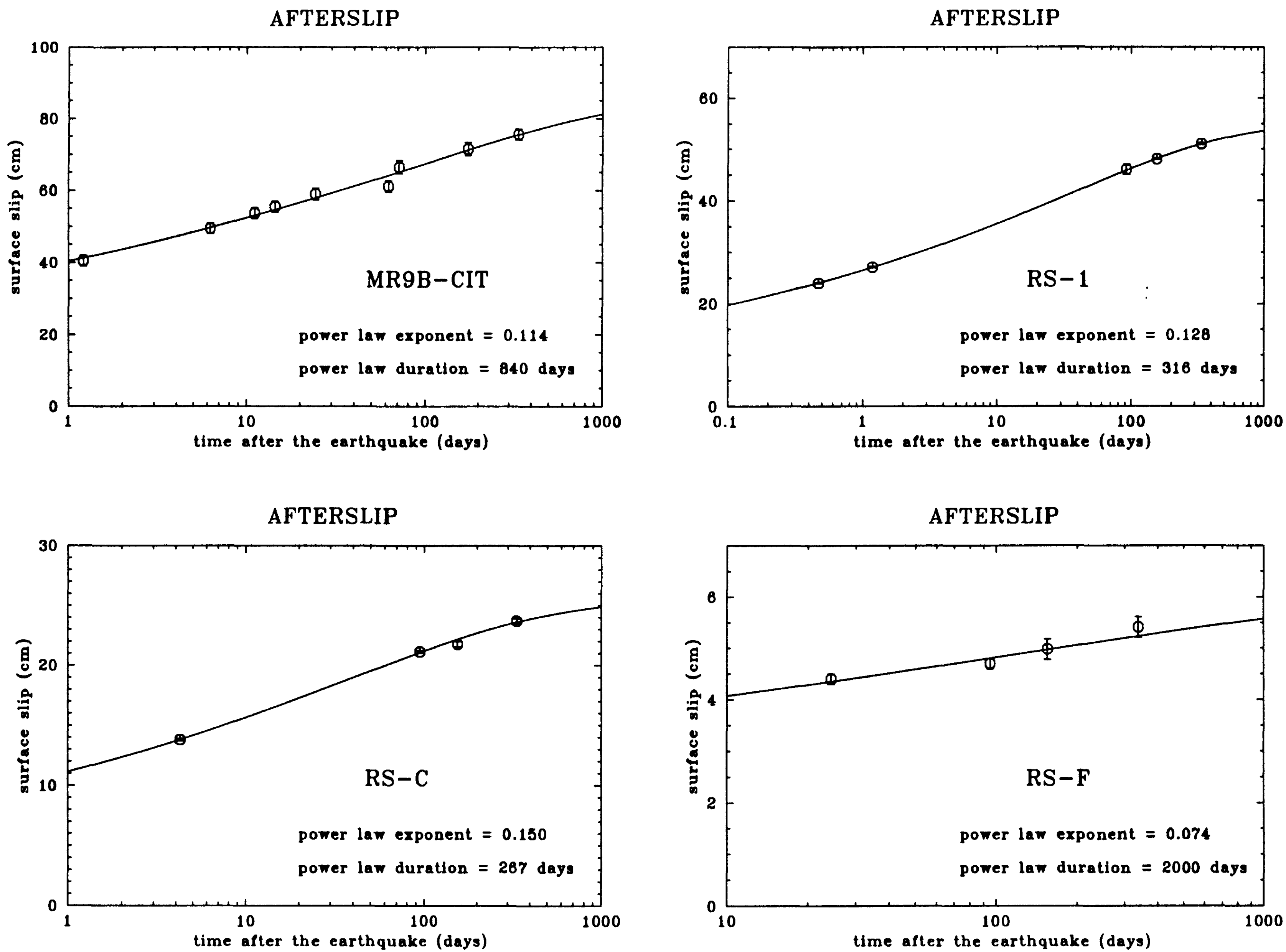


Figure 4. continued

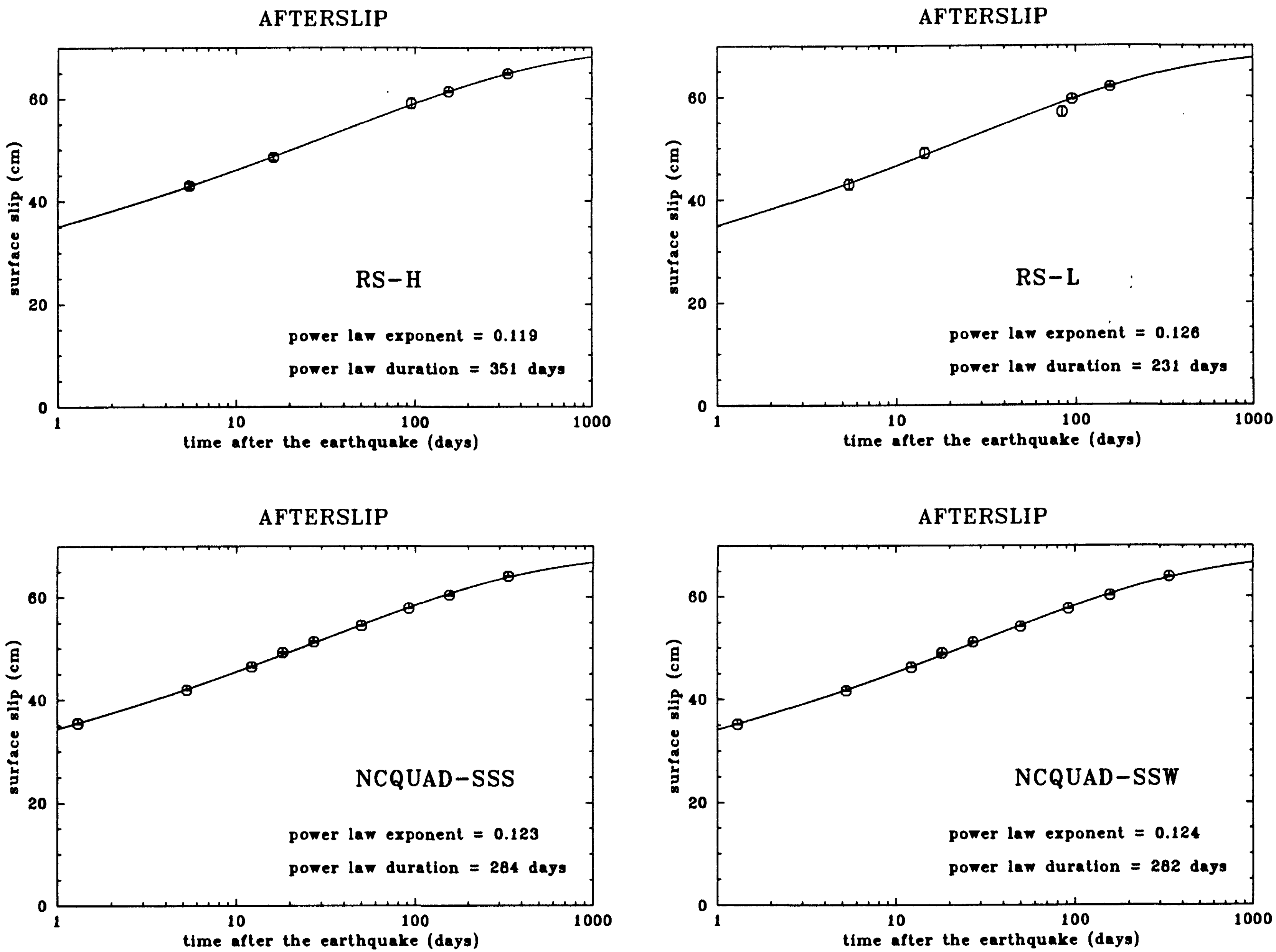


Figure 4. continued

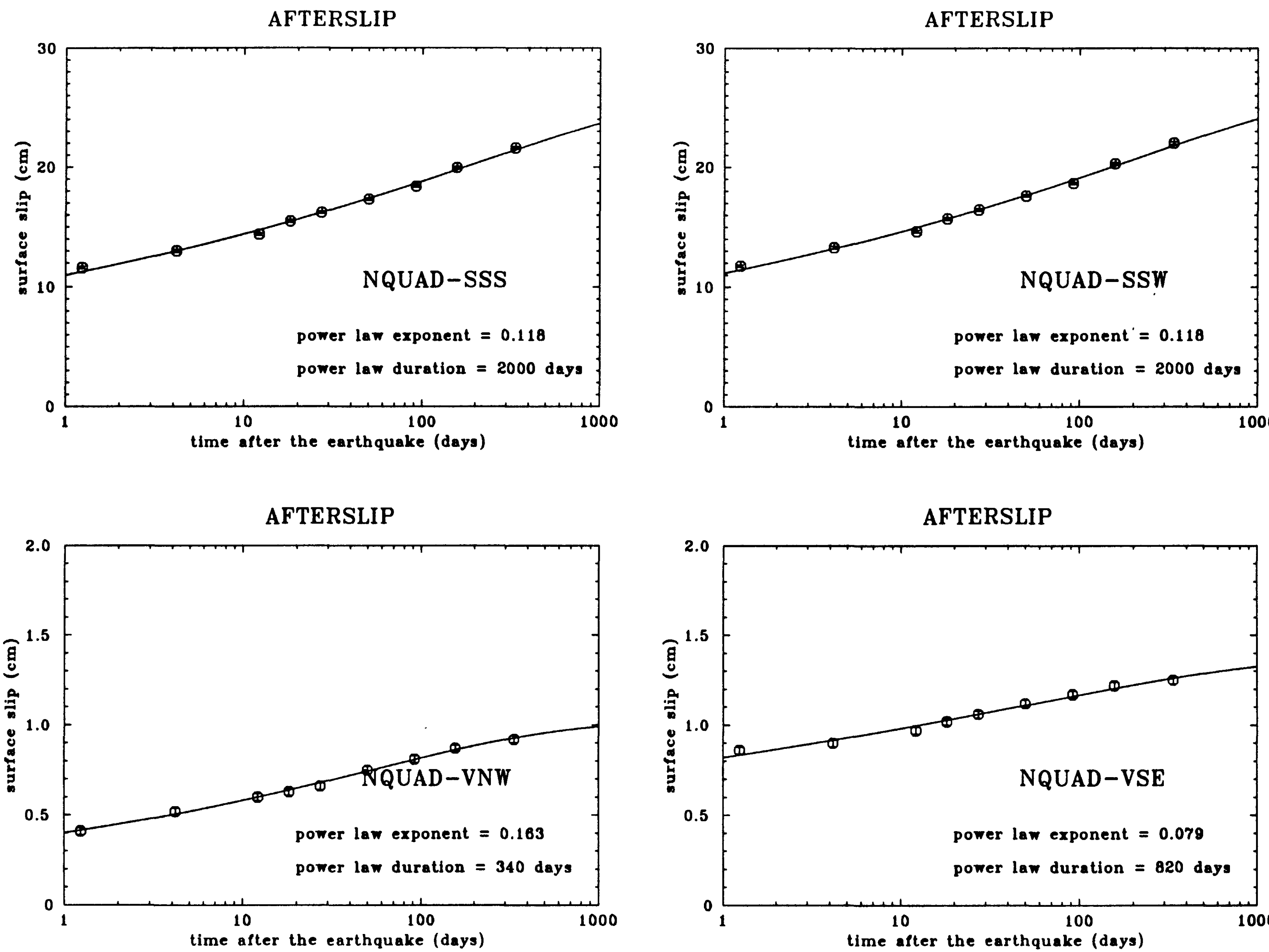


Figure 4. continued

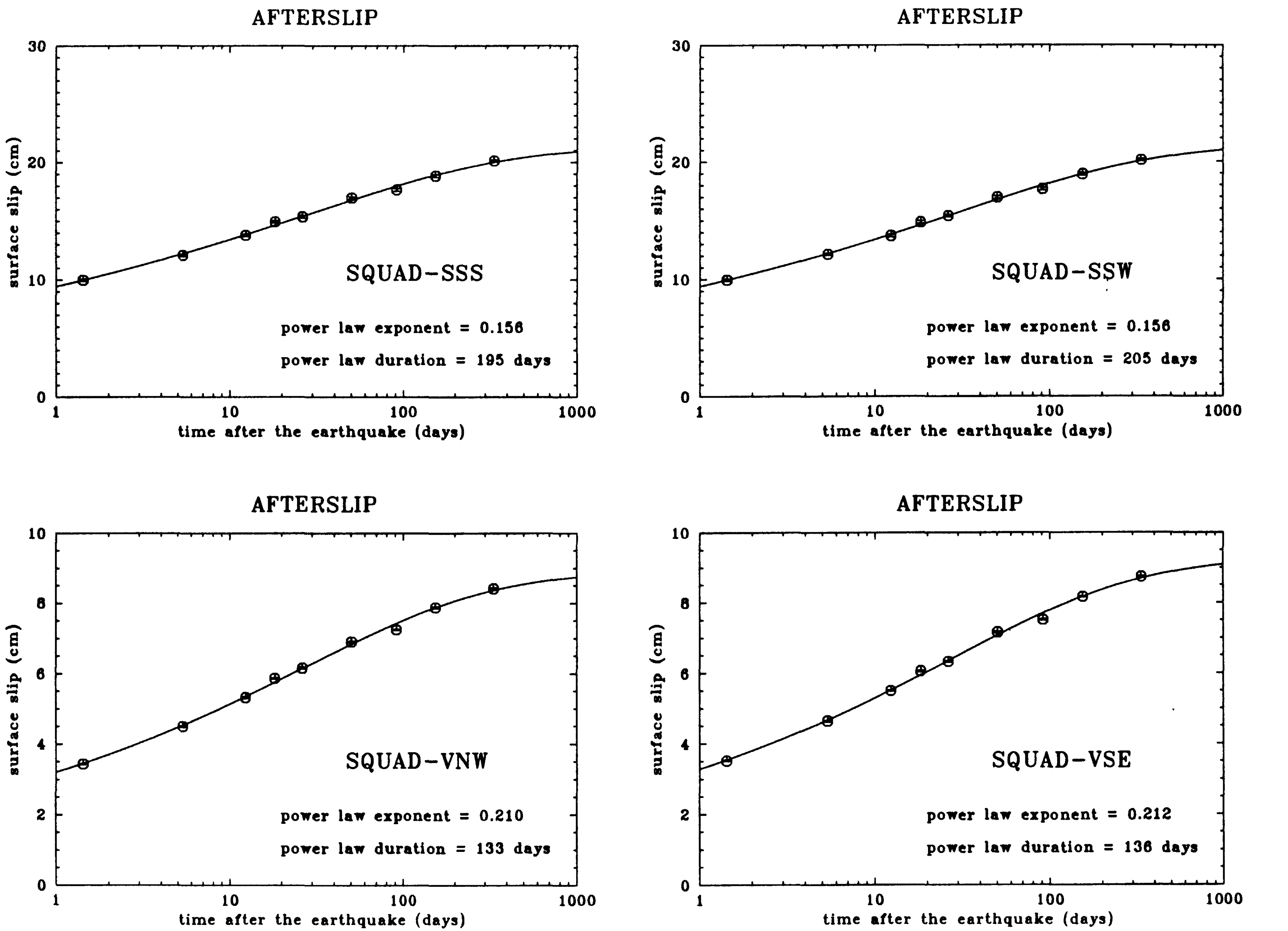


Figure 4. continued

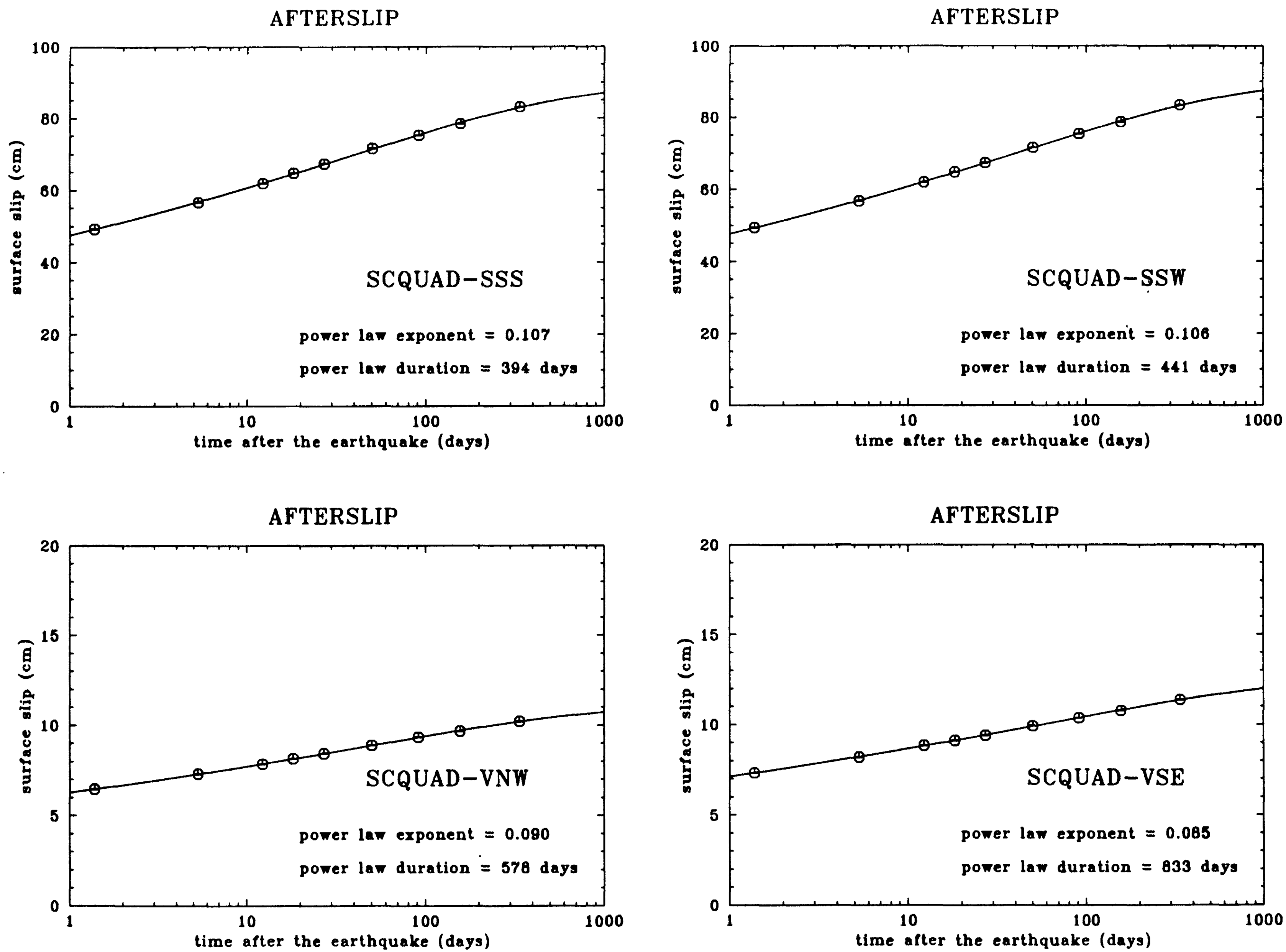


Figure 4. continued

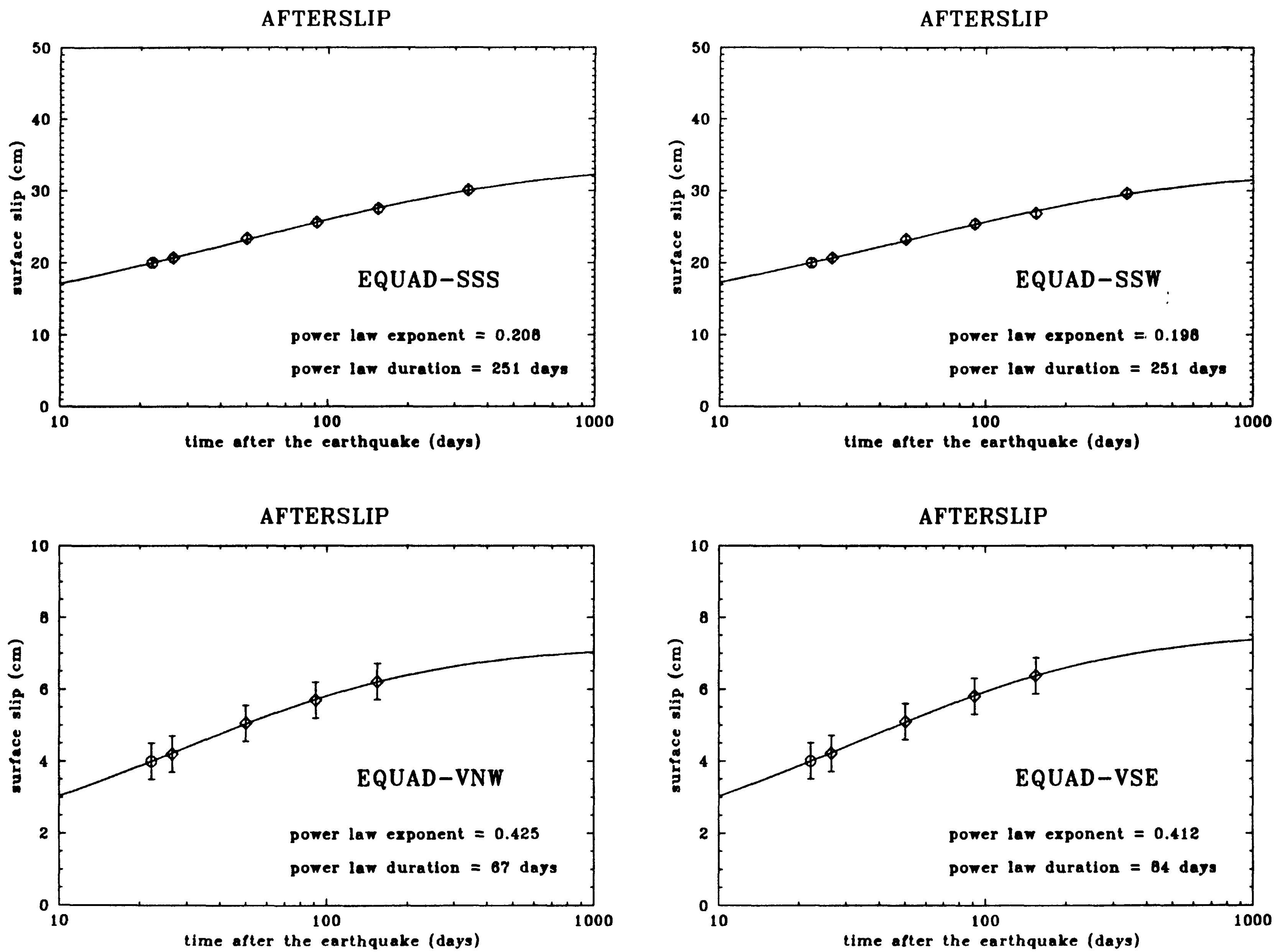


**FIGURE 5.** Model fits of afterslip with calculated error bars and parameters determined for those sites analyzed by the program GATHER.

