

TECHNICAL REPORT 85-3

SEISMIC ACTIVITY NEAR THE V.C. SUMMER NUCLEAR STATION

**For the Period
July - September 1985**

by
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INTRODUCTION

An analysis of the seismic activity near the V.C. Summer Nuclear Station in South Carolina during July-September, 1985 is presented in this report. A total of 32 events were located. Two events occurring in July had magnitudes between 1.0 and 2.0, with the majority having magnitudes less than 1.0. Forty percent of the B quality events located at depths within 2 km from the surface.

SEISMIC NETWORK

The report is based primarily on data recorded by the four station network operated by S.C.E.&G. and the USGS/USC stations JSC, 6A, 7 and 9A. The locations of the stations are shown in Figure 1 and their coordinates are listed in Appendix I.

DATA ANALYSIS

Hypocentral locations of the events are determined by using the HYP071 program (Lee and Lahr, 1972) and the velocity model listed in Appendix II. The event magnitude (M_L) is determined from signal duration at station JSC, using the following relation:

$$M_L = -1.83 + 2.04 \log D$$

where D is the signal duration (seconds).

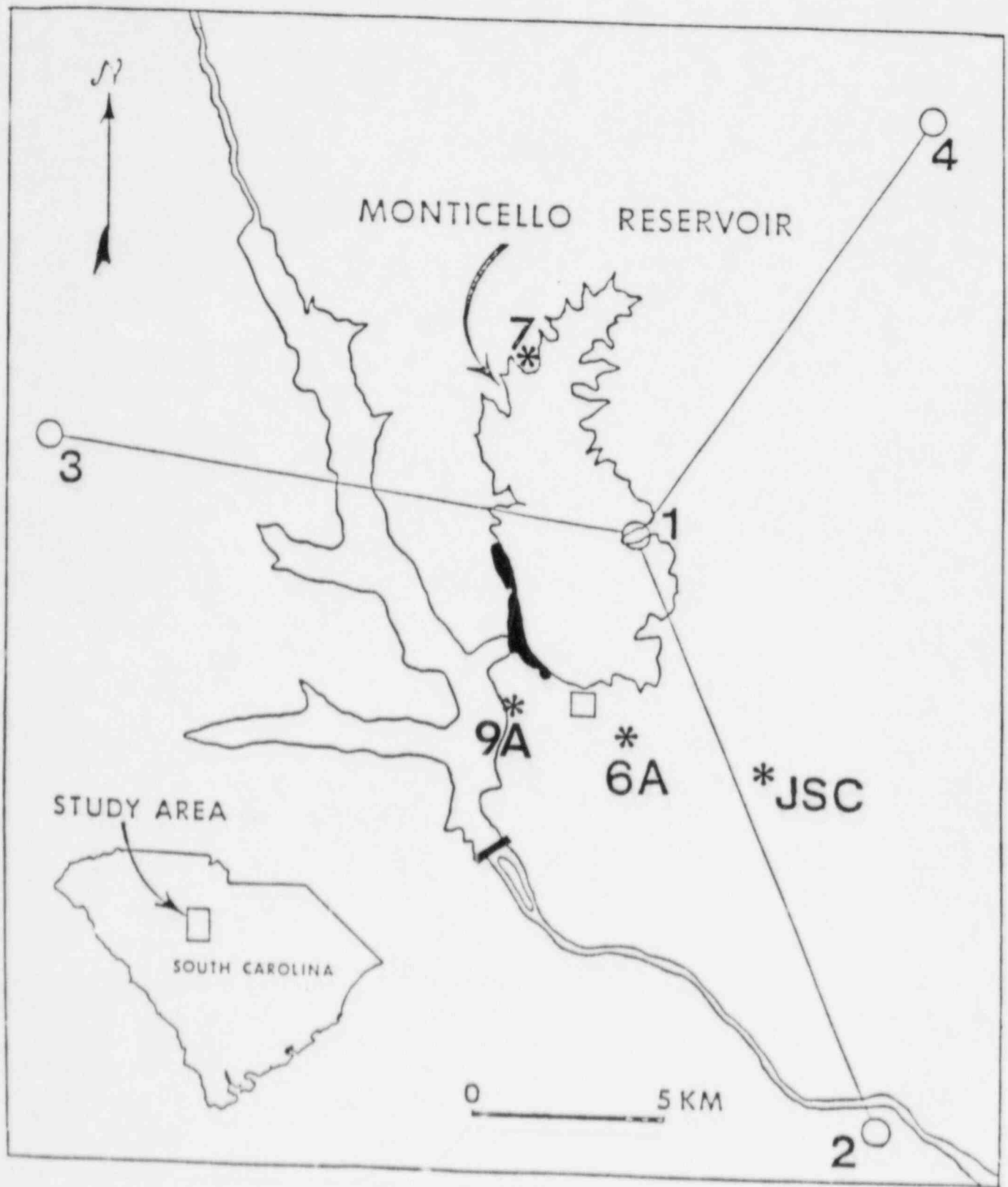


Figure 1

An estimate of daily energy release is determined using a simplified magnitude (M_L) energy (E) relation by Gutenberg and Richter (1956).

