

TECHNICAL REPORT 84-1

SEISMIC ACTIVITY NEAR THE V.C. SUMMER NUCLEAR STATION

**For the Period
January - March 1984**

by
Pradeep Talwani
Principal Investigator
Geology Department
University of South Carolina
Columbia, S.C. 29208
Contract No. N355486

Technical Report 84-1

SEISMIC ACTIVITY NEAR
THE V. C. SUMMER NUCLEAR STATION

For the Period
January - March 1984

by

Pradeep Talwani, Principal Investigator
and
Jill Rawlins, Research Assistant

Geology Department
University of South Carolina
Columbia, S.C. 29208

Contract No. N355486

INTRODUCTION

This report presents a summary of seismic activity near the V. C. Summer Nuclear Power Station in South Carolina for the three month period between January 1 and March 31, 1984. During this reporting period, a total of 31 locatable events were recorded. The largest event was of magnitude 2.0 on March 7, four events had magnitudes between 1.0 and 2.0, and the remaining events were small ($M_L < 1.0$).

SEISMIC NETWORK

The report is based on the data recorded by a four-station network operated by S.C.E. and G. In addition, data from a permanent station (JSC) of the South Carolina seismographic network are also used. Location of all these stations is shown in Figure 1, and their coordinates are listed in Appendix I.

DATA ANALYSIS

Location of the events is determined using HYP071 program (Lee and Lahr, 1972) and the velocity model given 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).

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

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

RESULTS

The 31 located events recorded during this period are listed in Appendix III. One event was of magnitude 2.0 (March 7, 1984), four