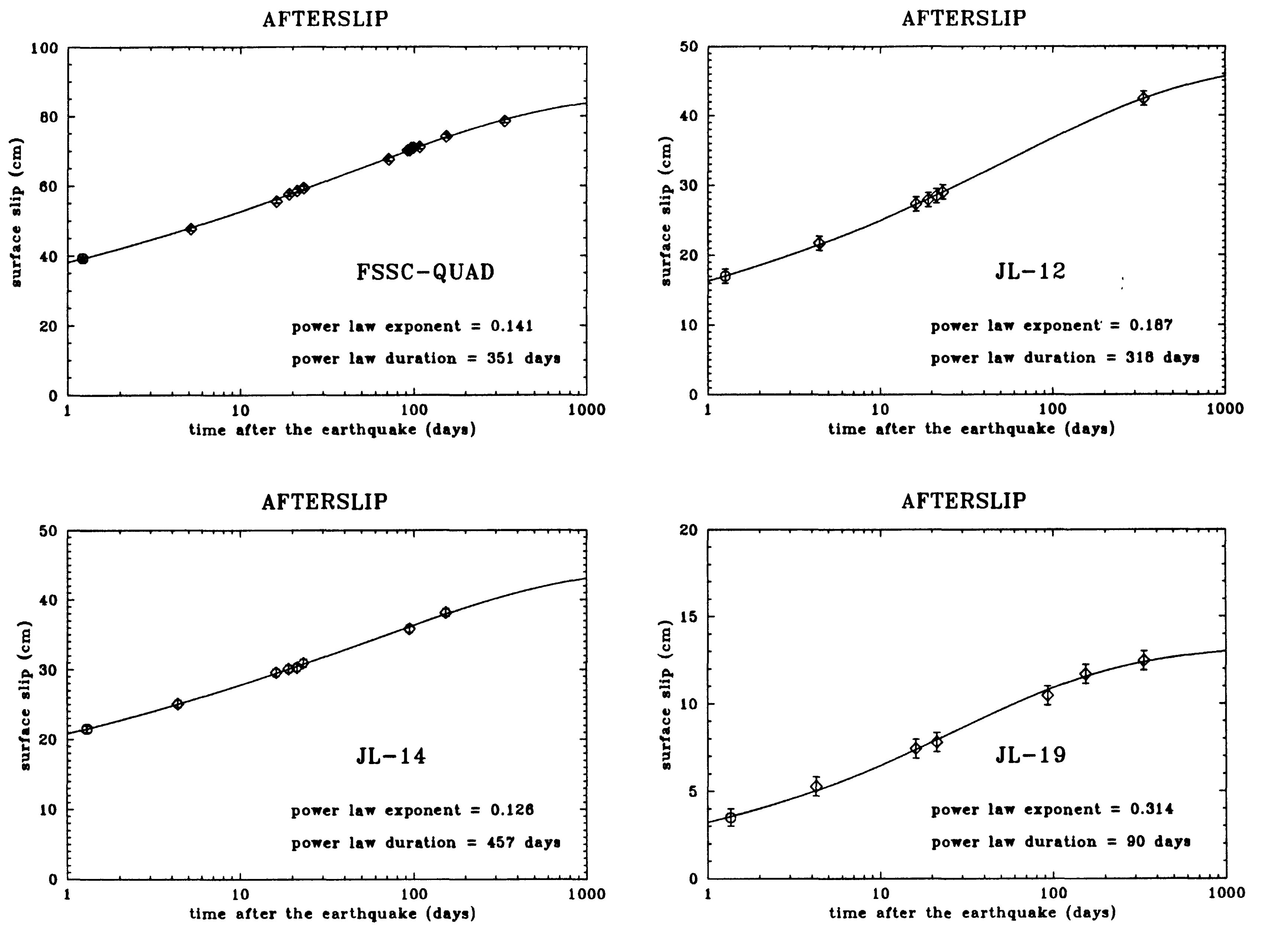


Figure 5. continued

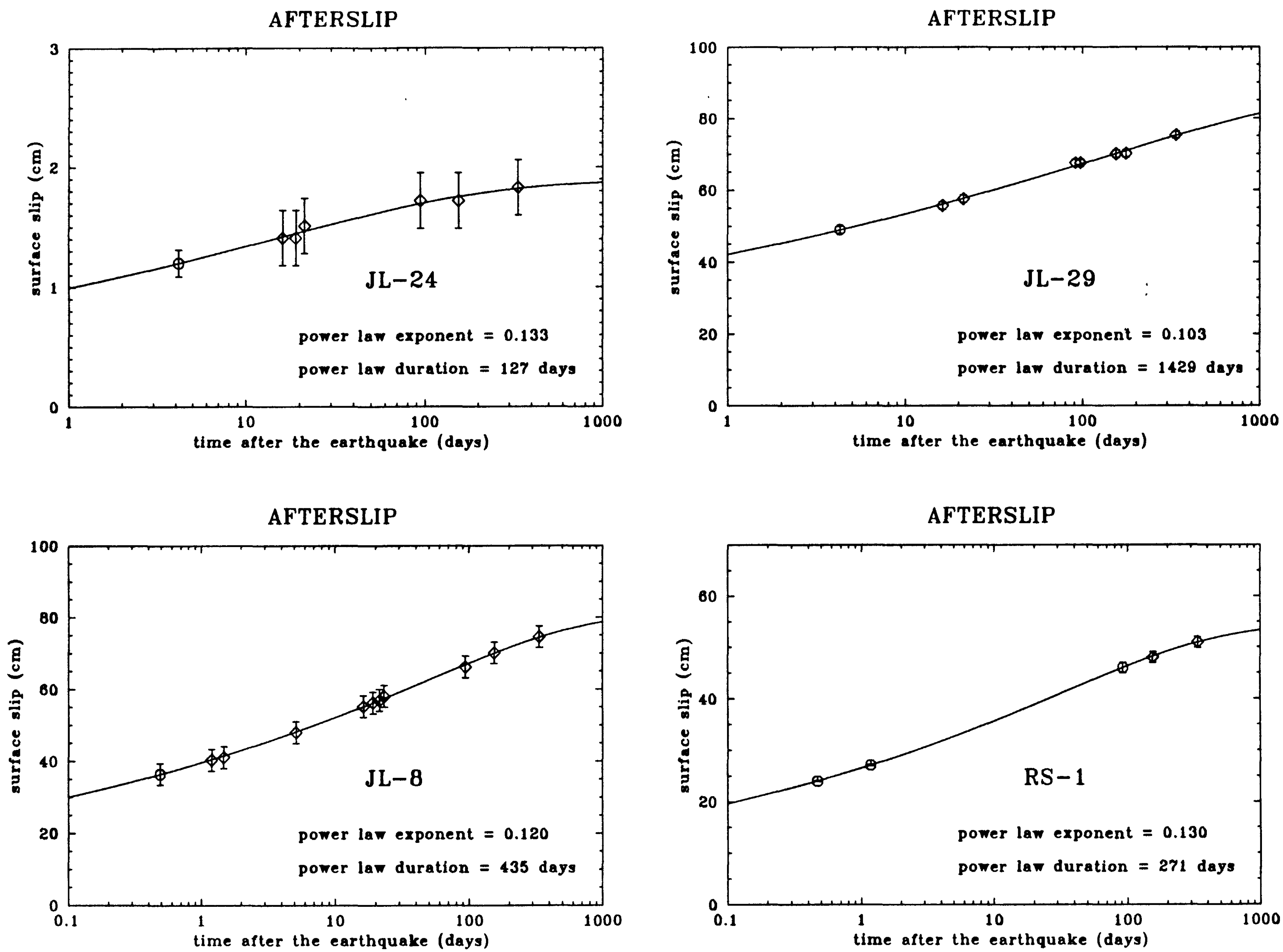


Figure 5. continued

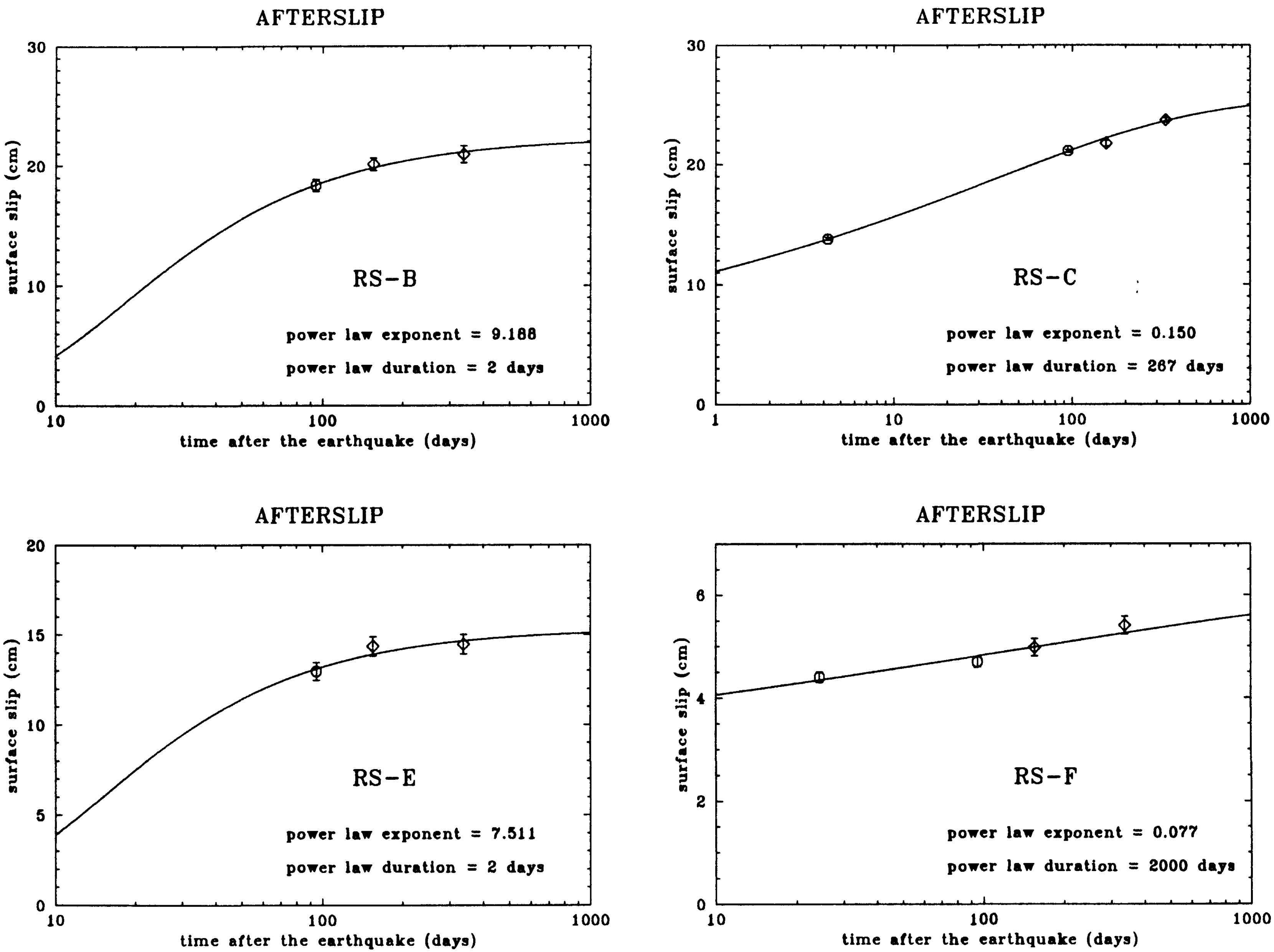


Figure 5. continued

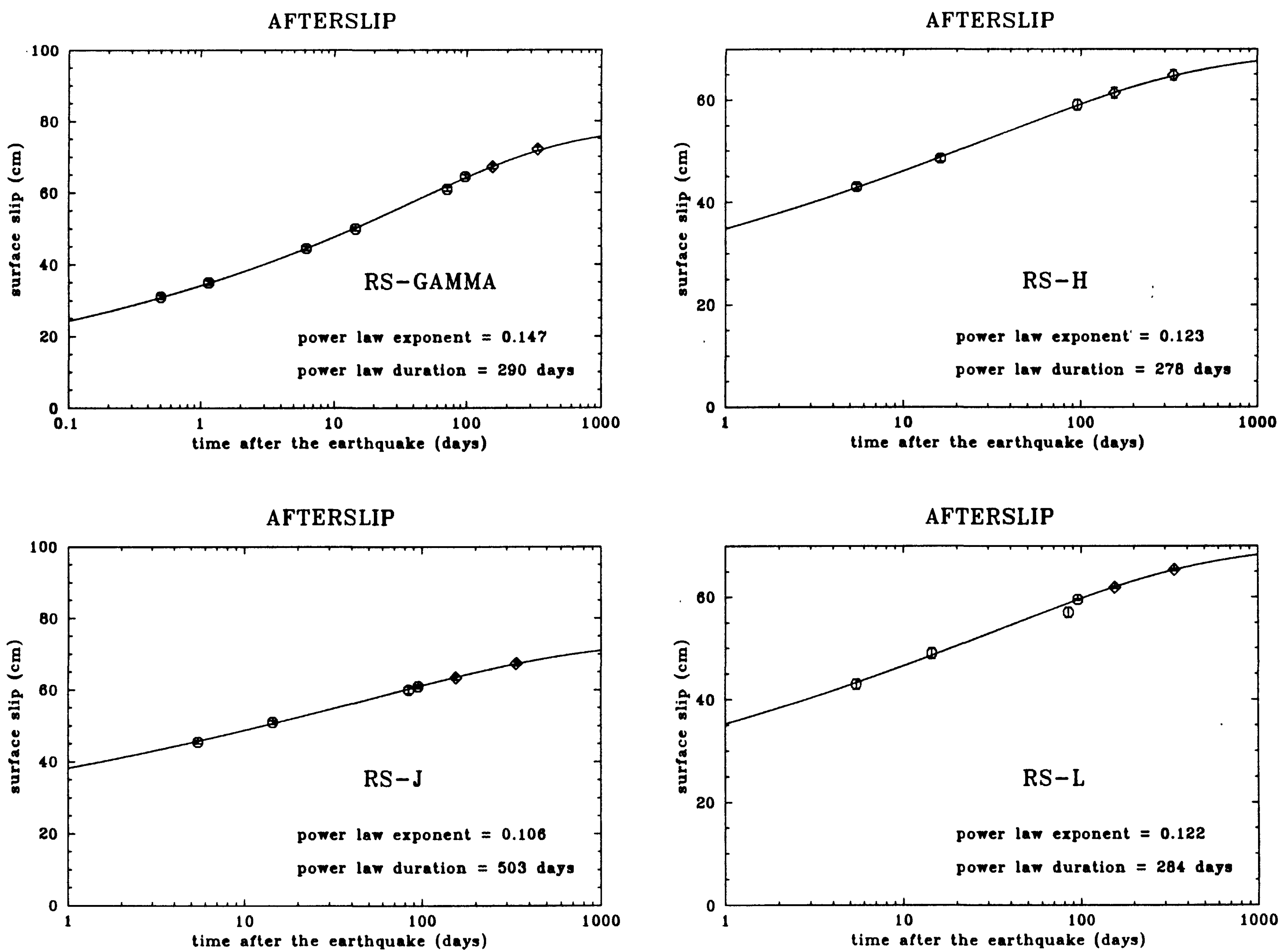


Figure 5. continued

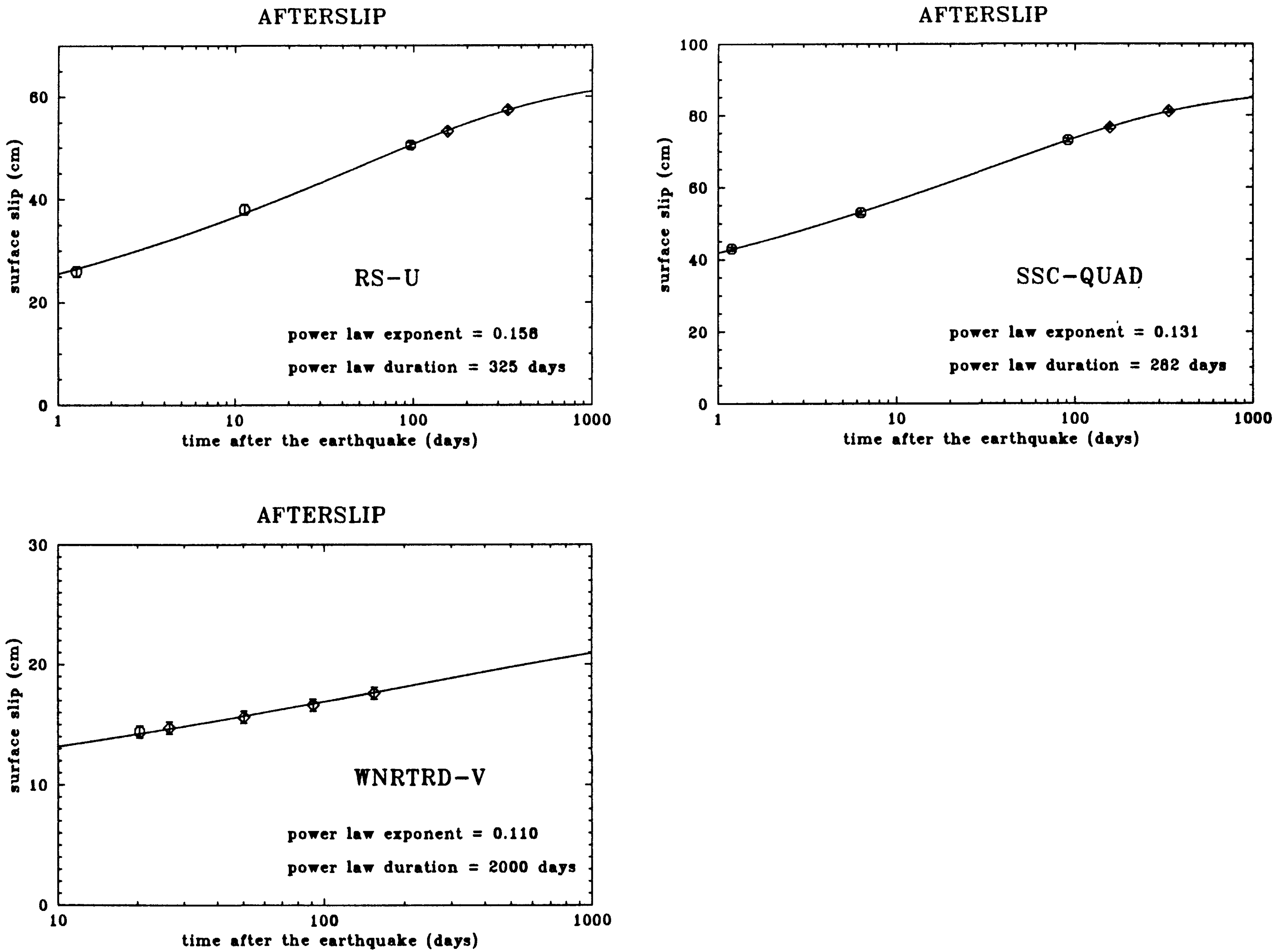


Figure 5. continued

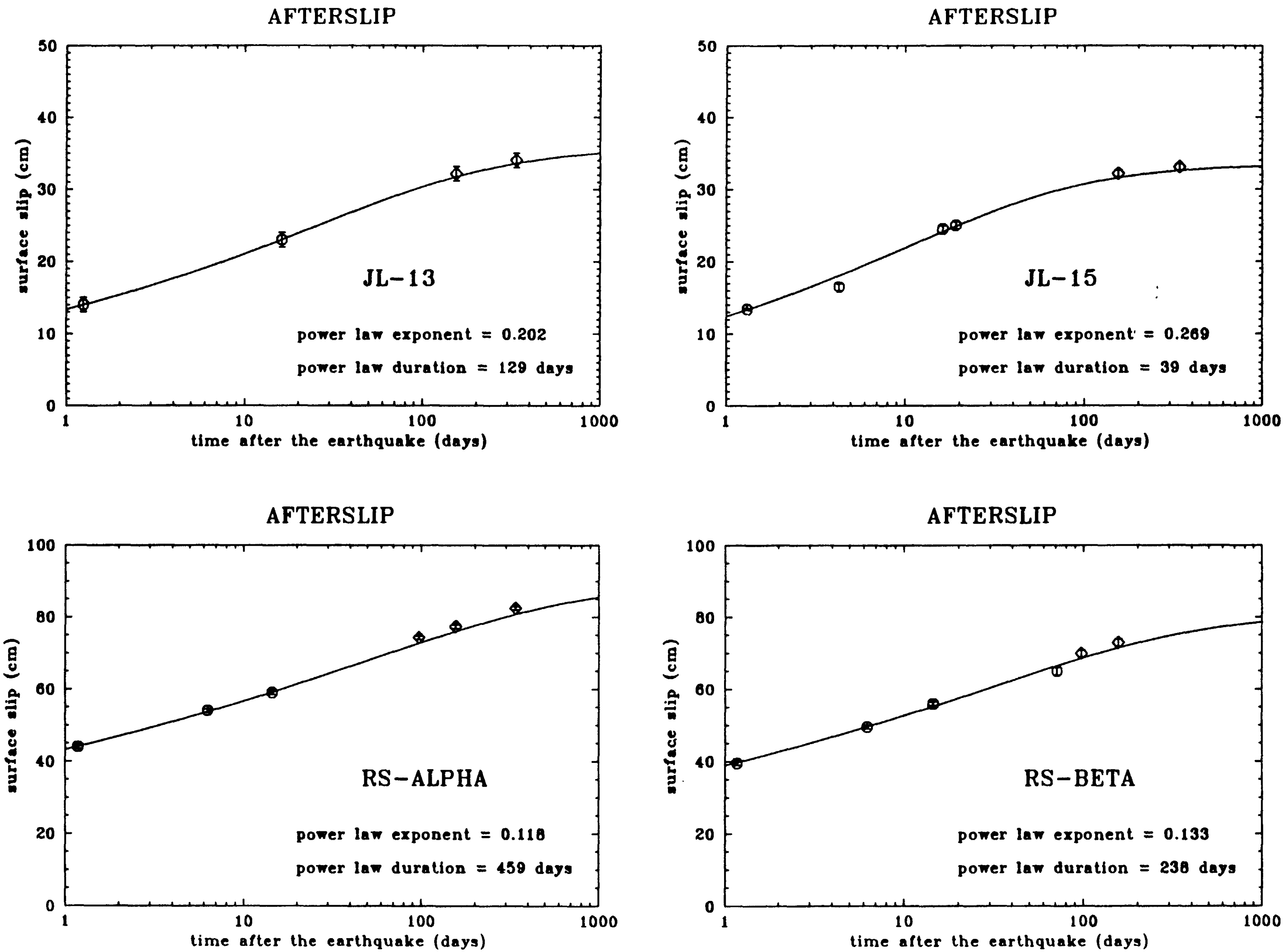


**FIGURE 6.** Model fits of afterslip with calculated error bars and parameters determined for those sites analyzed by the program DIFFER.

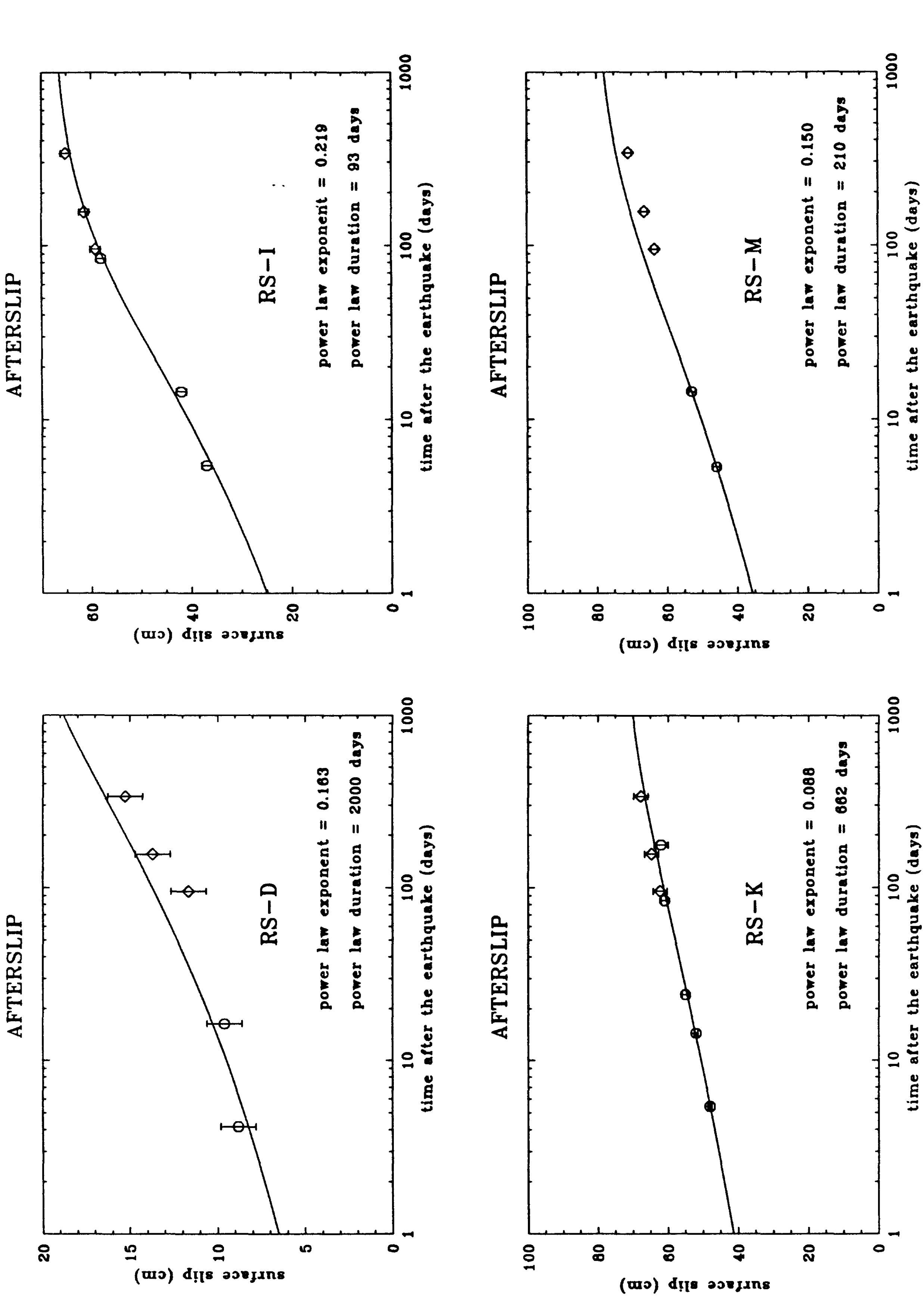


Figure 6. continued

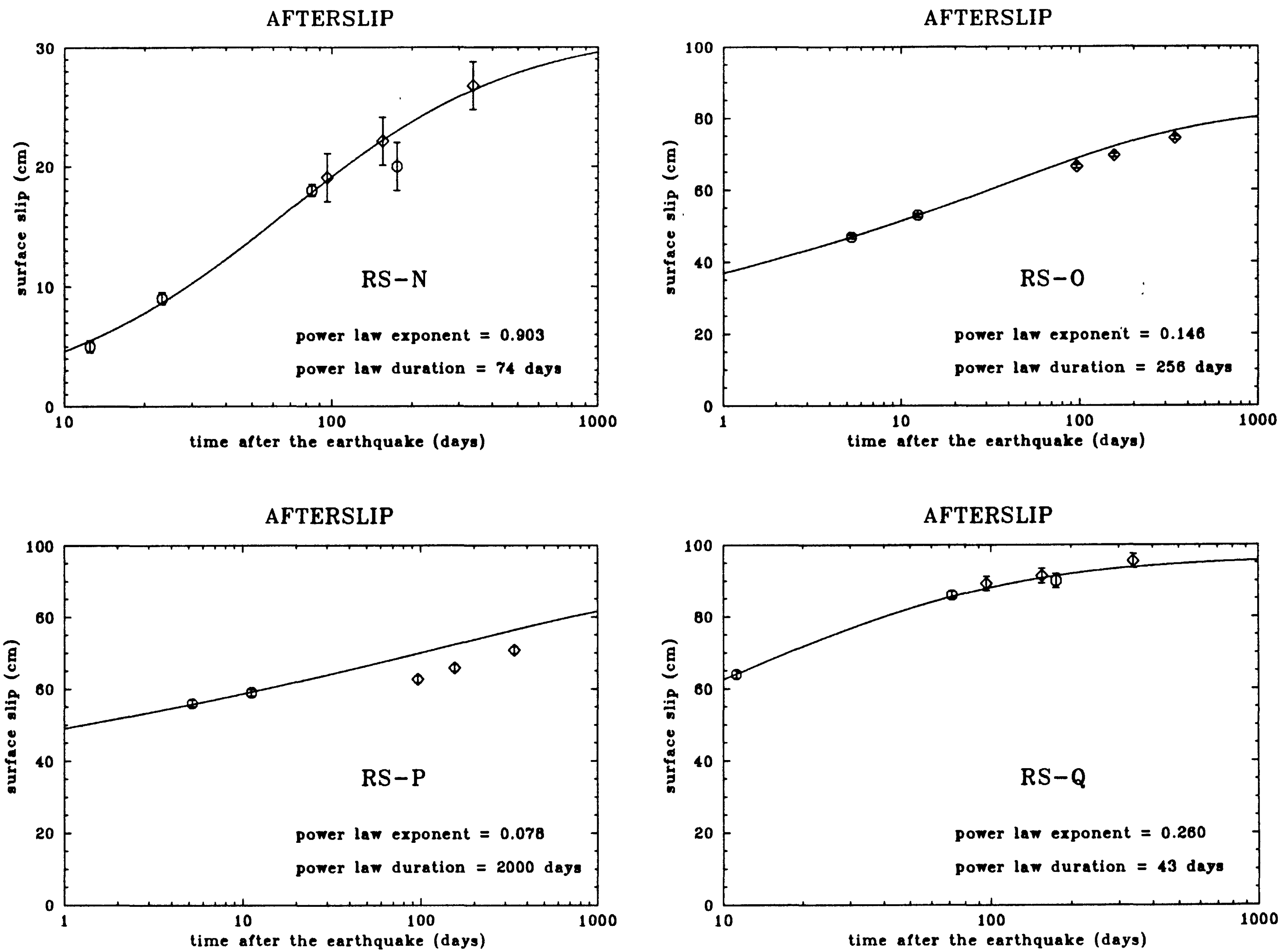


Figure 6. continued

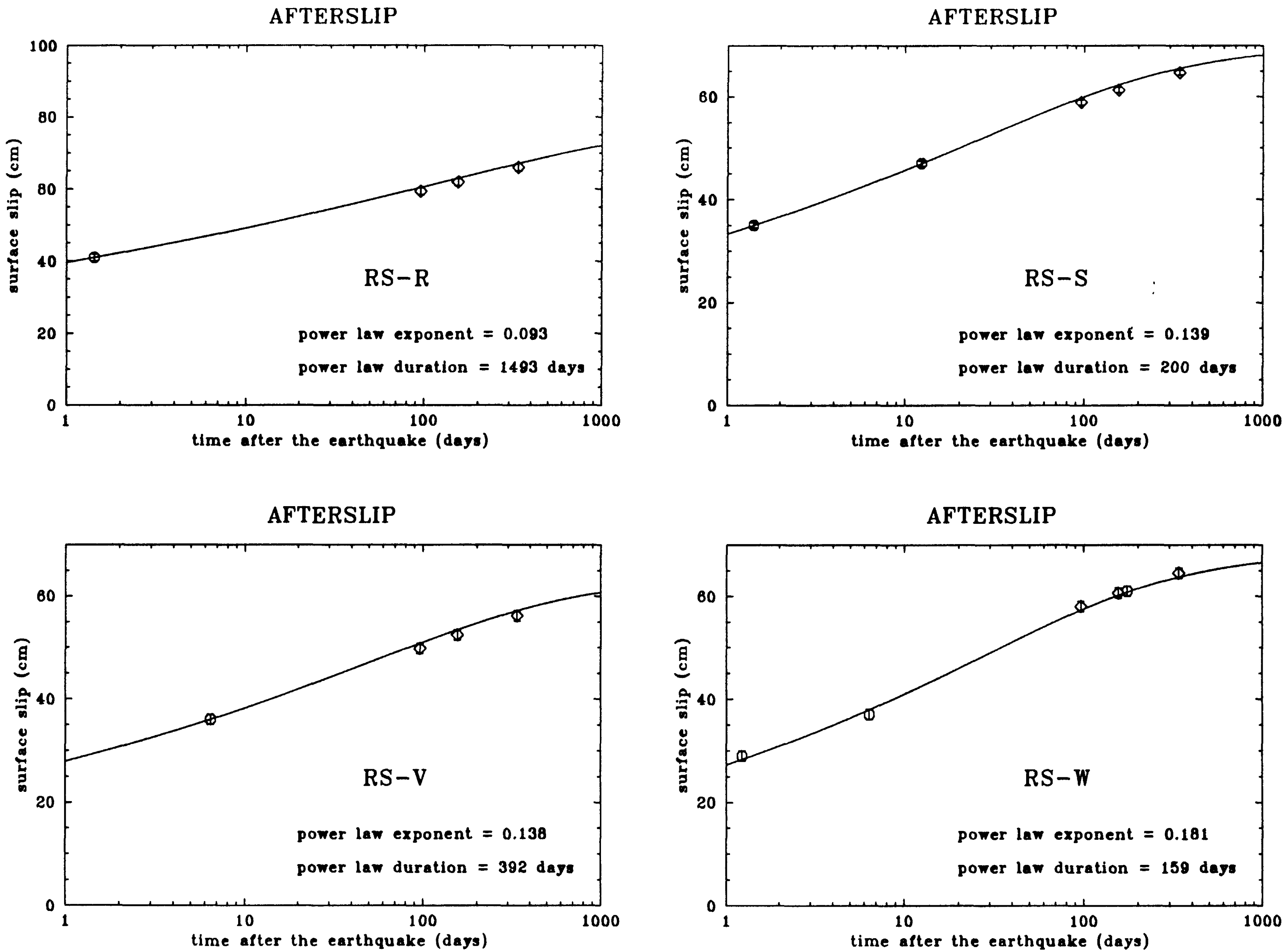


Figure 6. continued

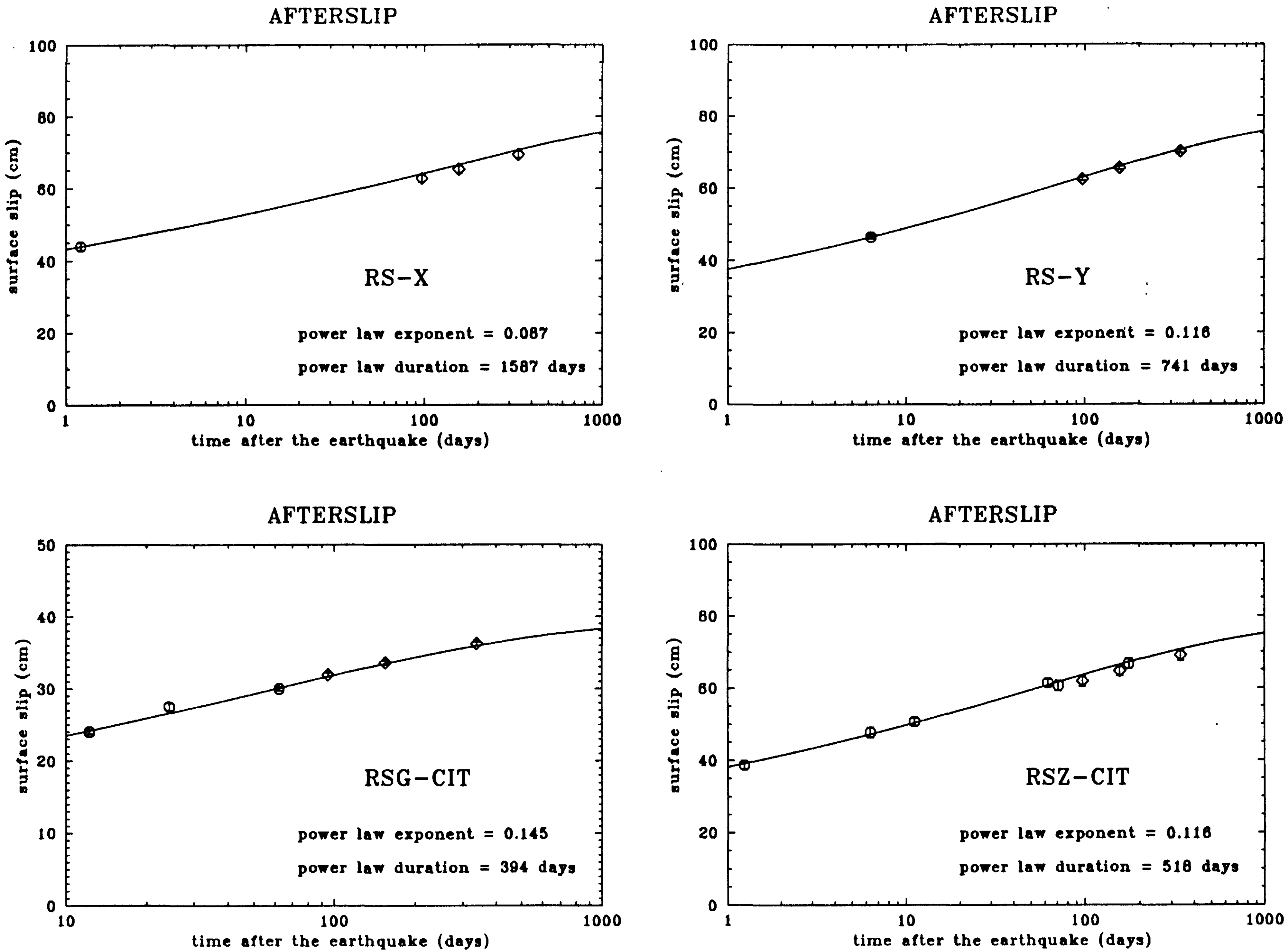


Figure 6. continued

## A NOTE ON DIRECTORY STRUCTURE

We chose to structure the directories according to measurement strategies, and consequently, the power-law program used. For example, all the data from displacement sites to be reduced by the program AFTER are in the AFTER directory as 'SITE'.DAT files. Thus, all the data files in a particular directory have the same format. Because the power-law programs and data evolved during our analysis of the SHFZ data, we found it convenient to use 'PROGALL'.COM files which run the programs on all the data simultaneously. For example, the GATALL.COM file is shown below. We also found it convenient to copy all the 'SITE'.OUT files into one 'DIRECTORY'.OUT file (that is, COPY *.OUT 'DIRECTORY'.OUT) to obtain a compact file which could be quickly printed. For future earthquakes and displacement data sets, where all the data files might be in GATHER format, a geographical or structural division of data files based on location on separate fault strands might be used. The primary motive in separating the data into specific directories is to keep the directories small to facilitate data manipulation.

```
$ TYP GATALL.COM
$DEL *.OUT;*
$gather
EQUAD-SSS
$gather
EQUAD-SSW
$gather
EQUAD-VNW
$gather
EQUAD-VSE
$gather
JL-14
$gather
JL-19
$gather
JL-24
$gather
JL-29
$gather
JL-8
$gather
FSSC-QUAD
$gather
RS-1
$gather
RS-C
$gather
RS-F
$gather
RS-GAMMMA
$gather
RS-H
$gather
RS-J
$gather
RS-L
$gather
RS-U
$gather
SSC-QUAD
$gather
WNRTRD-V
$COPY *.OUT GATHER.OUT
```