$$\log_{10} E = 11.8 + 1.5 M_L .$$

OBSERVED SEISMICITY FOR THE PERIOD JULY-SEPTEMBER, 1985

During this three month period 92, events were recorded with 32 being locatable (see Figure 2 and Appendix III). Two swarms of events occurred, August 22-23 with 7 earthquakes, and September 8 with 14 earthquakes, for which only 3 were locatable due to poor or not enough records. In the reporting period, no records were obtained for stations 1-4 for 12, 9, 9 and 13 days, respectively. Additionally, stations 1 and 4 were down for 3 and 28 days, respectively. If more data had been available, approximately half of the events would have been locatable.

The level of activity decreased from the early part of the year but was higher than that observed in recent years. There were two events with magnitudes greater than 1.0 with the remaining events being less. Six events of B quality located at depths greater than or equal to 2.0 km. Although the seismic activity was scattered throughout the Monticello Reservoir area, the majority of the earthquakes located in the central western side of the reservoir. A cumulative plot of epicenters of all the events located during this period is shown in Figure 2 and a cross section of events located

MONTICELLO EARTHQUAKES JULY - SEPTEMBER 1985

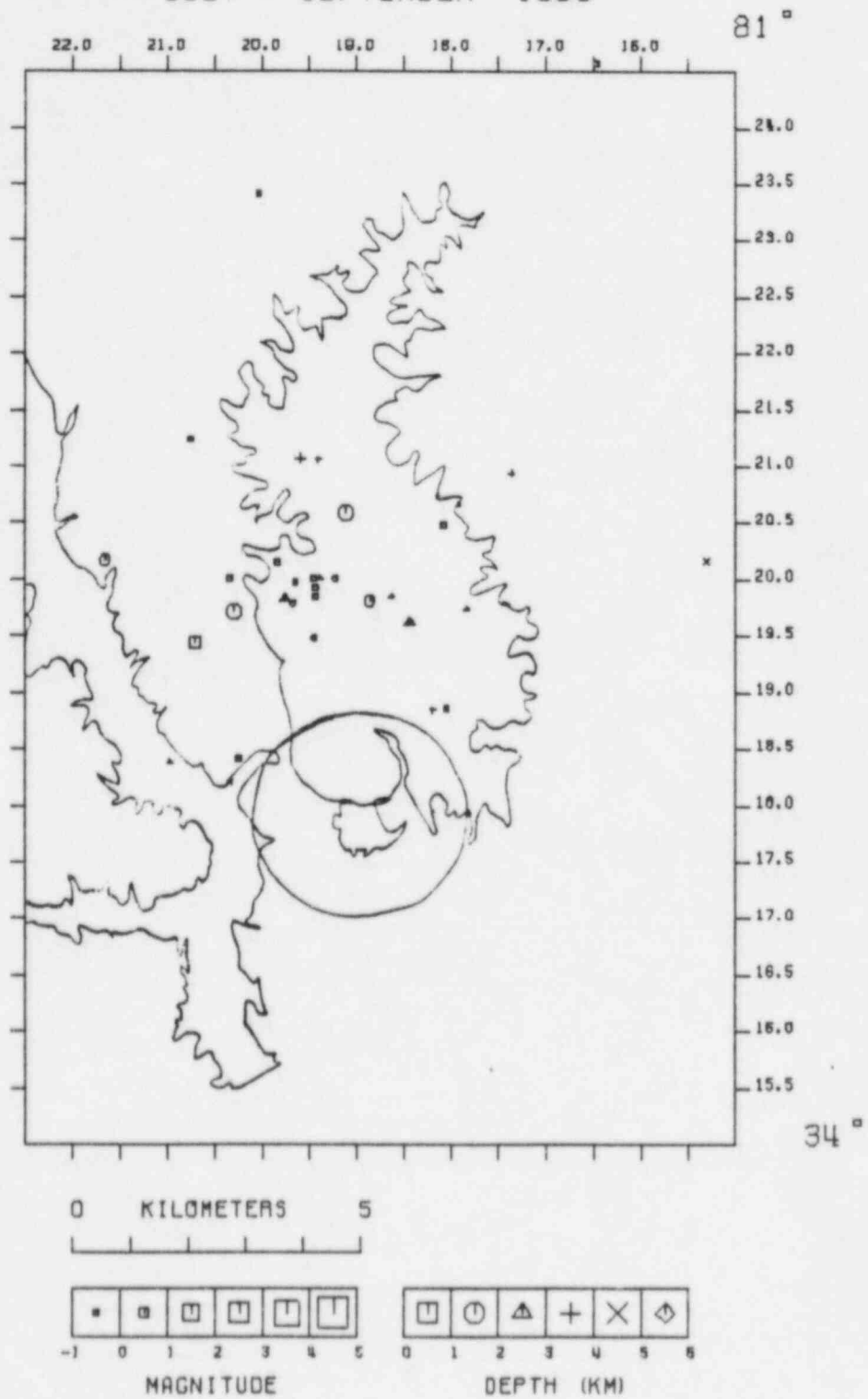


Figure 2

MONTICELLO EARTHQUAKES JULY - SEPTEMBER 1985

