United States Department of Agriculture
Soil Conservation Service

Northeast NTC
Chester, PA 19013

Subject: EM-38 Survey of sodium affected soils in southern Illinois; 24-30 March 1991

Date: 30 April 1991

To: Robert McLeese
State Soil Scientist
Soil Conservation Service
Champaign, IL

fact - 1/2

Purpose:
To provide EM field assistance and training to soil scientist in southern Illinois.

Participants:
Kent Brinkman, Soil Scientist, Washington Co., Nashville, IL
Les Bushue, Soil Correlator, SCS, Champaign, IL
Jim Doolittle, Soil Specialist, SSIV, SCS, Chester, PA
Tonie Endres, Soil Survey Party Leader, SCS, Louisville, IL
Brian Fitch, Soil Scientist, SCS, Mt. Vernon, IL
Marsha Gajewski, Soil Scientist, Washington Co., Nashville, IL
Ken Gotsch, Area Soil Scientist, SCS, Effingham, IL
Dana Grantham, Area Soil Scientist, SCS, Carbondale, IL
Gary Hamilton, Soil Survey Party Leader, SCS, Carlyle, IL
Bob Hetzler, Graduate Student, U. of Illinois, Champaign, IL
Max Hodges, Soil Scientist, SCS, Champaign, IL
Sam Indorante, Soil Project Leader, MLRA Update, SCS, Belleville, IL
William McCauley, Soil Scientist, SCS, Nashville, IL
Bob Mcleese, State Soil Scientist, SCS, Champaign, IL
Dennis Nettleton, Research Soil Scientist, NSSC, SCS, Lincoln, NE
Terry Pittman, Soil Scientist, Clay County, Louisville, IL
Larry Sabata, Soil Survey Party Leader, SCS, Nashville, IL
Larry Staley, Soil Scientist, Cumberland Co., Toledo, IL
Bob Tegeler, Soil Survey Party Leader, SCS, Toledo, IL
Rufus Williams, Soil Scientist, SCS, Belleville, IL

Activities:
Nine potential sites had been selected in Cumberland, Clay, Clinton, Washington, and St. Clair counties. Field work began on the morning of 25 March 1991. Field work was completed in Cumberland County (1 site) on 26 March, Clay County (2 sites) on 26 March, Clinton County (2 sites) on 28 March, Washington County (1 site) on 29 March, and St. Clair County (2 sites) on 2 April 1991. I participated in the field study during the week of 24 to 29 March. I began my return to Chester, Pennsylvania, late in the afternoon of 28 March. The EM-38 meter was left with Dana Grantham, the most qualified EM-38 meter operator, until the completion of field activities the following week.

Equipment:
The GEONICS Limited, EM38 Ground Conductivity meters were used in this study. Meters were supplied by the Soil Survey Investigation Staff of the NSSC and the University of Illinois.

Discussion:

Most grids were squares with dimensions of 140 meters and an interval of 10 meters. This provided 225 observation points at each site. The following information was obtained at each of these observation points: (1) the elevations of the ground surface, and (2) EM measurement in both the horizontal and vertical mode. In addition several studies were performed evaluating the precision and accuracy of the two EM meters, and the repeatability of EM measurements with (1) different operators and (2) with the passage of time.

Dr. Dennis Nettleton collected soil samples for laboratory characterization at multiple observation points within each site.[1]. Selection of sampling points were guided by the conductivity values measured with the EM-38 meter.

The operation of the EM-38 conductivity meter was explained to all participants. Participants were encouraged to use the EM-38 meter in the field. Several participants received intensive training on the operation of the EM-38 conductivity meter.

Results:
1. The range of values of EM measurements obtained in June of 1990 (Clay County) were similar to those obtained in March of 1991. The soil was moist throughout during each study period (the optimal condition for an EM measurement of sodium affect soils). Results obtained with the EM meter appear to be repeatable over time.

2. Preliminary results indicate that soils with EM measurements greater than 50 mS/m will have SAR values greater than or equal to 13 and will have a natric horizon. Results suggest that not only the present of a natric horizon but possibly series placement may be accomplished based on the absolute and the relative (horizontal and vertical measurements) EM values obtained at sites. However, while preliminary results appear most promising, conclusions must await completion of laboratory analysis.

3. Tonie Endres, Dana Grantham, Sam Indorante, and Bob Hetzler completed surveys with the EM-38 conductivity meter and are to be considered qualified on the calibration and field operation of the EM-38 conductivity meter. I was most impressed by the progress of these individuals.

---

1. Nettleton, Wiley D. 1991. SOI-Report-Soil Sampling, Soil Investigations South Central Illinois, March 25-April 4, 1991. SCS, NSSC, Lincoln, NE. Dated 19 April 1991.

4. Enclosed are preliminary two-dimensional contour plots of EM measurements (horizontal and vertical mode) for each site. All EM measurements are in mS/m. Also, I have enclosed three-dimensional surface nets of the topography at each site. Vertical exaggeration is about 5X. The following is the identification of each site:

Site 2	Cumberland County	Bluford-Darmstadt complex
Site 3	Clay County	Cisne-Huey complex a
Site 4	Clay County	Cisne-Huey complex b
Site 5	Clinton County	Cisne-Huey complex c
Site 6	Clinton County	Cisne-Huey complex d
Site 7	Washington County	Cisne-Huey complex
Site 8	St. Clair County	Darmstadt
Site 9	St. Clair County	Darmstadt

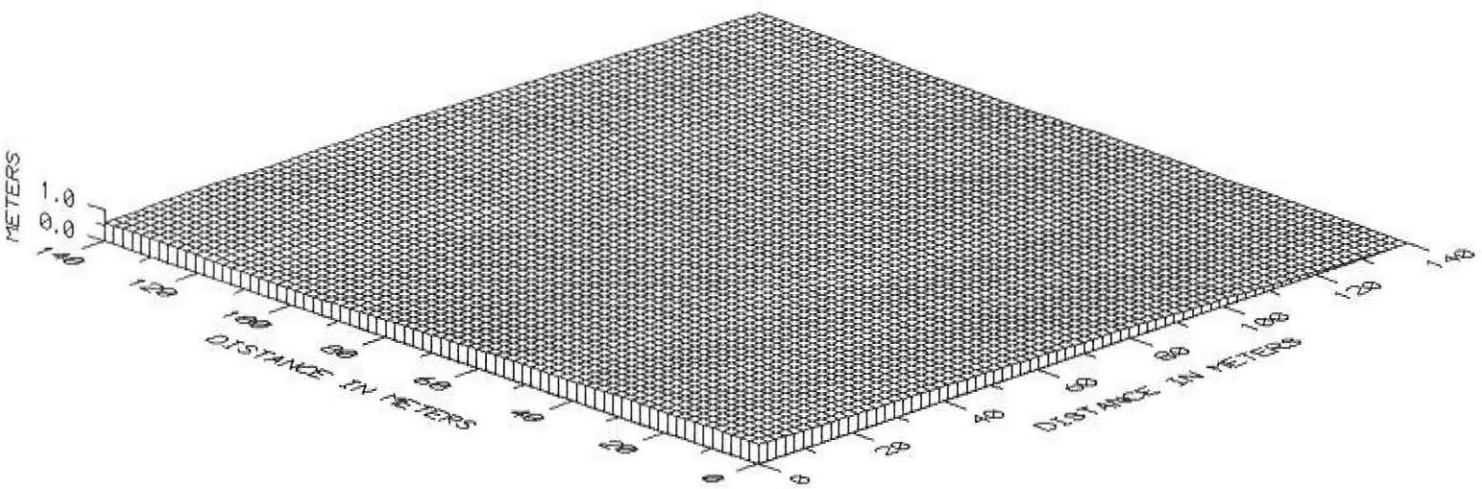
I will assist with the necessary multiple regression equations once the results of the laboratory analysis are available.

With kind regards.

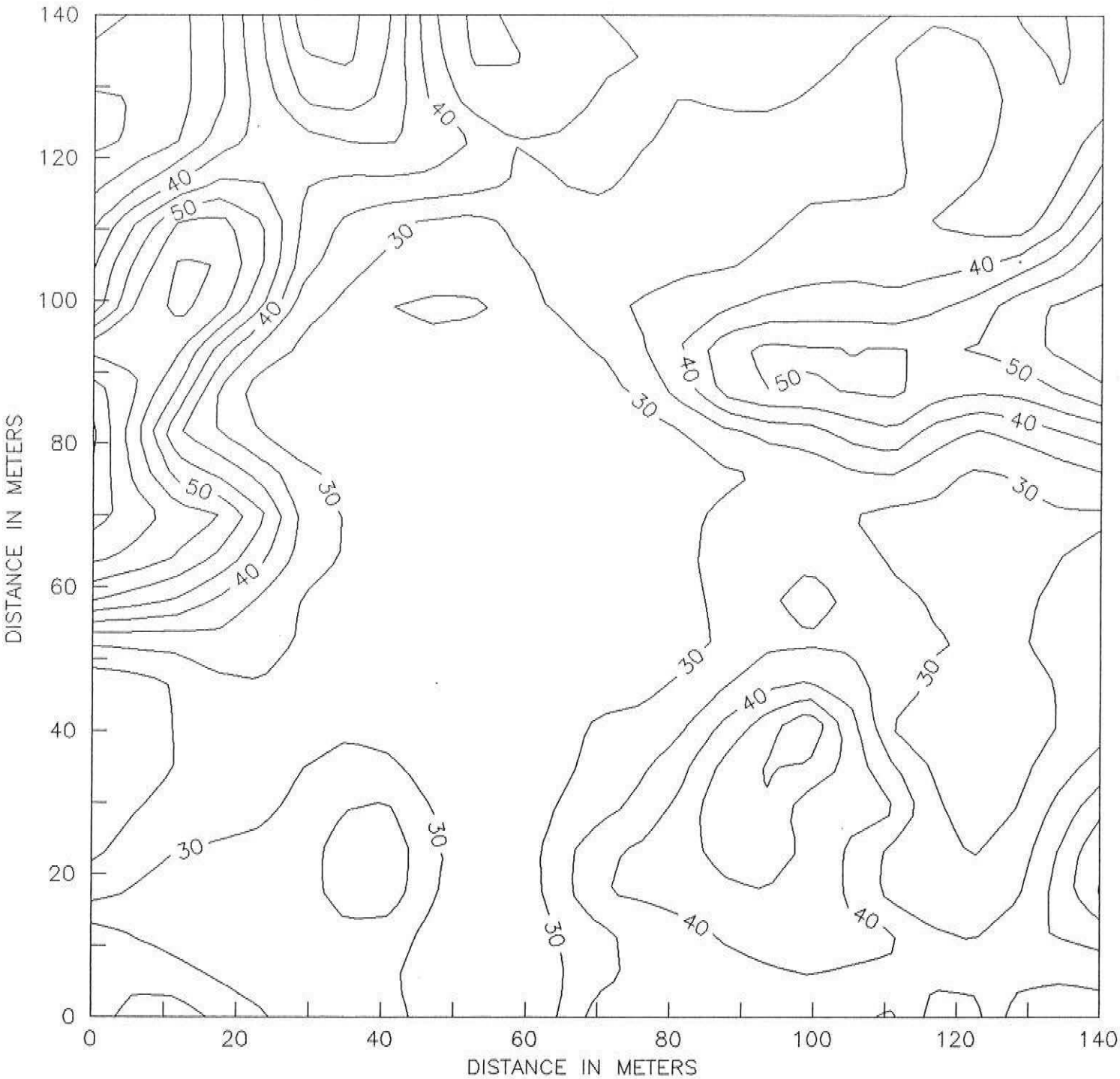
James A. Doolittle
Soil Specialist (GPR)

cc:
E. Knox, Nat'l. Leader, SSIV, NSSC, SCS, Lincoln, NE
C. Olson, Research Soil Scientist, SSIV, NSSC, SCS, Lincoln, NE
W. Nettleton, Research Soil Scientist, SSIV, NSSC, SCS, Lincoln, NE