## TABULATING PROGRAMS

The 'SITE'.OUT files created by the power-law programs are manipulated and organized by two tabulating programs, TABLE and REDUCE. These programs both require a file which contains the filenames for all the output files to be tabulated. A 'DIRECTORY'.DRC file is created which lists the 'SITE'.OUT files to be tabulated in a particular directory. For example, the QUAD.DRC file shown below contains the filenames of all the 'SITE'.OUT files generated by running AFTER on the QUAD.DAT files. The following procedure then tabulates the quadrilateral output into Table 3.

```
$ TYP QUAD.DRC
NCQUAD-SSS.OUT
NCQUAD-SSW.OUT
NQUAD-SSS.OUT
NQUAD-SSW.OUT
NQUAD-VNW.OUT
NQUAD-VSE.OUT
SCQUAD-SSS.OUT
SCQUAD-SSW.OUT
SCQUAD-VNW.OUT
SCQUAD-VSE.OUT
SQUAD-SSS.OUT
SQUAD-SSW.OUT
SQUAD-VNW.OUT
SQUAD-VSE.OUT


$ RUN [BUDDING.SLIP]TABLE
enter name of directory file: QUAD.DRC
enter program name: AFTER
FORTRAN STOP
```

The program REDUCE combines the two strike-slip or vertical components of displacement for a quadrilateral, determined from the QUAD3D program, into a single strike-slip or vertical estimate. For example, NCQUAD-SSS.OUT (strike-slip component for corner S wrt E) and NCQUAD-SSW.OUT (strike-slip component for corner W wrt N) becomes NCQUAD-SS (strike-slip component NC quadrilateral). The file names listed in the 'DIRECTORY'.DRC file must be ordered as pairs of similiar components. The program reduces the quadrilateral data (strike-slip components used as an example) using the appropriate uncertainties as

$$\frac{1}{\sigma_{ss}^2} = \left(\frac{1}{\sigma_{sss}^2} + \frac{1}{\sigma_{ssw}^2}\right)$$

$$u_{ss} = \sigma_{ss}^2 \left(\frac{u_{sss}}{\sigma_{sss}^2} + \frac{u_{ssw}}{\sigma_{ssw}^2}\right)$$

where $u_{sss}$ and $u_{ssw}$ are the measured strike-slip displacements and $\sigma_{sss}$ and $\sigma_{ssw}$ are the uncertainties associated with these measurements. REDUCE does not adequately calculate the new range of the combined estimate of $\beta$, but only interpolates the ranges of the two components.

Running REDUCE on the QUAD.DRC file, as shown below, creates Table 4.

```
$ RUN [BUDDING.SLIP]REDUCE
enter file with QUAD names: QUAD.DRC
enter program name: AFTER
FORTRAN STOP
```

**TABLE 3.** Calculated parameters for all the 'QUAD'.DAT files analyzed by the program AFTER.

| station | program | #m | prct | lg | duration & range (days) | | power law exponent | initial slip (cm) | final slip (cm) | afterslip ratio |
|---|---|---|---|---|---|---|---|---|---|---|
| NCQUAD-SSS | AFTER | 9 | 99 | A | 284 | 267 to 301 | 0.123 +/- 0.001 | 34.4 +/- 0.1 | 68.9 +/- 0.3 | 2.00 +/- 0.01 |
| NCQUAD-SSW | AFTER | 9 | 99 | A | 282 | 265 to 298 | 0.124 +/- 0.001 | 34.2 +/- 0.1 | 68.7 +/- 0.3 | 2.01 +/- 0.01 |
| NQUAD-SSS | AFTER | 9 | | C | 2000 | | 0.118 | 11.0 | 26.9 | 2.45 |
| NQUAD-SSW | AFTER | 9 | | C | 2000 | | 0.118 | 11.2 | 27.4 | 2.45 |
| NQUAD-VNW | AFTER | 9 | 93 | A | 340 | 200 to 679 | 0.163 +/- 0.012 | 0.4 +/- 0.0 | 1.0 +/- 0.1 | 2.59 +/- 0.13 |
| NQUAD-VSE | AFTER | 9 | 67 | B | 821 | 355 to 2000 | 0.079 +/- 0.006 | 0.8 +/- 0.0 | 1.4 +/- 0.0 | 1.70 +/- 0.06 |
| SCQUAD-SSS | AFTER | 9 | 99 | A | 394 | 371 to 416 | 0.107 +/- 0.001 | 47.6 +/- 0.1 | 90.1 +/- 0.3 | 1.89 +/- 0.01 |
| SCQUAD-SSW | AFTER | 9 | 99 | A | 440 | 413 to 467 | 0.106 +/- 0.001 | 47.7 +/- 0.1 | 90.9 +/- 0.4 | 1.90 +/- 0.01 |
| SCQUAD-VNW | AFTER | 9 | 99 | A | 577 | 505 to 655 | 0.090 +/- 0.001 | 6.3 +/- 0.0 | 11.2 +/- 0.1 | 1.78 +/- 0.01 |
| SCQUAD-VSE | AFTER | 9 | 99 | A | 833 | 709 to 973 | 0.085 +/- 0.001 | 7.1 +/- 0.0 | 12.6 +/- 0.1 | 1.77 +/- 0.02 |
| SQUAD-SSS | AFTER | 9 | 99 | A | 195 | 170 to 226 | 0.156 +/- 0.004 | 9.4 +/- 0.1 | 21.5 +/- 0.2 | 2.27 +/- 0.02 |
| SQUAD-SSW | AFTER | 9 | 99 | A | 205 | 179 to 237 | 0.156 +/- 0.004 | 9.4 +/- 0.1 | 21.6 +/- 0.2 | 2.29 +/- 0.02 |
| SQUAD-VNW | AFTER | 9 | 99 | A | 133 | 127 to 140 | 0.210 +/- 0.002 | 3.2 +/- 0.0 | 9.0 +/- 0.0 | 2.79 +/- 0.01 |
| SQUAD-VSE | AFTER | 9 | 99 | A | 136 | 129 to 142 | 0.212 +/- 0.002 | 3.3 +/- 0.0 | 9.3 +/- 0.0 | 2.84 +/- 0.01 |

**TABLE 4.** Calculated parameters for the reduced 'QUAD'.DAT files analyzed by the program AFTER.

| station | program | #m | prct | lg | duration & range (days) | | power law exponent | initial slip (cm) | final slip (cm) | afterslip ratio |
|---|---|---|---|---|---|---|---|---|---|---|
| NCQUAD-SS | AFTER | 9 | 99 | A | 283 | 267 to 300 | 0.123 +/- 0.001 | 34.3 +/- 0.1 | 68.8 +/- 0.2 | 2.01 +/- 0.01 |
| NQUAD-SS | AFTER | 9 | | A | 2000 | | 0.118 | 11.1 | 27.2 | 2.45 |
| NQUAD-V | AFTER | 9 | 80 | A | 529 | 270 to 1173 | 0.096 +/- 0.006 | 0.6 +/- 0.0 | 1.3 +/- 0.0 | 1.86 +/- 0.05 |
| SCQUAD-SS | AFTER | 9 | 99 | A | 416 | 391 to 441 | 0.106 +/- 0.000 | 47.7 +/- 0.1 | 90.5 +/- 0.2 | 1.89 +/- 0.01 |
| SCQUAD-V | AFTER | 9 | 99 | A | 701 | 605 to 808 | 0.087 +/- 0.001 | 6.7 +/- 0.0 | 11.6 +/- 0.1 | 1.78 +/- 0.01 |
| SQUAD-SS | AFTER | 9 | 99 | A | 200 | 175 to 232 | 0.156 +/- 0.003 | 9.4 +/- 0.1 | 21.5 +/- 0.2 | 2.28 +/- 0.01 |
| SQUAD-V | AFTER | 9 | 99 | A | 134 | 128 to 141 | 0.211 +/- 0.002 | 3.3 +/- 0.0 | 9.2 +/- 0.0 | 2.82 +/- 0.01 |

# TABLE-MELDING PROGRAMS

The program MELD was written to combine any set of tables generated by TABLE and REDUCE. A location file SITES.LOC, which determines the order of the entries in the melded table, is required to run MELD. The SITES.LOC file for the SHFZ is given in Table 5. The format of this file is (1X,A9,3X,F6.2,4X,A3,5X,I3,2X,I3). The site name for the location is listed in the first column (as in Appendix 2). BRUPT1, ERUPT1, etc. are sites of zero slip which designate end points for the fault strands within the SHFZ. The second column is distance in km of the site from 0 km at the northwest end of the fault. The third column is the site number assigned to each location used on the surface displacement map (Plates 1A and 1B in Sharp *et al.*, 1989); generally the site numbers increase from NW to SE. The last two columns of integers are used in plotting programs which also require this file.

An example run of the program MELD follows. The STEM names of all the tables to be combined are required as input, followed by the filename for the site positions (SITES.LOC is the default). The choice to limit the entries in the output file gives the option of tabulating the results of running more than one program at a particular site. Entering N (the default) causes all the parameters from the 'SITE'.OUT files to be tabulated. For example, the parameters calculated by running both AFTER and GATHER on site RS-F are given in Table 6. Entering Y causes the program to select the set of parameters with the higher value of 'prct'. This value represents the probability that the estimate of the inverse duration lies within the range $0.0005 \leq \beta \leq 0.5$. If more than one program obtains the same percentage, MELD then chooses the result with the smallest uncertainty associated with the power-law exponent. The next input required is a stem name for the output table, whose filename then becomes 'STEM'.TBL. Keying the table to the site numbers replaces the site names with the numbers listed in the third column of the SITES.LOC file. The default for this option is N, in which case the site names are used (the first column of the SITES.LOC file). Site names listed in the SITES.LOC file which are not analyzed by any of the power-law programs are written to the screen during the run. The example shown produces the table SHFREAL.TBL which contains the parameters from all the 'SITE'.OUT files created by running the programs AFTER, GATHER, and DIFFER on the displacement data and which is written out as Table 6.

```
$ RUN [BUDDING.SLIP]MELD
type STEM name for tables to be melded: [.AFTER]AFTER
type STEM name for tables to be melded: [.GATHER]GATHER
type STEM name for tables to be melded: [.DIFFER]DIFFER
type STEM name for tables to be melded: [.QUAD]QUAD
type STEM name for tables to be melded: CR IF COMPLETE
type filename for site positions: CR = SITES.LOC
limit entries in output file? CR = N
type stem name for output table: SHFREAL
key table to site numbers? CR = N
station BRUPT1    is not in the tables to be melded
station ERUPT1    is not in the tables to be melded
station BRUPT2    is not in the tables to be melded
station ERUPT2    is not in the tables to be melded
station BRUPT3    is not in the tables to be melded
station EQUAD-SS  is not in the tables to be melded
station EQUAD-V   is not in the tables to be melded
station NSBP      is not in the tables to be melded
station BUCKLEYS  is not in the tables to be melded
station WNRTRD-SS is not in the tables to be melded
station DITCH     is not in the tables to be melded
station ERUPT3    is not in the tables to be melded
FORTRAN STOP
```

Command files may be written to create various tabulations of the data. The first command file shown produces SHFREAL.TBL. The second command file produces SHFRE.TBL, which contains the reduced quadrilateral parameters (*e.g.* NCQUAD-SS) and the preferred power-law solutions (parameters) when more than one program is run on the data (*e.g.* RS-C reduced by GATHER). The NOSLIP.TBL file contains parameter information for those sites along the SHFZ where no right-lateral displacement occurred. The parameters tabulated in the SHFRE.TBL file are plotted using the program discussed the the next section.

```
$ TYP SHFREALMELD.COM
$MELD
[.AFTER]AFTER
[.DIFFER]DIFFER
[.GATHER]GATHER
[.GATHER]EQUAD
[.QUAD]QUAD

SITES.LOC
N
SHFREAL
N
```

```
$ TYP SHFREMELD.COM
$MELD
[.QUAD]QUADR
[.AFTER]AFTER
[.DIFFER]DIFFER
[.GATHER]GATHER
[.GATHER]EQUADR
NOSLIP

SITES.LOC
Y
SHFRE
N
```

**TABLE 5.** SITES.LOC file for the displacement sites along the SHFZ analyzed by one of the power-law programs.

| | | | | |
|---|---|---|---|---|
| BRUPT1 | 0.00 | | | |
| RS-F | 0.10 | 107 | 1 | |
| MA10-CIT | 1.06 | 600 | | |
| NQUAD-SS | 1.68 | 124 | | |
| NQUAD-V | 1.68 | 124 | | |
| RS-D | 2.04 | 127 | 0 | 2 |
| RS-C | 2.43 | 134 | | |
| KK-06 | 3.35 | 145 | | |
| RSG-CIT | 3.68 | 700 | | |
| RS-1 | 5.09 | 151 | | |
| RS-H | 5.83 | 153 | | |
| RS-I | 6.69 | 154 | -1 | |
| NCQUAD-SS | 6.93 | 156 | | |
| RS-J | 7.28 | 157 | | |
| RS-K | 7.53 | 158 | 1 | |
| RS-L | 7.81 | 159 | 2 | |
| RS-M | 8.66 | 164 | | |
| RS-N | 9.09 | 701 | | |
| RS-O | 9.43 | 166 | -1 | |
| SCQUAD-SS | 9.68 | 168 | | |
| SCQUAD-V | 9.68 | 168 | | |
| RS-P | 10.69 | 173 | | |
| RS-Q | 11.50 | 702 | -3 | |
| MR103-CIT | 11.65 | 601 | 4 | -18 |
| RS-R | 11.83 | 183 | 2 | |
| RS-S | 12.31 | 189 | | |
| ERUPT1 | 14.91 | | | |
| BRUPT2 | 11.28 | | | |
| MR-20 | 13.08 | 199 | | |
| RS-U | 13.82 | 217 | | |
| RS-V | 14.21 | 222 | -1 | -1 |
| MR16B-CIT | 14.40 | 602 | | |
| RS-W | 14.84 | 229 | | |
| RS-X | 15.31 | 231 | -1 | |
| RS-Y | 15.46 | 232 | 1 | |
| RSZ-CIT | 15.89 | 603 | -1 | |
| SSC-QUAD | 16.30 | 235 | -3 | |
| RS-ALPHA | 16.58 | 236 | -2 | |
| RS-BETA | 16.76 | 238 | | |
| MR9B-CIT | 16.91 | 604 | 2 | |
| RS-GAMMA | 17.39 | 243 | -2 | 1 |
| MR6B-CIT | 17.52 | 605 | 2 | 2 |
| MR-3 | 17.80 | 703 | | |
| IMLER-CIT | 18.18 | 606 | 4 | -18 |
| JL-29 | 18.77 | 269 | | |
| JL-8 | 19.11 | 270 | -1 | 1 |
| FSSC-QUAD | 19.24 | 271 | 2 | |
| HM5-CIT | 19.68 | 607 | | |
| JL-12 | 20.64 | 275 | | |
| JL-13 | 21.24 | 276 | -2 | |
| JL-14 | 21.41 | 277 | | |
| JL-15 | 21.84 | 280 | | |
| SQUAD-SS | 22.52 | 284 | -1 | |
| SQUAD-V | 22.52 | 284 | | |
| JL-19 | 22.67 | 285 | 2 | |
| JL-24 | 23.05 | 289 | 0 | 2 |
| ERUPT2 | 23.17 | | | |
| BRUPT3 | 21.32 | | | |
| ERDL | 23.17 | 517 | | |
| EQUAD-SS | 23.86 | 519 | | |
| EQUAD-V | 23.86 | 519 | | |
| NSBP | 24.58 | | 1 | |
| BUCKLEYS | 25.76 | 520 | | |
| WNRTRD-V | 26.06 | 521 | | |
| WNRTRD-SS | 26.06 | 521 | 1 | |
| DITCH | 26.94 | 523 | -2 | |

**TABLE 6.** SHFREAL.TBL containing the calculated parameters for the displacement sites along the SHFZ analyzed by one or more of the power-law programs.

| station | program | #m | prct | lg | duration & range (days) | | power law exponent | initial slip (cm) | final slip (cm) | afterslip ratio |
|---|---|---|---|---|---|---|---|---|---|---|
| RS-F | AFTER | 4 | 2 | UC | 2000 | 2000 to 2000 | 0.074 +/- 0.044 | 3.4 +/- 0.5 | 6.0 +/- 0.7 | 1.76 +/- 0.16 |
| RS-F | GATHER | 4 | 2 | C | 2000 | 2000 to 2000 | 0.077 +/- 0.018 | 3.4 +/- 0.2 | 6.1 +/- 0.5 | 1.79 +/- 0.17 |
| MA10-CIT | AFTER | 5 | 27 | C | 2000 | 461 to 2000 | 0.090 +/- 0.024 | 8.9 +/- 0.6 | 17.7 +/- 1.7 | 1.98 +/- 0.19 |
| NQUAD-SSS | AFTER | 9 | | C | | 2000 | 0.118 | 11.0 | 26.9 | 2.45 |
| NQUAD-SSW | AFTER | 9 | | C | | 2000 | 0.118 | 11.2 | 27.4 | 2.45 |
| NQUAD-VNW | AFTER | 9 | 93 | A | 340 | 200 to 679 | 0.163 +/- 0.012 | 0.4 +/- 0.0 | 1.0 +/- 0.1 | 2.59 +/- 0.13 |
| NQUAD-VSE | AFTER | 9 | 67 | B | 821 | 355 to 2000 | 0.079 +/- 0.006 | 0.8 +/- 0.0 | 1.4 +/- 0.0 | 1.70 +/- 0.06 |
| RS-D | DIFFER | 5 | 16 | UC | 2000 | 1009 to 2000 | 0.163 +/- 0.127 | 6.5 +/- 1.5 | 22.5 +/- 1.5 | 3.45 +/- 1.44 |
| RS-C | AFTER | 4 | 99 | UA | 268 | 200 to 400 | 0.150 +/- 0.006 | 11.1 +/- 0.2 | 25.8 +/- 0.7 | 2.31 +/- 0.05 |
| RS-C | GATHER | 4 | 99 | A | 267 | 198 to 322 | 0.150 +/- 0.005 | 11.1 +/- 0.2 | 25.8 +/- 0.5 | 2.32 +/- 0.04 |
| KK-06 | AFTER | 4 | 17 | UC | 2000 | 2 to 2000 | 0.137 +/- 0.229 | 9.8 +/- 1.4 | 27.7 +/- 10.4 | 2.82 +/- 0.84 |
| RSG-CIT | DIFFER | 6 | 98 | A | 394 | 260 to 589 | 0.145 +/- 0.013 | 16.9 +/- 0.6 | 40.2 +/- 1.0 | 2.38 +/- 0.08 |
| RS-1 | AFTER | 5 | 99 | A | 317 | 243 to 433 | 0.128 +/- 0.003 | 26.5 +/- 0.1 | 55.5 +/- 1.0 | 2.09 +/- 0.04 |
| RS-1 | GATHER | 5 | 99 | A | 271 | 227 to 332 | 0.130 +/- 0.005 | 26.5 +/- 0.1 | 55.0 +/- 0.9 | 2.07 +/- 0.03 |
| RS-H | AFTER | 5 | 99 | A | 352 | 258 to 501 | 0.119 +/- 0.007 | 35.1 +/- 0.7 | 70.6 +/- 1.2 | 2.01 +/- 0.03 |
| RS-H | GATHER | 5 | 99 | A | 278 | 207 to 394 | 0.123 +/- 0.012 | 34.8 +/- 1.0 | 69.7 +/- 0.6 | 2.00 +/- 0.07 |
| RS-I | DIFFER | 6 | 99 | A | 93 | 74 to 111 | 0.219 +/- 0.023 | 25.1 +/- 1.4 | 67.7 +/- 0.9 | 2.70 +/- 0.17 |
| NCQUAD-SSS | AFTER | 9 | 99 | A | 284 | 267 to 301 | 0.123 +/- 0.001 | 34.4 +/- 0.1 | 68.9 +/- 0.3 | 2.00 +/- 0.01 |
| NCQUAD-SSW | AFTER | 9 | 99 | A | 282 | 265 to 298 | 0.124 +/- 0.001 | 34.2 +/- 0.1 | 68.7 +/- 0.3 | 2.01 +/- 0.01 |
| RS-J | GATHER | 6 | 99 | A | 504 | 378 to 690 | 0.106 +/- 0.007 | 38.2 +/- 0.8 | 74.1 +/- 1.0 | 1.94 +/- 0.03 |
| RS-K | DIFFER | 8 | 92 | A | 660 | 385 to 1249 | 0.088 +/- 0.008 | 41.3 +/- 0.8 | 73.2 +/- 1.1 | 1.77 +/- 0.03 |
| RS-L | AFTER | 5 | 99 | A | 231 | 147 to 452 | 0.126 +/- 0.013 | 35.0 +/- 1.4 | 69.4 +/- 2.2 | 1.98 +/- 0.07 |
| RS-L | GATHER | 6 | 99 | A | 284 | 217 to 363 | 0.122 +/- 0.010 | 35.3 +/- 1.3 | 70.4 +/- 0.7 | 2.00 +/- 0.06 |
| RS-M | DIFFER | 5 | 94 | UA | 210 | 120 to 371 | 0.150 +/- 0.032 | 35.9 +/- 2.3 | 80.1 +/- 1.9 | 2.23 +/- 0.20 |
| RS-N | DIFFER | 7 | 99 | E | 74 | 59 to 97 | 0.903 +/- 0.140 | 0.6 +/- 0.3 | 31.5 +/- 0.5 | 48.75 +/- 9.99 |
| RS-O | DIFFER | 5 | 98 | UA | 257 | 175 to 372 | 0.146 +/- 0.019 | 37.0 +/- 1.4 | 83.0 +/- 1.2 | 2.24 +/- 0.11 |
| SCQUAD-SSS | AFTER | 9 | 99 | A | 394 | 371 to 416 | 0.107 +/- 0.001 | 47.6 +/- 0.1 | 90.1 +/- 0.3 | 1.89 +/- 0.01 |
| SCQUAD-SSW | AFTER | 9 | 99 | A | 440 | 413 to 467 | 0.106 +/- 0.001 | 47.7 +/- 0.1 | 90.9 +/- 0.4 | 1.90 +/- 0.01 |
| SCQUAD-VNW | AFTER | 9 | 99 | A | 577 | 505 to 655 | 0.090 +/- 0.001 | 6.3 +/- 0.0 | 11.2 +/- 0.1 | 1.78 +/- 0.01 |
| SCQUAD-VSE | AFTER | 9 | 99 | A | 833 | 709 to 973 | 0.085 +/- 0.001 | 7.1 +/- 0.0 | 12.6 +/- 0.1 | 1.77 +/- 0.02 |
| RS-P | DIFFER | 5 | 20 | UC | 2000 | 664 to 2000 | 0.078 +/- 0.048 | 49.0 +/- 4.4 | 88.9 +/- 4.2 | 1.81 +/- 0.27 |
| RS-Q | DIFFER | 6 | 99 | A | 43 | 33 to 51 | 0.260 +/- 0.040 | 36.3 +/- 3.0 | 96.8 +/- 0.9 | 2.67 +/- 0.25 |
| MR103-CIT | AFTER | 8 | 39 | C | 2000 | 196 to 2000 | 0.094 +/- 0.025 | 47.3 +/- 2.5 | 96.4 +/- 12.7 | 2.04 +/- 0.24 |
| RS-R | DIFFER | 4 | 53 | UB | 1491 | 221 to 2000 | 0.093 +/- 0.043 | 39.6 +/- 1.2 | 78.5 +/- 4.8 | 1.98 +/- 0.14 |
| RS-S | DIFFER | 5 | 99 | UA | 200 | 165 to 241 | 0.139 +/- 0.009 | 33.4 +/- 0.6 | 69.9 +/- 1.0 | 2.09 +/- 0.05 |
| MR-20 | AFTER | 3 | 89 | UA | 88 | 44 to 283 | 0.142 +/- 0.014 | 27.0 +/- 0.5 | 51.0 +/- 3.3 | 1.89 +/- 0.12 |

Table 6. continued

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| RS-U | GATHER | 5 | 99 | A | 325 | 256 to 418 | 0.158 +/- 0.011 | 25.5 +/- 0.9 | 63.8 +/- 0.8 | 2.50 +/- 0.08 |
| RS-V | DIFFER | 4 | 72 | UB | 392 | 85 to 2000 | 0.138 +/- 0.154 | 27.9 +/- 4.6 | 63.5 +/- 5.7 | 2.27 +/- 1.24 |
| MR16B-CIT | AFTER | 8 | 70 | B | 583 | 271 to 2000 | 0.127 +/- 0.010 | 31.0 +/- 0.8 | 69.7 +/- 4.0 | 2.25 +/- 0.13 |
| RS-W | DIFFER | 6 | 99 | A | 159 | 133 to 191 | 0.181 +/- 0.012 | 27.3 +/- 0.8 | 68.3 +/- 0.8 | 2.50 +/- 0.08 |
| RS-X | DIFFER | 4 | 51 | UB | 1577 | 219 to 2000 | 0.087 +/- 0.043 | 43.3 +/- 1.1 | 82.1 +/- 5.7 | 1.90 +/- 0.13 |
| RS-Y | DIFFER | 4 | 69 | UB | 740 | 266 to 2000 | 0.116 +/- 0.031 | 37.6 +/- 2.0 | 80.7 +/- 1.8 | 2.15 +/- 0.15 |
| RSZ-CIT | DIFFER | 9 | 99 | A | 519 | 372 to 790 | 0.116 +/- 0.008 | 38.2 +/- 1.0 | 78.7 +/- 1.3 | 2.06 +/- 0.04 |
| SSC-QUAD | GATHER | 6 | 99 | A | 282 | 252 to 309 | 0.131 +/- 0.004 | 41.9 +/- 0.5 | 87.7 +/- 0.4 | 2.09 +/- 0.02 |
| RS-ALPHA | DIFFER | 6 | 99 | A | 458 | 346 to 561 | 0.118 +/- 0.006 | 43.3 +/- 0.5 | 89.4 +/- 0.9 | 2.07 +/- 0.03 |
| RS-BETA | DIFFER | 6 | 99 | A | 237 | 171 to 312 | 0.133 +/- 0.006 | 39.0 +/- 0.4 | 80.8 +/- 2.1 | 2.07 +/- 0.05 |
| MR9B-CIT | AFTER | 9 | 63 | B | 840 | 278 to 2000 | 0.114 +/- 0.012 | 40.4 +/- 1.1 | 87.1 +/- 4.8 | 2.16 +/- 0.10 |
| RS-GAMMA | GATHER | 8 | 99 | A | 290 | 258 to 325 | 0.147 +/- 0.003 | 34.2 +/- 0.3 | 78.5 +/- 0.6 | 2.30 +/- 0.02 |
| MR6B-CIT | AFTER | 7 | 99 | A | 134 | 95 to 188 | 0.153 +/- 0.005 | 36.4 +/- 0.3 | 77.1 +/- 2.1 | 2.12 +/- 0.06 |
| MR-3 | AFTER | 4 | | UE | | 2 | 0.452 | 39.5 | 53.4 | 1.35 |
| IMLER-CIT | AFTER | 12 | 39 | C | 2000 | 1028 to 2000 | 0.162 +/- 0.003 | 29.7 +/- 0.2 | 101.5 +/- 9.1 | 3.42 +/- 0.31 |
| JL-29 | GATHER | 8 | 67 | A | 1424 | 1032 to 1486 | 0.103 +/- 0.002 | 42.2 +/- 1.0 | 89.1 +/- 1.8 | 2.11 +/- 0.04 |
| JL-8 | GATHER | 11 | 99 | A | 435 | 351 to 489 | 0.120 +/- 0.008 | 39.7 +/- 3.1 | 82.2 +/- 3.8 | 2.07 +/- 0.07 |
| FSSC-QUAD | GATHER | 14 | 99 | A | 350 | 335 to 364 | 0.141 +/- 0.001 | 38.2 +/- 0.5 | 87.3 +/- 0.6 | 2.29 +/- 0.01 |
| HM5-CIT | AFTER | 4 | 54 | UB | 167 | 21 to 2000 | 0.136 +/- 0.058 | 34.6 +/- 2.4 | 69.2 +/- 8.4 | 2.00 +/- 0.31 |
| JL-12 | GATHER | 7 | 99 | A | 319 | 279 to 370 | 0.187 +/- 0.009 | 16.3 +/- 0.9 | 48.0 +/- 1.4 | 2.95 +/- 0.10 |
| JL-13 | DIFFER | 4 | 99 | UA | 129 | 82 to 183 | 0.203 +/- 0.040 | 13.4 +/- 1.1 | 35.9 +/- 2.1 | 2.68 +/- 0.33 |
| JL-14 | GATHER | 8 | 99 | A | 456 | 350 to 664 | 0.126 +/- 0.003 | 20.8 +/- 0.5 | 45.1 +/- 1.8 | 2.17 +/- 0.08 |
| JL-15 | DIFFER | 6 | 99 | A | 39 | 30 to 47 | 0.269 +/- 0.011 | 12.5 +/- 0.1 | 33.5 +/- 1.1 | 2.67 +/- 0.10 |
| SQUAD-SSS | AFTER | 9 | 99 | A | 195 | 170 to 226 | 0.156 +/- 0.004 | 9.4 +/- 0.1 | 21.5 +/- 0.2 | 2.27 +/- 0.02 |
| SQUAD-SSW | AFTER | 9 | 99 | A | 205 | 179 to 237 | 0.156 +/- 0.004 | 9.4 +/- 0.1 | 21.6 +/- 0.2 | 2.29 +/- 0.02 |
| SQUAD-VNW | AFTER | 9 | 99 | A | 133 | 127 to 140 | 0.210 +/- 0.002 | 3.2 +/- 0.0 | 9.0 +/- 0.0 | 2.79 +/- 0.01 |
| SQUAD-VSE | AFTER | 9 | 99 | A | 136 | 129 to 142 | 0.212 +/- 0.002 | 3.3 +/- 0.0 | 9.3 +/- 0.0 | 2.84 +/- 0.01 |
| JL-19 | GATHER | 7 | 99 | A | 90 | 68 to 113 | 0.314 +/- 0.037 | 3.2 +/- 0.5 | 13.4 +/- 0.7 | 4.12 +/- 0.44 |
| JL-24 | GATHER | 7 | 62 | B | 127 | 9 to 2000 | 0.133 +/- 0.109 | 1.0 +/- 0.1 | 1.9 +/- 0.2 | 1.91 +/- 0.29 |
| ERDL | AFTER | 3 | 73 | UE | 31 | 2 to 154 | 0.501 +/- 0.551 | 3.8 +/- 2.3 | 21.3 +/- 1.1 | 5.54 +/- 9.82 |
| EQUAD-SSS | GATHER | 6 | 99 | A | 251 | 212 to 283 | 0.208 +/- 0.009 | 10.7 +/- 0.5 | 33.8 +/- 0.6 | 3.16 +/- 0.09 |
| EQUAD-SSW | GATHER | 6 | 99 | A | 251 | 208 to 286 | 0.198 +/- 0.009 | 11.0 +/- 0.5 | 32.9 +/- 0.6 | 2.98 +/- 0.08 |
| EQUAD-VNW | GATHER | 5 | 99 | E | 67 | 53 to 81 | 0.424 +/- 0.079 | 1.2 +/- 0.4 | 7.2 +/- 0.5 | 5.97 +/- 1.77 |
| EQUAD-VSE | GATHER | 5 | 99 | E | 84 | 67 to 100 | 0.412 +/- 0.072 | 1.2 +/- 0.4 | 7.6 +/- 0.6 | 6.20 +/- 1.77 |
| WNRTRD-V | GATHER | 5 | | C | | 2000 | 0.110 | 10.2 | 23.6 | 2.31 |