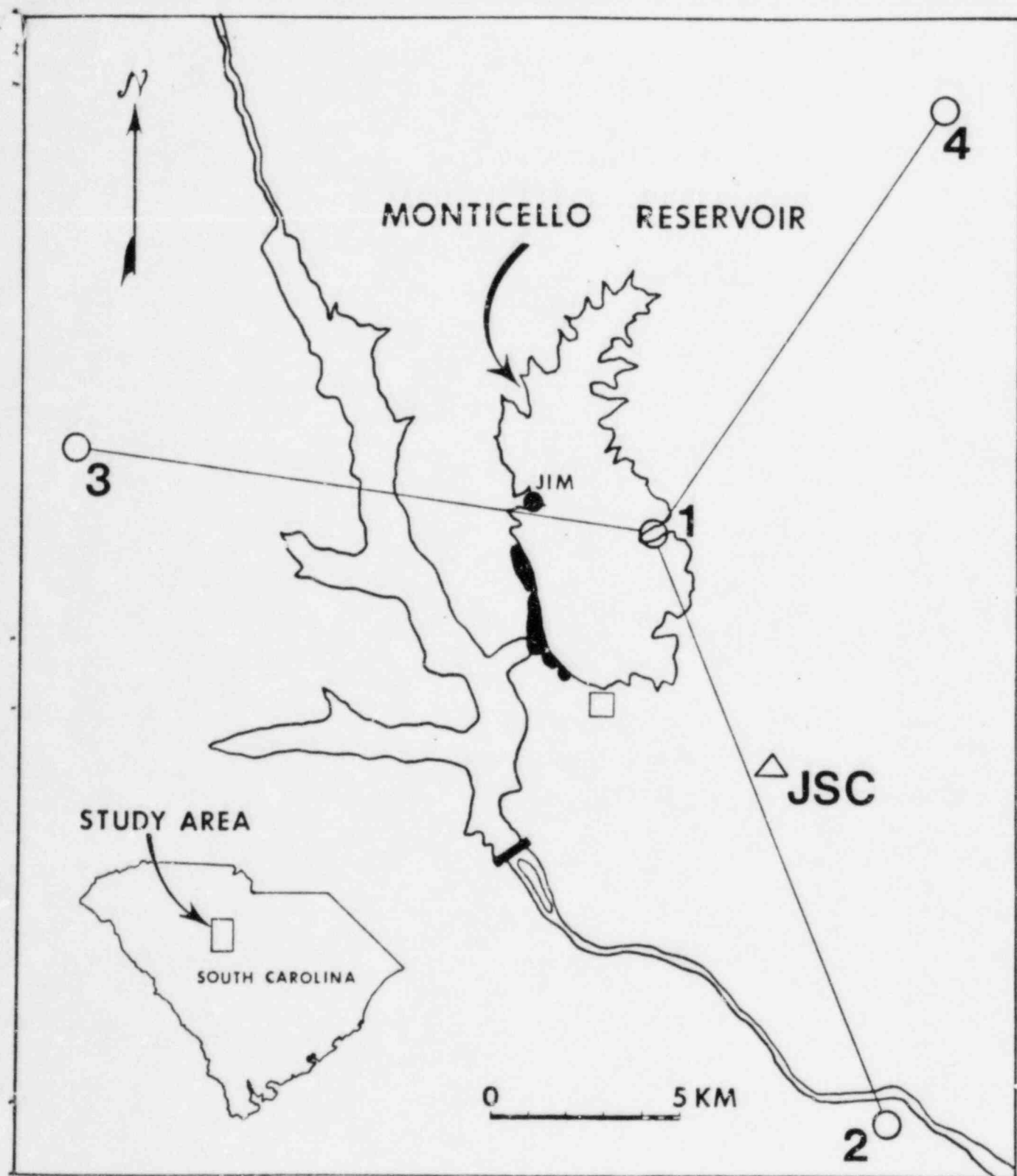


Figure 1

had magnitudes greater than 1.0 (Table 1), and the rest were small.

TABLE 1

| <u>Date</u> | <u>Magnitude</u> |
|-------------|------------------|
| March 7 | 1.09 |
| March 7 | 2.00 |
| March 18 | 1.02 |
| March 18 | 1.18 |
| March 20 | 1.32 |

Depth analyses for this reporting period were not divided into 0.5 km increments as in the past year's reports due to the low number of events. However, 87% of all the events located during this period occurred within the top two kilometers and the deepest event occurred at 2.53 km.

A cumulative plot of epicenters of events located during this period is shown in Figure 2 and a cross section in Figure 3, which appears to show a southwest dipping plane defined by the events within 1.0 km of the cross section. A monthly breakdown of epicentral locations is shown in Figures 4-6. Most of the activity occurred in mid-March in a broad east-west band across the center of the reservoir.