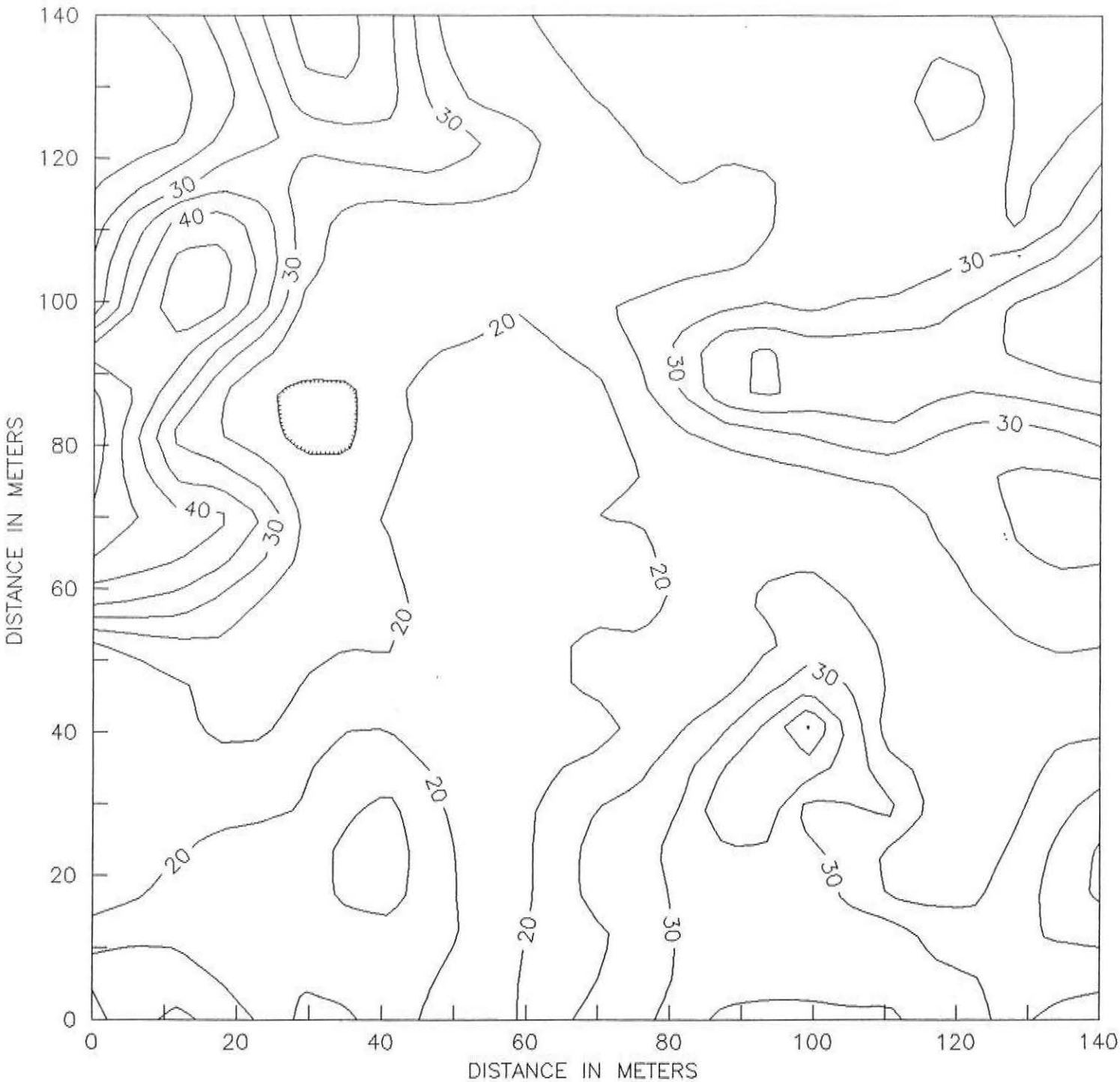
SITE 2



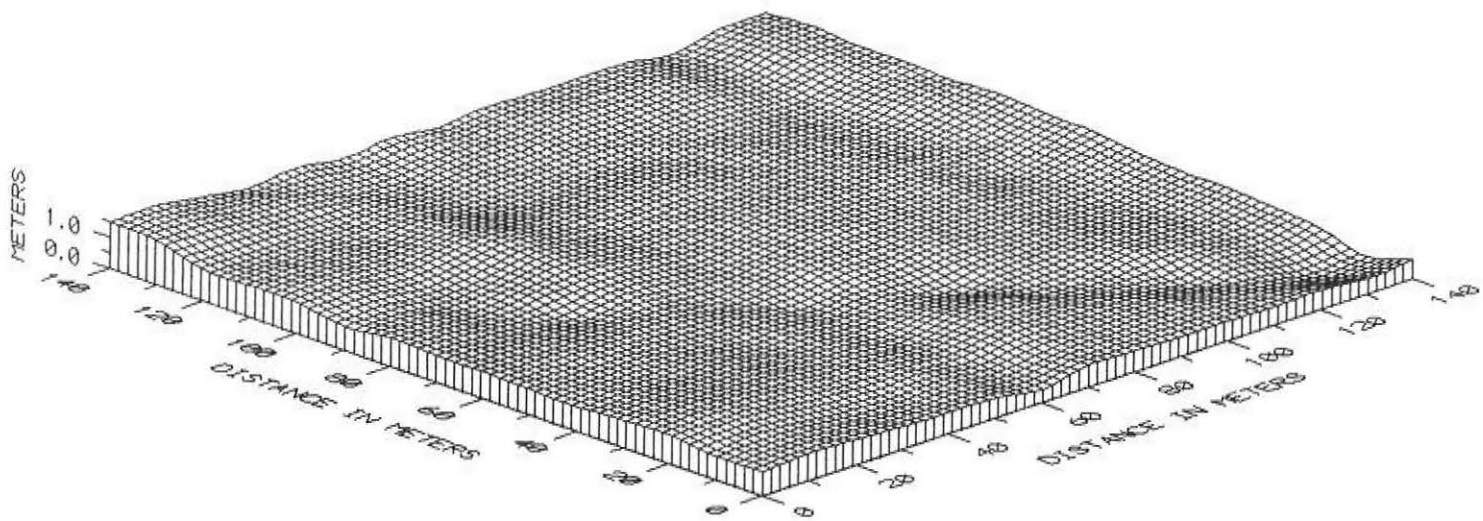
SITE 2 – EM38(V)