The letter grade A indicates a well-resolved duration, B indicates a constrained range of duration, C indicates a constrained duration, and E indicates a power law exponent greater than 0.4. The prefix U indicates an undersampled site. The range for the power law duration and the parameter uncertainties can not be calculated for sites with PRCNT = 0

## PARAMETER-PLOTTING PROGRAM

The program SLIPPER is used to plot the parameters contained in tables generated by MELD. These tables contain parameters from any grouping of sites where the entries are limited to the best power-law fit when more than one program was attempted. Running the plotting program SLIPPER, as shown below, is straightforward. The last two columns of integers in the SITES.LOC file are required to run SLIPPER and adjust the position of the displacement site labels. The fourth column adjusts the position of the label horizontally, positive to the right, and the fifth column adjusts the label vertically, positive upward. The default position centers the label horizontally on the data point and positions it six mm vertically above the point.

```
$ RUN [BUDDING.SLIP]SLIPPER
type STEM name for table:  SHFRE

indicate parameter to plot:
  1 = final slip
  2 = initial slip
  3 = initial and final slip
  4 = power law exponent
  5 = power law duration
  6 = afterslip ratio
CR gives initial and final slip

plot using site numbers?  CR = N, plots using site names

type filename for site positions:  CR = sites.loc

finished reading table with 59 entries

[plotting package prompts]
```

Figures 9 through 12 show the results of plot options 3 through 6 run on the file SHFRE.TBL. In options 1 and 2, SLIPPER calculates the average slip over the fault length of the plotted slip parameter; in option 3, SLIPPER calculates the average slip over the fault length based on the area defined by the final slip. These averages are only output to the screen. The average final slip for the SHFZ (see Figure 9) is 54.3 cm. Open symbols in Figures 10 through 12 indicate sites for which the $prct < 0.3$; the parameter uncertainties could not be reliably estimated for these sites. Diamonds indicate estimates obtained from vertical measurements. Sites with a power-law exponent of >0.4 (graded as 'E') are automatically excluded from all plots as they are markedly outside of the average population. The error bars on the plot of afterslip ratio are determined by dividing the afterslip uncertainty by the afterslip ratio. Note that if $y = \ln x$ then

$$\sigma_y^2 = \left(\frac{dy}{dx}\right)^2 \sigma_x^2 = \frac{\sigma_x^2}{x^2} .$$

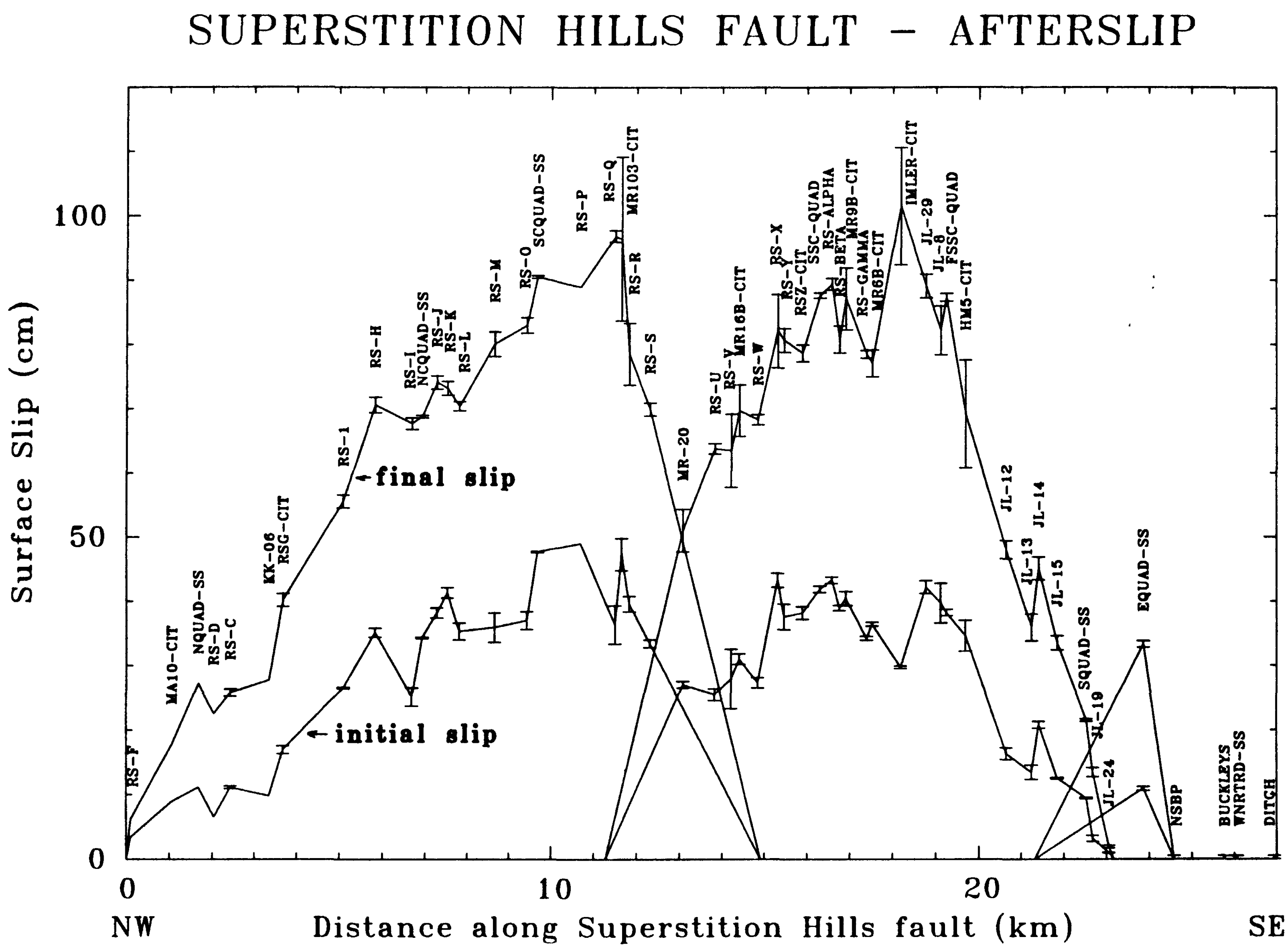


**FIGURE 9.** Initial (slip at one day) and final afterslip values with calculated error bars for the displacement sites along the SHFZ.

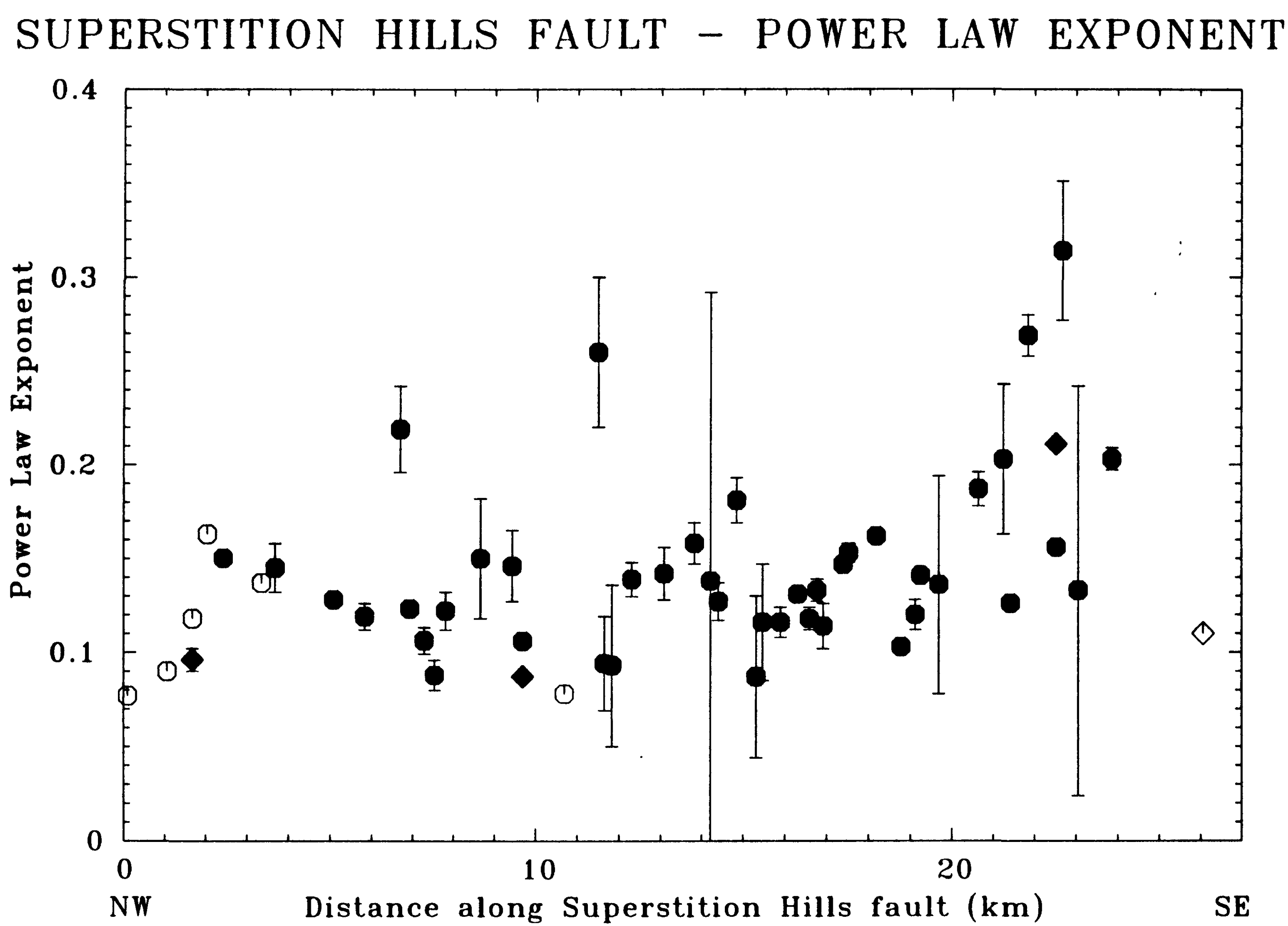


**FIGURE 10.** Power-law exponents with calculated error bars (on over-determined sites) for the displacement sites along the SHFZ. Open symbols indicate even and nearly even-determined sites; closed symbols indicate over-determined sites. Diamonds indicate estimates obtained from vertical measurements.

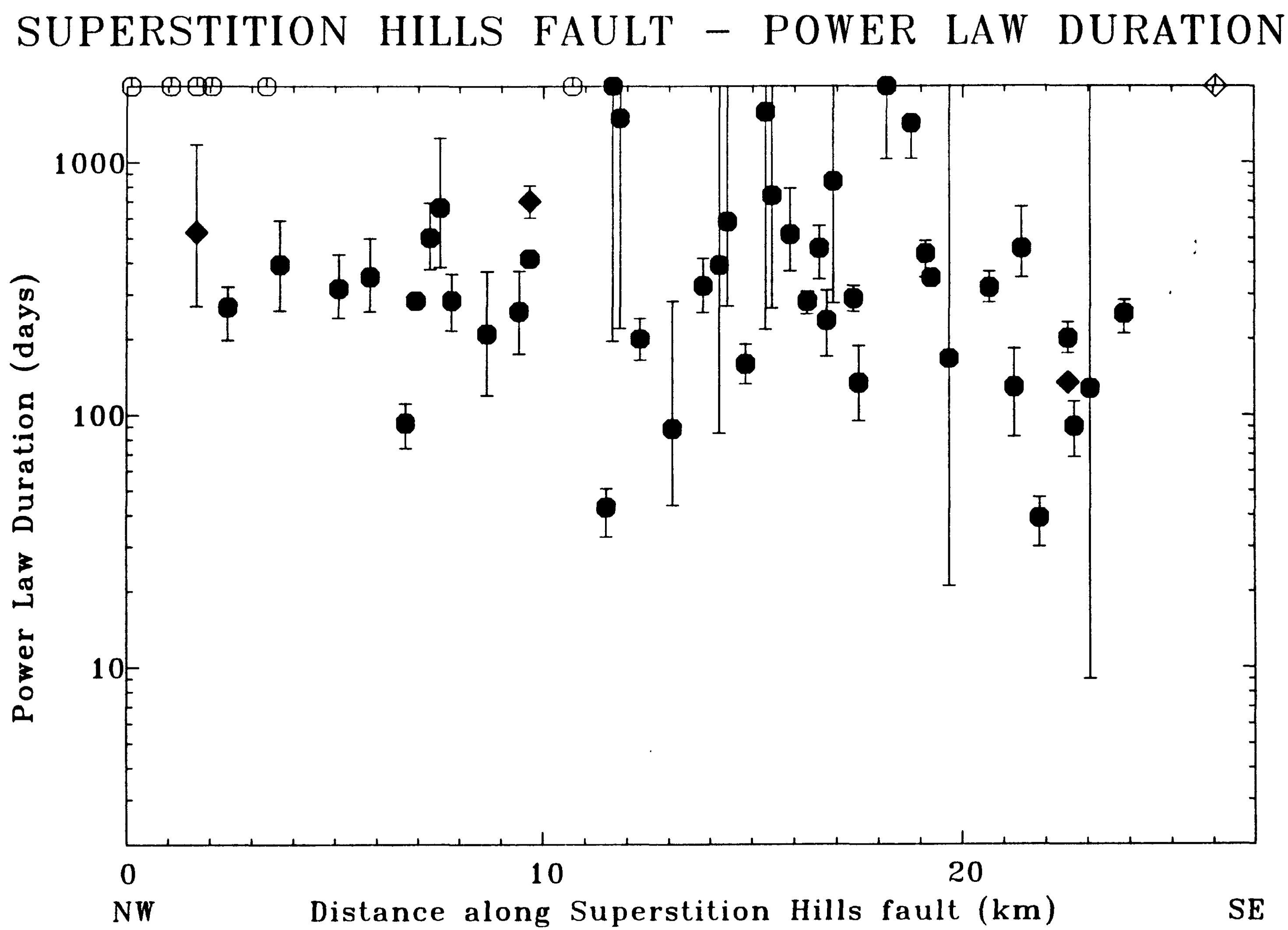


**FIGURE 11.** Power-law durations with calculated error bars (on over-determined sites) for the displacement sites along the SHFZ. Open symbols indicate even and nearly even-determined sites; closed symbols indicate over-determined sites. Diamonds indicate estimates obtained from vertical measurements.

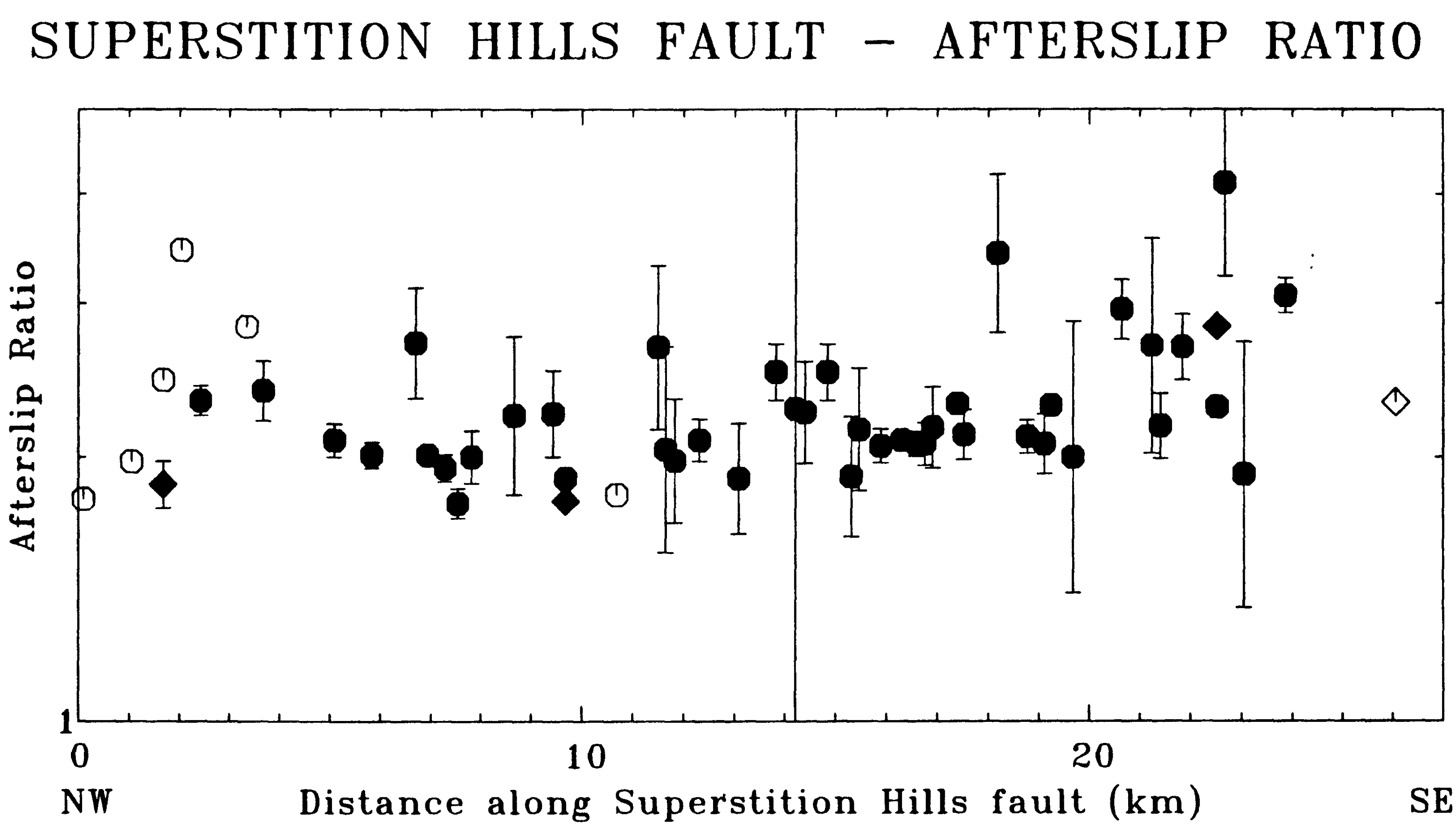


**FIGURE 12.** Afterslip ratio for the displacement sites along the SHFZ. Error bars are determined by dividing the afterslip uncertainty by the afterslip ratio. Open symbols indicate even and nearly even-determined sites; closed symbols indicate over-determined sites. Diamonds indicate estimates obtained from vertical measurements.