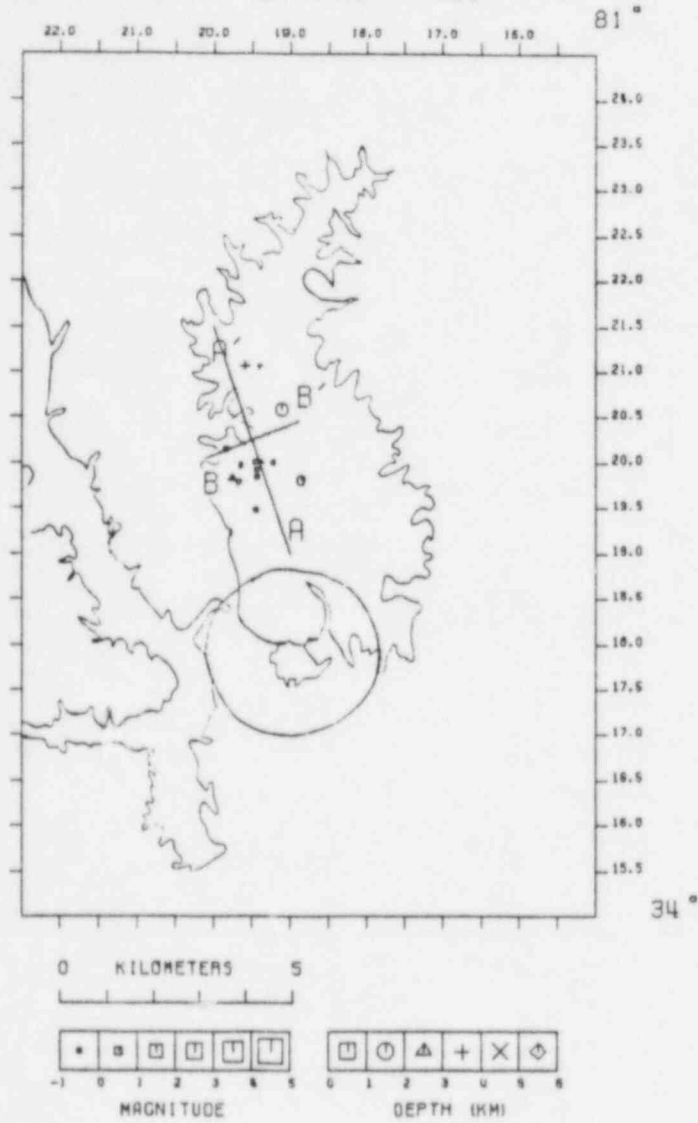


Figure 3

within 1.0 km on each side of line AA' and line BB' is shown in Figure 3. Separation of all epicentral locations by month are shown in Figures 4-6.

EARTHQUAKE BLOOPER

In Technical Report 85-1, the earthquake on January 19, 1985 (1409 UTC or 1009 EST) with a magnitude of 0.95 was computed from paper records to have a depth of 7.23 km with a B quality using 14 phases. A relocation of this event using tape data was conducted by Steve Acree and Jill Rawlins, Research Assistants. A new depth of 0.63 km using 11 phases was found while still keeping its B quality.

RESERVOIR WATER LEVEL AND ITS COMPARISON WITH SEISMICITY

Monticello Reservoir is a pumped storage facility. Any decrease in reservoir level associated with power generation is recovered when water is pumped back into the reservoir. There can be variations up to about five feet per day between the maximum and minimum water level. We have been monitoring this water level to see if there is any correlation between the daily or seasonal changes in the reservoir level and the local seismicity. Figure 7 shows the comparison of water level to seismicity. The top two graphs show the water level and the change of water level per day. The log of energy released per day and the number of events per day are shown on the lower two graphs. These histograms include the unlocated events around the reservoir.