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

MONTICELLO EARTHQUAKES

JANUARY - MARCH 1983

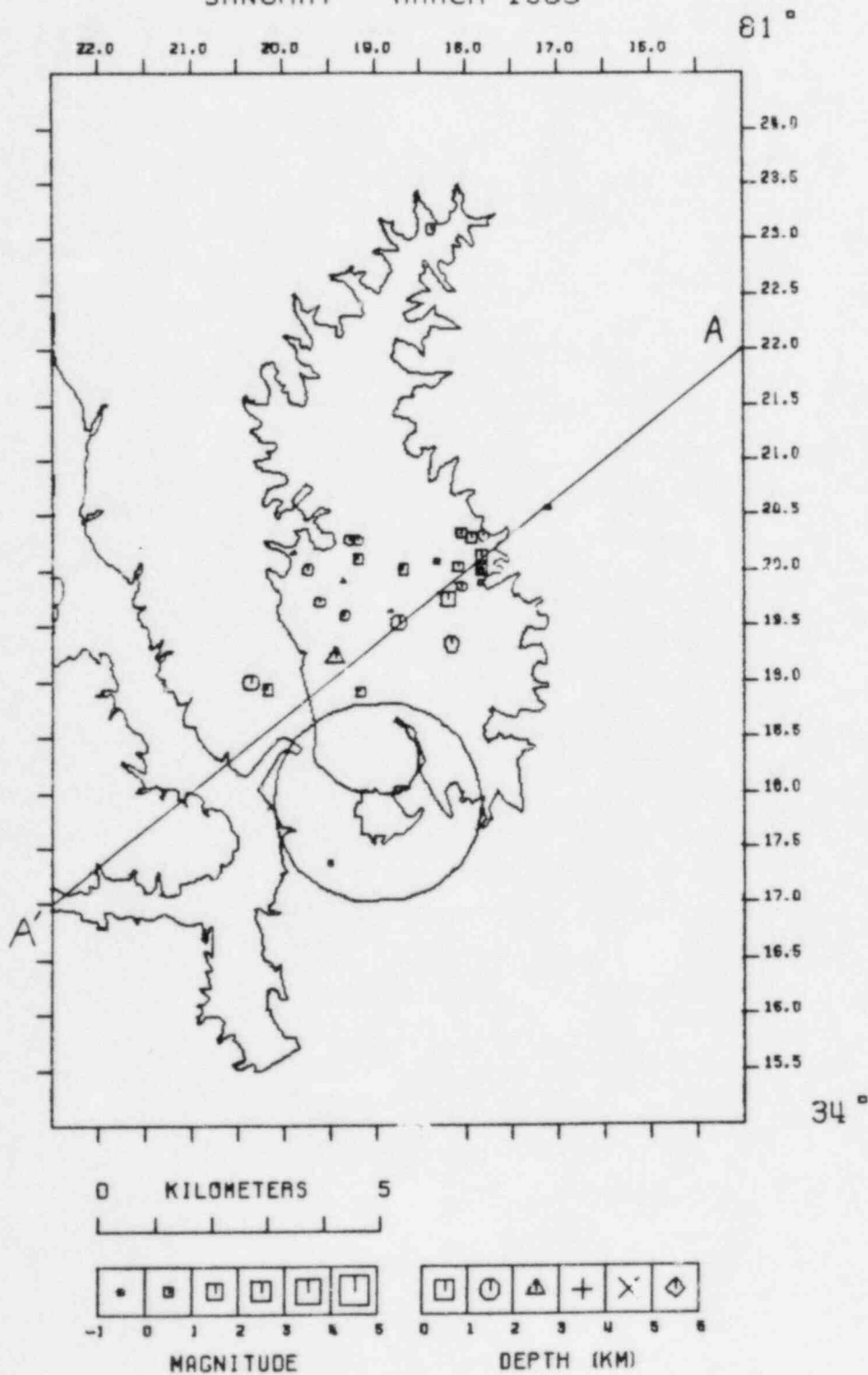


Figure 2



Figure 3

MONTICELLO EARTHQUAKES JANUARY 1983

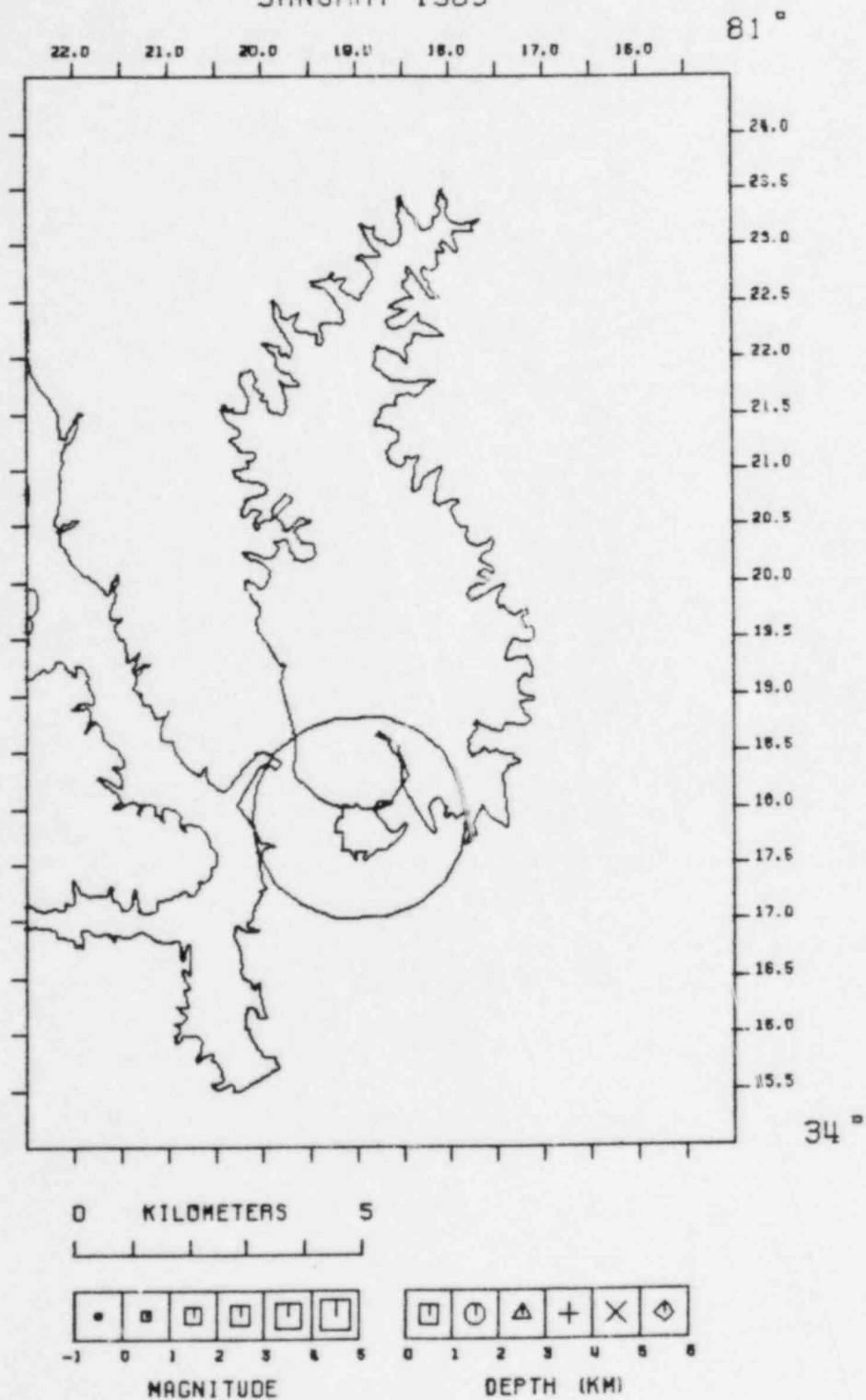


Figure 4

MONTICELLO EARTHQUAKES FEBRUARY 1983

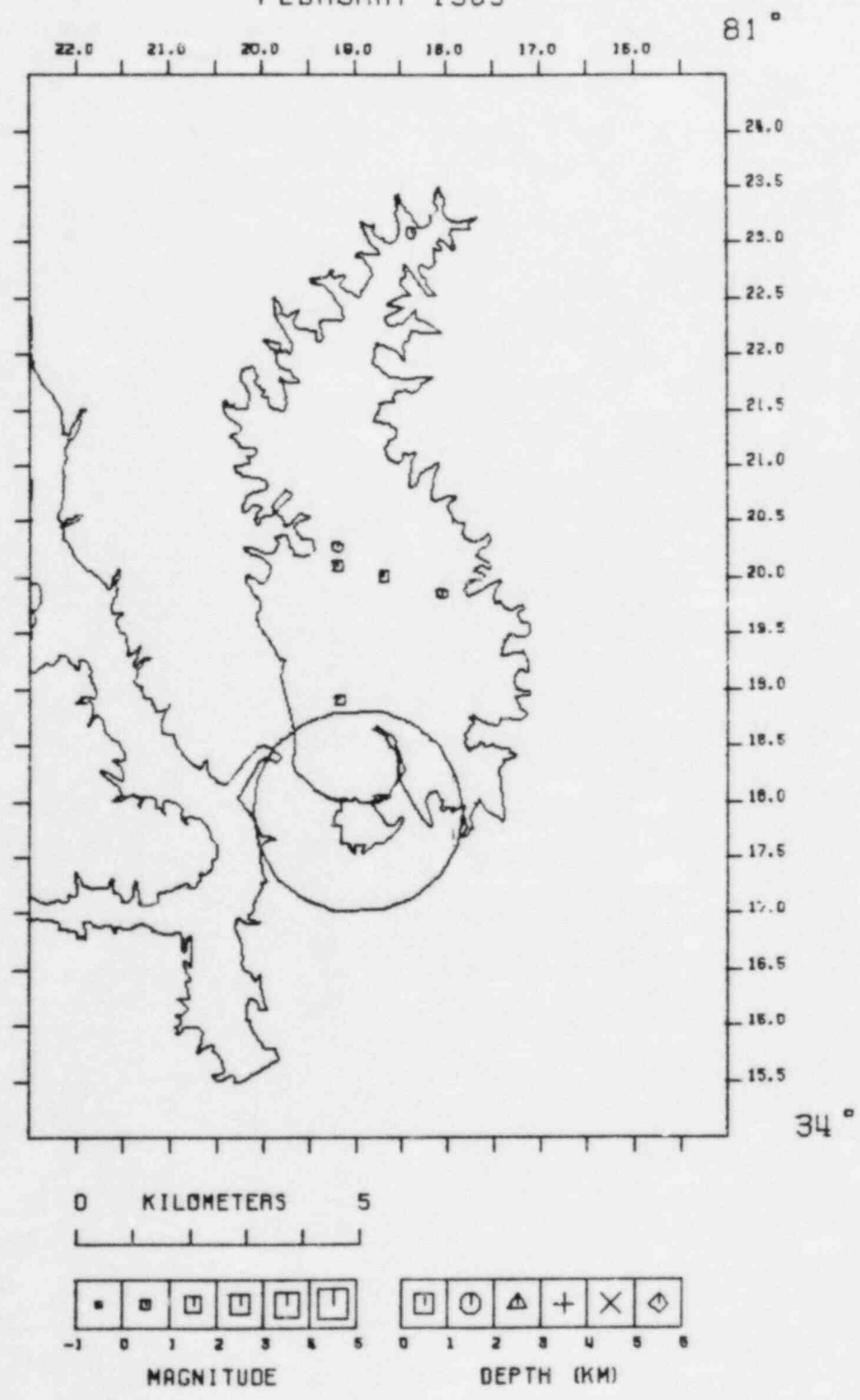