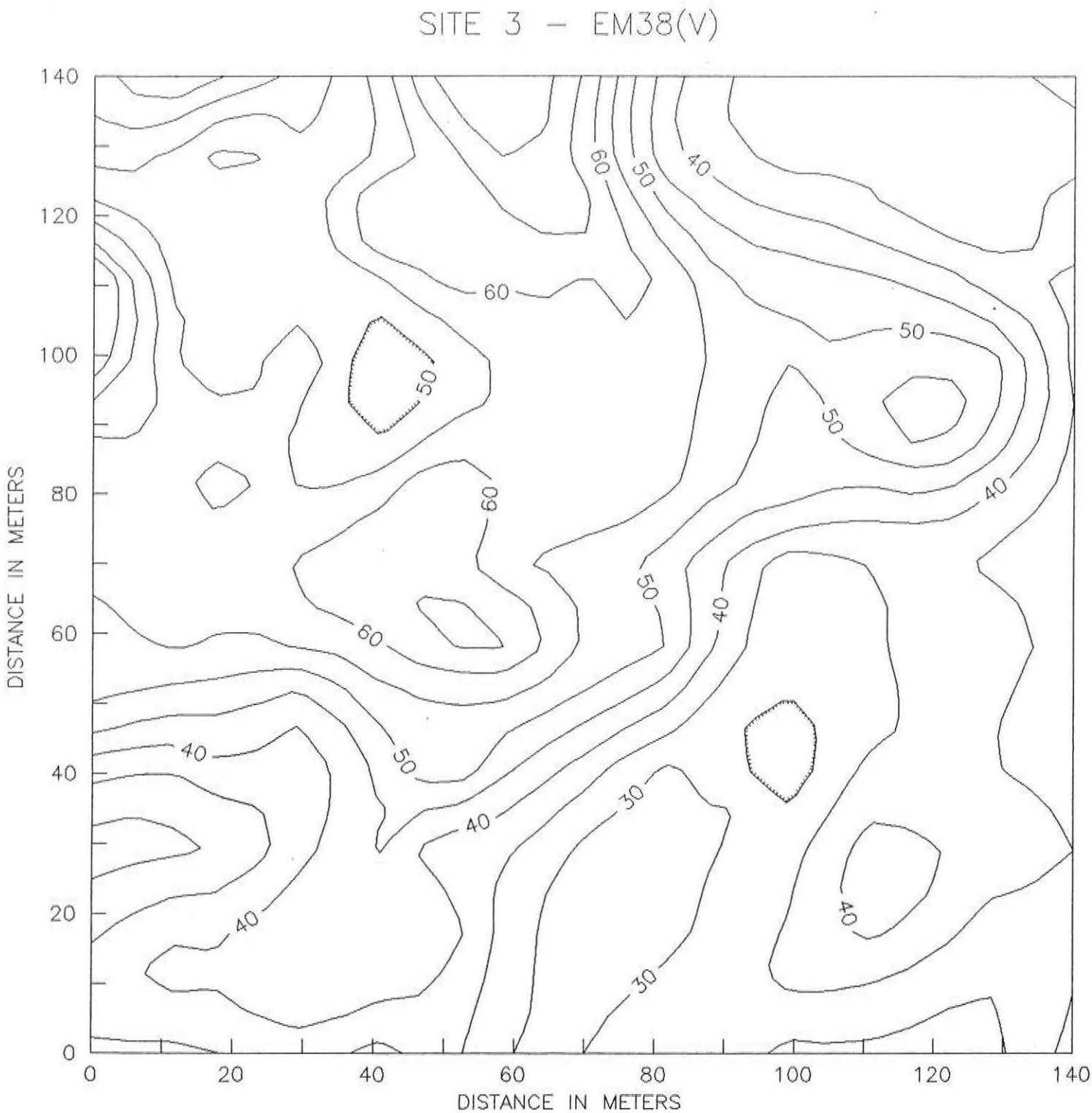

DISTANCE IN METERS
0
20
40
60
80
100
120
140
DISTANCE IN METERS
30
40
50

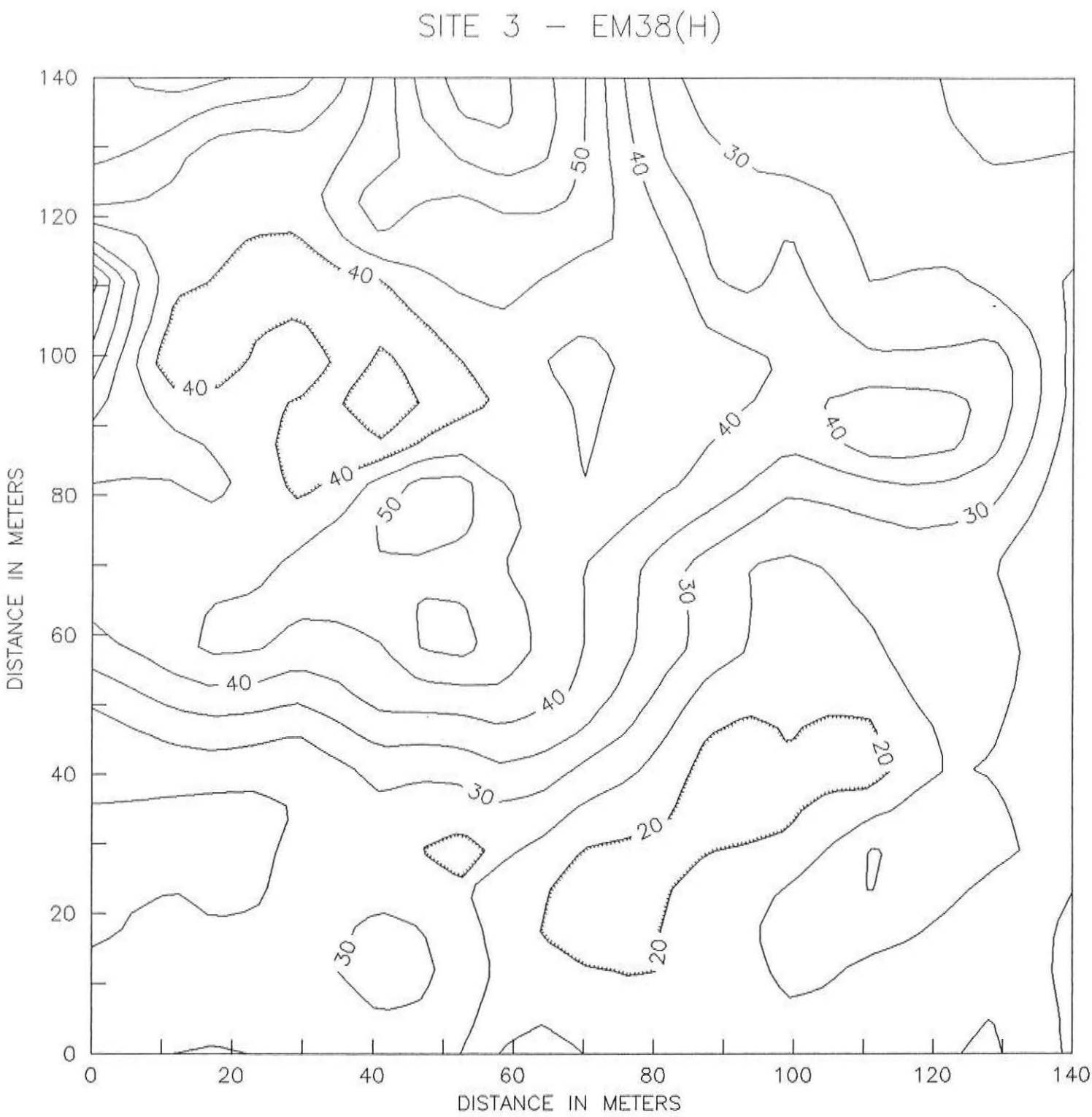
SITE 2 – EM38(H)