MONTICELLO EARTHQUAKES JULY 1985

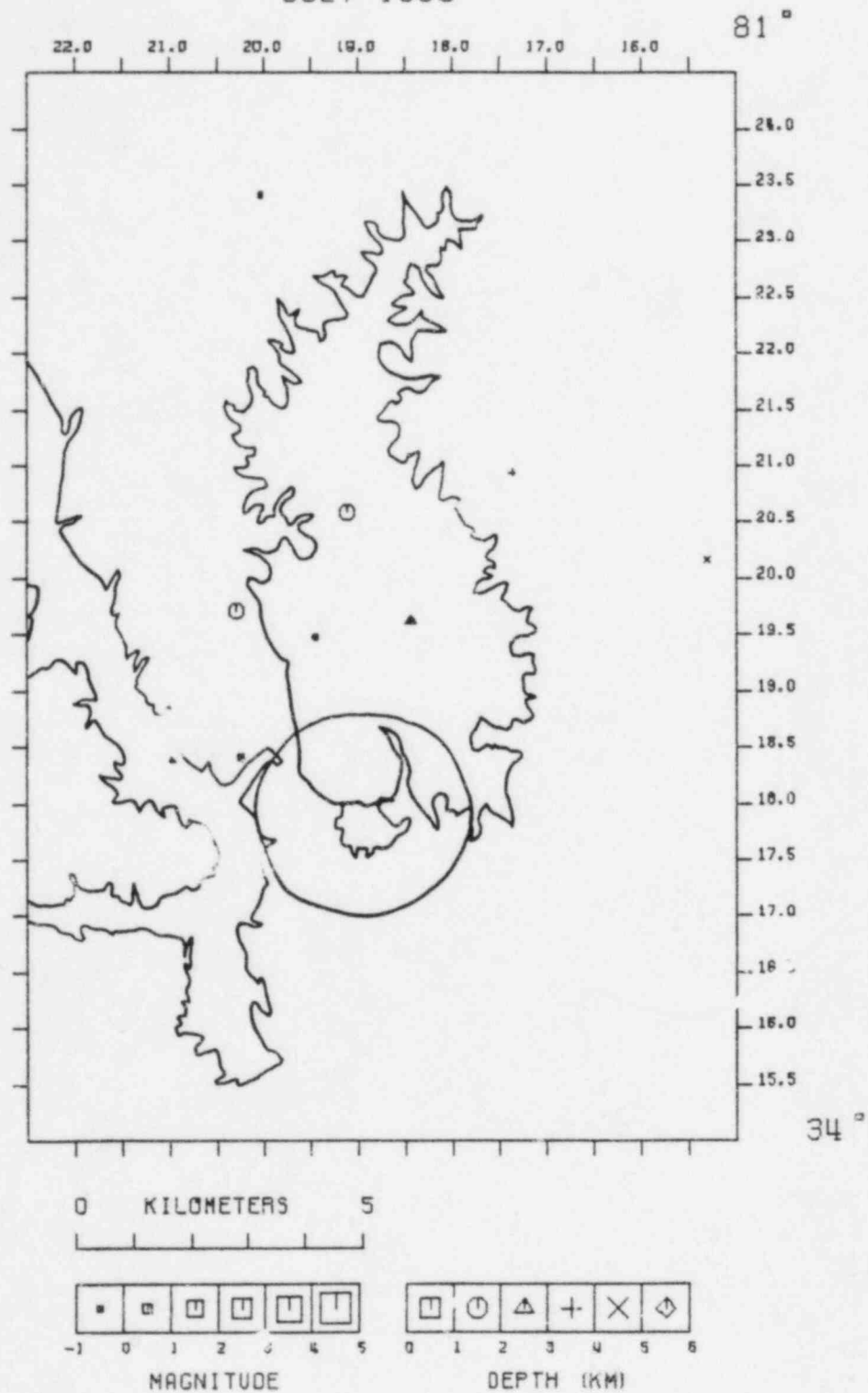


Figure 4

MONTICELLO EARTHQUAKES AUGUST 1985

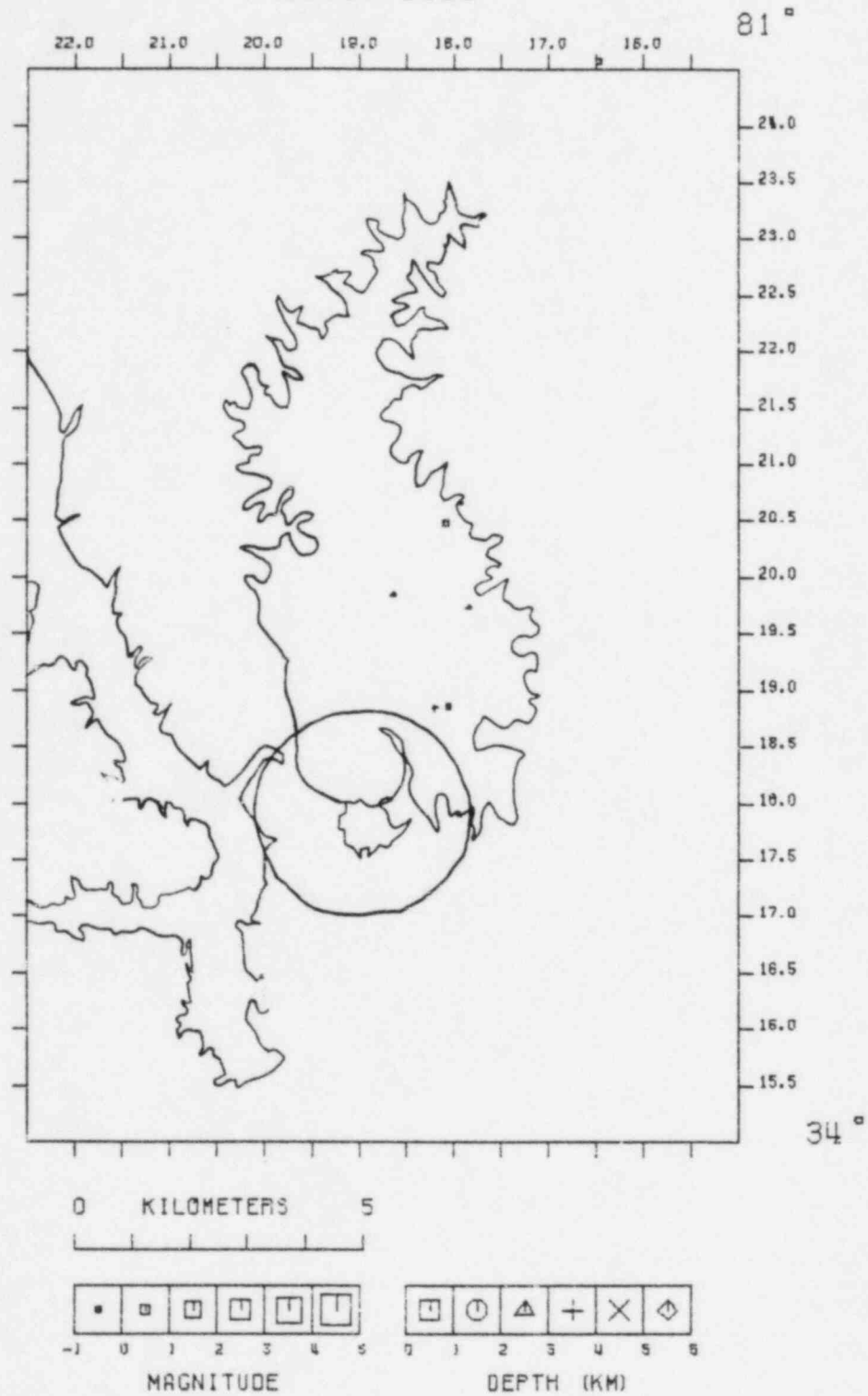


Figure 5

MONTICELLO EARTHQUAKES SEPTEMBER 1985

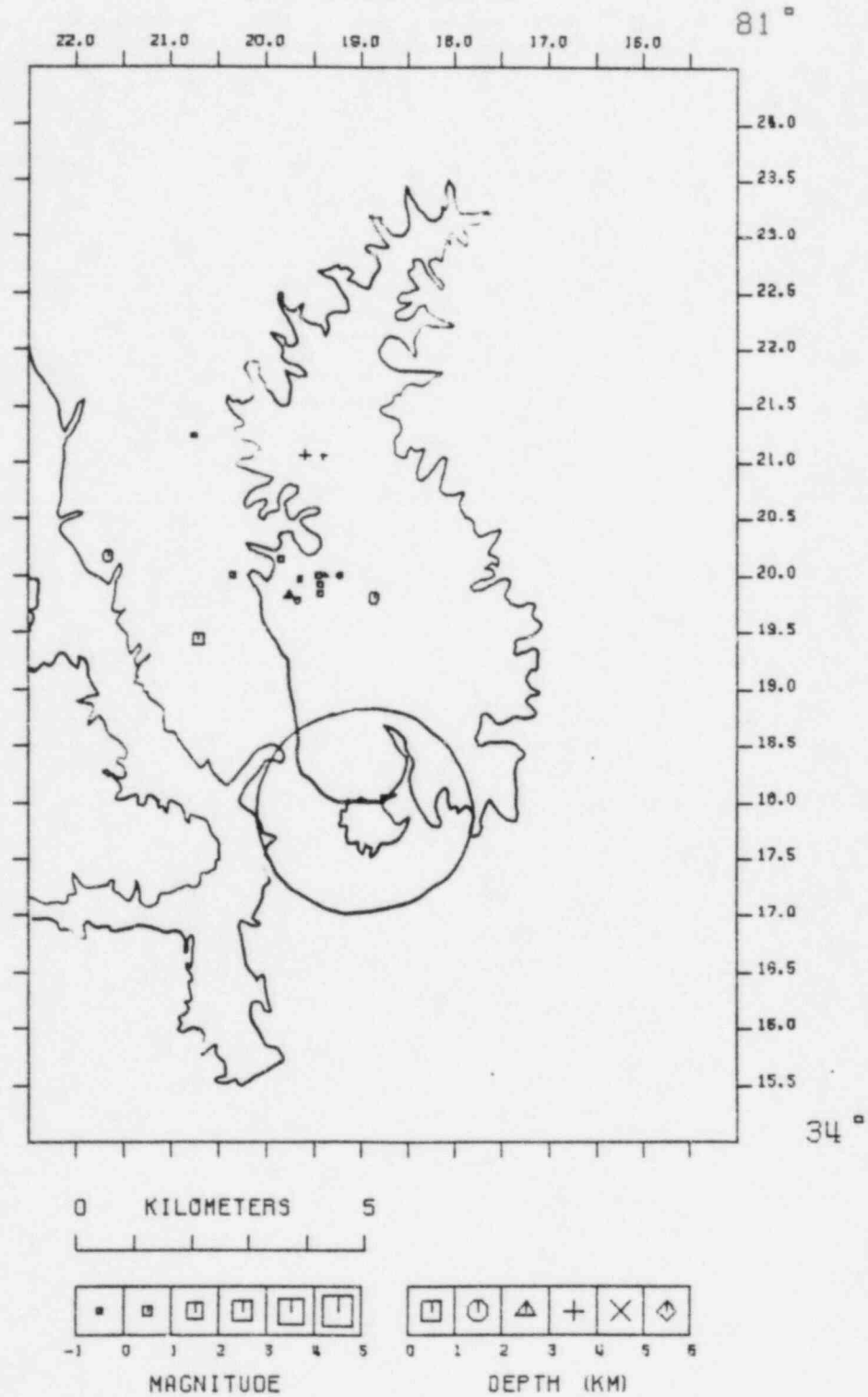


Figure 6

CONCLUSIONS

Compared to the first half of 1985, the level of seismicity decreased discernably. However, it remained higher than in the preceding two years (Figure 8). The third quarter of 1985 was characterized by a moderate level of activity of low magnitude earthquakes ($M_L < 1$), mostly within the upper 2 km. As seen in Figure 7, discrete swarms were dispersed throughout the three month reporting period.

REFERENCES

- Gutenberg, B. and Richter, C.F. (1956). Magnitude and energy of earthquakes, Ann. Geof. 9, p. 1-15.
- Lee, W.H.K. and Lahr, J.C. (1972). A computer program for determining hypocenter, magnitude and first motion pattern of local earthquakes, Revisions of HYPO 71, U.S.G.S. Open-File Report, 100 pp.