Figure 5

MONTICELLO EARTHQUAKES MARCH 1983

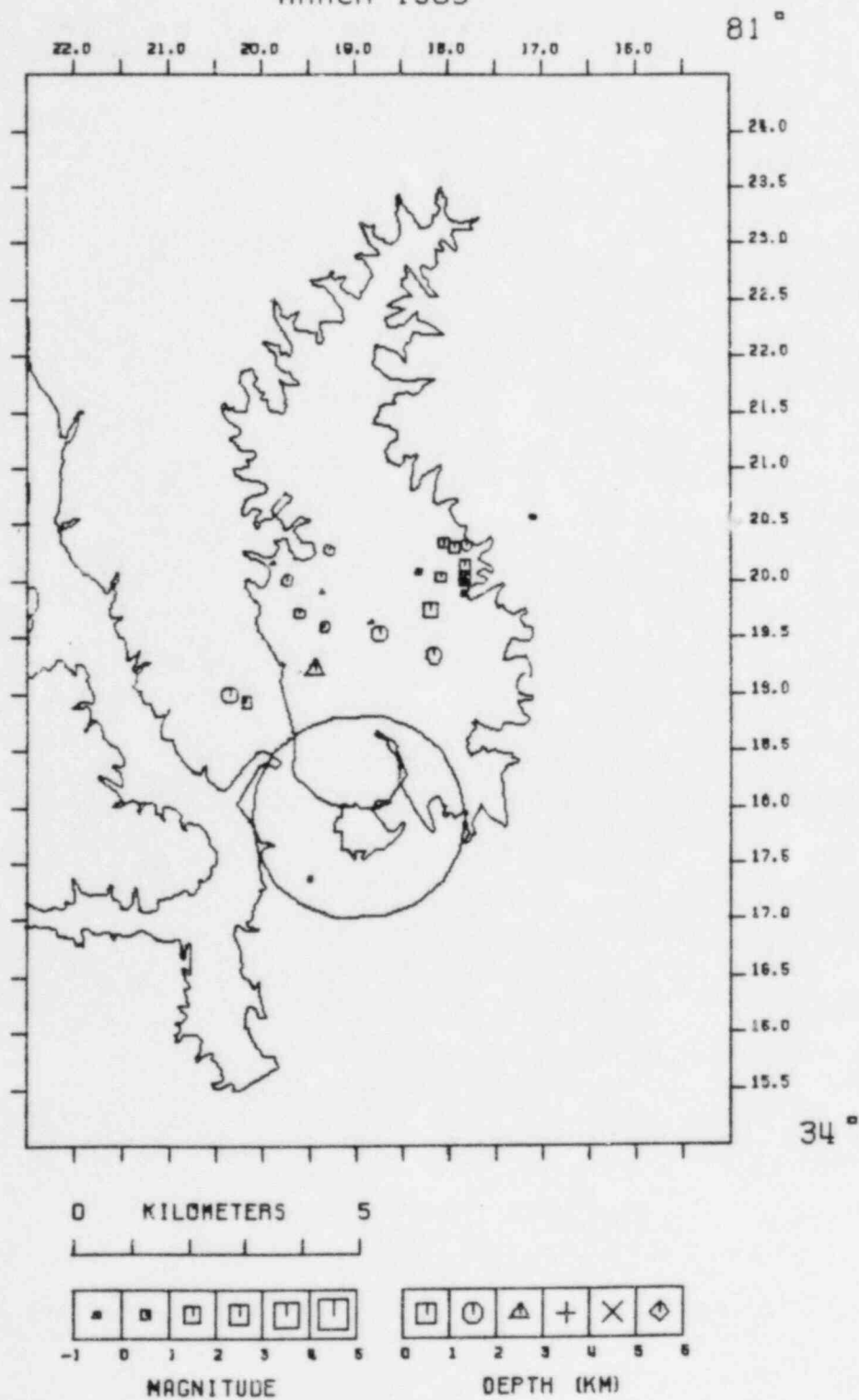


Figure 6

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 number of events per day and log of energy released per day are shown on the lower two graphs. The histograms showing events per day and log of energy release include the unlocated events around the reservoir.

CONCLUSIONS

Monticello Reservoir experienced a low level of seismic activity for the January 1 through March 31, 1984 reporting period, with increased seismicity in the middle of March. A trend of discrete swarms separated by relatively quiet periods has been apparent for approximately five years (Figure 8) and the seismicity level for this period continues to agree with the trend, including a general decline in activity. Depth of seismicity for this reporting period was primarily within the uppermost two kilometers.

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 HYP071, U.S.G.S. Open-File Report, 100 pp.