DISTANCE IN METERS
0
20
40
60
80
100
120
140
DISTANCE IN METERS
20
30
40

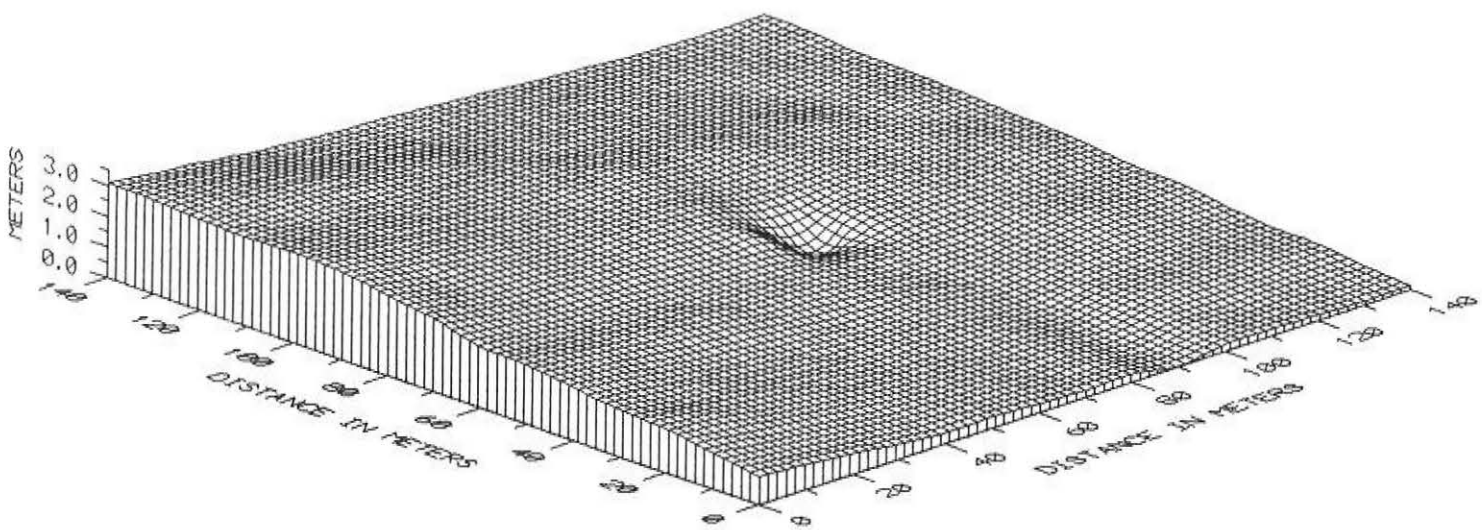
SITE 3



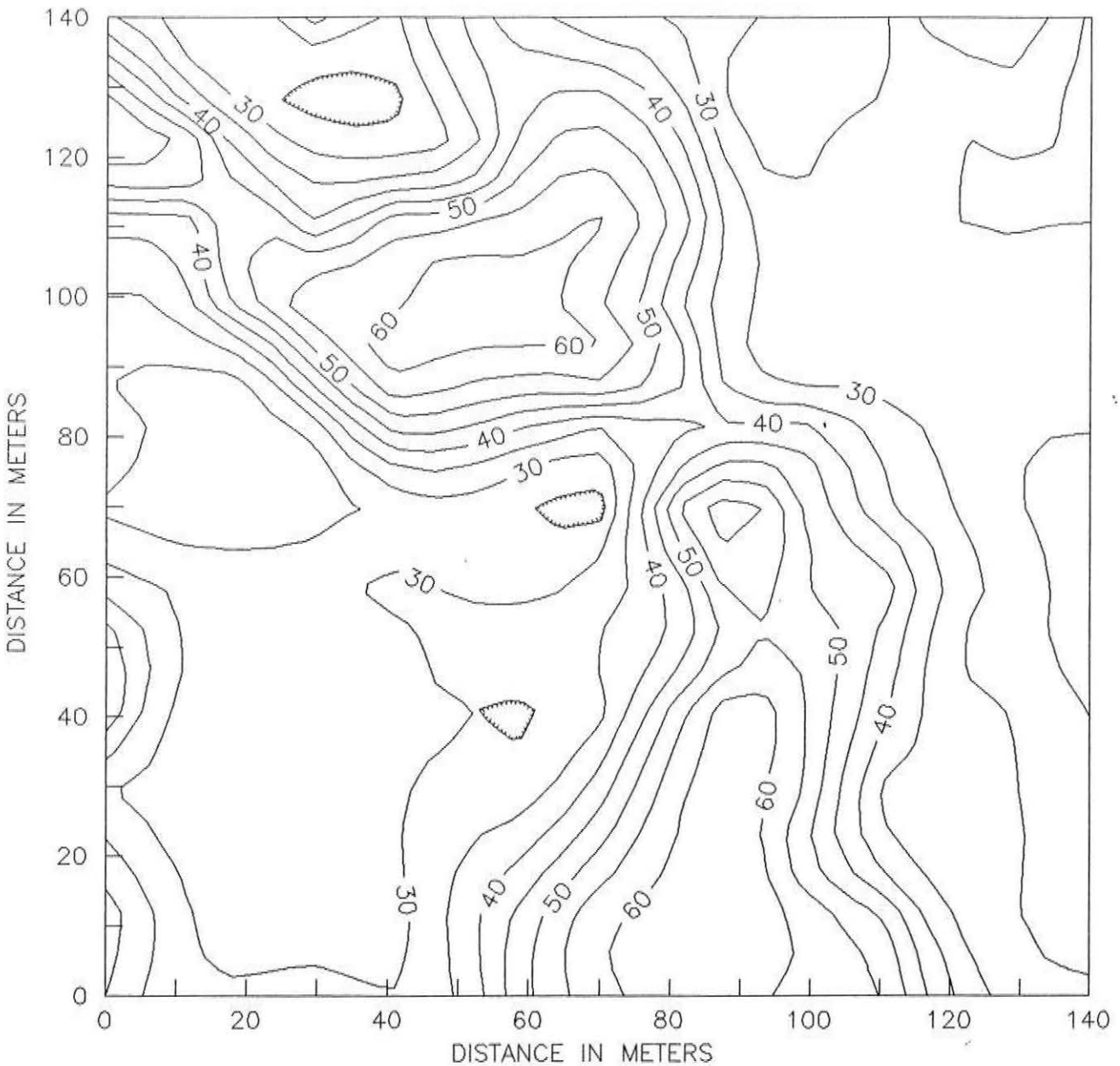

SITE 3 – EM38(V)
DISTANCE IN METERS
0
20
40
60
80
100
120
140
DISTANCE IN METERS
60
50
40
30


SITE 3 – EM38(H)
DISTANCE IN METERS
DISTANCE IN METERS
0
20
40
60
80
100
120
140
50
40
30
20

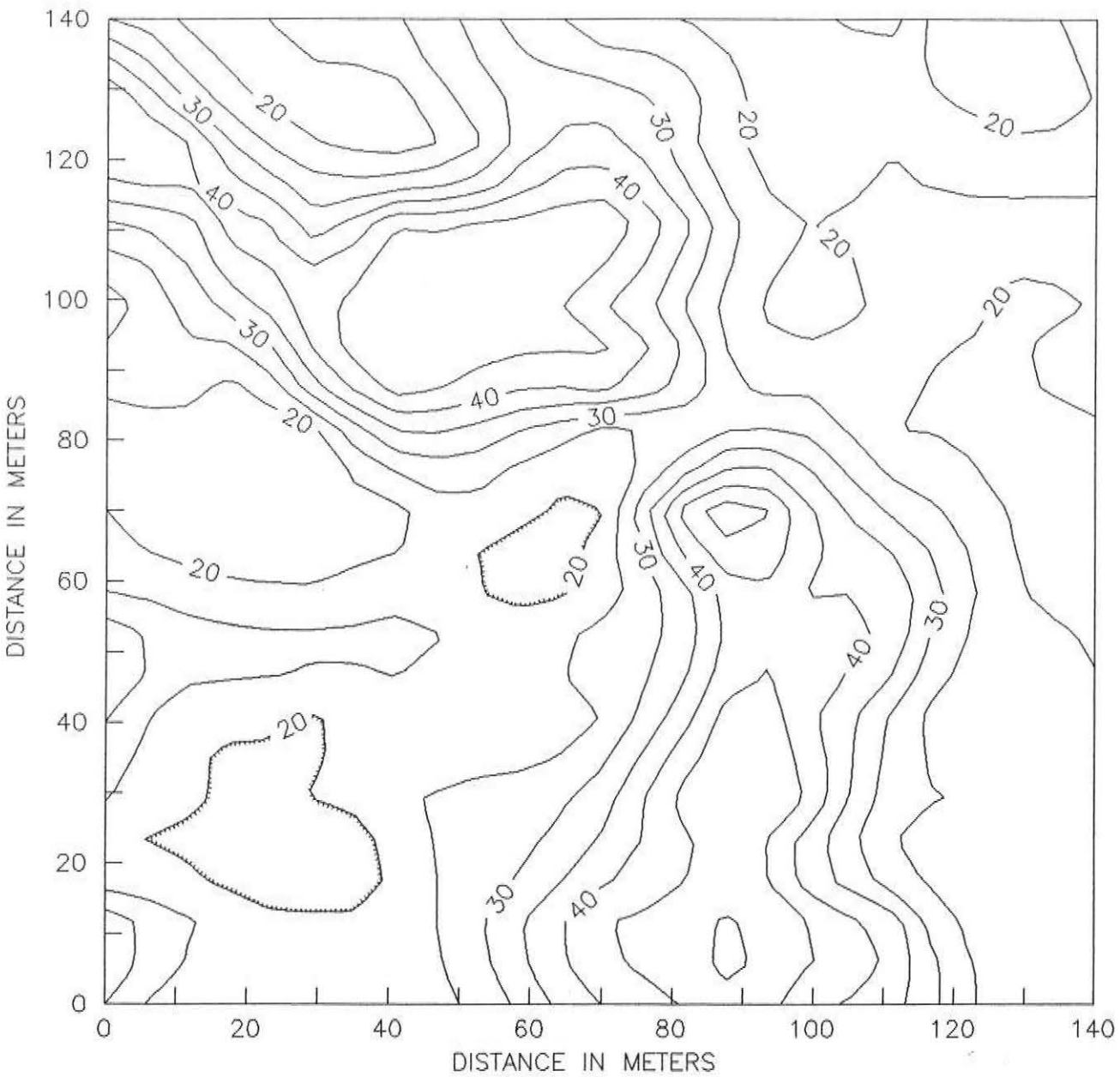
SITE 4



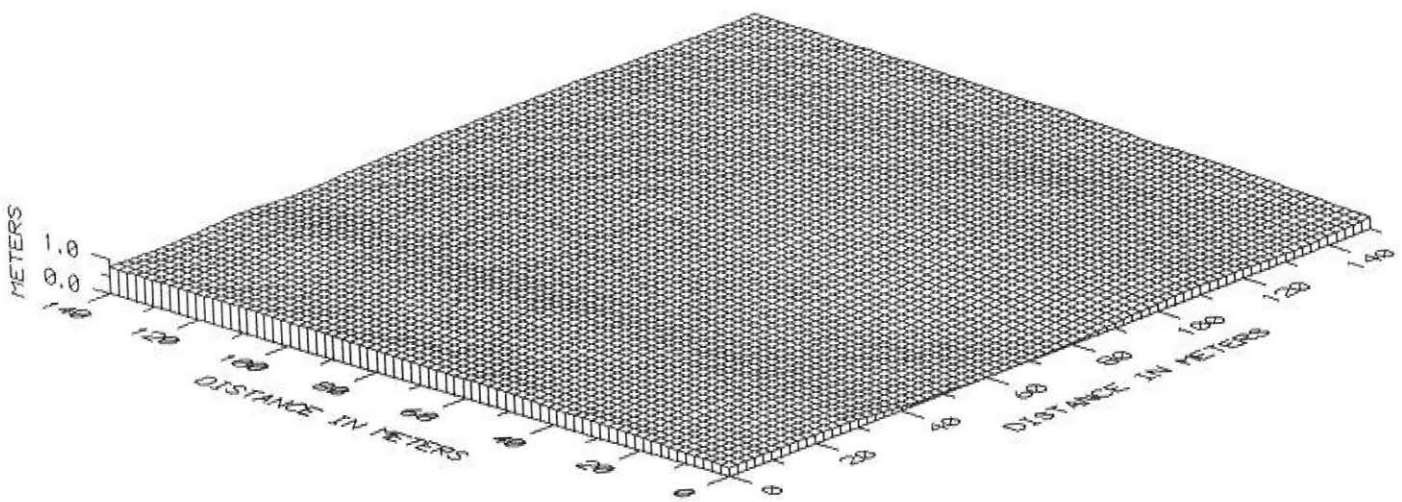
SITE 4 – EM(V)


DISTANCE IN METERS
0
20
40
60
80
100
120
140
DISTANCE IN METERS
30
40
50
60

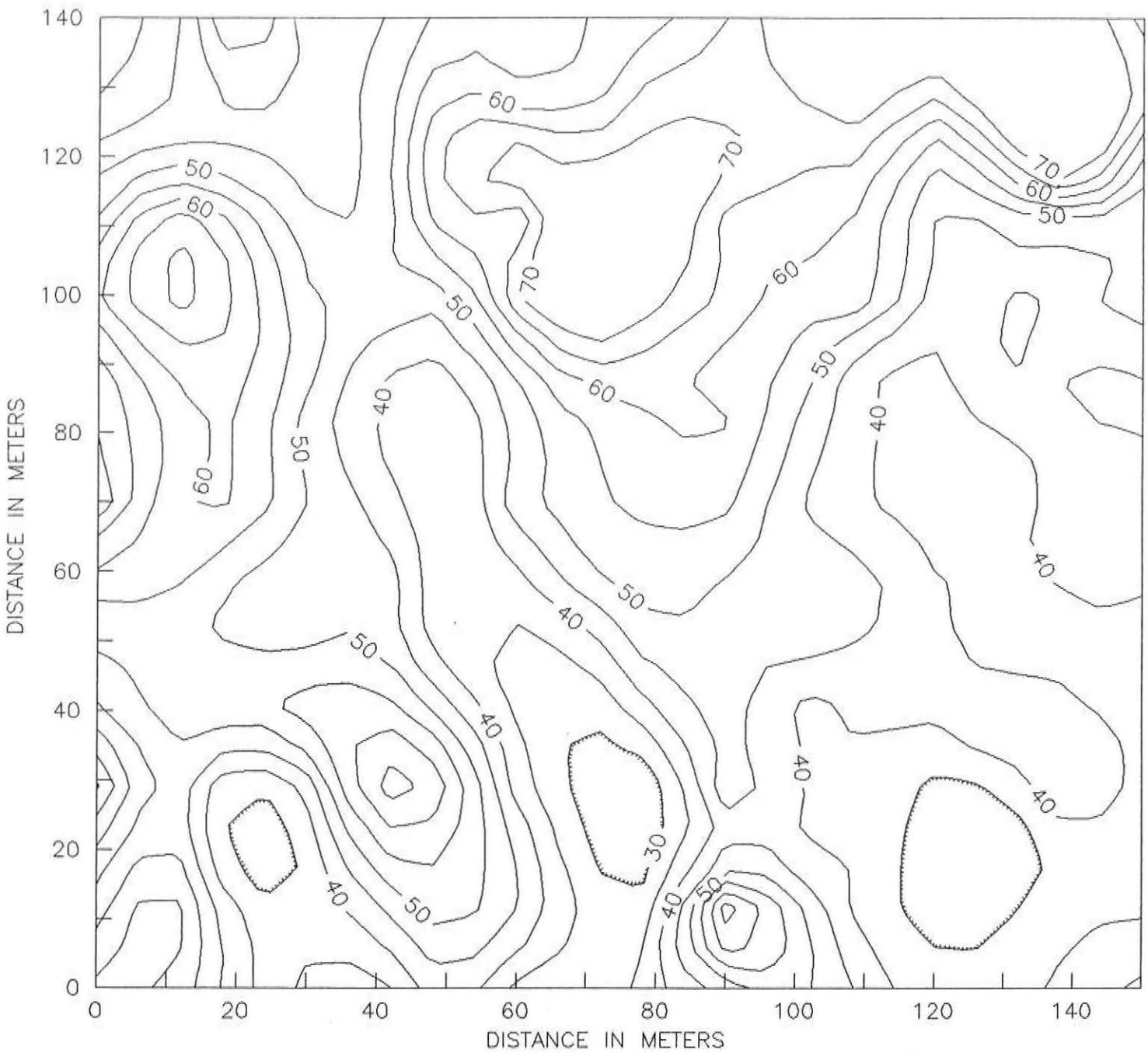
SITE 4 – EM(H)