## ACKNOWLEDGMENTS

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APPENDIX 1. FORTRAN code for QUAD3D, AFTER, and GATHER programs.

```
c THIS PROGRAM REDUCES HORIZONTAL DIMENSIONS AND ELEVATION DIFFERENCES BETWEEN
C QUAD CORNERS TO CARTESIAN COOORDINATES FOR THE SOUTH, EAST, AND WEST CORNERS
C RELATIVE TO THE NORTH CORNER AND FAULT STRIKE.
C
C XE,YE,XS,YS,XW,YW ARE X AND Y COORDINATE PAIRS FOR THE EAST, SOUTH, AND WEST
C CORNERS, RESPECTIVELY, WITH X AXIS PARALLEL TO FAULT STRIKE (POSITIVE TOWARD
C SE) AND Y AXIS HORIZONTAL AND NORMAL TO FAULT STRIKE (POSITIVE TOWARD NE).

C SSS AND SSW ARE STRIKE SLIP-COMPONENTS FOR S WRT E AND W WRT N.  POSITIVE
C STRIKE SLIP IS RIGHT LATERAL.

C ES AND WE ARE EXTENSIONAL COMPONENTS OF S WRT E AND W WRT N.  POSITIVE
C EXTENSION INDICATES THE TWO POINTS ARE MOVING APART.

C SLS AND SLW ARE SLIP VECTORS OF S WRT E AND W WRT N.

C VSE AND VNW ARE CHANGES IN ELEVATION DIFFERENCES OF S WRT E AND N WRT W.
C POSITIVE VALUES INDICATE S AND W RISING WRT E AND N, RESPECTIVELY.

C HS AND HW ARE HORIZONTAL COMPONENTS OF SLS AND SLW.

C AHS, IN DEGREES W OF N, IS THE AZIMUTH OF SLS.
C AHW, IN DEGREES W OF N, IS THE AZIMUTH OF SLW.

C DIPS AND DIPW ARE DIP SLIP COMPONENTS OF SLS AND SLW.

C DIP<S AND DIP<W ARE DIP ANGLES OF S WRT E AND W WRT N.  THE ANGLE IS POSITIVE
C WHEN EXTENSION IS POSITIVE (S AND W POINTS ARE MOVING AWAY FROM THE N AND E
C POINTS) AND VICE VERSA.

C PLNGS AND PLNGW ARE PLUNGES OF SLS AND SLW.  A NEGATIVE VALUE INDICATES
C PLUNGE TO THE NW AND A POSITIVE VALUE INDICATES PLUNGE TO THE SE FOR A RIGHT-
C LATERAL FAULT STRIKING NW.

C DLSE AND DLNW ARE THE ELEVATION DIFFERENCES OF S WRT E AND N WRT W.

C FE IS HORIZONTAL DISTANCE FROM E TO A LINE PARALLEL TO THE FAULT, PASSING
C THROUGH N, AS MEASURED ALONG THE DIRECTION OF QUAD EDGE SE.

C NE, NW, SW, NS, SE, AND EW ARE HORIZONTAL DISTANCES BETWEEN QUAD CORNERS
C CORRECTED FOR CHANGES IN ELEVATION AND TEMPERATURE

C K1 IS THE RATIO OF THE SLOPE DISTANCE BETWEEN E AND THE FAULT TO THE SLOPE
C DISTANCE BETWEEN E AND S.
C K2 IS THE RATIO OF THE SLOPE DISTANCE BETWEEN N AND THE FAULT TO THE SLOPE
C DISTANCE BETWEEN N AND W.


        REAL*8 XE(30),YE(30),XS(30),YS(30),XW(30),YW(30),DLSE(30),DLNW(3
     10),FE(30),NE(30),NW(30),SW(30),NS(30),SE(30),EW(30),K1,K2,NF
        CHARACTER*10 DA(30),QUAD,FNAME,FOUT
        LOGICAL DOT
        DEG=57.2957795
        TYPE*,'ENTER QUAD NAME'
        READ(5,100)NCHRS,QUAD
100     FORMAT (Q,A)
        FNAME=QUAD
        FOUT=FNAME
        FNAME(NCHRS+1:)='.DAT'
        FOUT(NCHRS+1:)='.OUT'
        OPEN(UNIT=8,FILE=FOUT,STATUS='NEW',RECL=132)
        OPEN(UNIT=7,NAME=FNAME,STATUS='OLD')
        READ (7,1110)ANE,AF,K1,K2
        TYPE *,' WORKING...'
        I=0
20      I=I+1
```

```
      READ(7,1100,END=1200)DA(I)
      READ(7,1120)DLNW(I),DLSE(I),FE(I)
      READ(7,1120)NE(I),NS(I),NW(I),EW(I),SW(I),SE(I)
      GOTO 20
1200  NTOT=I-1
1100  FORMAT(A10)
1110  FORMAT(F4.2,F6.2,2F9.6)
1120  FORMAT(6F9.4)
      CLOSE(7)
      WRITE (8,1310)QUAD,DA(1)
1310  FORMAT(' DATA FROM THE ',A10,'QUAD. MOVEMENT RELATIVE TO:',A10)
      WRITE (8,1370)
1370  FORMAT(/,'   DATE          XE          YE          XS          YS          XW
     1  YW')
      DO 30 I=1,NTOT
      CALL SCALAR(SE(I),NE(I),NS(I),FEN)
      NF=SQRT(FE(I)**2+NE(I)**2-2*FE(I)*NE(I)*COS(FEN))
      ENF=(FE(I)/NF)*SIN(FEN)
      ENF=ATAN2(ENF,SQRT(-ENF*ENF+1))
      XE(I)=(NE(I))*COS(ENF)
      YE(I)=NE(I)*SIN(ENF)
      CALL SCALAR (NF,NS(I),SE(I)-FE(I),SFNS)
      XS(I)=NS(I)*COS(SFNS)
      YS(I)=-NS(I)*SIN(SFNS)
      CALL SCALAR (NE(I),NW(I),EW(I),ENW)
      WNG=180.-DEG*(ENW-ENF)
      WNG=WNG/DEG
      XW(I)=-NW(I)*COS(WNG)
      YW(I)=-NW(I)*SIN(WNG)
      WRITE (8,1300)DA(I),XE(I),YE(I),XS(I),YS(I),XW(I),YW(I)
30    CONTINUE
1300  FORMAT(1X,A10,2X,6(F7.4,2X))
C     ADD HEADERS FOR OUTPUT
C
C
      WRITE(8,1320)
1320  FORMAT(/,'   DATE         SSS       SSW       ES        WE       SLS       SL
     1W       VSE       VNW     HS        HW          AHS        AHW')
      DO 40 I=2,NTOT
      SSS=(XE(I)-XS(I))-(XE(1)-XS(1))
      SSW=-XW(I)+XW(1)
      ES=(YE(I)-YS(I))-(YE(1)-YS(1))
      WE=-YW(I)+YW(1)
      VSE=DLSE(I)-DLSE(1)
      VNW=DLNW(I)-DLNW(1)
      SLS=SQRT(SSS**2+ES**2+VSE**2)
      HS=SQRT(SSS**2+ES**2)
      IF (ES.EQ.0. .AND. SSS.EQ.0.) GO TO 41
      AHS=AF-(ATAN2(ES,SSS))*DEG
      SLW=SQRT(SSW**2+WE**2+VNW**2)
      HW=SQRT(SSW**2+WE**2)
      IF (WE.EQ.0. .AND. SSW.EQ.0.) GO TO 41
      AHW=AF-(ATAN2(WE,SSW))*DEG
      WRITE(8,1360)DA(I),SSS*100,SSW*100,ES*100,WE*100,SLS*100,SLW*10
     10,VSE*100,VNW*100,HS*100,HW*100,AHS,AHW
      GO TO 40
41    WRITE (8,1360)DA(I)
40    CONTINUE
      WRITE (8,1365)
1365  FORMAT(//,'   DATE         DIPS      DIPW    DIP<S
     1 DIP<W   PLNGS    PLNGW')
      DO 50 I=2,NTOT
      SSS=(XE(I)-XS(I))-(XE(1)-XS(1))
      SSW=-XW(I)+XW(1)
      ES=(YE(I)-YS(I))-(YE(1)-YS(1))
      WE=-YW(I)+YW(1)
```

```
        VSE=DLSE(I)-DLSE(1)
        VNW=DLNW(I)-DLNW(1)
        DIPSS=SQRT(ES**2+VSE**2)
        IF (VSE.EQ.0. .AND. ES.EQ.0.) GO TO 51
        DIPPS=DEG*ATAN2(VSE,ES)
        PLUNGES=DEG*ATAN2(VSE,SQRT(SSS**2+ES**2))
        DIPSW=SQRT(WE**2+VNW**2)
        IF (VNW.EQ.0. .AND. WE.EQ.0.) GO TO 51
        DIPPW=DEG*ATAN2(VNW,WE)
        PLUNGEW=DEG*ATAN2(VNW,SQRT(SSW**2+WE**2))
        WRITE (8,1371)DA(I),DIPSS*100,DIPSW*100,DIP
     1PS,DIPPW,PLUNGES,PLUNGEW
        GO TO 50
51      WRITE (8,1371)DA(I)
50     CONTINUE
C
1371    FORMAT(1X,A10,6(F6.1,2X))
C
1360    FORMAT(1X,A10,2X,10(F6.2,2X),F6.1,2X,F6.1)
C1300   FORMAT(A10,6F7.4,10F5.2,2F6.1)
        STOP
        END
c
c
c
        SUBROUTINE SCALAR(X,Y,Z,ANG)
        TEM=(X**2+Y**2-Z**2)/(2*X*Y)
        ANG=ACOS(TEM)
        RETURN
        END
```

```
c
c  program AFTER analyzes a set of measurements of surface slip
c  as a function of time and differential slip after some given time
c  for the parameters of the final slip, UF, at the site,
c  the time coefficient, BETA, and the damping coefficient, C
c  and then uses a Monte Carlo permutation of the data
c  to determine the statistics of the derived parameters
c  edited by Jack Boatwright, 10/88 from the original AFTER
c  which was written 7/88
c
      parameter(izt=100, imc=7)
      parameter(lr=5, lw=6, lin=15, lout=16)
      implicit real*8 (a-h,o-z)
      real*8 t(40),u(40),um(40),us(40),v(40),e(40),o(40)
      real*8 ua(40)
      real*8 d(2),g(2,2),dd(2),h(2,2),dp(2),ddp(2)
      real*8 c(31),aluf(31),b(31),fpr(31),chi2(31)
      real*8 pr(7),pm(7),sr(7),sm(7)
      real*8 stat(100)
      double precision dseed
      logical search,vari
      character anser*1,infile*40
      ttr = 1.E-6
      btr = 1.E-4
      bbgn = 5.0D-4
      bbnd = 5.0D-1
      bu = 0.0D+0
      bl = 1.0D-1
      search = .true.
      dseed = 91827364.5D0
      do 70 in=1,70
70    call ggnqf(dseed)
     write(lw,100)
 100 format('$enter name of input file: ')
     read(lr,200) nchar,infile
 200 format(q,a)
      write(lw,311) infile
311   format(//,18x,' site ',a20,/)
      if (nchar.eq.0) then
      infile = 'slip.dat'
      nchar = 4
      end if
c
c  open INPUT and OUTPUT files
c
      open(lin,file=infile,form='formatted',status='old')
      infile(nchar+1:nchar+4) = '.out'
      open(lout,file=infile,form='formatted',status='new')
      infile(nchar+1:20) = ' '
      write(lout,311) infile
c
c  read in data
c
      do 11 k=1,20
31    read(lin,300,err=400) t(k),ua(k),e(k)
      if (e(k).le.0.) e(k) = 1.0
c
c  all slip measurements are converted
c  to log space data and uncertainties
c
      write(lw,300) t(k),ua(k),e(k)
11    continue
      close(lin)
300   format(6x,f12.4,3(10x,f8.3))
      go to 550
400   k = k - 1
```

```
      if (k.lt.3) write(6,500)
500   format(' not enough measurements!')
550   continue
c
c  Monte Carlo (?) permutation of input data
c
      itt = 0
      rft = 0.
      do 85 ir=1,7
85    sr(ir) = 0.
      do 73 iz=1,izt
c     if (iz.gt.1 .and. iz.lt.10) write(lw,910)
910   format(/,' permutated data',/)
      do 75 i=1,k
      u(i) = ua(i) + e(i)*ggnqf(dseed)
      if (iz.eq.1) u(i) = ua(i)
      v(i) = dlog(u(i))
      o(i) = e(i)/u(i)
c     write(lw,300) t(i),u(i),e(i)
75    continue
1020  format(q,f,f)
c
c  iterate over values of beta
c
      dxl = -1.
      its = 0
12    it = 1
      btp = bbgn
      stp = dlog(2.D+0)
      dlb = (dlog(bbnd)-dlog(bbgn))/2.
c
c  initialize data and matrices
c
21    ch21 = ch2
      im = 0
      do 14 i=1,2
      d(i) = 0.
      do 14 ii=1,2
14    g(i,ii) = 0.
c
c  sum over slip measurements for least squares
c
      do 15 j=1,k
      yb = 1./(btp*t(j))
      alnb = dlog(1.+yb)
      o2 = o(j)**2
      d(1) = d(1) + v(j)/o2
      d(2) = d(2) + alnb*v(j)/o2
      g(1,1) = g(1,1) + 1./o2
      g(1,2) = g(1,2) - alnb/o2
      g(2,2) = g(2,2) - alnb**2/o2
15    continue
c
c  invert the 2x2 matrix
c
      del = g(1,1)*g(2,2)+g(1,2)**2
      if (dabs(del).lt.ttr) then
      write(lw,917)
917   format(' singular matrix!')
      go to 2100
      end if
      h(1,1) = g(2,2)/del
      h(2,2) = g(1,1)/del
      h(1,2) = -g(1,2)/del
      h(2,1) = g(1,2)/del
      aluf(it) = 0.
```

```
      c(it) = 0.
      dluf = 0.
      dc = 0.
      do 9 i=1,2
      aluf(it) = aluf(it) + h(1,i)*d(i)
      c(it) = c(it) + h(2,i)*d(i)
9     continue
      ui = dexp(aluf(it))*btp**c(it)
c
c  calculate the residual error CH2
c
      ch2 = 0.
      do 16 j=1,k
      yb = 1./(btp*t(j))
      alnb = dlog(1.+yb)
      e2 = e(j)**2
      o2 = o(j)**2
      dlum = aluf(it) - c(it)*alnb
      brkt = dlog(u(j)) - dlum
      um(j) = dexp(dlum)
16    ch2 = ch2 + (u(j) - um(j))**2/e2
      uf = dexp(aluf(it))
      its = its + 1
c
c  check for BETA with smallest CH2
c
      if (search) then
      if (its.eq.1) ach = ch2
      if (ch2.le.ach) then
      is = it
      bp = btp
      cp = c(it)
      ulp = aluf(it)
      uip = ui
      asp = bp**-cp
c
c  calculate variance of derived parameters
c
      do 51 i=1,2
51    ddp(i) = 0.
      do 52 j=1,k
      yb = 1./(btp*t(j))
      alnb = dlog(1.+yb)
      dd(1) = 1./o(j)
      dd(2) = alnb/o(j)
      do 54 i=1,2
      dp(i) = 0.
      do 53 l=1,2
53    dp(i) = dp(i) + h(i,l)*dd(l)
54    ddp(i) = ddp(i) + dp(i)**2
52    continue
      dulp = ddp(1)
      dcp = ddp(2)
      dui = dulp*(bp**cp)**2 + dcp*(uip*dlog(btp))**2
      ach = ch2
c     write(lw,903) ach,bp
903   format(' CH2 = ',e13.4,' at ',f8.6)
      if (iz.eq.1) then
      do 19 j=1,k
19    us(j) = um(j)
      end if
      end if
c
c  search for zero crossing in DX2DB as a function of BETA
c  if we get lucky, DX2DB is approximately 0
c
```

```
        if (its.eq.1) ch21 = ch2 + ttr
        if (dabs(stp).lt.ttr) then
c       write(lw,309) its
c       write(lout,309) its
309     format(/,4x,'minimum located after ',i3,' iterations',/)
        if (iz.eq.1) write(lw,905)
905     format(/,2x,'#itr',2x,'initial',2x,'final',7x,'C',
     &          7x,'beta',6x,'duration',8x,'X2',/)
        tdp = 1./btp
        if (jmod(iz,imc).eq.1) write(lw,907) its,ui,uf,c(it),btp,tdp,ch2
c       write(lout,907) its,ui,uf,c(it),btp,tdp,ch2
907     format(i5,1x,2(2x,f6.2),2x,f8.3,4x,f6.4,4x,f8.2,2x,e13.4)
        if (iz.eq.1) write(lw,363)
363     format(/,4x,'sampled Monte Carlo inversions',/)
c
c  iterative search passed the minimum
c
        else if (ch2.gt.ch21) then
39      stp = -stp/2.
        btp = dexp(stp)*btp
c       write(lw,102) uf,c(it),btp,ch2
        go to 21
c
c  iterative search requires another step towards minimum
c
        else if (ch2.lt.ch21) then
c
c  BETA is less than BBGN
c
        if (btp.lt.bbgn) then
        if (jmod(iz,imc).eq.1) write(lw,902) bbgn
902     format(' beta less than ',e13.4)
        if (iz.eq.1) write(lout,911) bp
        btp = bbgn
        tdp = 1./btp
        go to 74
c
c  BETA is greater than BBND
c
        else if (btp.gt.bbnd) then
        if (jmod(iz,imc).eq.1) write(lw,901) bbnd
901     format(' beta greater than ',f7.5)
        if (iz.eq.1) write(lout,911) btp
911     format(/,' beta fixed at ',e13.4)
        btp = bbnd
        tdp = 1./btp
        go to 74
        end if
c
c  take the next step towards the minimum in CH2
c
        btp = dexp(stp)*btp
c       write(lw,102) uf,c(it),btp,ch2
        go to 21
        end if
        end if
c
c  fill out parameter vector
c
74      cp = c(it)
        pr(1) = btp
        pr(2) = 1./btp
        stat(iz) = pr(2)
        pr(3) = cp
        pr(4) = uf
        pr(5) = ui
```

```
      pr(7) = uf/ui
      if (iz.eq.1) then
      do 81 ir=1,7
81    pm(ir) = pr(ir)
      else
      if (btp.gt.bbgn .and. btp.lt.bbnd) then
      itt = itt + 1
      do 83 ir=1,7
83    sr(ir) = sr(ir) + (pm(ir)-pr(ir))**2
      end if
      end if
      if (btp.gt.bu) bu = btp
      if (btp.lt.bl) bl = btp
73    continue
      do 87 ir=1,7
87    sm(ir) = dsqrt(sr(ir)/(float(itt)-1.))
c
c  determine model parameters and their statistics
c  start with BETA
c
      ift = jidnnt(100.*dble(itt)/dble(izt))
      ift = jmin0(ift,99)
      if (ift.gt.0) then
      write(lw,306) pm(1),sm(1),ift
      write(lout,306) pm(1),sm(1),ift
306   format(/,' beta = ',f7.5,' +/- ',f7.5,
     &              '      (range covers ',i2,'% of beta)')
      else
      write(lw,336) pm(1)
      write(lout,336) pm(1)
336   format(/,' beta = ',f7.5)
      end if
      if (ift.gt.0) then
      write(lw,919) bl,bu
      write(lout,919) bl,bu
919   format(/,5x,'Monte Carlo range is ',f7.5,' to ',f7.5)
      end if
c
c  reorder the set of duration measurements
c
      do 91 i=1,iz-1
      do 91 j=i+1,iz
      if (stat(j).lt.stat(i)) then
      stemp = stat(i)
      stat(i) = stat(j)
      stat(j) = stemp
      end if
91    continue
c
c  write out slip duration estimate and range
c
      itl = .15*izt
      itu = .85*izt
      stl = 0.
      stu = 0.
      do 93 j=-2,2
      stl = stl + stat(itl+j)/5.
93    stu = stu + stat(itu+j)/5.
      tl = dmax1(stl,2.D+0)
      tu = dmin1(stu,2.D+3)
      if (ift.gt.0) then
      write(lw,607) pm(2),tl,tu
      write(lout,607) pm(2),tl,tu
607   format(/,' slip duration =',f6.1,' days',
     &        '      (interval',f6.1,' to ',f6.1,' days)')
      else
```

```
        write(lw,670) pm(2)
        write(lout,670) pm(2)
670     format(/,' slip duration =',f6.1,' days')
        end if
c
c  mean and variance for C
c
        write(lw,308) pm(3),sm(3)
        write(lout,308) pm(3),sm(3)
308     format(/,' C = ',f6.4,' +/- ',f6.4)
c
c  mean and variance for UI
c
        write(lw,608) pm(5),sm(5)
        write(lout,608) pm(5),sm(5)
608     format(/,' initial slip = ',f6.2,' +/-',f6.2)
c
c  mean and variance for UF
c  remembering to map back from log space
c
        write(lw,307) pm(4),sm(4)
        write(lout,307) pm(4),sm(4)
307     format(/,' final slip = ',f6.2,' +/-',f6.2)
c
c  mean and variance for the afterslip ratio
c
        write(lw,609) pm(7),sm(7)
        write(lout,609) pm(7),sm(7)
609     format(/,' afterslip ratio =',f5.2,' +/-',f5.2)
c
c  write out model fits
c
        write(lw,109)
        write(lout,109)
109     format(/,6x,'time',7x,'measured slip',
     &          5x,'model slip',6x,'uncertainty',/)
        do 20 j=1,k
        write(lw,303) t(j),ua(j),us(j),e(j)
        write(lout,303) t(j),ua(j),us(j),e(j)
303     format(2x,f8.2,10x,3(f6.2,10x))
20      continue
        write(lout,303)
 2100   close(lout)
      stop
      end
```

```
c
c  program GATHER performs a Monte Carlo permutation
c  of a set of measurements of surface slip
c  as a function of time and differential slip after some given time
c  to evaluate the consequent statistics
c  of the parameters of the final slip, UF, at the site,
c  the unknown slip at the given time, UMS,
c  the time coefficient, BETA, and the damping coefficient, C
c  edited by Jack Boatwright, 10/88, from the original GATHER
c  which has been renamed GAFFER
c
        parameter(izt=100, imc=7)
        parameter(lr=5, lw=6, lin=15, lout=16, lvar=17)
        implicit real*8 (a-h,o-z)
        real*8 t(20),ua(20),u(20),um(20),us(20),v(20),q(20)
        real*8 wa(20),w(20),e(20),f(20),o(20),wm(20),ws(20)
        real*8 d(3),dm(3),g(3,3),dd(3),h(3,3),p(3),dp(3)
        real*8 c(31),aluf(31),b(31),stat(izt)
        real*8 pr(7),pm(7),sr(7),sm(7)
        double precision dseed
        logical search
        character anser*1,infile*40
        ttr = 1.E-6
        btr = 1.E-4
        bbgn = 5.0D-4
        bbnd = 5.0D-1
        bu = 0.0D+0
        bl = 1.0D-1
        dseed = 91827364.5D0
        do 70 in=1,85
70      call ggnqf(dseed)
        search = .true.
      write(lw,100)
  100 format('$enter name of input file: ')
      read(lr,200) nchar,infile
  200 format(q,a)
        write(lw,311) infile
311     format(//,18x,' site ',a20,/)
        if (nchar.eq.0) then
        infile = 'slip.dat'
        nchar = 4
        end if
c
c  open INPUT and OUTPUT files
c
        open(lin,file=infile,form='formatted',status='old')
        infile(nchar+1:nchar+4) = '.out'
        open(lout,file=infile,form='formatted',status='new')
        infile(nchar+1:20) = ' '
        write(lout,311) infile
c
c  read in data
c
        ul = 0.
        do 11 k=1,20
31      read(lin,300,err=400) t(k),ua(k),e(k)
        if (ua(k).lt.ul .and. m.eq.n) then
        m = k - 1
        ums = ua(m)
        n = k
        end if
        ul = ua(k)
c
c  differential slip measurements are transformed to slip measurements
c
        if (k.ge.n .and. m.ne.n) then
```

```
        wa(k) = ua(k)
        ua(k) = ua(m) + wa(k)
        f(k) = e(k)
        e(k) = sqrt(f(k)**2+e(m)**2)
        end if
c
c  log space data and uncertainties for all measurements
c
        write(lw,300) t(k),ua(k),e(k)
        if (k.ge.n .and. n.ne.m) write(lw,301) wa(k),f(k)
11      continue
        close(lin)
300     format(6x,f12.4,4(10x,f8.3))
301     format(18x,3(10x,f8.4))
      goto 550
  400   k = k - 1
        umn = ua(1) - 2.*e(1)
        nlib = k - 1
        if (n.eq.k) nlib = k - 2
        if (nlib.le.0) write(6,500)
  500 format(' not enough measurements!')
  550 continue
c
c  Monte Carlo permutation of input data
c
        itt = 0
        do 85 ir=1,7
85      sr(ir) = 0.
        do 73 iz=1,izt
c       if (iz.gt.1 .and. iz.lt.10) write(lw,910)
910     format(/,' permutated data',/)
        do 75 i=1,k
        if (i.le.m) then
        u(i) = ua(i) + e(i)*ggnqf(dseed)
        if (iz.eq.1) u(i) = ua(i)
        else
        w(i) = wa(i) + f(i)*ggnqf(dseed)
        if (iz.eq.1) w(i) = wa(i)
        q(i) = f(i)/w(i)
        u(i) = w(i) + u(m)
        end if
        v(i) = dlog(u(i))
        o(i) = e(i)/u(i)
75      continue
1020    format(q,f,f)
c
c  iterate over values of beta
c
        dxl = -1.
        its = 0
12      it = 1
        btp = bbgn
        stp = dlog(2.D+0)
23      dlb = (dlog(bbnd)-dlog(bbgn))
        il = 0
        umb = ums
c
c  initialize data and matrices
c
21      continue
        im = 0
        do 14 i=1,3
        dm(i) = 0.
        do 14 ii=1,3
14      g(i,ii) = 0.
c
```

```
c  sum over slip measurements for least squares
c
       do 15 j=1,k
       yb = 1./(btp*t(j))
       alnb = dlog(1.+yb)
       o2 = o(j)**2
       dm(1) = dm(1) + v(j)/o2
       dm(2) = dm(2) + alnb*v(j)/o2
       g(1,1) = g(1,1) + 1./o2
       g(1,2) = g(1,2) - alnb/o2
       g(2,2) = g(2,2) - alnb**2/o2
15     continue
c
c  sum over differential slip measurements for least squares
c
       do 25 j=n,k
       yb = 1./(btp*t(j))
       alnb = dlog(1.+yb)
       q2 = q(j)**2
       g(1,3) = g(1,3) - 1./q2
       g(2,2) = g(2,2) - alnb**2/q2
       g(2,3) = g(2,3) - alnb/q2
25     continue
       g(1,1) = g(1,1) - g(1,3)
       g(1,2) = g(1,2) + g(2,3)
       g(2,1) = -g(1,2)
24     continue
c
c  initialize the iterated part of the matrix, data and uncertainty vector
c
       do 28 i=1,3
       g(3,i) = 0.
28     d(i) = dm(i)
       do 26 j=n,k
       yb = 1./(btp*t(j))
       alnb = dlog(1.+yb)
       q2 = q(j)**2
       gama = umb/(w(j)+umb)
       g(3,1) = g(3,1) + gama/q2
       g(3,2) = g(3,2) - gama*alnb/q2
       alga = -dlog(gama)
       d(1) = d(1) + alga/q2
       d(2) = d(2) + alga*alnb/q2
       d(3) = d(3) + gama*alga/q2
26     continue
       g(3,3) = -g(3,1)
c
c  invert the 3x3 matrix
c
       call cmain(3,g,h)
       do 27 i=1,3
       p(i) = 0.
       dp(i) = 0.
       do 27 l=1,3
       p(i) = p(i) + d(l)*h(i,l)
27     continue
       im = im + 1
c
c  missing slip estimate must be greater than last slip measurement
c  if the change of the estimate is less than the differential uncertainty
c  accept the new estimate
c
       uf = dexp(p(1))
       umc = .8*dexp(p(3))+.2*umb
       umc = dmax1(umn,umc)
c      write(lw,907) uf,umc,p(2),btp
```

```
      if (dabs(umb-umc).gt.e(n)/100.) then
      umb = umc
      go to 24
      else
      umb = umc
      end if
c     write(lw,204) ums,umb,im,btp
204   format(' iterated from ',f6.2,' to ',f6.2,
   &         ' in ',i2,' steps at beta = ',f7.5)
c
c  assign parameters
c
      aluf(it) = p(1)
      c(it) = p(2)
      ui = dexp(p(1))*btp**p(2)
c
c  calculate the residual error CH2
c
      ch21 = ch2
      ch2 = 0.
      do 16 j=1,k
      yb = 1./(btp*t(j))
      alnb = dlog(1.+yb)
      e2 = e(j)**2
      f2 = f(j)**2
      dlum = aluf(it) - c(it)*alnb
      um(j) = dexp(dlum)
      ch2 = ch2 + (u(j) - um(j))**2/e2
      if (j.le.m) then
      daln = aluf(it) - c(it)*alnb
      else if (j.ge.n) then
      wm(j) = dexp(dlum) - dexp(daln)
      ch2 = ch2 + (w(j) - wm(j))**2/f2
      end if
16    continue
      uf = dexp(aluf(it))
      its = its + 1
c
c  check for BETA with smallest CH2
c
      if (search) then
      if (its.eq.1) ach = ch2
      if (ch2.le.ach) then
      is = it
      bp = btp
      cp = c(it)
      ulp = aluf(it)
      uip = ui
      uma = umb
      asp = bp**-cp
      ach = ch2
c     write(lw,903) ach,bp
903   format(' CH2 = ',e13.4,' at ',f8.6)
      if (iz.eq.1) then
      do 19 j=1,k
      if (k.ge.n) ws(j) = wm(j)
19    us(j) = um(j)
      end if
      end if
c
c  search for minimum in CH2
c
c     write(lw,907) uf,uma,c(it),btp,ch2
      if (its.eq.1) ch21 = ch2 + ttr
      if (dabs(stp).lt.ttr) then
c     write(lw,309) its
```

```
c       write(lout,309) its
309     format(/,4x,'minimum located after ',i3,' iterations',/)
        if (iz.eq.1) write(lw,905)
905     format(/,2x,'#itr',2x,'initial',2x,'final',2x,'missing',6x,'C',
     &          7x,'beta',6x,'duration',8x,'X2',/)
        tdp = 1./btp
        if (jmod(iz,imc).eq.1) write(lw,907) its,ui,uf,umb,c(it),btp,tdp,ch2
c       write(lout,907) its,ui,uf,umb,c(it),btp,tdp,ch2
907     format(i5,1x,3(2x,f6.2),2x,f8.3,4x,f6.4,4x,f8.2,2x,e13.4)
        if (iz.eq.1) write(lw,363)
363     format(/,4x,'sampled Monte Carlo inversions',/)
c
c  iterative search passed the minimum
c
        else if (ch2.gt.ch21) then
39      stp = -stp/2.
        btp = dexp(stp)*btp
c       write(lw,102) uf,c(it),btp,ch2
        go to 21
c
c  iterative search requires another step towards minimum
c
        else if (ch2.lt.ch21) then
c
c  BETA is less than BBGN
c
        if (btp.lt.bbgn) then
        if (jmod(iz,imc).eq.1) write(lw,902) bbgn
902     format(' beta less than ',e13.4)
        if (iz.eq.1) write(lout,911) bp
        btp = bbgn
        go to 74
c
c  BETA is greater than BBND
c
        else if (btp.gt.bbnd) then
        if (jmod(iz,imc).eq.1) write(lw,901) bbnd
901     format(' beta greater than ',f7.5)
        if (iz.eq.1) write(lout,911) btp
911     format(/,' beta fixed at ',e13.4)
        btp = bbnd
        go to 74
        end if
c
c  take the next step towards the minimum in CH2
c
        btp = dexp(stp)*btp
c       write(lw,102) uf,c(it),btp,ch2
        go to 21
        end if
        end if
c
c  fill out parameter vector
c
74      cp = c(it)
        pr(1) = btp
        pr(2) = 1./btp
        stat(iz) = pr(2)
        pr(3) = cp
        pr(4) = uf
        pr(5) = ui
        pr(6) = umb
        pr(7) = uf/ui
        if (iz.eq.1) then
        do 81 ir=1,7
81      pm(ir) = pr(ir)
```

```
      else
      if (btp.gt.bbgn .and. btp.lt.bbnd) then
      itt = itt + 1
      do 83 ir=1,7
83    sr(ir) = sr(ir) + (pm(ir)-pr(ir))**2
      end if
      end if
      if (btp.gt.bu) bu = btp
      if (btp.lt.bl) bl = btp
73    continue
      do 87 ir=1,7
87    sm(ir) = dsqrt(sr(ir)/(itt-1.))
c
c  determine model parameters and their statistics
c  start with BETA
c
      ift = jidnnt(100.*dble(itt)/dble(izt))
      ift = jmin0(ift,99)
      if (ift.gt.0) then
      write(lw,306) pm(1),sm(1),ift
      write(lout,306) pm(1),sm(1),ift
306   format(/,' beta = ',f7.5,' +/- ',f7.5,
     &               '      (range covers ',i2,'% of beta)')
      else
      write(lw,336) pm(1)
      write(lout,336) pm(1)
336   format(/,' beta = ',f7.5)
      end if
      if (ift.gt.0) then
      write(lw,919) bl,bu
      write(lout,919) bl,bu
      end if
919   format(/,5x,'Monte Carlo range is ',f7.5,' to ',f7.5)
c
c  reorder the set of duration measurements
c
      do 91 i=1,iz-1
      do 91 j=i+1,iz
      if (stat(j).lt.stat(i)) then
      stemp = stat(i)
      stat(i) = stat(j)
      stat(j) = stemp
      end if
91    continue
c
c  write out slip duration estimate and range
c
      itl = .15*izt
      itu = .85*izt
      stl = 0.
      stu = 0.
      do 93 j=-2,2
      stl = stl + stat(itl+j)/5.
93    stu = stu + stat(itu+j)/5.
      tl = dmax1(stl,2.D+0)
      tu = dmin1(stu,2.D+3)
      if (ift.gt.0) then
      write(lw,607) pm(2),tl,tu
      write(lout,607) pm(2),tl,tu
607   format(/,' slip duration =',f6.1,' days',
     &          '       (interval',f6.1,' to ',f6.1,' days)')
      else
      write(lw,670) pm(2)
      write(lout,670) pm(2)
670   format(/,' slip duration =',f6.1,' days')
      end if
```

```
c
c  mean and variance for C
c
        write(lw,308) pm(3),sm(3)
        write(lout,308) pm(3),sm(3)
308     format(/,' C = ',f6.4,' +/- ',f6.4)
c
c  mean and variance for UI
c
        write(lw,608) pm(5),sm(5)
        write(lout,608) pm(5),sm(5)
608     format(/,' initial slip = ',f6.2,' +/-',f6.2)
c
c  mean and variance for UF
c
        write(lw,307) pm(4),sm(4)
        write(lout,307) pm(4),sm(4)
307     format(/,' final slip = ',f6.2,' +/-',f6.2)
c
c  mean and variance for the afterslip ratio
c
        write(lw,609) pm(7),sm(7)
        write(lout,609) pm(7),sm(7)
609     format(/,' afterslip ratio =',f5.2,' +/-',f5.2)
c
c  mean and variance for the missing slip
c
c       write(lw,319) pm(6),sm(6),t(n-1)
        write(lout,319) pm(6),sm(6),t(n-1)
319     format(/,' missing slip = ',f6.2,' +/-',f6.2,
     &          '  at ',f5.1,' days')
c
c  write out model fits
c
        write(lw,109)
        write(lout,109)
109     format(/,5x,'time',8x,'measured slip',
     &          5x,'model slip',6x,'uncertainty',/)
        do 20 j=1,m
        write(lw,303) t(j),ua(j),us(j),e(j)
        write(lout,303) t(j),ua(j),us(j),e(j)
303     format(1x,f9.2,10x,3(f6.2,10x))
20      continue
        write(lw,119)
        write(lout,119)
119     format(/,5x,'time',7x,'cumulative slip',
     &          4x,'model slip',6x,'uncertainty',/)
        do 40 j=n,k
        write(lw,303) t(j),ua(j),us(j),e(j)
        write(lout,303) t(j),ua(j),us(j),e(j)
40      continue
        write(lw,129)
        write(lout,129)
129     format(/,5x,'time',6x,'differential slip',
     &          3x,'model diff',6x,'uncertainty',/)
        e(n) = e(n+1)
        do 42 j=n,k
        write(lw,303) t(j),wa(j),ws(j),f(j)
        write(lout,303) t(j),wa(j),ws(j),f(j)
42      continue
        write(lout,303)
2100    close(lout)
      stop
      end
```

## Appendix 2. Displacement measurements made along the Superstition Hills fault zone and nearby faults.

Alphanumeric sites, e.*g*. KS16a and KS16b, are two separate measured features located at one site. Field numbers followed by CIT (e.*g*. MA10-CIT) are sites measured by both USGS and California Institute of Technology personnel. Site HM5-CIT was measured by Cal Tech only. R listed under field number indicates a repeat measurement at a previously occupied site; D listed under field number indicates a differential slip measurement at a previously occupied site. A strike-slip component of 0.0 cm preceeding a differential slip measurement represents the date and time the nails were emplaced. Abbreviations under the sense of slip column include: RL - right-lateral, LL - left-lateral, EXT - extension, NO - normal, LRV - left-reverse, etc. The uncertainty associated with the measured slip length and calculated strike slip and dip slip components is +/- 1 mm, with the following exceptions: " indicates an uncertainty of +/- 0.2 cm, * indicates an uncertainty of +/- 0.5 cm, and # indicates an unceraint of $\geqq$ +/- 1 cm. Measurements of the plunge of the slip vector reported as ~ 0 are estimated to be zero, whereas 0 indicates measured zero degrees. If the plunge is $<5°$ the dip is not determined. Where the sense of displacement is normal, the dip is not entered if it is $<60°$.