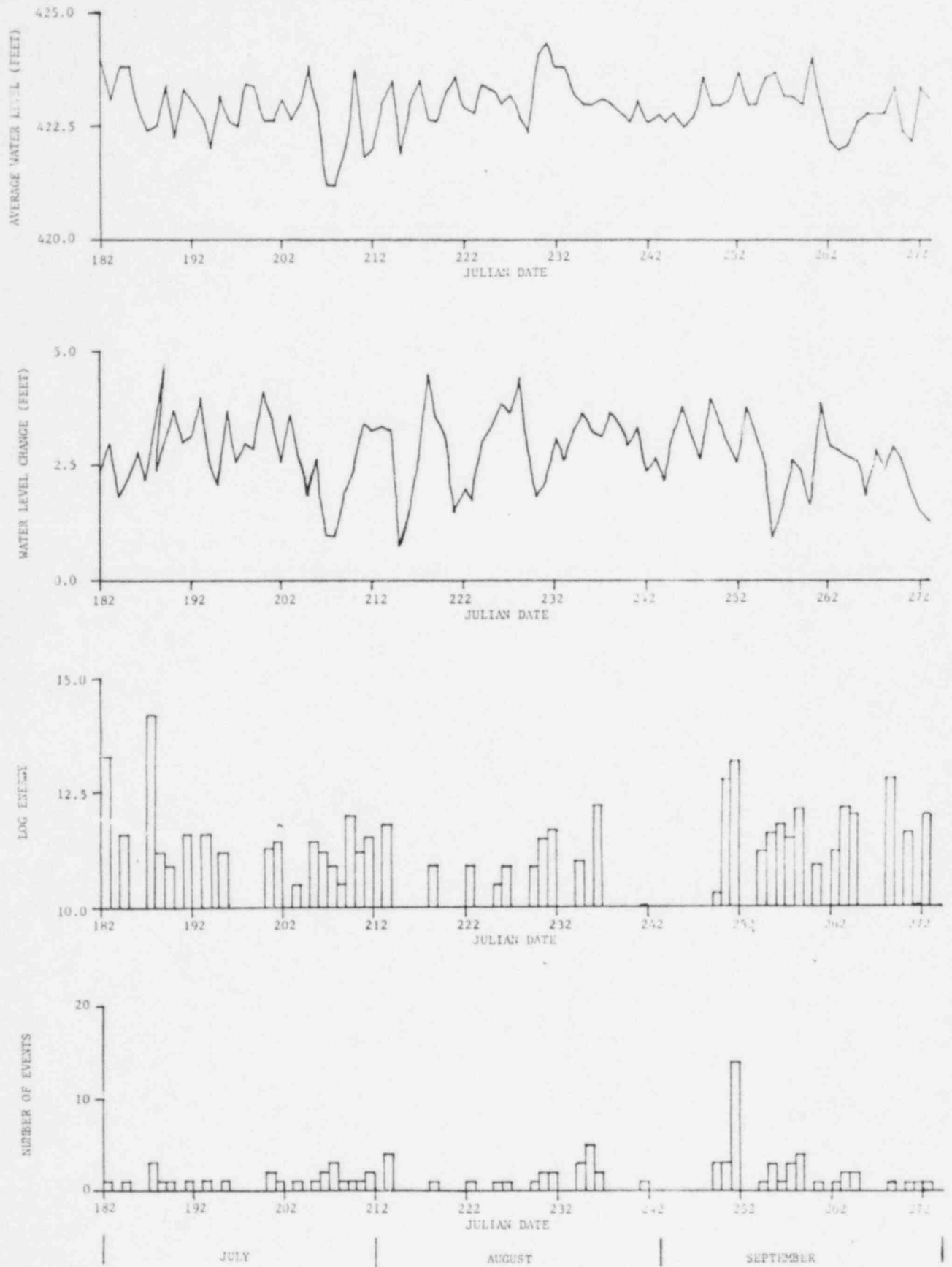


Figure 7

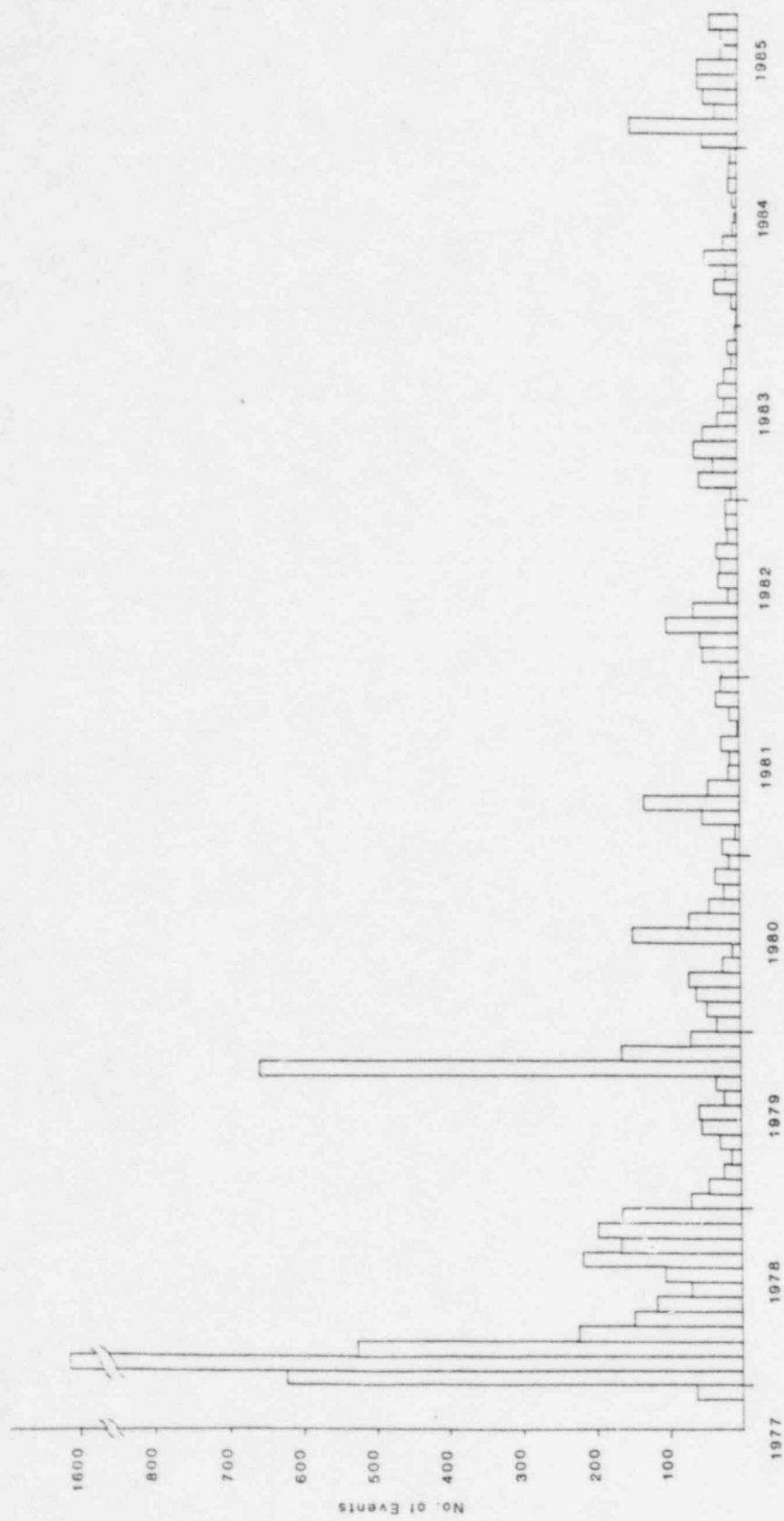


Figure 8

APPENDICES

APPENDIX I

STATION LOCATIONS

NO	STN.	LAT. °N	LONG. °W
1	001	34° 19.91'	81° 17.74'
2	002	34° 11.58'	81° 13.81'
3	003	34° 21.09'	81° 27.41'
4	004	34° 25.72'	81° 12.99'
5	JSC	34° 16.80'	81° 12.99'
6	06A	34° 17.32'	81° 18.15'
7	007	34° 22.23'	81° 19.50'
8	09A	34° 17.24'	81° 18.15'