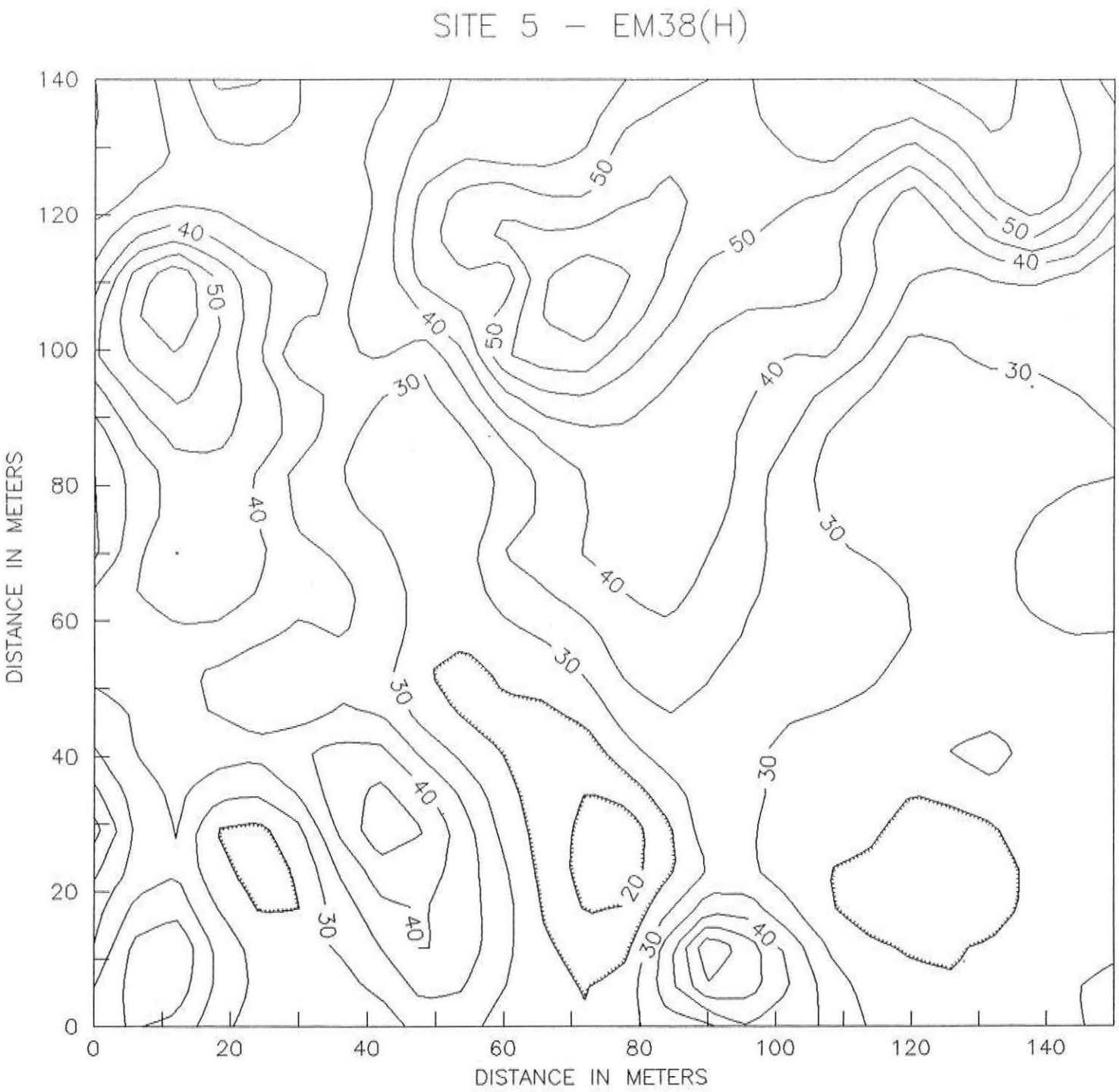

DISTANCE IN METERS
0
20
40
60
80
100
120
140
DISTANCE IN METERS
0
20
40
60
80
100
120
140
20
30
40

SITE 5

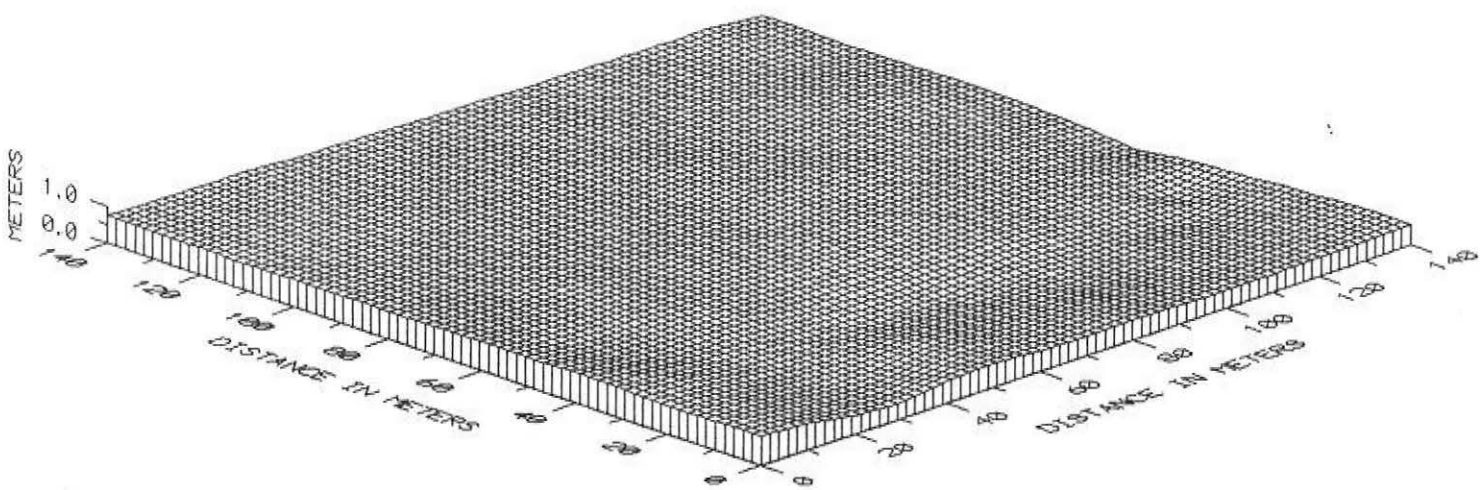


SITE 5 – EM38(V)