Appendix 2. continued

| Field No. | Date | Time | Sense of Slip | Slip (cm) | Slip Azimuth (deg) | Slip Plunge (deg) | Fault Azimuth (deg) | Strike Slip Component (cm) | Dip Slip Component (cm) | Dip (deg) | Extension |
|---|---|---|---|---|---|---|---|---|---|---|---|
| MR-78 | 12/1/87 | 12:38 | RNO | 2.4 | 110 | 71 | 170 | 0.4 | 2.4 | 73 | |
| MR-76 | 12/1/87 | 11:30 | LL | 0.4 | 178 | 0 | 173 | 0.4 | --- | --- | |
| MR-73 | 12/1/87 | 10:23 | LL | 1.5 | 6 | 23 | 168 | 1.3 | 0.7 | 54 | |
| MR-75 | 12/1/87 | 11:06 | RL | 1.7 | 134 | 13 | 136 | 1.7 | 0.4 | 81 | |
| R | 12/18/87 | | | 2.8 | | | | 2.8 | 0.6 | 81 | |
| RVS-205 | 11/28/87 | | RL | 1.3 | 132 | 9 | 132 | 1.3 | 0.2 | --- | |
| MR-74 | 12/1/87 | 10:42 | RL | 1.1 | 141 | 15 | 141 | 1.1 | 0.3 | --- | |
| RVS-204 | 11/28/87 | | RL | 2.2 | 294 | 0 | 294 | 2.2 | --- | --- | |
| RVS-203 | 11/28/87 | | RL | 4.0 | 286 | 7 | 296 | 3.9 | 0.8 | 35 | |
| RS-F | 12/18/87 | 10:00 | RL | 4.4 | 116 | 1 | 111 | 4.4 | 0.4 | --- | |
| R | 2/27/88 | 12:00 | | 4.7 | | | | 4.7 | 0.4 | --- | |
| D | 4/27/88 | 9:55 | | | | | | 0.3 " | | | |
| D | 10/26/88 | 12:35 | | | | | | 0.7 " | | | |
| RVS-202 | 11/28/87 | | RL | 1.6 | 292 | 0 | 292 | 1.6 | --- | --- | |
| RVS-604 | 12/18/87 | | RL | 5.4 | 106 | 2 | 111 | 5.4 | 0.5 | --- | |
| RVS-602 | 12/18/87 | | RL | 3.3 | 285 | 7 | 286 | 3.3 | 0.4 | 82 | |
| RVS-603 | 12/18/87 | | RL | 1.4 | 93 | 1 | 106 | 1.4 | 0.3 | --- | |
| MR-132 | 12/7/87 | 13:49 | RL | 4.6 | 100 | 38 | 134 | 3.0 | 3.5 | 54 | |
| RVS-601 | 12/18/87 | | RL | 5.7 | 283 | 4 | 291 | 5.6 | 0.9 | --- | |
| RVS-201 | 11/28/87 | | RL | 7.3 | 282 | 0 | 281 | 7.3 | --- | --- | |
| RVS-608 | 12/18/87 | | RL | 7.8 | 280 | 10 | 291 | 7.5 | 2.0 | 43 | |
| MR-127 | 12/7/87 | 12:28 | RL | 1.3 | 153 | 45 | 1 | 0.8 | 1.0 | 65 | |
| MA10-CIT | 11/27/87 | 14:00 | RL | | | | | 10.3 * | | | |
| R | 12/6/87 | 13:10 | | | | | | 11.1 " | | | |
| R | 12/18/87 | 16:30 | | | | | | 11.3 | | | |
| R | 1/26/88 | 14:52 | | | | | | 13.1 " | | | |
| R | 10/26/88 | 12:00 | | | | | | 15 " | | | |
| RVS-2 | 11/25/87 | 10:30 | RL | 8.2 | 116 | 24 | 112 | 7.5 | 3.4 | 81 | |
| RVS-200 | 11/28/87 | 10:15 | RL | 15.0 | 293 | 25 | 293 | 13.6 | 6.3 | --- | |
| MR-126 | 12/7/87 | 11:31 | RL | 0.5 | 333 | 11 | 188 | 0.4 | 0.3 | 19 | |
| RVS-3 | 11/25/87 | 11:45 | RL | 11.7 | 283 | 14 | 288 | 11.3 | 3.0 | 71 | |
| MR-96 | 12/4/87 | 14:46 | RL | 1.2 | 147 | 24 | 148 | 1.1 | 0.5 | 88 | |
| MR-97 | 12/4/87 | 15:01 | RL | 5.8 | 151 | 39 | 174 | 4.1 | 4.1 | 64 | |
| MR-125 | 12/7/87 | 10:29 | RL | 0.4 | 354 | 0 | 344 | 0.4 | --- | --- | |
| N Quad | 11/25/87 | 10:45 | RL | 11.6 | 285 | 4 | 284 | 11.6 | 0.8 | --- | |
| R | 11/28/87 | 9:15 | | 13.0 | | | | 13.0 | 0.9 | --- | |
| R | 12/6/87 | 9:35 | | 14.4 | | | | 14.4 | 1.0 | --- | |

Appendix 2. continued

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| R | 12/12/87 | 9:40 | | 15.5 | | | | 15.5 | 1.1 | --- |
| R | 12/21/87 | 11:50 | | 16.2 | | | | 16.2 | 1.2 | --- |
| R | 1/13/88 | 9:25 | | 17.4 | | | | 17.4 | 1.3 | --- |
| R | 2/24/88 | 10:15 | | 18.4 | | | | 18.4 | 1.3 | --- |
| R | 4/29/88 | 11:51 | | 20.0 | | | | 19.9 | 1.4 | --- |
| R | 10/26/88 | 10:14 | | 21.6 | | | | 21.6 | 1.2 | --- |
| MR-98 | 12/4/87 | 15:07 | RL | 3.9 | 157 | 29 | 164 | 3.4 | 1.9 | 78 |
| MR-99 | 12/4/87 | 13:25 | NO | 30.0 | 80 | 44 | 170 | 0.0 | 30.0 | --- |
| RS-D | 11/28/87 | 9:15 | RL | 8.9 + | 291 | 4 | 282 | 8.8 + | 1.5 + | --- |
| R | 12/10/87 | 12:40 | | 9.7 + | | | | 9.6 + | 1.7 + | --- |
| | 2/27/88 | 9:45 | | | | | | 0.0 | | |
| D | 4/27/88 | 12:08 | | | | | | 2.1 " | | |
| D | 10/26/88 | 10:25 | | | | | | 3.6 " | | |
| MR100 | 12/4/87 | 15:57 | RL | 2.1 | 140 | 11 | 140 | 2.1 | 0.4 | --- |
| KK-02 | 11/28/87 | | RL | 11.5 | 300 | 1 | 286 | 11.2 | 2.8 | --- |
| R | 12/10/87 | | | 12.8 | | | | 12.4 | 3.1 | --- |
| MR-135 | 12/8/87 | 10:27 | RL | 2.8 | 141 | 2 | 146 | 2.8 | 0.3 | --- |
| MR-134 | 12/8/87 | 10:23 | RL | 1.8 | 146 | 0 | 153 | 1.8 | --- | --- |
| KK-14 | 11/30/87 | | RL | 15.0 | 288 | 12 | 294 | 14.6 | 3.5 | 64 |
| R | 12/10/87 | | | 16.7 | | | | 16.2 | 3.9 | 64 |
| MR-133 | 12/8/87 | 9:48 | RL | 2.2 | 148 | 0 | 164 | 2.1 | --- | --- |
| RS-C | 11/28/87 | 11:00 | RL | 14.2 | 272 | 1 | 285 | 13.8 | 3.2 | --- |
| R | 2/26/88 | 16:45 | | 21.7 | | | | 21.1 | 4.9 | --- |
| D | 4/27/88 | 11:50 | | | | | | 0.6 " | | |
| D | 10/26/88 | 11:30 | | | | | | 2.6 " | | |
| MR-138 | 12/8/87 | 12:36 | RL | 3.0 | 326 | 20 | 320 | 2.8 | 1.1 | 74 |
| MR-139 | 12/8/87 | 12:50 | LRV | 5.6 | 75 | 27 | 101 | 4.5 | 3.4 | 49 |
| MR-91 | 12/4/87 | 10:30 | RL | 1.4 | 120 | 36 | 115 | 1.1 | 0.8 | 83 |
| MR-90 | 12/4/87 | 10:17 | RL | 4.7 | 138 | 7 | 133 | 4.6 | 0.7 | 55 |
| KK-04 | 11/28/87 | | RL | 17.0 * | 263 | 3 | 285 | 15.5 * | 6.5 * | --- |
| MR-89 | 12/4/87 | 9:55 | RL | 3.2 | 325 | 4 | 325 | 3.2 | 0.2 | --- |
| KK-05 | 11/28/87 | | RL | 21.0 * | 286 | 0 | 286 | 21.0 * | --- | --- |
| MR-88 | 12/4/87 | 9:44 | RL | 2.6 | 328 | 11 | 330 | 2.6 | 0.5 | 80 |
| MR-85 | 12/2/87 | 15:22 | RL | 2.6 | 330 | 21 | 334 | 2.4 | 0.9 | 80 |
| MR-87 | 12/4/87 | 9:15 | RL | 2.5 | 323 | 7 | 325 | 2.5 | 0.3 | 74 |
| KK-06 | 11/28/87 | 13:15 | RL | 12.0 * | 299 | 2 | 298 | 12.0 * | 0.5 * | --- |
| R | 12/4/87 | 9:12 | | 13.5 * | | | | 13.5 * | 0.5 * | --- |
| R | 12/10/87 | 11:45 | | 14.0 * | | | | 14.0 * | 1.5 * | --- |
| R | 12/14/87 | 16:30 | | 15.0 * | | | | 15.0 * | 0.5 * | --- |
| KK-15 | 11/30/87 | | RL | 36.0 * | 291 | 0 | 290 | 36.0 * | --- | --- |
| R | 12/10/87 | | | 40.0 * | | | | 40.0 * | --- | --- |
| RSG-CIT | 12/6/87 | 10:55 | RL | | | | | 24.0 " | | |

Appendix 2. continued

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|---|---|---|---|---|---|---|---|---|---|---|
| R | 12/18/87 | 14:30 | | | | | | 27.5 * | | |
| R | 1/25/88 | 17:00 | | | | | | 30.0 " | | |
| | 2/27/88 | 12:45 | | | | | | 0.0 | | |
| D | 4/27/88 | 13:15 | | | | | | 1.7 " | | |
| D | 10/26/88 | 14:05 | | | | | | 4.3 " | | |
| KK-07 | 11/28/87 | 13:45 | RL | 19.0 | 55 | 15 | 117 | 8.6 | 16.9 | 17 |
| KK-08 | 11/28/87 | 14:45 | RL | 34.5 | 117 | 9 | 129 | 33.3 | 8.9 | 37 |
| R | 12/10/87 | 11:15 | | 39.7 | | | | 38.4 | 10.2 | 37 |
| R | 12/14/87 | 15:00 | | 41.6 | | | | 40.2 | 10.7 | 37 |
| R | 12/18/87 | 14:00 | | 42.1 | | | | 40.7 | 10.9 | 37 |
| MR-82 | 12/2/87 | 15:19 | RL | 1.5 | 149 | 11 | 144 | 1.5 | 0.3 | 66 |
| KK-11 | 11/29/87 | | RL | 24.0 * | 114 | 8 | 139 | 21.5 * | 10.5 * | 18 |
| R | 12/10/87 | | | 26.0 * | | | | 23.5 * | 11.5 * | 18 |
| RS-1 | 11/24/87 | 16:28 | RL | 24.0 | 315 | ~0 | 315 | 24.0 | --- | --- |
| R | 11/25/87 | 9:30 | | 27.1 | | | | 27.1 | --- | --- |
| R | 2/24/88 | 9:00 | | 46 # | | | | 46 # | --- | --- |
| D | 4/27/88 | 13:58 | | | | | | 2.1 " | | |
| D | 10/26/88 | 14:35 | | | | | | 5.0 " | | |
| KK-12 | 11/29/87 | | RL | 42.0 * | 310 | 0 | 310 | 42.0 * | --- | --- |
| R | 12/10/87 | | | 47.5 * | | | | 47.5 * | --- | --- |
| RS-H | 11/29/87 | 15:15 | RL | 44.0 * | 130 | 11 | 130 | 43.0 * | 8.5 * | --- |
| R | 12/10/87 | 10:00 | | 49.5 * | | | | 48.5 * | 9.5 * | --- |
| R | 2/27/88 | 14:00 | | 60 # | | | | 59 # | 11 # | --- |
| D | 4/27/88 | 14:15 | | | | | | 2.3 " | | |
| D | 10/26/88 | 15:00 | | | | | | 5.9 " | | |
| RS-I | 11/29/87 | 16:37 | RL | 37 # | 133 | 5 | 129 | 37 # | 4 # | 51 |
| R | 12/8/87 | 15:40 | | 42 # | | | | 42 # | 5 # | 51 |
| R | 2/16/87 | 11:42 | | 58 # | | | | 58 # | 7 # | 51 |
| | 2/27/88 | 14:40 | | | | | | 0.0 | | |
| D | 4/27/88 | 14:45 | | | | | | 2.3 " | | |
| D | 10/26/88 | 15:10 | | | | | | 6.0 " | | |
| MR-53 | 11/29/87 | 16:25 | RL | 35.5 * | 131 | 2 | 131 | 35.5 * | 1.0 * | --- |
| NC Quad | 11/25/87 | 12:20 | RL | 35.5 | 311 | 1 | 311 | 35.5 | --- | --- |
| R | 11/29/87 | 11:30 | | 42.0 | | | | 42.0 | --- | --- |
| R | 12/6/87 | 11:20 | | 46.5 | | | | 46.5 | --- | --- |
| R | 12/12/87 | 11:05 | | 49.2 | | | | 49.2 | --- | --- |
| R | 12/21/87 | 10:45 | | 51.3 | | | | 51.3 | --- | --- |
| R | 1/13/88 | 10:20 | | 54.4 | | | | 54.4 | --- | --- |
| R | 2/24/88 | 13:00 | | 57.8 | | | | 57.8 | --- | --- |
| R | 4/29/88 | 10:56 | | 60.4 | | | | 60.4 | --- | --- |
| R | 10/26/88 | 15:50 | | 64.1 | | | | 64.1 | --- | --- |
| RS-J | 11/29/87 | 16:01 | RL | 45.5 * | 312 | 3 | 310 | 45.5 * | 3.0 * | --- |

Appendix 2. continued

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|---|---|---|---|---|---|---|---|---|---|
| R | 12/8/87 | 15:31 | | 51.0 * | | | | 51.0 * | 3.0 * | --- |
| R | 2/16/88 | 11:32 | | 60 # | | | | 60 # | 4 # | --- |
| R | 2/27/88 | 15:10 | | 61 # | | | | 61 # | 4 # | --- |
| D | 4/27/88 | 15:15 | | | | | | 2.4 " | | |
| D | 10/27/88 | 9:15 | | | | | | 6.4 " | | |
| RS-K | 11/29/87 | 15:43 | RL | 48.0 * | 308 | 1 | 308 | 48.0 * | 1.0 * | --- |
| R | 12/8/87 | 15:26 | | 52.0 * | | | | 52.0 * | 1.0 * | --- |
| R | 12/18/87 | 8:00 | | 55 # | | | | 55 # | 1 # | --- |
| R | 2/16/88 | 11:27 | | 61 # | | | | 61 # | 1 # | --- |
| R | 5/17/88 | 18:45 | | 62 # | | | | 62 # | 1 # | --- |
| | 2/27/88 | 15:30 | | | | | | 0.0 | | |
| D | 4/27/88 | 15:20 | | | | | | 2.5 " | | |
| D | 10/27/88 | 9:29 | | | | | | 5.5 " | | |
| RS-L | 11/29/87 | 15:29 | RL | 43 # | 312 | 1 | 314 | 43 # | 2 # | --- |
| R | 12/8/87 | 15:22 | | 49 # | | | | 49 # | 2 # | --- |
| R | 2/16/88 | 11:22 | | 57 # | | | | 57 # | 2 # | --- |
| R | 2/27/88 | 15:51 | | 59.5 * | | | | 59.5 * | 2.5 * | --- |
| D | 4/27/88 | 15:36 | | | | | | 2.4 " | | |
| D | 10/27/88 | 9:40 | | | | | | 5.9 " | | |
| MR-48 | 11/29/87 | 15:18 | RL | 41.5 * | 306 | 1 | 309 | 41.5 * | 2.5 * | --- |
| R | 12/8/87 | 15:18 | | 47.5 * | | | | 47.5 * | 2.5 * | --- |
| R | 12/17/87 | | | 49.0 * | | | | 49.0 * | 2.5 * | --- |
| R | 2/16/88 | 11:20 | | 63 # | | | | 63 # | 4 # | --- |
| R | 5/17/88 | 18:34 | | 69 # | | | | 69 # | 4 # | --- |
| MR-47 | 11/29/87 | 15:00 | RL | 37 # | 310 | 0 | 310 | 37 # | --- | --- |
| R | 12/8/87 | 15:15 | | 44 # | | | | 44 # | --- | --- |
| R | 2/16/88 | 11:18 | | 74 # | | | | 74 # | --- | --- |
| MR-45 | 11/29/87 | 14:40 | RL | 40 # | 302 | 8 | 305 | 40 # | 6 # | 70 |
| R | 12/8/87 | 15:10 | | 52 # | | | | 51 # | 8 # | 70 |
| MR-44 | 11/29/87 | 14:25 | RL | 35.0 * | 300 | 7 | 305 | 34.5 * | 5.0 * | 55 |
| R | 12/8/87 | 15:06 | | 38.0 * | | | | 37.5 * | 5.5 * | 55 |
| RS-M | 11/29/87 | 14:06 | RL | 46 # | 307 | 5 | 307 | 46 # | 4 # | --- |
| R | 12/8/87 | 15:00 | | 53 # | | | | 53 # | 5 # | --- |
| | 2/27/88 | 12:16 | | | | | | 0.0 | | |
| D | 4/27/88 | 15:48 | | | | | | 2.9 " | | |
| O | 10/27/88 | 10:10 | | | | | | 7.3 " | | |
| MR-42 | 11/29/87 | 13:51 | RL | 47 # | 310 | 10 | 310 | 46 # | 8 # | --- |
| R | 12/6/88 | 16:14 | | 55 # | | | | 54 # | 10 # | --- |
| RS-N | 12/6/87 | 16:04 | RL | | | | | 5.0 * | | |
| R | 12/17/87 | 11:00 | | | | | | 9.0 * | | |
| R | 2/16/88 | 10:30 | | | | | | 18.0 * | | |
| R | 5/17/88 | 17:48 | | | | | | 20 + | | |

Appendix 2. continued

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|---|---|---|---|---|---|---|---|---|---|---|
| | 2/28/88 | 9:30 | | | | | | 0.0 | | |
| D | 4/27/88 | 15:56 | | | | | | 3.1 " | | |
| D | 10/27/88 | 9:30 | | | | | | 7.7 " | | |
| RS-O | 11/29/87 | 12:36 | RL | 47.5 * | 304 | 6 | 304 | 47.0 * | 5.0 * | --- |
| R | 12/6/87 | 15:54 | | 53.5 * | 304 | 6 | 304 | 53.0 * | 5.5 * | --- |
| | 2/28/88 | 9:50 | | | | | | 0.0 | | |
| D | 4/27/88 | 16:05 | | | | | | 3.1 " | | |
| D | 10/27/88 | 11:00 | | | | | | 7.9 " | | |
| MR-123 | 12/6/87 | 15:41 | RL | 57 # | 310 | 8 | 310 | 56 # | 8 # | --- |
| SC Quad | 11/25/87 | 14:02 | RL | 49.8 | 311 | 8 | 310 | 49.3 | 7.0 | 83 |
| R | 11/29/87 | 12:15 | | 57.3 | | | | 56.7 | 8.0 | 83 |
| R | 12/6/87 | 12:20 | | 62.6 | | | | 62.0 | 8.8 | 83 |
| R | 12/12/87 | 12:05 | | 65.4 | | | | 64.8 | 9.2 | 83 |
| R | 12/21/87 | 9:35 | | 68.1 | | | | 67.4 | 9.6 | 83 |
| R | 1/13/88 | 11:25 | | 72.4 | | | | 71.7 | 10.2 | 83 |
| R | 2/23/88 | 9:45 | | 76.0 | | | | 75.2 | 10.7 | 83 |
| R | 4/29/88 | 10:10 | | 79.2 | | | | 78.4 | 11.1 | 83 |
| R | 10/27/88 | 11:35 | | 83.9 | | | | 83.1 | 11.8 | 83 |
| MR-122 | 12/6/87 | 15:35 | RL | 59.0 * | 305 | 8 | 305 | 58.5 * | 8.0 * | --- |
| MR-38 | 11/29/87 | 11:47 | RL | 60 # | 311 | 10 | 311 | 59 # | 10 # | --- |
| R | 12/6/87 | 15:21 | | 65 # | | | | 64 # | 11 # | --- |
| MR-37 | 11/29/87 | 11:31 | RL | 57 # | 314 | 7 | 309 | 56 # | 9 # | 55 |
| R | 12/6/87 | 15:81 | | 62 # | | | | 61 # | 9 # | 55 |
| R | 12/17/87 | | | 69 # | | | | 69 # | 10 # | 55 |
| R | 2/16/88 | 10:00 | | 79 # | | | | 78 # | 12 # | 55 |
| MR-35 | 11/29/87 | 10:50 | RL | 37 # | 304 | ~0 | 303 | 37 # | --- | --- |
| RS-P | 11/29/87 | 10:37 | RL | 56 # | 310 | 3 | 310 | 56 # | 3 # | --- |
| R | 12/5/87 | 9:17 | | 59 # | | | | 59 # | 3 # | --- |
| | 2/28/88 | 10:22 | | | | | | 0.0 | | |
| D | 4/27/88 | 16:18 | | | | | | 3.2 " | | |
| D | 10/27/88 | 11:55 | | | | | | 8.1 " | | |
| MR-34 | 11/25/87 | 16:19 | RL | 37 # | 290 | ~0 | 304 | 36 # | --- | --- |
| R | 11/29/87 | 10:29 | | 40 # | | | | 39 # | --- | --- |
| R | 12/5/87 | 9:15 | | 44 # | | | | 43 # | --- | --- |
| MR-101 | 12/5/87 | 9:21 | RL | 54.5 * | 312 | ~0 | 310 | 54.5 * | --- | --- |
| MR-33 | 11/25/87 | 16:07 | RL | 43.5 * | 132 | 1 | 132 | 43.5 * | 1.0 * | --- |
| MR-147 | 12/6/87 | 14:40 | RL | 0.4 | 310 | ~0 | 310 | 0.4 | --- | --- |
| RS-Q | 12/5/87 | 9:51 | RL | 64 # | 309 | 3 | 309 | 64 # | 3 # | --- |
| R | 2/3/88 | 16:20 | | 86 # | | | | 86 # | 5 # | --- |
| R | 5/17/88 | 16:20 | | 90 # | | | | 90 # | 5 # | --- |
| | 2/28/88 | 11:15 | | | | | | 0.0 | | |
| D | 4/27/88 | 16:40 | | | | | | 2.1 " | | |

Appendix 2. continued

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|---|---|---|---|---|---|---|---|---|---|---|
| D | 10/27/88 | 10:00 | | | | | | 6.3 " | | |
| MR-121 | 12/6/87 | 14:33 | RL | 1.5 | 314 | 4 | 314 | 1.5 | 0.1 | --- |
| MR-32 | 11/25/87 | 15:54 | RL | 43 # | 312 | 1 | 312 | 43 # | 1 # | --- |
| R | 12/5/87 | 10:00 | | 58 # | | | | 58 # | 1 # | --- |
| MR103-CIT | 11/25/87 | 14:02 | RL | | | | | 49 # | | |
| R | 12/5/87 | 10:03 | | | | | | 59.5 * | | |
| R | 12/5/87 | 11:36 | | | | | | 60 # | | |
| R | 1/25/88 | 13:11 | | | | | | 71 # | | |
| R | 2/3/88 | 16:00 | | | | | | 70.5 * | | |
| R | 2/8/88 | 12:15 | | | | | | 70 # | | |
| R | 5/17/88 | 16:10 | | | | | | 75 # | | |
| R | 10/28/88 | 12:45 | | | | | | 81 # | | |
| MR-148 | 12/6/87 | 14:20 | RL | 3.6 | 130 | 3 | 130 | 3.6 | 0.2 | --- |
| MR-149 | 12/6/87 | 14:10 | RL | 2 | 130 | 2 | 130 | 2.0 | 0.1 | --- |
| RS-R | 11/25/87 | 15:42 | RL | 41 # | 314 | 3 | 314 | 41 # | 2 # | --- |
| | 2/28/88 | 11:40 | | | | | | 0.0 | | |
| D | 4/27/88 | 17:10 | | | | | | 2.6 " | | |
| D | 10/27/88 | 12:35 | | | | | | 6.6 " | | |
| MR-150 | 12/6/87 | 14:00 | RL | 1.5 | 128 | 1 | 128 | 1.5 | 0.0 | --- |
| MR-151 | 12/6/87 | 13:50 | RL | 2 | 128 | 2 | 128 | 2.0 | 0.1 | --- |
| MR-30 | 11/25/87 | 15:29 | RL | 43 # | 313 | 2 | 313 | 43 # | 2 # | --- |
| R | 12/6/87 | 13:58 | | 51 # | | | | 51 # | 2 # | --- |
| R | 12/18/87 | | | 64 # | | | | 64 # | 2 # | --- |
| R | 2/3/88 | 12:55 | | 68 # | | | | 68 # | 3 # | --- |
| MR-112 | 12/5/87 | 16:35 | RL | 7.5 * | 126 | 23 | 126 | 7.0 * | 3.0 * | --- |
| MR-29 | 11/16/87 | 15:16 | RL | 37 # | 311 | 2 | 311 | 37 # | 1 # | --- |
| MR-152 | 12/6/87 | 13:40 | RL | 3.5 | 130 | 2 | 130 | 3.5 | 0.1 | --- |
| RS-S | 11/25/87 | 15:11 | RL | 35.0 * | 309 | 2 | 314 | 35.0 * | 3.5 * | --- |
| R | 12/6/87 | 13:43 | | 47.0 * | | | | 47.0 * | 4.5 * | --- |
| | 2/28/88 | 12:12 | | | | | | 0.0 | | |
| D | 4/27/88 | 17:22 | | | | | | 2.4 " | | |
| D | 10/27/88 | 12:48 | | | | | | 5.8 " | | |
| MR-27 | 11/25/87 | 15:05 | RL | 44 # | 318 | 1 | 318 | 44 # | 1 # | --- |
| R | 12/6/87 | 13:33 | | 55 # | | | | 55 # | 1 # | --- |
| MR-153 | 12/6/87 | 13:30 | RL | 2 | 130 | 2 | 130 | 2.0 | 0.1 | --- |
| MR-26 | 11/25/87 | 14:56 | RL | 31.0 * | 318 | 6 | 318 | 31.0 * | 3.0 * | --- |
| R | 12/6/87 | 12:45 | | 42.0 * | | | | 42.0 * | 4.5 * | --- |
| MR-22 | 11/25/87 | 13:27 | RL | 5.2 | 145 | 15 | 145 | 5.0 | 1.3 | --- |
| R | 12/5/87 | 16:06 | | 8.3 | | | | 8.0 | 2.1 | --- |
| MR-154 | 12/6/87 | 12:35 | RL | 0.3 | 355 | ~0 | 355 | 0.3 | --- | --- |
| MR-119 | 12/6/87 | 12:30 | RL | 3.5 | 295 | 44 | 320 | 2.3 | 2.7 | 66 |
| MR-21 | 11/25/87 | 13:15 | RL | 22 * | 132 | 11 | 132 | 21.5 * | 4.0 * | --- |