APPENDIX II

MONTICELLO RESERVOIR

VELOCITY MODEL

Velocity km/sec	Depth to top km
1.00	0.00
5.40	0.03
5.90	0.18
6.10	0.46
6.30	0.82
8.10	30.00

APPENDIX III

MONTICELLO EARTHQUAKES JULY - SEPTEMBER 1985

850701	1555	6.13	34-19.71	81-20.30	1.47	1.09	9	137	3.9	0.03	0.2	0.7	81
850703	1525	52.54	34-19.48	81-19.45	1.98	-0.11	8	134	2.7	0.04	0.5	1.0	81
850706	345	12.39	34-20.59	81-19.11	1.90	-1.15	6	183	3.1	0.03	0.6	0.9	C1
850706	533	13.15	34-20.16	81-15.31	4.51	-0.60	6	243	6.2	0.01	0.2	0.2	C1
850708	555	0.64	34-18.41	81-20.25	0.84	-1.22	4	257	4.8	0.07			C1
850710	126	31.81	34-19.62	81-18.45	2.29	0.51	7	127	1.2	0.06	0.8	1.0	81
850719	2046	58.36	34-23.41	81-20.04	0.93	-0.86	5	262	7.4	0.04	0.2	9.4	D1
850719	2048	39.83	34-18.39	81-20.98	2.04	-0.40	7	158	5.7	0.04	0.4	1.9	81
850720	2344	33.37	34-20.94	81-17.36	3.26	-0.60	4	324	2.0	0.02			C1
850801	744	54.22	34-24.58	81-16.47	1.00	-0.60	4	338	8.8	0.06			C1
850801	830	2.01	34-20.49	81-18.09	0.15	-0.24	4	239	1.2	0.06			C1
850801	2016	38.33	34-19.74	81-17.84	2.74	-0.24	4	228	0.3	0.01			C1
850817	124	13.16	34-19.85	81-18.64	2.24	-0.60	7	126	1.4	0.05	0.3	0.4	81
850818	418	38.98	34-18.86	81-18.06	1.66	-0.40	5	151	2.0	0.04	0.3	0.6	C1
850818	223	4.49	34-18.85	81-18.20	3.11	-0.40	4	153	2.1	0.09			C1
850819	043	34.07	34-20.66	81-17.93	2.75	-0.40	6	161	3.8	0.07	0.0	1.3	81
850907	38	34.29	34-19.44	81-20.70	0.44	0.57	8	258	4.6	0.09	0.9	2.2	C1
850907	354	6.50	34-19.98	81-19.65	0.10	-0.40	7	230	2.9	0.08	1.1	2.9	C1
850907	455	22.25	34-20.01	81-20.34	0.48	-0.60	4	248	4.0	0.04	0.3	0.6	C1
850908	1421	32.76	34-21.07	81-19.60	3.37	-0.44	4	222	2.1	0.02			C1
850908	1430	5.07	34-21.06	81-19.41	3.81	-0.11	4	223	2.2	0.00			C1
850908	1430	36.52	34-20.17	81-21.66	1.00	0.37	3	277	5.0	0.01			C1
850913	2337	40.14	34-20.15	81-19.85	0.15	-0.24	8	234	3.3	0.05	0.2	0.4	C1
850914	641	41.41	34-19.93	81-19.44	0.50	-0.86	6	224	3.6	0.05	0.5	1.1	C1
850914	1018	40.82	34-20.01	81-19.23	1.53	-0.60	7	142	3.3	0.06	0.3	0.8	81
850917	148	34.01	34-19.79	81-19.68	1.78	-0.86	4	233	3.0	0.01			C1
850919	937	56.63	34-19.85	81-19.44	0.80	-0.60	8	147	2.6	0.09	0.4	1.0	81
850920	1221	39.27	34-19.81	81-18.86	1.59	0.21	7	195	1.7	0.08	0.8	1.6	C1
850925	858	49.52	34-19.83	81-19.77	2.85	0.57	10	132	3.1	0.07	0.3	0.6	81
850927	1114	5.58	34-21.24	81-20.76	1.76	-0.24	2	270	2.7	0.03	0.3	0.3	C1
850928	185	24.84	34-20.01	81-19.46	0.18	-0.86	2	224	2.7	0.07	0.6	0.9	C1
850929	106	32.61	34-20.01	81-19.39	2.57	-0.40	9	144	2.5	0.08	0.4	0.7	81