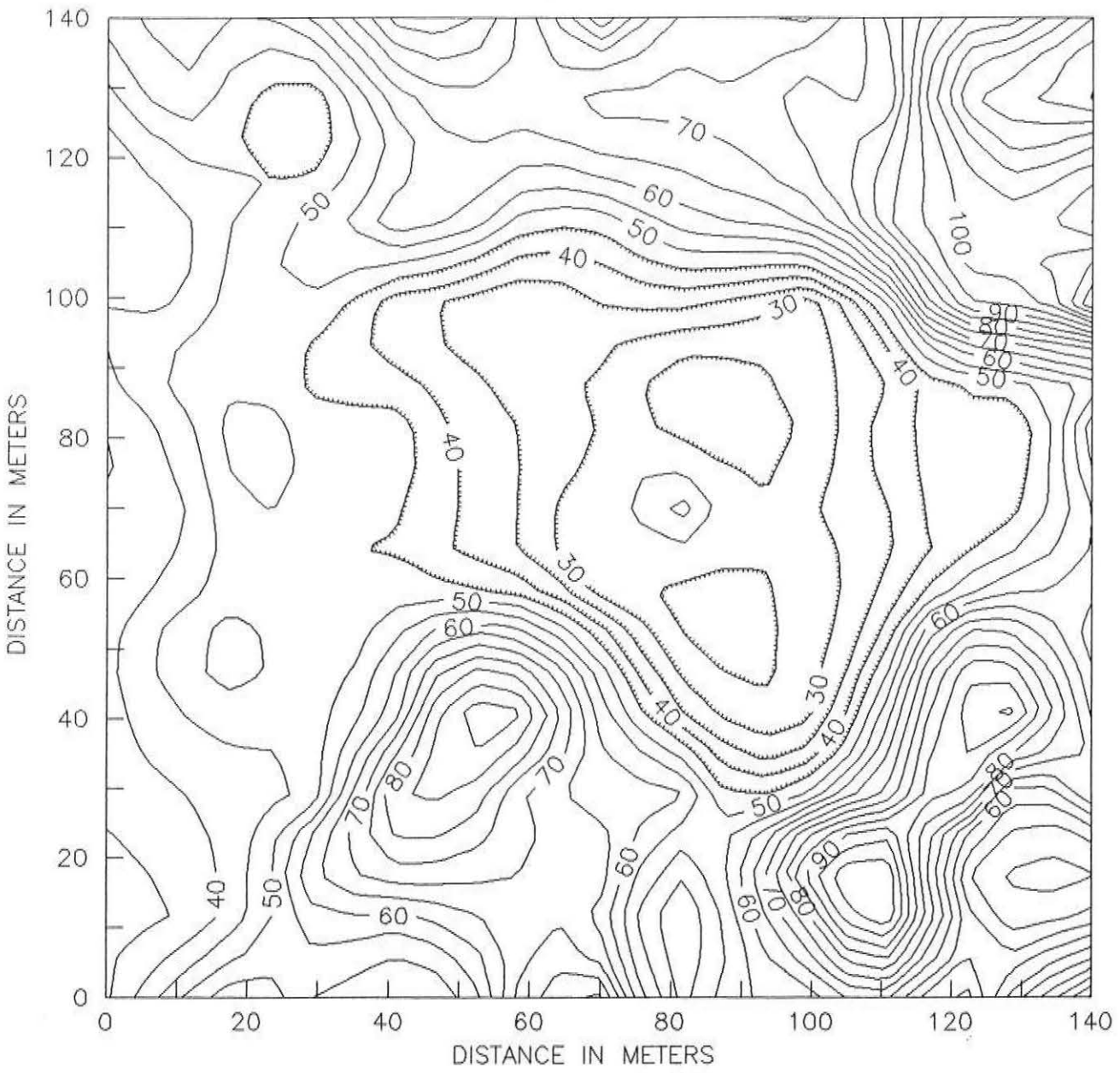

DISTANCE IN METERS
0
20
40
60
80
100
120
140
DISTANCE IN METERS
70
60
50
40
30


SITE 5 – EM38(H)
DISTANCE IN METERS
DISTANCE IN METERS
0
20
40
60
80
100
120
140
50
40
30
20

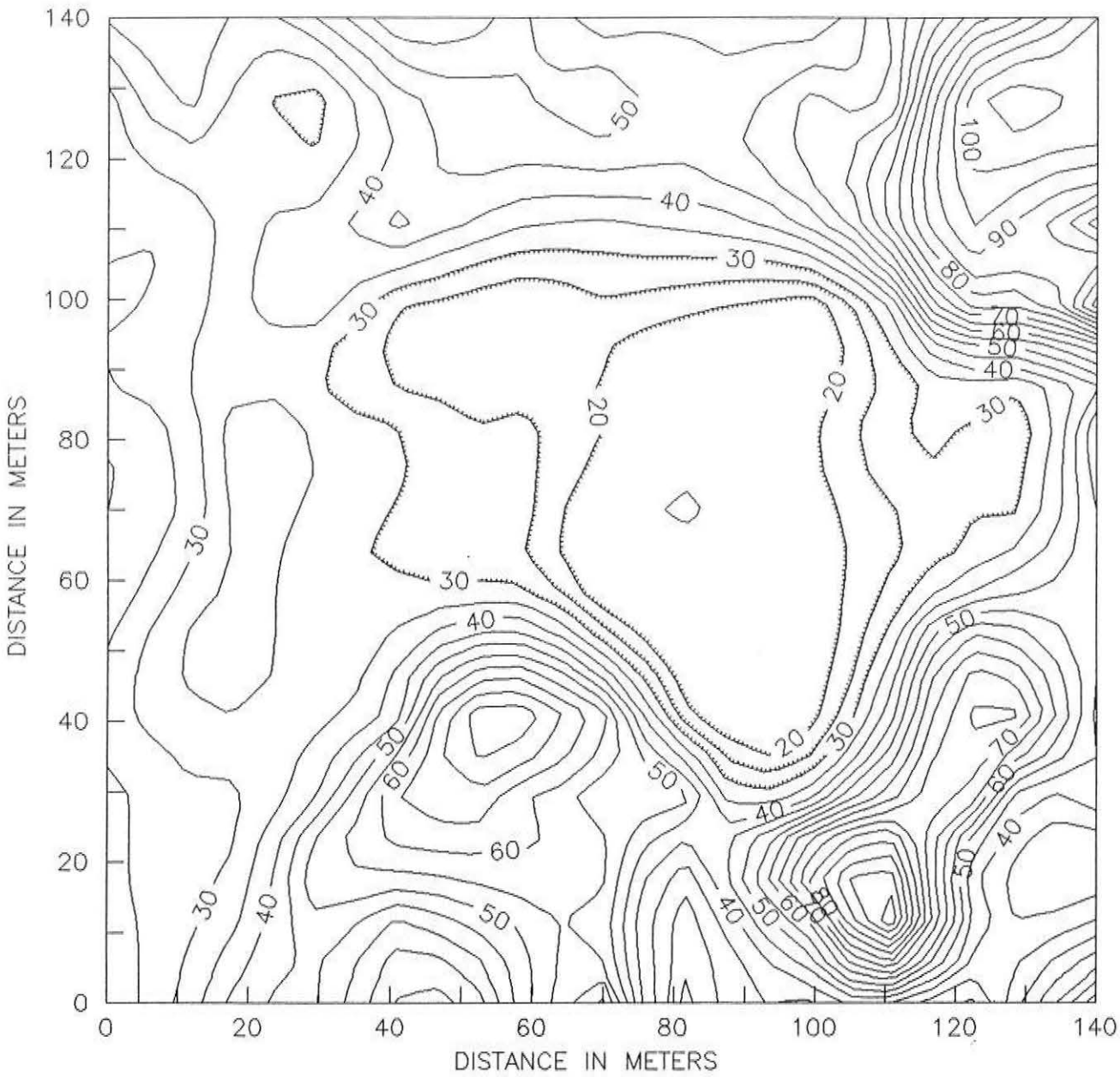
SITE 6



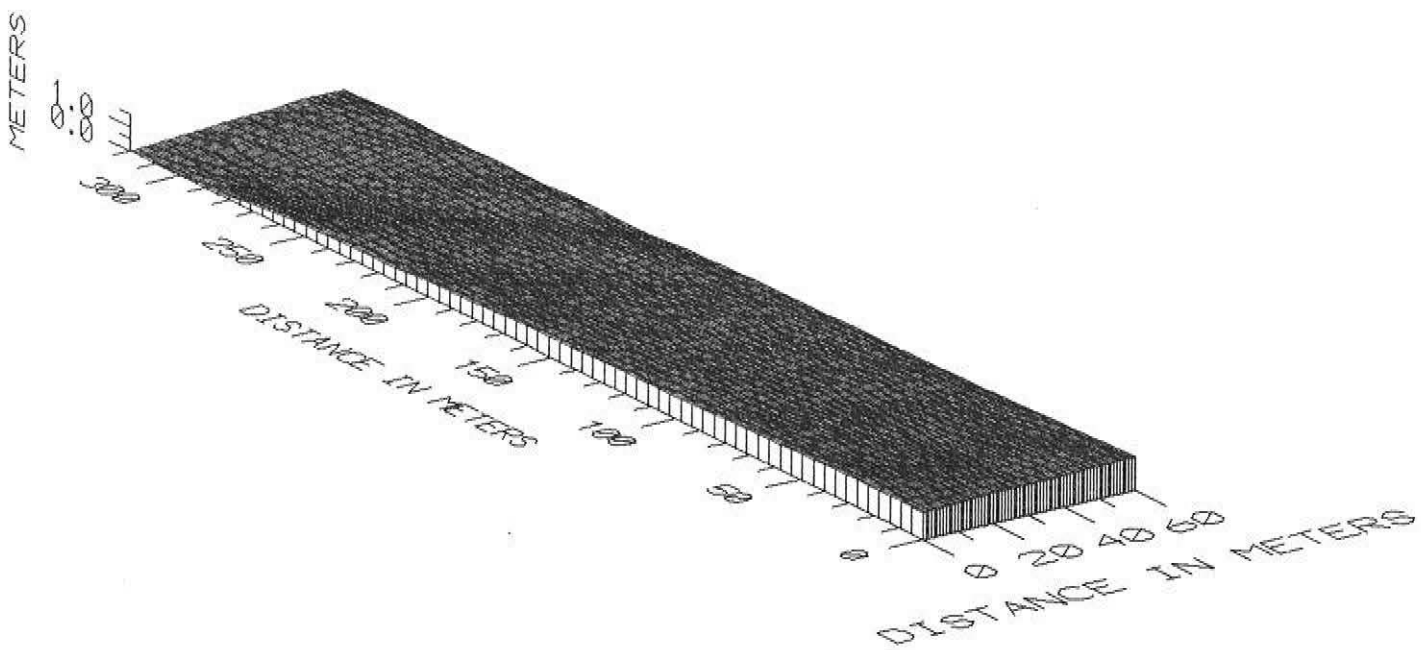
SITE 6 – EM(V)

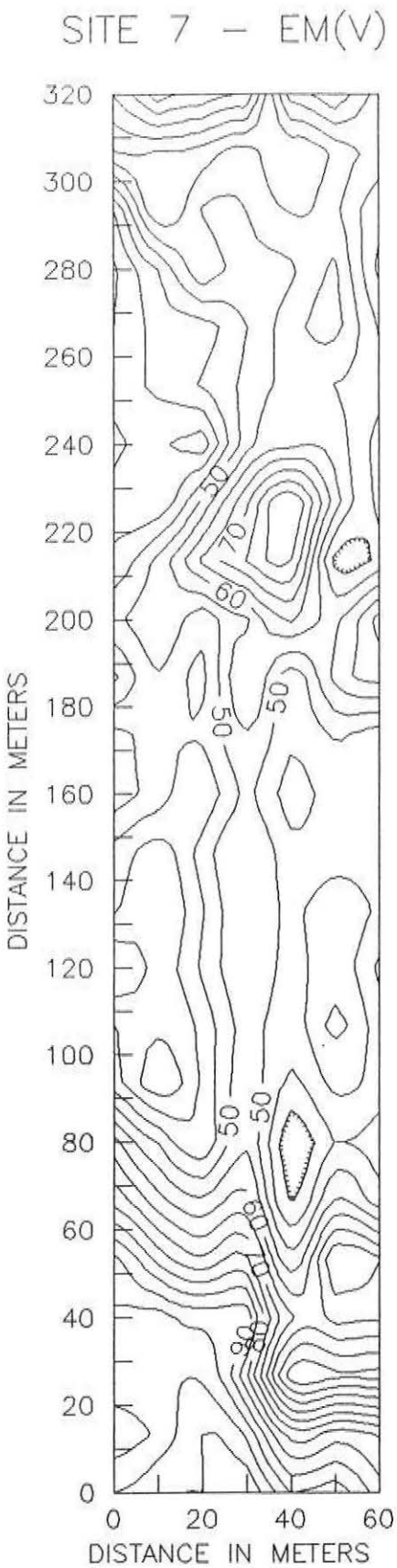

DISTANCE IN METERS
0
20
40
60
80
100
120
140
DISTANCE IN METERS
0
20
40
60
80
100
120
140

SITE 6 – EM(H)