Appendix 2. continued

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|---|---|---|---|---|---|---|---|---|---|---|
| R | 12/5/87 | 15:58 | | 26.5 * | | | | 26.0 * | 5.0 * | --- |
| MR-162 | 2/3/88 | 12:28 | LL | 4.1 | 235 | 3 | 235 | 4.1 | 0.2 | --- |
| MR-163 | 2/3/88 | 12:32 | RL | 1.5 | 12 | 0 | 12 | 1.5 | --- | --- |
| MR-20 | 11/25/87 | 12:56 | RL | 28.5 * | 150 | 12 | 150 | 28.0 * | 6.0 * | --- |
| R | 12/5/87 | 15:46 | | 38.5 * | | | | 37.5 * | 8.0 * | --- |
| R | 2/3/88 | 12:22 | | 46.5 * | | | | 45.5 * | 9.5 * | --- |
| MR-24 | 11/25/87 | 14:26 | RL | 11.2 | 230 | 63 | 310 | 0.9 | 11.2 | 63 |
| R | 12/6/87 | 11:42 | | 12.5 | | | | 1.0 | 12.5 | 63 |
| MR-140 | 11/25/87 | 13:40 | RL | 0.8 | 310 | 7 | 310 | 0.8 | 0.1 | --- |
| MR-155 | 12/5/87 | 13:40 | RL | 1 | 136 | 30 | 136 | 0.9 | 0.5 | --- |
| MR-141 | 11/25/87 | 14:00 | LL | 0.8 | 2 | ~0 | 2 | 0.8 | --- | --- |
| MR-118 | 12/6/87 | 11:26 | RL | 4.7 | 322 | 32 | 344 | 3.7 | 2.9 | 59 |
| MR-23 | 11/25/87 | 14:11 | RL | 2.6 | 329 | 11 | 340 | 2.5 | 0.7 | 46 |
| R | 12/6/87 | 11:56 | | 2.6 | | | | 2.5 | 0.7 | 46 |
| MR-107 | 12/5/87 | 13:31 | RL | 5.5 * | 340 | 0 | 340 | 5.5 * | --- | --- |
| R | 2/3/88 | 12:20 | | 5.5 * | | | | 5.5 * | --- | --- |
| MR-143 | 12/6/87 | 11:05 | RL | 0.6 | 320 | ~0 | 320 | 0.6 | --- | --- |
| MR-110 | 12/5/87 | 15:00 | LL | 2.3 | 32 | 5 | 25 | 2.3 | 0.3 | 36 |
| MR-109 | 12/5/87 | 14:48 | LL | 1.2 | 58 | 0 | 30 | 1.1 | --- | --- |
| MR-156 | 12/6/87 | 11:10 | RRV | 1.9 | 140 | 56 | 105 | 0.9 | 1.7 | 69 |
| MR-19a | 11/25/87 | 12:38 | RL | 33 # | 160 | 5 | 160 | 33 # | 3 # | --- |
| MR-19b | 12/5/87 | 13:08 | RL | 48 # | 160 | 9 | 160 | 47 # | 8 # | --- |
| MR-144 | 12/6/87 | 10:59 | RL | 0.5 | 275 | ~0 | 275 | 0.5 | --- | --- |
| MR-145 | 12/6/87 | 10:54 | LL | 1 | 170 | 7 | 170 | 1.0 | 0.1 | --- |
| MR-108 | 12/5/87 | 14:39 | RL | 1.3 | 321 | 4 | 320 | 1.3 | 0.1 | --- |
| MR-146 | 12/6/87 | 10:50 | RL | 0.8 | 300 | 7 | 300 | 0.8 | 0.1 | --- |
| MR-116 | 12/6/87 | 10:09 | RL | 8.9 | 315 | 12 | 306 | 8.6 | 2.3 | 54 |
| RS-U | 11/25/87 | 11:49 | RL | 26 # | 134 | 4 | 135 | 26 # | 2 # | --- |
| R | 12/5/87 | 12:52 | | 38 # | | | | 38 # | 3 # | --- |
| R | 2/28/88 | 13:50 | | 50.5 * | | | | 50.5 * | 3.5 * | --- |
| D | 4/27/88 | 17:52 | | | | | | 2.7 " | | |
| D | 10/27/88 | 13:24 | | | | | | 6.9 " | | |
| MR-105 | 12/5/87 | 12:41 | RL | 42.0 * | 140 | 7 | 140 | 41.5 * | 5.0 * | --- |
| MR-117 | 12/6/87 | 10:41 | RL | 3.8 | 317 | 12 | 320 | 3.7 | 0.8 | 76 |
| MR-115 | 12/6/87 | 9:58 | RL | 8.6 | 305 | 11 | 310 | 8.4 | 1.8 | 66 |
| MR-142 | 12/6/87 | 9:40 | RL | 4.5 | 316 | ~0 | 316 | 4.5 | --- | --- |
| RS-V | 11/30/87 | 16:11 | RL | 36.5 * | 314 | 10 | 310 | 36.0 * | 7.0 * | 68 |
| | 2/28/88 | 14:17 | | | | | | 0.0 | | |
| D | 4/27/88 | 18:07 | | | | | | 2.6 " | | |
| D | 10/27/88 | 13:42 | | | | | | 6.3 " | | |
| MR-104 | 12/5/87 | 12:20 | RL | 38 # | 306 | 12 | 306 | 37 # | 8 # | --- |
| R | 2/3/88 | 12:18 | | 51 # | | | | 50 # | 11 # | --- |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| MR-114 | 12/6/87 | 9:31 | RL | 3.5 | 319 | 0 | 319 | 3.5 | --- | --- |
| MR-17 | 11/25/87 | 11:04 | RL | 22 # | 305 | 5 | 303 | 22 # | 2 # | 68 |
| MR-16B | 11/25/87 | 10:52 | RL | 23.0 * | 305 | 5 | 305 | 23.0 * | 2.0 * | --- |
| R | 11/30/87 | 15:44 | | 35.5 * | | | | 35.5 * | 3.0 * | --- |
| R | 12/5/87 | 12:09 | | 38.5 * | | | | 38.5 * | 3.5 * | --- |
| MR16B-CIT | 11/25/87 | 12:00 | RL | | | | | 31 # | | |
| R | 11/30/87 | 15:44 | | | | | | 41 # | | |
| R | 12/5/87 | 14:52 | | | | | | 43.6 " | | |
| R | 12/18/87 | 14:00 | | | | | | 45.0 * | | |
| R | 1/25/88 | 13:30 | | | | | | 51.7 " | | |
| R | 2/3/88 | 12:15 | | | | | | 52.0 * | | |
| R | 5/17/88 | 14:11 | | | | | | 58 # | | |
| R | 10/27/88 | 13:58 | | | | | | 62 # | | |
| MR-113 | 12/6/87 | 8:20 | RL | 1.6 | 346 | 68 | 341 | 0.6 | 1.5 | 88 |
| MR-70 | 11/30/87 | 14:42 | RL | 39.5 * | 312 | 3 | 308 | 39.5 * | 3.5 * | --- |
| RS-W | 11/25/87 | 10:40 | RL | 29 # | 309 | 6 | 309 | 29 # | 3 # | --- |
| R | 11/30/87 | 14:30 | | 37 # | | | | 37 # | 4 # | --- |
| R | 5/17/88 | 13:45 | | 61 # | | | | 61 # | 6 # | --- |
| | 2/28/88 | 14:40 | | | | | | 0.0 | | |
| D | 4/28/88 | 8:13 | | | | | | 2.6 " | | |
| D | 10/27/88 | 14:05 | | | | | | 6.5 " | | |
| MR-69 | 11/30/87 | 14:24 | RL | 34 # | 312 | 2 | 312 | 34 # | 1 # | --- |
| R | 12/8/87 | 17:12 | | 43 # | | | | 43 # | 2 # | --- |
| RS-X | 11/25/87 | 10:15 | RL | 44 # | 310 | 1 | 313 | 44 # | 2 # | --- |
| | 2/29/88 | 8:40 | | | | | | 0.0 | | |
| D | 4/28/88 | 8:36 | | | | | | 2.5 " | | |
| D | 10/27/88 | 14:20 | | | | | | 6.5 " | | |
| RS-Y | 11/30/87 | 13:50 | RL | 46.5 * | 313 | ~0 | 313 | 46.5 * | --- | --- |
| | 2/29/88 | 8:55 | | | | | | 0.0 | | |
| D | 4/28/88 | 8:43 | | | | | | 3.0 " | | |
| D | 10/27/88 | 14:30 | | | | | | 7.7 " | | |
| MR-66 | 11/30/87 | 13:37 | RL | 47 # | 305 | 1 | 311 | 47 # | 5 # | --- |
| RSZ-CIT | 11/25/87 | 11:00 | RL | | | | | 39 # | | |
| R | 11/30/87 | 12:58 | | | | | | 48 # | | |
| R | 12/5/87 | 8:42 | | | | | | 50.7 " | | |
| R | 1/25/88 | 12:45 | | | | | | 61.4 " | | |
| R | 2/3/88 | 12:08 | | | | | | 61 # | | |
| R | 5/17/88 | 12:30 | | | | | | 67 # | | |
| | 2/29/88 | 9:15 | | | | | | 0.0 | | |
| D | 4/28/88 | 8:55 | | | | | | 2.8 " | | |
| D | 10/27/88 | 14:45 | | | | | | 7.2 " | | |
| MR-64 | 11/30/87 | 12:43 | RL | 55 # | 314 | 5 | 312 | 55 # | 5 # | 68 |
| R | 12/8/87 | 16:43 | | 60 # | | | | 60 # | 6 # | 68 |

Appendix 2. continued

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| SSC Quad | 11/25/87 | 9:48 | RL | 43.5 * | 313 | 7 | 312 | 43.0 * | 5.5 * | 82 |
| R | 11/30/87 | 12:35 | | 53.5 * | | | | 53.0 * | 6.6 * | 82 |
| R | 2/23/88 | 11:45 | | 73.5 * | | | | 73.0 * | 9.0 * | 82 |
| D | 3/10/88 | 12:48 | | | | | | 1.2 | | |
| D | 4/29/88 | 9:51 | | | | | | 3.6 | 0.0 | 0 |
| D | 10/27/88 | 15:15 | | | | | | 8.1 | 0.0 | 0 |
| RS-ALPHA | 11/25/87 | 9:29 | RL | 44.5 * | 313 | 10 | 313 | 44.0 * | 7.5 * | --- |
| R | 11/30/87 | 12:20 | | 55.0 * | | | | 54.0 * | 9.5 * | --- |
| R | 12/8/87 | 16:38 | | 60.0 * | | | | 59.0 * | 10.5 * | --- |
| | 2/29/88 | 9:40 | | | | | | 0.0 | | |
| D | 4/28/88 | 9:02 | | | | | | 3.0 " | | |
| D | 10/27/88 | 15:25 | | | | | | 8.1 " | | |
| MR-63 | 11/30/87 | 12:09 | RL | 46 # | 312 | 8 | 316 | 45 # | 7 # | 64 |
| R | 12/8/87 | 16:38 | | 52 # | | | | 51 # | 8 # | 64 |
| RS-BETA | 11/25/87 | 9:17 | RL | 40.0 * | 310 | 6 | 315 | 39.5 * | 5.5 * | 50 |
| R | 11/30/87 | 11:36 | | 50.0 * | | | | 49.5 * | 7.0 * | 50 |
| R | 12/8/87 | 16:34 | | 56.5 * | | | | 56.0 * | 7.5 * | 50 |
| R | 2/3/88 | 11:58 | | 66 # | | | | 65 # | 9 # | 50 |
| | 2/29/88 | 10:05 | | | | | | 0.0 | | |
| D | 4/28/88 | 9:15 | | | | | | 3.0 " | | |
| MR-62 | 11/30/87 | 11:31 | RL | 53 # | 313 | 8 | 315 | 53 # | 8 # | 76 |
| R | 12/8/87 | 16:32 | | 59 # | | | | 58 # | 9 # | 76 |
| MR-9A | 11/25/87 | 9:09 | RL | 40.0 * | 310 | 1 | 312 | 40.0 * | 1.5 * | --- |
| R | 11/30/87 | 11:15 | | 49.0 * | | | | 49.0 * | 2.0 * | --- |
| R | 12/8/87 | 16:30 | | 53.0 * | | | | 53.0 * | 2.0 * | --- |
| MR9B-CIT | 11/25/87 | 10:25 | RL | | | | | 41 # | | |
| | 11/30/87 | 11:15 | | | | | | 49.5 | | |
| | 12/5/87 | 8:10 | | | | | | 53.7 " | | |
| | 12/8/87 | 16:30 | | | | | | 55.5 | | |
| | 12/18/87 | 15:30 | | | | | | 59.0 * | | |
| | 1/25/88 | 12:10 | | | | | | 61.2 " | | |
| | 2/3/88 | 11:55 | | | | | | 67 # | | |
| | 5/17/88 | 11:58 | | | | | | 72 # | | |
| | 10/27/88 | 15:51 | | | | | | 75.6 " | | |
| MR-61 | 11/30/87 | 11:04 | RL | 46 # | 313 | 5 | 316 | 46 # | 5 # | 59 |
| R | 12/17/87 | | | 50 # | | | | 50 # | 5 # | 59 |
| MR-60 | 11/30/87 | | RL | 40 # | 314 | 0 | 313 | 40 # | --- | --- |
| R | 12/8/87 | 16:22 | | 48 # | | | | 48 # | --- | --- |
| RS-GAMMA | 11/24/87 | 17:12 | RL | 31.0 * | 314 | 2 | 314 | 31.0 * | 1.0 * | --- |
| R | 11/25/87 | 8:47 | | 35.0 * | | | | 35.0 * | 1.0 * | --- |
| R | 11/30/87 | 10:21 | | 44.5 * | | | | 44.5 * | 1.5 * | --- |
| R | 12/8/87 | 16:20 | | 50.0 * | | | | 50.0 * | 1.5 * | --- |

Appendix 2. continued

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| R | 2/3/88 | 11:45 | | 61.0 * | | | | 61.0 * | 2.0 * | --- |
| R | 2/29/88 | 10:58 | | 64.5 * | | | | 64.5 * | 2.0 * | --- |
| D | 4/28/88 | 9:29 | | | | | | 2.7 " | | |
| D | 10/27/88 | 16:00 | | | | | | 7.6 " | | |
| MR-6A | 11/24/87 | 17:05 | RL | 29.0 * | 313 | 6 | 313 | 29.0 * | 3.0 * | --- |
| R | 11/25/87 | 8:42 | | 35.0 * | | | | 34.0 * | 3.5 * | --- |
| R | 11/30/87 | 10:12 | | 45.0 * | | | | 45.0 * | 4.5 * | --- |
| R | 12/8/87 | 16:16 | | 48.0 * | | | | 47.5 * | 5.0 * | --- |
| MR-5 | 11/24/87 | 16:56 | RL | 2.9 | 118 | 31 | 144 | 2.2 | 1.8 | 54 |
| R | 11/25/87 | 8:16 | | 3.6 | | | | 2.8 | 2.3 | 54 |
| MR-4 | 11/24/87 | 16:45 | RL | 15.0 * | 329 | ~0 | 319 | 15.0 * | --- | --- |
| R | 11/25/87 | 8:36 | | 17.5 * | | | | 17.0 * | --- | --- |
| MR6B-CIT | 11/25/87 | 9:45 | RL | | | | | 38.3 " | | |
| R | 12/5/87 | 7:43 | | | | | | 52.5 " | | |
| R | 12/8/87 | 16:18 | | | | | | 53.5 * | | |
| R | 12/17/87 | 12:00 | | | | | | 58.5 * | | |
| R | 1/25/88 | 11:40 | | | | | | 65.0 " | | |
| R | 2/3/88 | 11:30 | | | | | | 64.5 * | | |
| R | 5/17/88 | 11:34 | | | | | | 72 # | | |
| MR-59 | 11/30/87 | 9:47 | RL | 46 # | 335 | 8 | 316 | 43 # | 16 # | 23 |
| MR-3 | 11/24/87 | 16:38 | RL | 23.5 * | 311 | 12 | 316 | 23.0 * | 5.5 * | 68 |
| R | 11/25/87 | 8:30 | | 37.5 * | | | | 36.5 * | 8.5 * | 68 |
| R | 11/30/87 | 9:33 | | 48.5 * | | | | 47.5 * | 11.0 * | 68 |
| R | 12/5/87 | 8:52 | | 50.0 * | | | | 48.5 * | 11.0 * | 68 |
| C | 12/18/87 | | RL | 3.2 | 104 | 9 | 153 | 2.1 | 2.4 | 12 |
| MR-2 | 11/24/87 | 16:30 | RL | 18 # | 322 | 3 | 315 | 18 # | 2 # | --- |
| R | 11/25/87 | 8:25 | | 23 # | | | | 23 # | 3 # | --- |
| R | 11/30/87 | 9:13 | | 33 # | | | | 33 # | 4 # | --- |
| R | 12/5/87 | 8:46 | | 38 # | | | | 38 # | 5 # | --- |
| MR-57 | 11/30/87 | 9:20 | RL | 37.0 * | 314 | 1 | 315 | 37.0 * | 1.0 * | --- |
| R | 12/5/87 | 8:46 | | 41.0 * | | | | 41.0 * | 1.0 * | --- |
| D | 12/18/87 | | RL | 2.6 | 114 | 17 | 145 | 2.1 | 1.5 | 31 |
| B | 12/18/87 | | RL | 5.1 | 139 | 9 | 143 | 5.0 | 0.9 | 66 |
| 1A | 12/17/87 | | RL | 40.0 * | 318 | 7 | 320 | 39.7 * | 5.1 * | 74 |
| MR-56 | 11/30/87 | 8:51 | RL | 1.5 * | 117 | 9 | 140 | 1.5 * | 0.5 * | 22 |
| R | 12/5/87 | 8:41 | | 1.5 * | | | | 1.5 * | 0.5 * | 22 |
| MR-1 | 11/24/87 | 16:15 | RL | 16.0 * | 322 | 7 | 314 | 15.5 * | 3.0 * | 41 |
| R | 11/25/87 | 7:57 | | 29.0 * | | | | 28.5 * | 5.5 * | 41 |
| MR-55 | 11/30/87 | 8:10 | RL | 35 # | 316 | 3 | 314 | 35 # | 2 # | --- |
| R | 12/5/87 | 8:37 | | 39 # | | | | 39 # | 3 # | --- |
| E | 12/18/87 | | RL | 3.5 | 317 | 0 | 334 | 3.3 | --- | --- |
| A | 12/18/87 | | RL | 2.4 | 332 | 1 | 329 | 2.4 | 0.1 | --- |

Appendix 2. continued

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|---|---|---|---|---|---|---|---|---|---|---|
| JL-71 | 11/29/87 | | RL | 6.5 * | 315 | ~0 | 315 | 6.5 * | --- | --- |
| JL-1 | 11/24/87 | 12:42 | RL | 29 # | 310 | ~0 | 310 | 29 # | --- | --- |
| R | 11/24/87 | 16:02 | | 31 # | | | | 31 # | --- | --- |
| R | 11/25/87 | 9:28 | | 35 # | | | | 35 # | --- | --- |
| R | 11/25/87 | 16:56 | | 35 # | | | | 35 # | --- | --- |
| R | 11/29/87 | 13:40 | | 41 # | | | | 41 # | --- | --- |
| R | 12/13/87 | 10:19 | | 50 # | | | | 50 # | --- | --- |
| IMLR-CIT | 11/24/87 | 7:25 | RL | | | | | 18.5 * | | |
| R | 11/24/87 | 13:59 | | | | | | 25.3 " | | |
| R | 11/24/87 | 16:40 | | | | | | 27.3 " | | |
| R | 11/25/87 | 8:55 | | | | | | 30.8 " | | |
| R | 11/25/87 | 16:53 | | | | | | 31.0 " | | |
| R | 11/27/87 | 12:00 | | | | | | 36.2 " | | |
| R | 12/6/87 | 14:35 | | | | | | 44.3 " | | |
| R | 12/9/87 | 8:30 | | | | | | 46 # | | |
| R | 12/16/87 | 16:15 | | | | | | 50 # | | |
| R | 1/25/88 | 12:00 | | | | | | 58 # | | |
| R | 2/8/88 | 13:45 | | | | | | 61 # | | |
| R | 10/25/88 | 10:00 | | | | | | 75 # | | |
| JL-72 | 11/29/87 | | RL | 6.0 * | 315 | ~0 | 315 | 6.0 * | --- | --- |
| JL-73 | 11/29/87 | | RL | 5.0 * | 315 | ~0 | 315 | 5.0 * | --- | --- |
| JL-75 | 11/29/87 | | RL | 3.0 * | 315 | ~0 | 315 | 3.0 * | --- | --- |
| RVS-2000 | 2/3/88 | | RL | 4.5 | 116 | 45 | 146 | 2.8 | 3.6 | 63 |
| JL-30 | 11/29/87 | 12:58 | RL | 41 # | 310 | ~0 | 310 | 41 # | --- | --- |
| JL-6 | 11/24/87 | 16:40 | RL | 19.5 * | 310 | ~0 | 310 | 19.5 * | --- | --- |
| JL-7 | 11/24/87 | 16:50 | RL | 28 # | 310 | ~0 | 310 | 28 # | --- | --- |
| R | 11/29/87 | 12:25 | | 39 # | | | | 39 # | --- | --- |
| R | 12/10/87 | 11:44 | | 47 # | | | | 47 # | --- | --- |
| JL-29 | 11/28/87 | 11:35 | RL | 49 # | 317 | ~0 | 317 | 49 # | --- | --- |
| D | 12/10/87 | 11:35 | | 6.7 " | | | | 6.7 " | --- | --- |
| D | 12/15/87 | 14:28 | | 8.6 " | | | | 8.6 " | --- | --- |
| D | 2/23/88 | 12:12 | | 18.5 " | | | | 18.5 " | --- | --- |
| D | 2/29/88 | 13:30 | | 18.5 " | | | | 18.5 " | --- | --- |
| D | 4/26/88 | 14:18 | | 21.1 " | | | | 21.1 " | --- | --- |
| D | 5/17/88 | 10:30 | | 21.2 " | | | | 21.2 " | --- | --- |
| D | 10/25/88 | 10:20 | | 26.3 " | | | | 26.3 " | --- | --- |
| JL-8 | 11/24/87 | 17:05 | RL | 36 # | 316 | ~0 | 316 | 36 # | --- | --- |
| D | 11/25/87 | 10:04 | | 3.9 " | | | | 3.9 " | --- | --- |
| D | 11/25/87 | 16:41 | | 4.7 " | | | | 4.7 " | --- | --- |
| D | 11/29/87 | 8:40 | | 11.6 " | | | | 11.6 " | --- | --- |
| D | 12/10/87 | 11:20 | | 18.8 " | | | | 18.8 " | --- | --- |
| D | 12/13/87 | 9:45 | | 19.9 " | | | | 19.9 " | --- | --- |

Appendix 2. continued

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|---|---|---|---|---|---|---|---|---|---|---|
| D | 12/15/87 | 14:20 | | 20.6 " | | | | 20.6 " | --- | --- |
| D | 12/17/87 | 9:30 | | 21.6 " | | | | 21.6 " | --- | --- |
| D | 2/26/88 | 10:00 | | 29.8 " | | | | 29.8 " | --- | --- |
| D | 4/26/88 | 14:33 | | 33.7 " | | | | 33.7 " | --- | --- |
| D | 10/25/88 | 10:40 | | 38.2 " | | | | 38.2 " | --- | --- |
| FSSC Qd | 11/25/87 | 10:30 | RL | 39.5 * | 314 | 0 | 314 | 39.5 * | --- | --- |
| D | 11/29/87 | 8:50 | | 8.4 | | | | 8.4 | --- | --- |
| D | 12/10/87 | 11:10 | | 16.2 | | | | 16.2 | --- | --- |
| D | 12/13/87 | 9:40 | | 18.3 | | | | 18.3 | --- | --- |
| D | 12/15/87 | 14:25 | | 19.2 | | | | 19.2 | --- | --- |
| D | 12/17/87 | 11:45 | | 20.0 | | | | 20.0 | --- | --- |
| D | 2/3/88 | 13:55 | | 28.3 | | | | 28.3 | --- | --- |
| D | 2/23/88 | 12:30 | | 30.8 | | | | 30.8 | --- | --- |
| D | 2/26/88 | 10:15 | | 30.8 | | | | 30.8 | --- | --- |
| D | 2/28/88 | 8:45 | | 31.6 | | | | 31.6 | --- | --- |
| D | 3/2/88 | 7:58 | | 31.6 | | | | 31.6 | --- | --- |
| D | 3/10/88 | 14:50 | | 31.8 | | | | 31.8 | --- | --- |
| D | 4/26/88 | 14:38 | | 34.8 | | | | 34.8 | --- | --- |
| D | 10/25/88 | 11:15 | | 39.2 | | | | 39.2 | --- | --- |
| JL-28 | 11/29/87 | 9:50 | RL | 42.5 * | 310 | ~0 | 310 | 42.5 * | --- | --- |
| R | 12/10/87 | 10:59 | | 51.1 " | | | | 51.1 " | --- | --- |
| R | 12/13/87 | 9:27 | | 51.9 " | | | | 51.9 " | --- | --- |
| R | 12/15/87 | 14:14 | | 52.7 " | | | | 52.7 " | --- | --- |
| R | 12/17/87 | 9:43 | | 53.5 " | | | | 53.5 " | --- | --- |
| R | 2/3/88 | 14:05 | | 89.5 " | | | | 89.5 " | --- | --- |
| HM5-CIT | 11/24/87 | 15:37 | RL | | | | | 31 # | | |
| R | 11/25/87 | 10:21 | | | | | | 35 # | | |
| R | 12/6/87 | 16:57 | | | | | | 48.3 " | | |
| R | 1/25/88 | 10:17 | | | | | | 58.0 " | | |
| JL-10 | 11/25/87 | 10:55 | RL | 25 # | 311 | 5 | 311 | 25 # | 2.2 # | --- |
| RVS-1016 | 12/20/87 | | RL | 2.0 | 109 | 50 | 134 | 1.2 | 1.6 | 70 |
| JL-12 | 11/25/87 | 11:30 | RL | 17 # | 312 | 3 | 312 | 17 # | 0.9 # | --- |
| D | 11/28/87 | 15:31 | | 4.7 " | | ~0 | | 4.7 " | --- | --- |
| D | 12/10/87 | 10:41 | | 10.3 " | | | | 10.3 " | --- | --- |
| D | 12/13/87 | 9:10 | | 11.0 " | | | | 11.0 " | --- | --- |
| D | 12/15/87 | 14:09 | | 11.5 " | | | | 11.5 " | --- | --- |
| D | 12/17/87 | 11:20 | | 12.0 " | | | | 12.0 " | --- | --- |
| D | 10/25/88 | 12:10 | | 25.4 " | | | | 25.4 " | --- | --- |
| JL-13 | 11/25/87 | 12:06 | RL | 14 # | 314 | 11 | 314 | 14 # | 2.7 # | --- |
| R | 12/10/87 | 10:34 | | 23 # | | | | 23 # | 4.4 # | --- |
| | 4/26/88 | 4:01 | | | | | | 0.0 | | |
| D | 10/25/88 | 12:25 | | | | | | 1.8 " | | |

Appendix 2. continued

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|---|---|---|---|---|---|---|---|---|---|---|
| JL-14 | 11/25/87 | 12:30 | RL | 21.5 * | 315 | ~0 | 315 | 21.5 * | --- | --- |
| D | 11/28/87 | 13:29 | | | | | | 3.6 " | --- | --- |
| D | 12/10/87 | 10:25 | | | | | | 8.1 " | --- | --- |
| D | 12/13/87 | 8:30 | | | | | | 8.6 " | --- | --- |
| D | 12/15/87 | 14:05 | | | | | | 8.8 " | --- | --- |
| D | 12/17/87 | 10:20 | | | | | | 9.4 " | --- | --- |
| D | 2/26/88 | 10:30 | | | | | | 14.3 " | --- | --- |
| D | 4/26/88 | 16:18 | | | | | | 16.6 " | --- | --- |
| RVS-1008 | 12/19/87 | | RL | 0.2 | 326 | ~0 | 340 | 0.2 | --- | --- |
| G5050 | 11/25/87 | | RL | 0.8 | 345 | 0 | 349 | 0.8 | --- | --- |
| JL-15 | 11/25/87 | 12:44 | RL | 13.4 | 319 | ~0 | 319 | 13.4 | --- | --- |
| R | 11/28/87 | 13:00 | | 16.5 * | | | | 16.5 * | --- | --- |
| R | 12/10/87 | 10:00 | | 24.5 * | | | | 24.5 * | --- | --- |
| R | 12/13/87 | 8:15 | | 25.0 * | | | | 25.0 * | --- | --- |
| | 4/26/88 | 16:32 | | | | | | 0.0 | | |
| D | 10/28/88 | 14:55 | | | | | | 0.9 " | | |
| JL-16 | 11/25/87 | 13:08 | RL | 12.5 * | 319 | ~0 | 319 | 12.5 * | --- | --- |
| JL-17 | 11/25/87 | 13:15 | RL | 6.0 * | 318 | ~0 | 318 | 6.0 * | --- | --- |
| R | 11/28/87 | 11:52 | | 8.0 * | | | | 8.0 * | --- | --- |
| R | 12/10/87 | 8:51 | | 11.0 * | | | | 11.0 * | --- | --- |
| R | 12/13/87 | 8:00 | | 11.5 * | | | | 11.5 * | --- | --- |
| JL-18 | 11/25/87 | 13:35 | RL | 4.5 * | 317 | ~0 | 317 | 4.5 * | --- | --- |
| R | 11/28/87 | 11:50 | | 6.0 * | | | | 6.0 * | --- | --- |
| S Quad | 11/25/87 | 15:21 | RL | 10.6 | 299 | 19 | 304 | 10.0 | 3.6 | 73 |
| R | 11/29/87 | 13:50 | | 13.1 | | | | 12.2 | 4.9 | 75 |
| R | 12/6/87 | 14:15 | | 15.0 | | | | 13.8 | 5.8 | 75 |
| R | 12/12/87 | 13:10 | | 16.3 | | | | 15.0 | 6.3 | 75 |
| R | 12/20/87 | 13:18 | | 16.8 | | | | 15.5 | 6.5 | 75 |
| R | 1/13/88 | 12:40 | | 18.3 | | | | 17.1 | 6.5 | 74 |
| R | 2/23/88 | 13:55 | | 19.4 | | | | 17.8 | 7.8 | 76 |
| R | 4/26/88 | 17:15 | | 20.8 | | | | 19.0 | 8.4 | 76 |
| R | 10/25/88 | 13:50 | | 22.1 | | | | 20.2 | 8.9 | 76 |
| JL-19 | 11/25/87 | 13:49 | RL | 3.5 * | 322 | ~0 | 322 | 3.5 * | --- | --- |
| D | 11/28/87 | 11:16 | | 1.8 " | | | | 1.8 " | --- | --- |
| D | 12/10/87 | 8:27 | | 3.9 " | | | | 3.9 " | --- | --- |
| D | 12/15/87 | 13:55 | | 4.3 " | | | | 4.3 " | --- | --- |
| D | 2/25/88 | 9:38 | | 7.0 " | | | | 7.0 " | --- | --- |
| D | 4/26/88 | 17:25 | | 8.2 " | | | | 8.2 " | --- | --- |
| D | 10/25/88 | 14:35 | | 9.0 " | | | | 9.0 " | --- | --- |
| JL-21 | 11/25/87 | 14:10 | RL | 0.1 | 330 | ~0 | 330 | 0.1 | --- | --- |
| R | 12/10/87 | 8:15 | | 0.2 | | | | 0.2 | --- | --- |
| R | 12/13/87 | 7:40 | | 0.2 | | | | 0.2 | --- | --- |

Appendix 2. continued

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| JL-22 | 11/25/87 | 14:15 | RL | 6 | # | 3 | 14 | 3 | 6 | # | 1.5 # | --- |
| R | 11/28/87 | 8:37 | | 6 | # | | | | 6 | # | 1.5 # | --- |
| JL-24 | 11/28/87 | 9:24 | RL | 1.2 | | 335 | ~0 | 335 | 1.2 | | --- | --- |
| D | 12/10/87 | 8:10 | | 0.2 | " | | | | 0.2 | " | --- | --- |
| D | 12/13/87 | 7:30 | | 0.2 | " | | | | 0.2 | " | --- | --- |
| D | 12/15/87 | 13:50 | | 0.3 | " | | | | 0.3 | " | --- | --- |
| D | 2/26/88 | 9:12 | | 0.5 | " | | | | 0.5 | " | --- | --- |
| D | 4/26/88 | 17:33 | | 0.5 | " | | | | 0.5 | " | --- | --- |
| D | 10/25/88 | 14:15 | | 0.6 | " | | | | 0.6 | " | --- | --- |
| JL-25 | 12/28/87 | 9:39 | RL | 0.8 | * | 335 | ~0 | 335 | 0.8 | * | --- | --- |