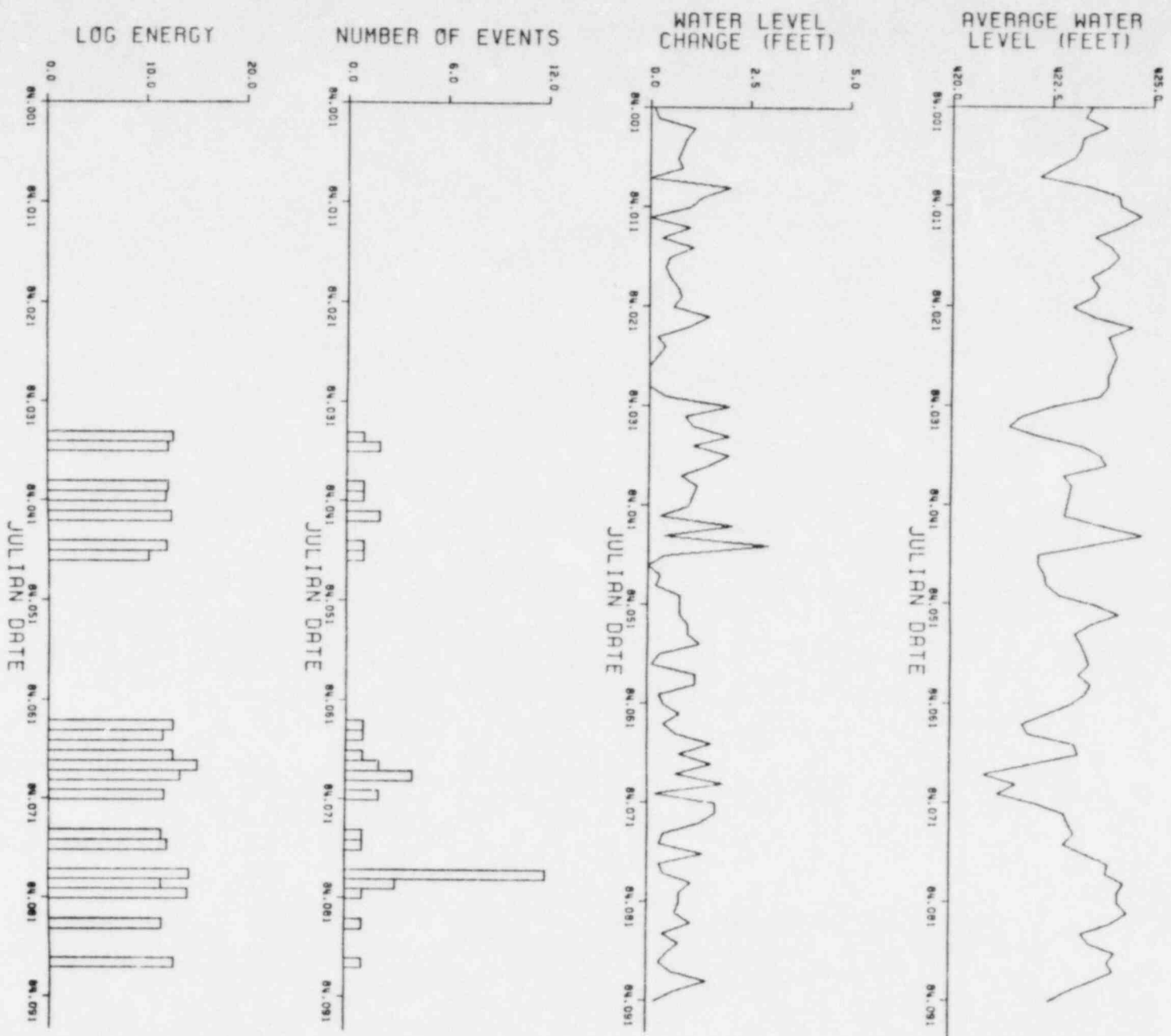


Figure 7

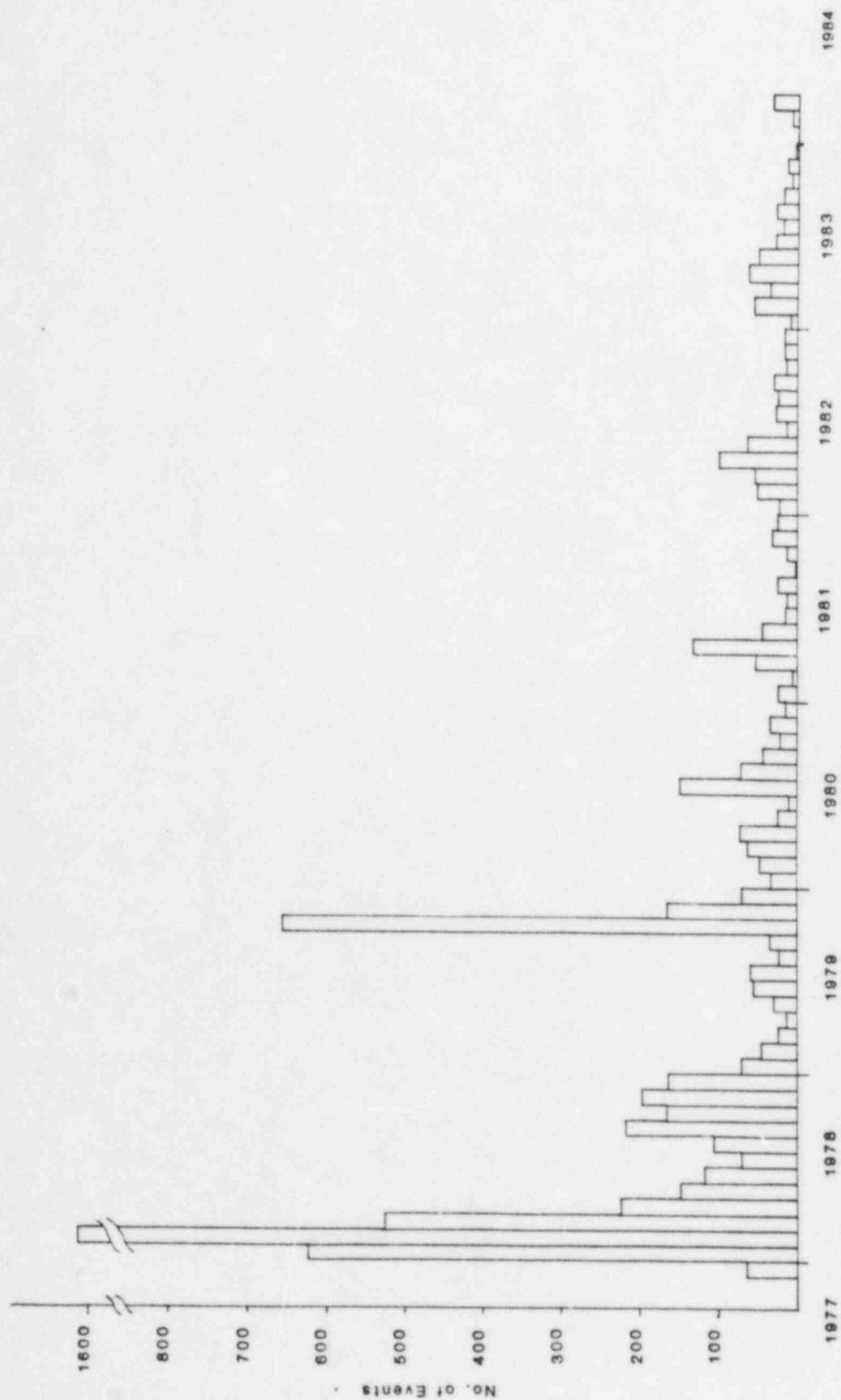


Figure 8

APPENDICES

APPENDIX I

STATION LOCATION

| <u>NO.</u> | <u>STN.</u> | <u>LAT. N.</u> | <u>LONG. W.</u> |
|------------|-------------|----------------|-----------------|
| 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°15.60' |

APPENDIX II

MONTICELLO RESERVOIR

VELOCITY MODEL

| Velocity km/sec | Depth 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

[illegible]