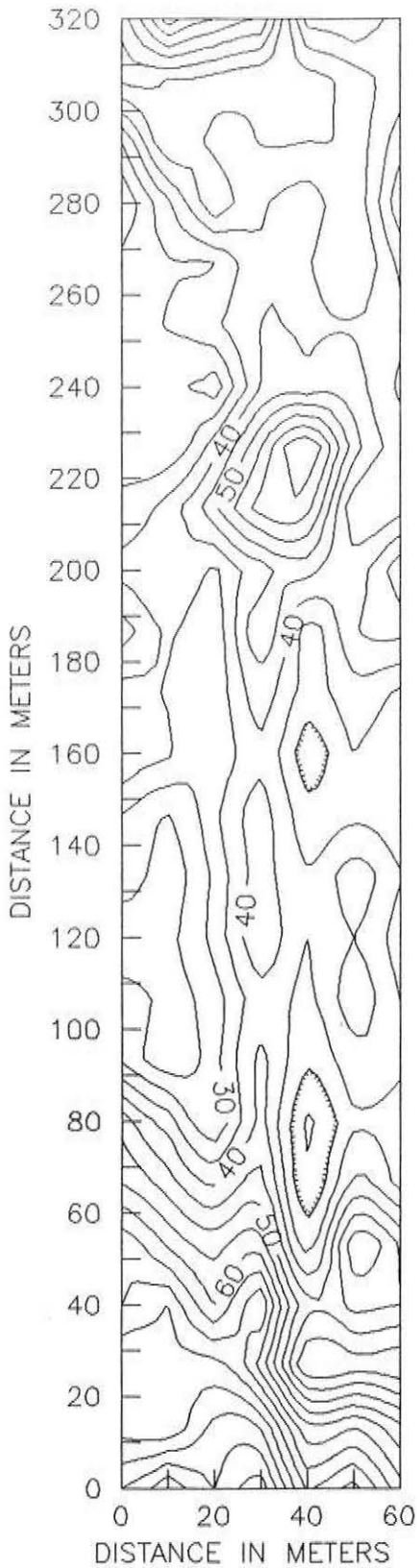

DISTANCE IN METERS
0
20
40
60
80
100
120
140
DISTANCE IN METERS

SITE 7

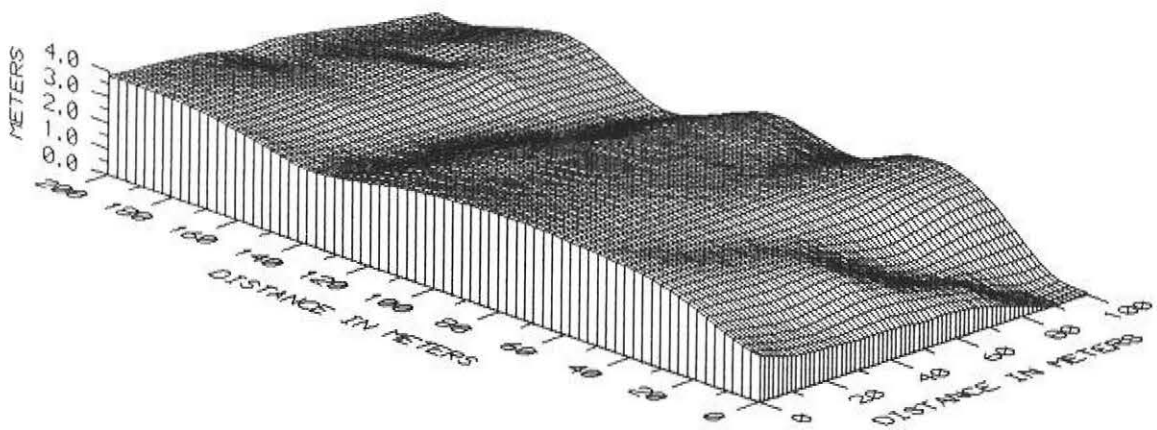

METERS
1.00
0.80
300
250
200
150
100
50
0
DISTANCE IN METERS
0 20 40 60
DISTANCE IN METERS


SITE 7 – EM(V)
DISTANCE IN METERS
0
20
40
60
80
100
120
140
160
180
200
220
240
260
280
300
320
0
20
40
60
DISTANCE IN METERS
50
70
60
50
50
50
50
60
70
80
80

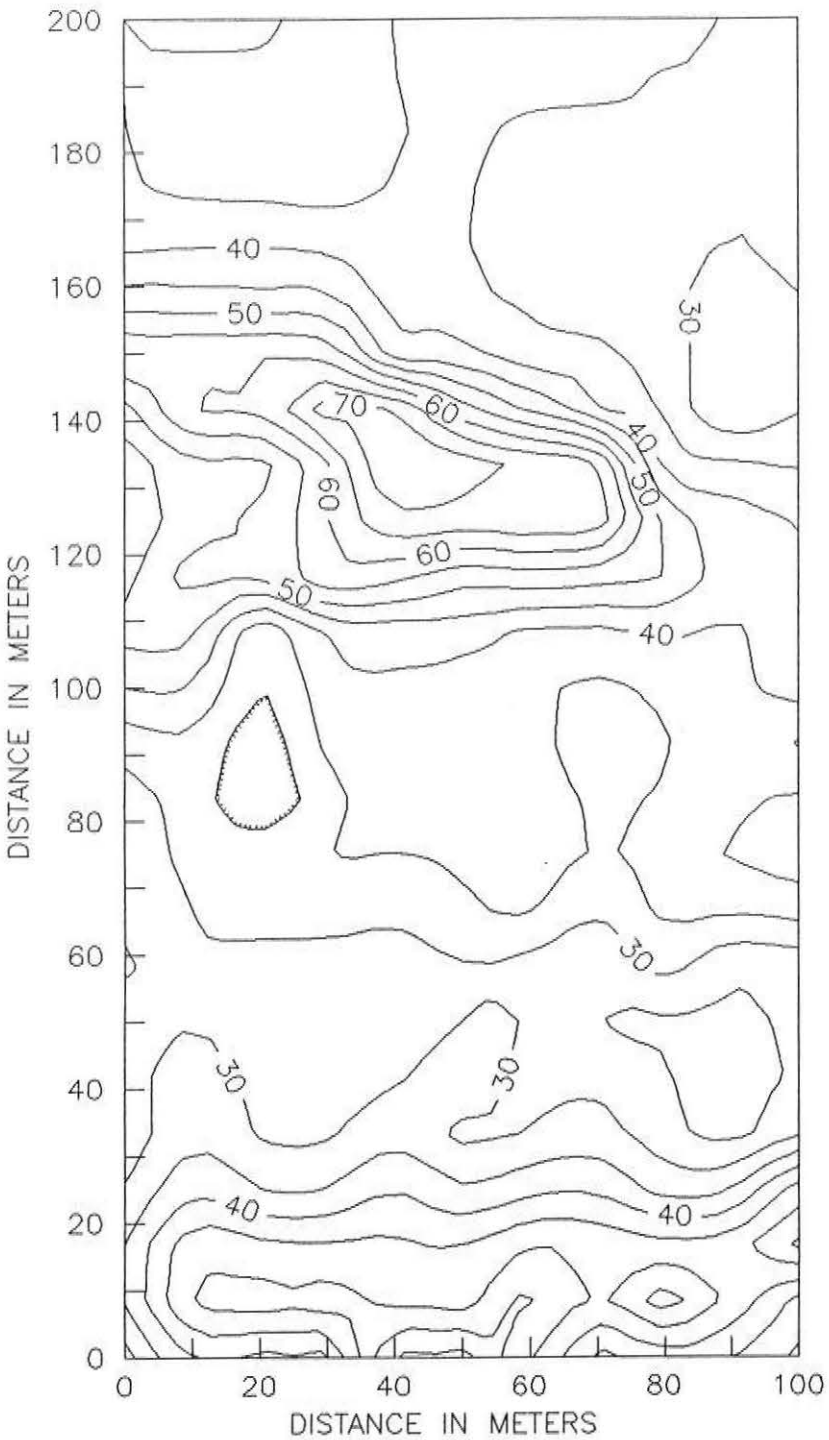
SITE 7 – EM(H)


320
300
280
260
240
220
200
180
160
140
120
100
80
60
40
20
0
DISTANCE IN METERS
0
20
40
60
DISTANCE IN METERS
40
50
40
40
30
40
50
60