Appendix 2. continued

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| AO-03 | 12/16/87 | LNO | 1.2 | 328 | 62 | 251 | 0.1 | 1.2 | 63 | |
| AO-02 | 12/16/87 | LNO | 3.2 | 169 | 49 | 105 | 0.9 | 3.1 | 52 | |
| MA-12 | 12/19/87 | NO | 3.2 | 332 | 27 | 242 | 0.0 | 3.2 | --- | |
| MG8-5 | 12/12/87 | LL | 1.1 | 33 | 0 | 44 | 1.1 | --- | --- | |
| KS-1a | 11/30/87 | LL | 0.4 | 36 | 0 | 42 | 0.4 | --- | --- | |
| KS-1b | 11/30/87 | LL | 0.5 | 40 | 0 | 42 | 0.5 | --- | --- | |
| JL-40 | 12/11/87 | LL | 1.0 | 20 | ~0 | 10 | 1.0 | --- | --- | |
| JL-39 | 12/11/87 | LL | 0.5 | 70 | ~0 | 60 | 0.5 | --- | --- | |
| RVS-206 | 11/28/87 | LL | 4.0 | 43 | 42 | 43 | 3.0 | 2.7 | --- | |
| KRL-10 | 12/11/87 | LL | 5.0 | 32 | 65 | 45 | 2.1 | 4.6 | 84 | |
| RVS-207 | 11/28/87 | LL | 0.6 | 67 | 39 | 6 | 0.2 | 0.6 | 43 | |
| KRL-11 | 12/12/87 | LL | 1.9 | 290 | 0 | 217 | 0.6 | --- | --- | |
| G5073a | 12/4/87 | LL | 2.0 * | 36 | 0 | 36 | 2.0 * | --- | --- | |
| G5073b | 12/4/87 | LL | 2.6 | 36 | 0 | 36 | 2.6 | --- | --- | |
| KRL-12 | 12/12/87 | LL | 1.2 | 57 | 0 | 45 | 1.2 | --- | --- | |
| MGB-2 | 12/10/87 | LL | >0.4 | 10 | 14 | 166 | 0.4 | 0.2 | 32 | |
| DMM-27 | 12/13/87 | LL | 1.6 | 10 | 12 | 0 | 1.5 | 0.4 | 51 | |
| DMM-28 | 12/13/87 | LL | 2.8 | 220 | 4 | 204 | 2.7 | 0.8 | --- | |
| JL-44 | 12/14/87 | LL | 0.7 | 31 | ~0 | 32 | 0.7 | --- | --- | |
| KRL-8 | 12/10/87 | LL | 1.4 | 62 | 0 | 45 | 1.3 | --- | --- | |
| G5075 | 12/4/87 | LL | 0.5 | 65 | 0 | 65 | 0.5 | --- | --- | |
| JL-45A | 12/15/87 | LL | 0.7 | 23 | 0 | 16 | 0.7 | --- | --- | |
| G5070 | 12/4/87 | LL | 0.9 | 43 | 0 | 43 | 0.9 | --- | --- | |
| KRL-2 | 12/8/87 | EXT | | | | | --- | --- | --- | 2.5 |
| KRL-5 | 12/9/87 | RL | 0.6 | 5 | 0 | 35 | 0.5 | --- | --- | |
| KRL-4 | 12/8/87 | LL | 2.0 | 10 | 0 | 22 | 2.0 | --- | --- | |
| KRL-7 | 12/9/87 | LL | 0.5 | 35 | 0 | 35 | 0.5 | --- | --- | |
| KRL-1 | 12/8/87 | LL | 0.7 | 40 | 0 | 20 | 0.7 | --- | --- | |
| G5059a | 12/2/87 | LL | 4.2 | 46 | 12 | 40 | 4.1 | 1.0 | 64 | |
| G5059b | 12/2/87 | LL | 5.3 | 43 | 0 | 40 | 5.3 | --- | --- | |
| 871205K | 12/5/87 | LL | 2.7 | 225 | 6 | 220 | 2.7 | 0.4 | 50 | |
| KK-33 | 12/8/87 | LL | 3.4 | 40 | ~0 | 38 | 3.4 | --- | --- | |
| KK-23 | 12/8/87 | LL | 0.8 | 31 | 0 | 30 | 0.8 | --- | --- | |
| KK-25 | 12/8/87 | LL | 5.5 | 212 | 2 | 214 | 5.5 | 0.3 | --- | |
| KK-26 | 12/8/87 | LL | 5.7 | 36 | 0 | 31 | 5.7 | --- | --- | |
| KK-27 | 12/8/87 | LL | 4.0 | 38 | 0 | 35 | 4.0 | --- | --- | |
| KK-29 | 12/8/87 | LL | 1.8 | 54 | ~0 | 50 | 1.8 | --- | --- | |
| KK-30 | 12/8/87 | LL | 2.0 | 25 | 0 | 32 | 2.0 | --- | --- | |
| KK-28 | 12/8/87 | LL | 1.5 | 210 | 24 | 165 | 1.0 | 1.1 | 32 | |
| KK-31 | 12/8/87 | LL | 4.4 | 20 | ~0 | 0 | 4.1 | --- | --- | |
| KK-32 | 12/8/87 | LL | 5.2 | 238 | 8 | 190 | 3.4 | 3.9 | 11 | |
| KS-30 | 12/2/87 | LL | 1.4 | 0 | 0 | 0 | 1.4 | --- | --- | |

Appendix 2. continued

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| KS-29 | 12/2/87 | | LL | 1.8 | 75 | 0 | 50 | 1.6 | --- | --- | |
| KS-28 | 12/2/87 | | LL | 11.4 | 26 | 0 | 15 | 11.2 | --- | --- | |
| KS-27 | 12/2/87 | | LL | 8.7 | 70 | 0 | 5 | 3.7 | --- | --- | |
| KS-26 | 12/2/87 | | LL | 6.3 | 32 | 0 | 32 | 6.3 | --- | --- | |
| KS-25 | 12/2/87 | | LL | 9.2 | 30 | 0 | 23 | 9.1 | --- | --- | |
| KS-23 | 12/2/87 | | LL | 8.3 | 27 | 0 | 27 | 8.3 | --- | --- | |
| RVS-210 | 11/28/87 | | LL | 7.0 | 34 | 5 | 38 | 7.0 | 0.8 | 51 | |
| KS-22 | 12/2/87 | | LL | 6.4 | 30 | 0 | 30 | 6.4 | --- | --- | |
| RVS-209 | 11/28/87 | | LL | 12.5 | 35 | 15 | 35 | 12.1 | 3.2 | --- | |
| KS-20 | 12/2/87 | | LL | 4.9 | 32 | 0 | 26 | 4.9 | --- | --- | |
| KS-7 | 11/30/87 | | LL | 2.2 | 27 | 5 | 8 | 2.1 | 0.7 | 15 | |
| KS-18 | 12/2/87 | | LL | 4.7 | 62 | 0 | 22 | 3.6 | --- | --- | |
| KS-5 | 11/30/87 | | LL | 5.6 | 196 | 0 | 196 | 5.6 | --- | --- | |
| KS-17 | 12/2/87 | | LL | 3.6 | 217 | 28 | 202 | 3.1 | 1.9 | 64 | |
| KS-16a | 12/2/87 | | LL | 1.1 | 45 | 0 | 35 | 1.1 | --- | --- | |
| KS-16b | 12/2/87 | | LL | 1.5 | 35 | 20 | 35 | 1.4 | 0.5 | --- | |
| KS-8 | 12/1/87 | | LL | 2.8 | 44 | 0 | 30 | 2.7 | --- | --- | |
| KS-15 | 12/2/87 | | LL | 1.5 | 20 | 0 | 14 | 1.5 | --- | --- | |
| KS-14 | 12/2/87 | | LL | 1.4 | 13 | 0 | 20 | 1.4 | --- | --- | |
| KS-13 | 12/2/87 | | LL | 2.2 | 57 | 13 | 24 | 1.8 | 1.3 | 23 | |
| KS-12 | 12/2/87 | | LL | 1.3 | 26 | 0 | 30 | 1.3 | --- | --- | |
| KS-11 | 12/2/87 | | LL | 1.0 | 54 | 0 | 15 | 0.8 | --- | --- | |
| KS-10 | 12/2/87 | | LL | 1.2 | 0 | 0 | 0 | 1.2 | --- | --- | |
| 871202C | 12/2/87 | | LL | 0.5 | 257 | 0 | 356 | 0.1 | --- | --- | |
| 871202D | 12/2/87 | | EXT | | | | | --- | --- | --- | 0.6 |
| MR-131 | 12/17/87 | 13:40 | LNO | 4.9 | 76 | 67 | 5 | 0.6 | 4.9 | 68 | |
| MR-130 | 12/7/87 | 13:31 | LL | 1.7 | 109 | 40 | 33 | 0.3 | 1.7 | 41 | |
| MR-128 | 12/7/87 | 12:52 | LL | 3.0 | 92 | 33 | 65 | 2.2 | 2.0 | 55 | |
| MR-129 | 12/7/87 | 13:05 | LL | 2.3 | 73 | 13 | 73 | 2.2 | 0.5 | --- | |
| G5060a | 12/2/87 | | LL | 2.0 | 62 | 0 | 62 | 2.0 | --- | --- | |
| G5060b | 12/2/87 | | LL | 5.0 * | 65 | ~0 | 56 | 5.0 * | --- | --- | |
| 871204H | 12/4/87 | | LL | 2.9 | 72 | 8 | 41 | 2.5 | 1.5 | 15 | |
| KK/KL-1 | 12/7/87 | | LL | 4.3 | 70 | 0 | 49 | 4.0 | --- | --- | |
| 871203G | 12/3/87 | | LL | 1.7 | 19 | 6 | 8 | 1.7 | 0.4 | 29 | |
| KRL-11 | 12/4/87 | | LL | 3.5 | 42 | 0 | 36 | 3.5 | --- | --- | |
| KB/KL-CC | 12/13/87 | | LL | 4.4 | 60 | 0 | 44 | 4.2 | --- | --- | |
| KB/KL-BB | 12/3/87 | | LL | 1.7 | 38 | 0 | 23 | 1.6 | --- | --- | |
| KB/KL-AA1 | 12/3/87 | | LL | 1.5 | 45 | 11 | 20 | 1.3 | 0.7 | 25 | |
| KB/KL-AA2 | 12/3/87 | | LL | 1.7 | 60 | 9 | 20 | 1.3 | 1.1 | 14 | |
| KB/KL-AA3 | 12/3/87 | | LL | 2.8 | 32 | 0 | 19 | 2.7 | --- | --- | |
| 871203A | 12/3/87 | | LL | 3.4 | 28 | 5 | 12 | 3.3 | 1.0 | 18 | |
| 871203F | 12/3/87 | | LL | 3.5 | 17 | ~0 | 12 | 3.5 | --- | --- | |

Appendix 2. continued

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 871203E | 12/3/87 | | LL | 1.5 | 27 | ~0 | 8 | 1.4 | --- | --- | |
| 871203D | 12/3/87 | | LL | 3.0 | 38 | 8 | 23 | 2.9 | 0.9 | 29 | |
| 871203C | 12/3/87 | | LL | 0.9 | 25 | ~0 | 5 | 0.8 | --- | --- | |
| DMM-24 | 12/13/87 | | NO | | | | 80 | --- | >=5 | --- | |
| DMM-25 | 12/13/87 | | NO | | | | 68 | --- | >=3 | --- | |
| MR-95 | 12/4/87 | 14:14 | EXT | | | | | --- | --- | --- | 1.5 |
| 871205F | 12/5/87 | | LL | 4.1 | 49 | 0 | 50 | 4.1 | --- | --- | |
| 871204D | 12/4/87 | | LL | 2.6 | 249 | 43 | 189 | 1.0 | 2.4 | 47 | |
| 871205D | 12/5/87 | | R/EXT | 3.1 | 287 | 45 | 335 | 1.5 | 2.7 | 53 | 3.4 |
| KRL-MM | 12/5/87 | | LL | 2.5 | 226 | 65 | 334 | 0.3 | 2.5 | 66 | |
| MR-136 | 12/8/87 | 10:56 | LL | 1.1 | 32 | 0 | 28 | 1.1 | --- | --- | |
| 871204B | 12/4/87 | | LL | 1.2 | 46 | ~0 | 12 | 1.0 | --- | --- | |
| 871205A | 12/5/87 | | LL | 2.7 | 42 | ~0 | 37 | 2.7 | --- | --- | |
| RVS-1219 | 12/4/87 | | LL | 1.2 | 11 | ~0 | 19 | 1.2 | --- | --- | |
| RVS-1218 | 12/4/87 | | RL | 2.3 | 315 | ~0 | 329 | 2.2 | --- | --- | |
| RVS-1217 | 12/4/87 | | RL | 3.3 | 149 | 14 | 147 | 3.2 | 0.8 | 82 | |
| DMM-23 | 12/3/87 | | RL | 3.5 | 131 | 6 | 158 | 3.1 | 1.6 | 13 | |
| RVS-1216 | 12/4/87 | | RL | 7.1 | 143 | 27 | 141 | 6.3 | 3.2 | 86 | |
| DMM-22 | 12/13/87 | | RL | 4.9 | 160 | 13 | 160 | 4.8 | 1.1 | --- | |
| RVS-1215 | 12/4/87 | | RL | 5.6 | 312 | ~0 | 324 | 5.5 | --- | --- | |
| DMM-21 | 12/13/87 | | RL | 3.7 | 132 | 8 | 150 | 3.5 | 1.2 | 24 | |
| RVS-1214 | 12/4/87 | | RL | 2.5 | 333 | ~0 | 338 | 2.5 | --- | --- | |
| RVS-1213 | 12/3/87 | | RL | 5.0 | 326 | ~0 | 319 | 5.0 | --- | --- | |
| DMM-20 | 12/13/87 | | RL | 2.1 | 143 | 9 | 139 | 2.1 | 0.4 | 66 | |
| DMM-20 | 12/13/87 | | RL | 4.5 | 319 | ~0 | 319 | 4.5 | --- | --- | |
| RVS-1212 | 12/3/87 | | RL | 2.4 | 326 | ~0 | 325 | 2.4 | --- | --- | |
| DMM-19 | 12/13/87 | | RL | 2.8 | 139 | 10 | 155 | 2.7 | 0.9 | 33 | |
| RVS-1225 | 12/4/87 | | RL | 1.9 | 325 | 4 | 331 | 1.9 | 0.2 | --- | |
| RVS-1226 | 12/4/87 | | RL | 0.7 | 316 | ~0 | 332 | 0.7 | --- | --- | |
| RVS-1221 | 12/4/87 | | RL | 2.1 | 307 | 42 | 343 | 1.3 | 1.7 | 57 | |
| RVS-1220 | 12/4/87 | | RL | 2.9 | 303 | 35 | 335 | 2.0 | 2.1 | 53 | |
| RVS-1222 | 12/4/87 | | RL | 2.3 | 301 | 55 | 343 | 1.0 | 2.1 | 65 | |
| RVS-1223 | 12/4/87 | | RL | 1.8 | 320 | 39 | 333 | 1.4 | 1.2 | 74 | |
| RVS-1224 | 12/4/87 | | RL | 1.0 | 320 | ~0 | 324 | 1.0 | --- | --- | |
| MR-93 | 12/4/87 | 11:18 | LL | 2.1 | 205 | 0 | 216 | 2.1 | --- | --- | |
| MR-92 | 12/4/87 | 11:03 | LL | 3.1 | 230 | 0 | 230 | 3.1 | --- | --- | |
| MR-94 | 12/4/87 | 11:34 | LL | 1.7 | 242 | 0 | 235 | 1.7 | --- | --- | |
| MR-137 | 12/8/87 | 12:08 | LL | 1.1 | 32 | 0 | 42 | 1.1 | --- | --- | |
| KK-21 | 12/1/87 | | LL | 1.2 | 42 | 1 | 11 | 1.0 | 0.6 | --- | |
| KK-20 | 12/1/87 | | LL | 1.4 | 39 | 13 | 22 | 1.3 | 0.5 | 38 | |
| KK-19 | 12/1/87 | | LL | 2.2 | 38 | 0 | 30 | 2.2 | --- | --- | |
| KK-18 | 12/1/87 | | LL | 3.9 | 50 | 9 | 42 | 3.8 | 0.8 | 49 | |

Appendix 2. continued

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| KK-17 | 12/1/87 | | LL | 3.2 | 28 | 16 | 42 | 3.0 | 1.2 | 50 |
| JL-69 | 11/30/87 | | LL | 2.4 | 51 | 0 | 49 | 2.4 | --- | --- |
| JL-68 | 11/30/87 | | LL | 1.9 | 51 | 0 | 51 | 1.9 | --- | --- |
| JL-66 | 11/30/87 | | LL | 3.7 | 34 | 0 | 34 | 3.7 | --- | --- |
| JL-64 | 11/30/87 | | LL | 3.6 | 41 | 0 | 41 | 3.6 | --- | --- |
| KRL-FF | 12/4/87 | | LL | 3.0 | 53 | 0 | 53 | 3.0 | --- | --- |
| JL-63 | 11/30/87 | | LL | 1.8 | 57 | 0 | 46 | 1.8 | --- | --- |
| JL-62 | 11/30/87 | | LL | 1.7 | 50 | 0 | 50 | 1.7 | --- | --- |
| JL-36A | 11/30/87 | 12:00 | LL | 1.8 | 45 | ~0 | 45 | 1.8 | --- | --- |
| JL-35 | 11/30/87 | 11:30 | LL | 4.5 | 45 | ~0 | 45 | 4.5 | --- | --- |
| KRL-GG | 12/4/87 | | LL | 3.0 | 55 | 20 | 42 | 2.7 | 1.2 | 58 |
| KRL-HH | 12/4/87 | | LL | 3.5 | 52 | 16 | 35 | 3.2 | 1.4 | 44 |
| JL-34 | 11/30/87 | 11:17 | LL | 4.9 | 36 | ~0 | 36 | 4.9 | --- | --- |
| JL-33 | 11/30/87 | 11:13 | LL | 2.9 | 34 | ~0 | 24 | 2.9 | --- | --- |
| JL-32 | 11/30/87 | 11:00 | LL | 1.0 | 54 | ~0 | 54 | 1.0 | --- | --- |
| KRL-OO | 12/5/87 | | LL | 4.0 | 222 | 19 | 222 | 3.8 | 1.3 | --- |
| KRL-JJ | 12/4/87 | | LL | 2.5 | 42 | 0 | 42 | 2.5 | --- | --- |
| JL-36B | 12/1/87 | 11:56 | LL | 2.5 | 50 | ~0 | 30 | 2.3 | --- | --- |
| JL-53 | 12/13/87 | | LL | 0.6 | 30 | 0 | 30 | 0.6 | --- | --- |
| JL-52 | 12/13/87 | | LL | 1.2 | 28 | 0 | 28 | 1.2 | --- | --- |
| JL-51 | 12/13/87 | | LL | 1.7 | 27 | 0 | 27 | 1.7 | --- | --- |
| JL-49 | 12/13/87 | | LL | 0.4 | 20 | 0 | 20 | 0.4 | --- | --- |
| JL-48 | 12/13/87 | | LL | 1.7 | 46 | 0 | 17 | 1.5 | --- | --- |
| DMM-12 | 12/12/87 | | LL | 0.9 | 64 | 6 | 6 | 0.5 | 0.8 | 7 |
| DMM-13 | 12/12/87 | | NO | | | | 355 | --- | >=4 | |
| DMM-14 | 12/12/87 | | NO | | | | 15 | --- | >=3 | |
| DMM-15 | 12/12/87 | | NO | | | | 9 | --- | >=1 | |
| JL-37 | 12/1/87 | 14:00 | NO | 2.4 | 68 | 60 | 158 | 0.0 | 2.4 | 60 |
| DMM-16 | 12/12/87 | | NO | | | | 355 | --- | >=3 | |
| DMM-11 | 12/12/87 | | LL | 1.6 | 232 | 20 | 217 | 1.5 | 0.7 | 55 |
| DMM-10 | 12/12/87 | | LL | 2.6 | 218 | 14 | 213 | 2.5 | 0.7 | 71 |
| DMM-9 | 12/12/87 | | LL | 1.9 | 219 | 15 | 217 | 1.8 | 0.5 | 83 |
| DMM-8 | 12/12/87 | | LL | 1.3 | 224 | 17 | 207 | 1.2 | 0.5 | 46 |
| DMM-7 | 12/12/87 | | LL | 0.8 | 212 | 18 | 206 | 0.8 | 0.3 | 72 |
| DMM-1 | 12/12/87 | | LL | 0.5 | 220 | 15 | 205 | 0.5 | 0.2 | 46 |
| RVS-1209 | 12/3/87 | | RL | 2.0 | 332 | ~0 | 327 | 2.0 | --- | --- |
| RVS-1210 | 12/3/87 | | RL | 2.3 | 331 | ~0 | 327 | 2.3 | --- | --- |
| RVS-1211 | 12/3/87 | | RL | 0.8 | 328 | ~0 | 327 | 0.8 | --- | --- |
| DMM-4 | 12/12/87 | | LL | 0.9 | 11 | 15 | 174 | 0.8 | 0.3 | 43 |
| DMM-5 | 12/12/87 | | LL | 0.5 | 1 | 13 | 164 | 0.5 | 0.2 | 38 |
| DMM-5 | 12/12/87 | | LL | 0.5 | 28 | ~0 | 164 | 0.4 | --- | --- |
| DMM-5 | 12/12/87 | | LL | 0.6 | 19 | 16 | 164 | 0.5 | 0.4 | 27 |

Appendix 2. continued

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| RVS-1204 | 12/3/87 | | LL | 2.2 | 8 | ~0 | 8 | 2.2 | --- | --- |
| RVS-1208 | 12/3/87 | | RL | 1.4 | 313 | ~0 | 313 | 1.4 | --- | --- |
| RVS-1206 | 12/3/87 | | RL | 0.8 | 315 | ~0 | 315 | 0.8 | --- | --- |
| RVS-1207 | 12/3/87 | | RL | 2.0 | 318 | ~0 | 318 | 2.0 | --- | --- |
| RVS-1205 | 12/3/87 | | RL | 2.0 | 314 | ~0 | 314 | 2.0 | --- | --- |
| RVS-1203 | 12/3/87 | | RL | 0.6 | 330 | ~0 | 330 | 0.6 | --- | --- |
| RVS-1201 | 12/3/87 | | RL | 1.0 | 322 | ~0 | 321 | 1.0 | --- | --- |
| RVS-1200 | 12/3/87 | | RL | 1.1 | 330 | ~0 | 330 | 1.1 | --- | --- |
| RVS-1202 | 12/3/87 | | RL | 1.7 | 317 | ~0 | 317 | 1.7 | --- | --- |
| RVS-1230 | 12/4/87 | | LL | 1.1 | 13 | 0 | 13 | 1.1 | --- | --- |
| RVS-1229 | 12/4/87 | | LL | 1.8 | 18 | 0 | 18 | 1.8 | --- | --- |
| RVS-1403 | 12/14/87 | | LL | 2.3 | 27 | 6 | 26 | 2.3 | 0.2 | 81 |
| RVS-1228 | 12/4/87 | | LL | 5.0 | 208 | 44 | 207 | 3.6 | 3.5 | 89 |
| RVS-1402 | 12/14/87 | | LL | 2.0 | 29 | ~0 | 29 | 2.0 | --- | --- |
| RVS-1227 | 12/4/87 | | RL | 0.7 | 8 | ~0 | 8 | 0.7 | --- | --- |
| RVS-1401 | 12/14/87 | | LL | 5.1 | 195 | 32 | 190 | 4.3 | 2.7 | 82 |
| RVS-1405 | 12/14/87 | | LL | 9.1 | 211 | 2 | 203 | 9.0 | 1.3 | --- |
| RVS-1404 | 12/14/87 | | LL | 3.4 | 10 | 1 | 19 | 3.4 | 0.5 | --- |
| RVS-503 | 12/13/87 | | LL | 4.2 | 13 | 36 | 10 | 3.4 | 2.5 | 86 |
| RVS-502 | 12/13/87 | | LL | 3.9 | 203 | 2 | 203 | 3.9 | 0.1 | --- |
| RVS-501 | 12/13/87 | | LL | 4.7 | 17 | 9 | 14 | 4.6 | 0.8 | 72 |
| RVS-500 | 12/13/87 | | LL | 2.9 | 24 | ~0 | 17 | 2.9 | --- | --- |
| RVS-504 | 12/13/87 | | LL | 0.6 | 26 | 52 | 5 | 0.3 | 0.5 | 74 |
| RVS-505 | 12/13/87 | | LL | 1.1 | 14 | 29 | 176 | 0.9 | 0.6 | 61 |
| MR-79 | 12/2/87 | 12:10 | LL | 2.4 | 45 | 24 | 166 | 1.1 | 2.1 | 27 |
| MR-80 | 12/2/87 | 12:16 | LL | 7.3 | 20 | 33 | 174 | 5.5 | 4.8 | 56 |
| MR-81 | 12/2/87 | 13:12 | LL | 1.3 | 14 | 67 | 176 | 0.5 | 1.2 | 83 |
| KK-22 | 12/1/87 | | LL | 2.9 | 17 | 4 | 19 | 2.9 | 0.2 | --- |
| 1908 | 12/19/87 | | LL | 1.8 | 36 | 18 | 4 | 1.5 | 1.1 | 32 |
| 1903 | 12/19/87 | | LL | 3.2 | 10 | 77 | 2 | 0.7 | 3.1 | 88 |
| 1901 | 12/19/87 | | LL | 3.3 | 332 | 76 | 354 | 0.7 | 3.2 | 85 |
| 1902 | 12/19/87 | | LL | 1.6 | 355 | 40 | 0 | 1.2 | 1.0 | 84 |
| MR-83 | 12/3/87 | 11:50 | LL | 1.8 | 22 | 0 | 11 | 1.8 | --- | --- |
| MR-84 | 12/3/87 | 12:01 | LL | 1.3 | 27 | 9 | 19 | 1.3 | 0.3 | 49 |
| 121587-1 | 12/15/87 | | LNO | 2.2 | 40 | 63 | 167 | 0.6 | 2.1 | 68 |
| 121587-2 | 12/15/87 | | LL | 1.9 | 31 | 32 | 5 | 1.4 | 1.2 | 55 |

Appendix 2. continued

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2003 | 12/20/87 | | RL | 11.0 | 169 | 16 | 5 | 10.2 | 4.2 | 46 | |
| RVS-1015 | 12/20/87 | | EXT | | | | | --- | --- | --- | 2.0 |
| RVS-1011 | 12/20/87 | | LL | 0.6 | 84 | ~0 | 10 | 0.2 | --- | --- | |
| RVS-1012 | 12/20/87 | | EXT | | | | | --- | --- | --- | 1.1 |
| RVS-1012′ | 12/20/87 | | R/EXT | 0.7 | 129 | 51 | 23 | 0.1 | 0.7 | 52 | 2.4 |
| RVS-1014 | 12/20/87 | | RNO | 2.8 | 143 | 44 | 30 | 0.8 | 2.7 | 46 | |
| RVS-1007 | 12/19/87 | | LNO | 8.3 | 96 | 58 | 20 | 1.1 | 8.2 | 59 | |
| RVS-1006 | 12/19/87 | | LNO | 4.2 | 87 | 47 | 28 | 1.5 | 3.9 | 51 | |
| RVS-1010 | 12/19/87 | | LL | 2.0 | 107 | 42 | 41 | 0.6 | 1.9 | 45 | |
| RVS-1009 | 12/19/87 | | RL | 0.5 | 343 | ~0 | 195 | 0.4 | --- | --- | |
| RVS-1013 | 12/20/87 | | L/EXT | 0.4 | 287 | 49 | 209 | 0.1 | 0.4 | 50 | 1.8 |
| RVS-1018 | 12/20/87 | | LNO | 3.9 | 290 | 46 | 217 | 0.8 | 3.8 | 47 | |
| RVS-1000 | 12/19/87 | | RL | 0.7 | 155 | 26 | 169 | 0.6 | 0.3 | 64 | |
| RVS-1001 | 12/19/87 | | RL | 1.6 | 153 | 31 | 156 | 1.4 | 0.8 | 85 | |
| RVS-1002 | 12/19/87 | | RL | 4.1 | 162 | 14 | 156 | 4.0 | 1.1 | 67 | |
| RVS-1003 | 12/19/87 | | RL | 6.3 | 143 | 26 | 156 | 5.5 | 3.0 | 65 | |
| RVS-1004 | 12/19/87 | | RL | 6.4 | 332 | ~0 | 340 | 6.3 | --- | --- | |
| RVS-1005 | 12/19/87 | | RL | 4.3 | 310 | ~0 | 324 | 4.2 | --- | --- | |
| ERDL | 12/16/87 | 15:00 | RL | | | | | 14.0 * | | | |
| R | 1/14/88 | 15:00 | | | | | | 17.0 * | | | |
| R | 10/25/88 | 15:35 | | | | | | 20.5 * | | | |
| RVS-1501 | 12/16/87 | | RL | 20.7 | 330 | 11 | 329 | 20.3 | 4.0 | 85 | |
| E Quad | 12/16/87 | 9:10 | RL | 20.5 * | 330 | 12 | 329 | 20.0 * | 4.3 * | 85 | |
| D | 12/20/87 | 15:32 | | | | | | 0.7 | 0.0 | --- | |
| D | 1/13/88 | 7:45 | | | | | | 3.4 | 0.0 | --- | |
| D | 2/23/88 | 14:35 | | | | | | 5.6 | 0.0 | --- | |
| D | 4/26/88 | 18:20 | | | | | | 7.5 | 0.0 | --- | |
| D | 10/25/88 | 9:26 | | | | | | 10.1 | 0.0 | --- | |
| BUCKLEYS | | | | | | | | | | | |
| WNRT RD | 12/14/87 | | NO | 15.0 | 0 | 90 | 0 | 0.0 | 15.0 | --- | |
| R | 1/3/88 | | | 16.4 | | | | 0.0 | 16.4 | --- | |
| R100 | 12/12/87 | | NO | 20.6 | 7 | 90 | 7 | 0.0 | 20.6 | --- | |
| DITCH | 12/14/87 | | NO | 8.0 | 332 | 90 | 332 | 0.0 | 8.0 | --- | |