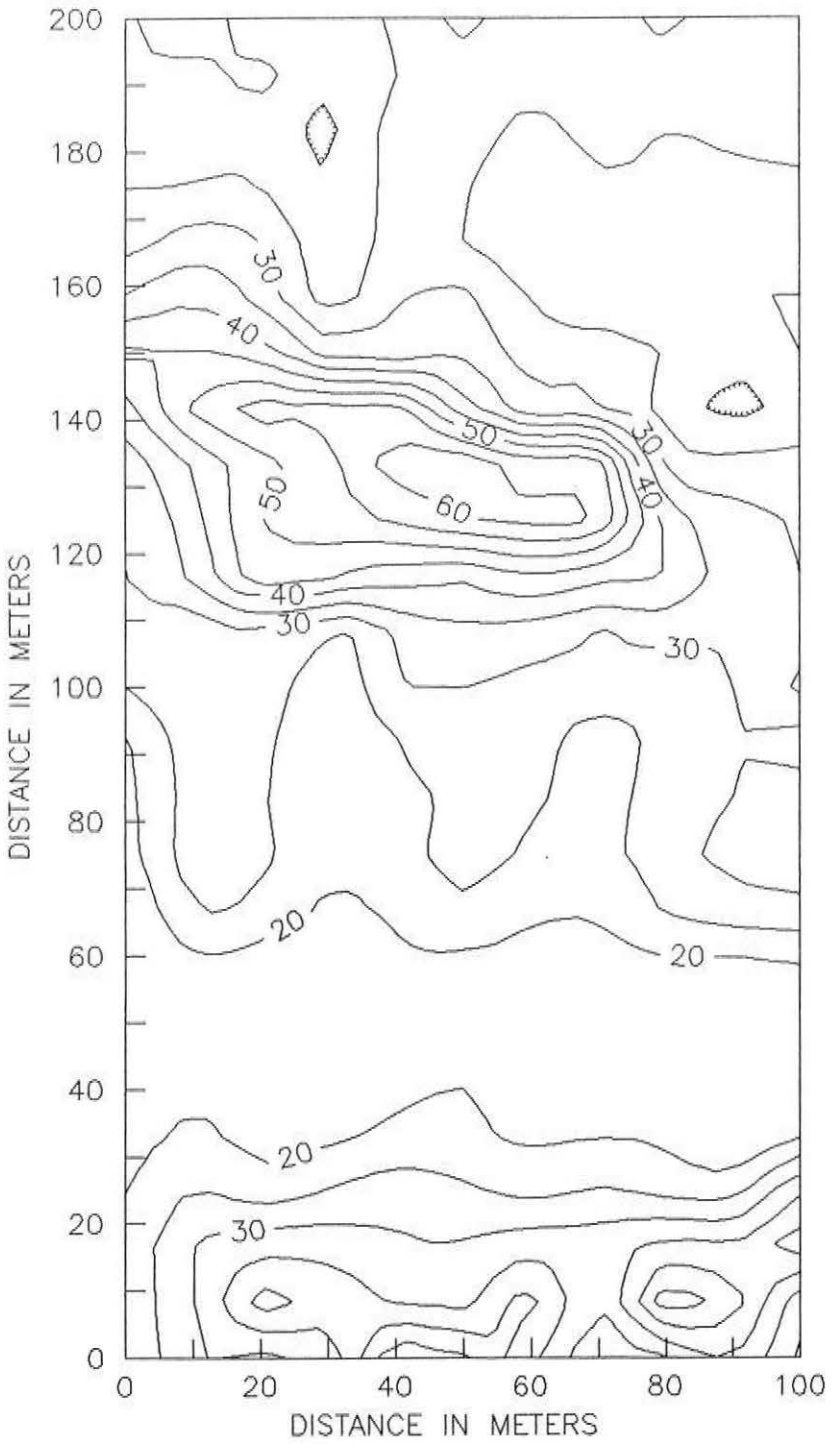
SITE 8


METERS
4.0
3.0
2.0
1.0
0.0
DISTANCE IN METERS
0
20
40
60
80
100
120
140
160
180
DISTANCE IN METERS

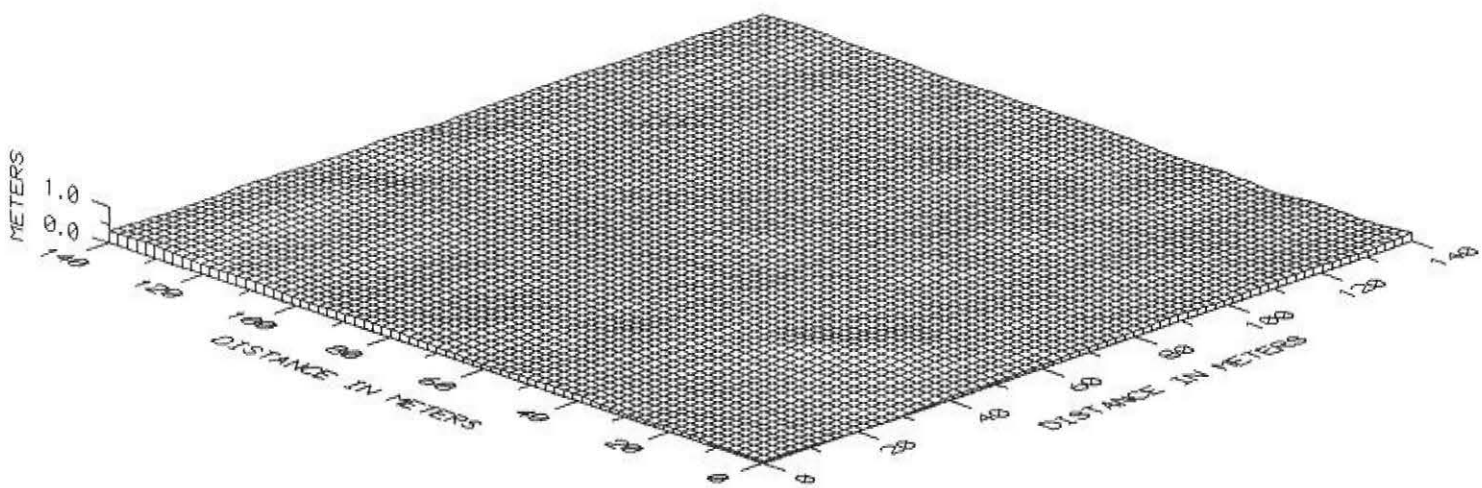
SITE 8 – EM(V)


200
180
160
140
120
100
80
60
40
20
0
DISTANCE IN METERS
0
20
40
60
80
100
DISTANCE IN METERS
40
50
70
60
30
40
50
60
50
40
30
30
40
40

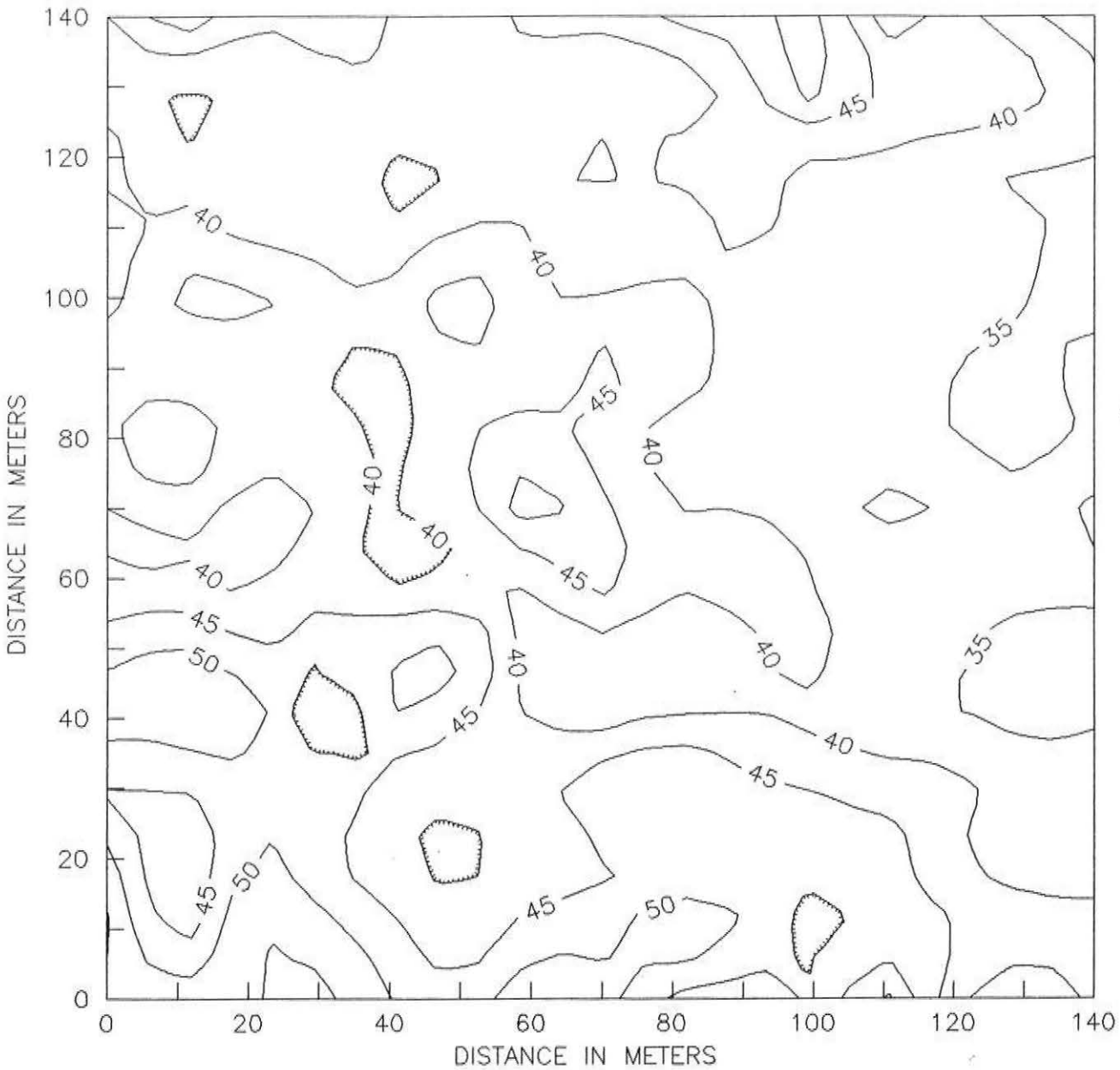
SITE 8 – EM(H)


200
180
160
140
120
100
80
60
40
20
0
DISTANCE IN METERS
0
20
40
60
80
100
DISTANCE IN METERS
30
40
50
60
50
40
30
30
20
20
20
30

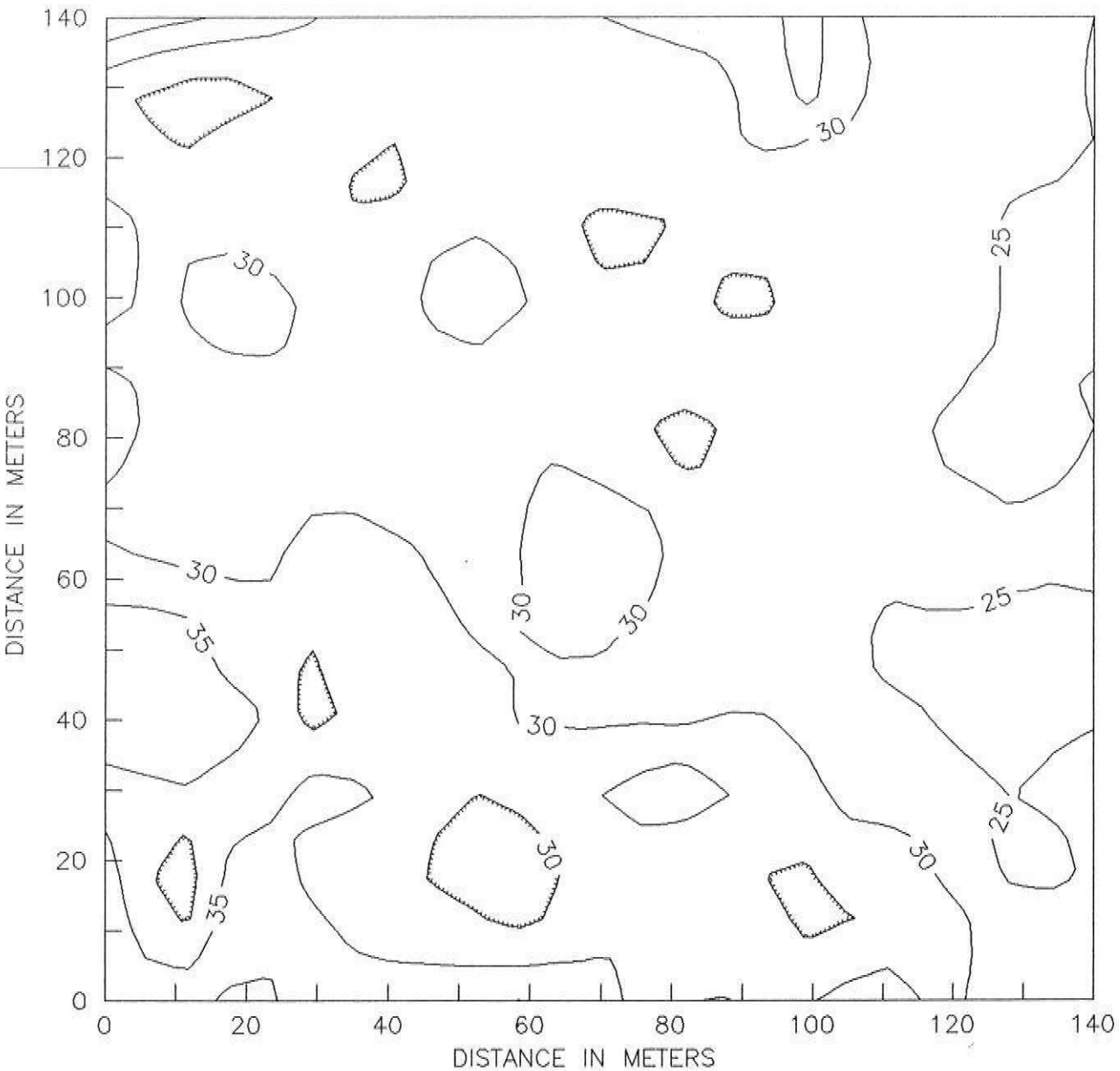
SITE 9



SITE 9 – EM(V)


DISTANCE IN METERS
0
20
40
60
80
100
120
140
DISTANCE IN METERS
0
20
40
60
80
100
120
140
35
40
45
50

SITE 9 – EM(H)



140
120
100
80
60
40
20
0
DISTANCE IN METERS
0
20
40
60
80
100
120
140
DISTANCE IN METERS
30
25
30
30
30
30
30
30
35
35
25
25