U.S. DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

Inversion results of time-domain electromagnetic soundings near Medicine Lake, California, geothermal area

by

W.L. Anderson, F.C. Frischknecht, P.V. Raab,
J.A. Bradley, J.Turnross, and T.W. Buckley

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Contents

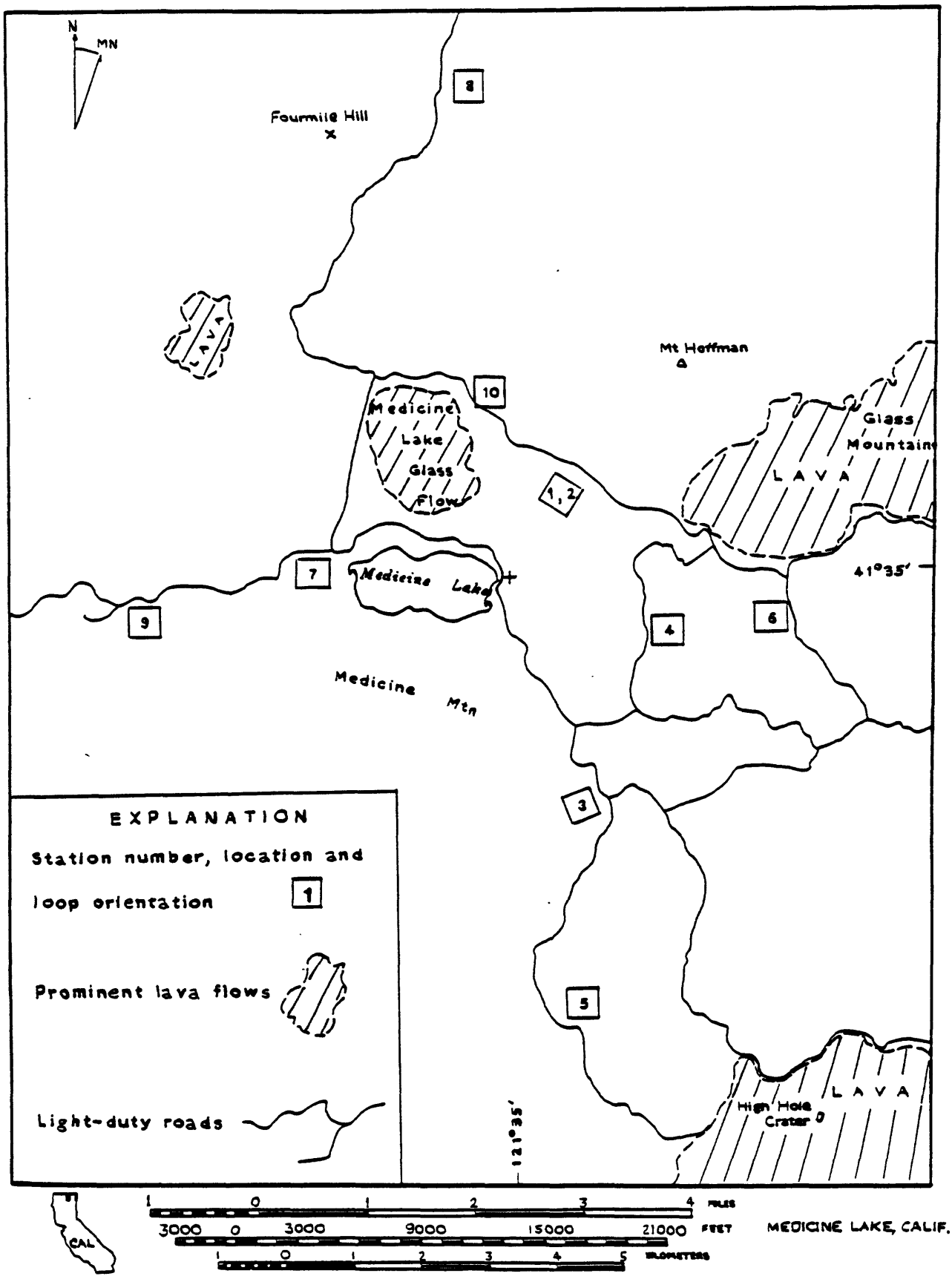
Introduction

A number of time-domain electromagnetic (TDEM) soundings were made in the vicinity of Medicine Lake, California, during July, 1982 (see Figure 1), as part of the U.S. Geological Survey's geothermal research program. The objectives were to evaluate the use of TDEM methods in this environment, to compare frequency and time-domain results, and to study variations in the conductive layer (Zohdy and Bisdorf, 1982) which were known to exist in the area of the Medicine Lake volcano. The TDEM soundings were made at nine sites (Figure 1) using both single and central loop configurations (Spies, 1980). At several of the sites, the large TDEM square loop (1500 ft. per side) was also used as a transmitter loop for loop-loop frequency domain soundings (Frischknecht, 1967). The frequency domain soundings have not been processed to-date; however, to make the data available, all TDEM results and their computer inversions are being presented in this preliminary report.

Equipment and field procedures

All TDEM measurements were made using a SIROTEM Mark II instrument (Busseli and O'Neill, 1977). This instrument transmits a sequence of bipolar square pulses with an off-time between pulses equal to the on-time. The system is powered by two 12 volt batteries and can deliver 1-to-7 amperes at 22 volts. The receiver can be connected directly to the transmitter loop for single loop (coincident loop system) operation, or it can be used with a separate receiving loop as in the central induction loop configuration.

Figure 1


N
MN
Fourmile Hill
8
LAVA
Mt Hoffman
10
Medicine
Lake
Glass
Flow
1, 2
Glass
Mountain
LAVA
41°35'
7
Medicine Lake
9
4
6
Medicine
Mtn
3
5
121°35'
High Hole
Crater
LAVA
EXPLANATION
Station number, location and
loop orientation
1
Prominent lava flows
Light-duty roads
CAL
MAP LOCATION
1 0 1 2 3 4 MILES
3000 0 3000 9000 15000 21000 FEET
1 0 1 2 3 4 5 KILOMETERS
MEDICINE LAKE, CALIF.

The transient voltage induced in the receiving loop is sampled at a maximum of 32 times starting at 0.4 ms after the end of the current pulse and ending at about 165 ms for the 32nd channel. Fewer than 32 channels can be selected, in which case both the current pulse and the off-time are shortened accordingly. In the Medicine Lake survey, at least 28 and usually 32 channels were used. To improve the signal to noise ratio, the signals from many pulses are stacked (averaged) together. The number of stacks can be set at 512, 1024, 2048, or 4096; in this survey, most of the data was collected using 2048 stacks. The time for collecting a single set of time-domain (transient) data when 32 channels and 2048 stacks are used is about 25 minutes.

A single turn of #12 copper wire was used to form square loops 1500 feet on a side. Lines were run through the woods without brushing using magnetic compasses for direction; typical closure errors at the last corner were 20 to 60 feet. The loop had a resistance of slightly less than 10 ohms so that the maximum current available from the internal transmitter was slightly over two amperes. To improve the signal to noise ratio, and to be able to make useful measurements at later times, an external high voltage transmitter was used to supply about 13 amps. The latter transmitter was connected to a direct current supply powered by a small 400 Hertz diesel generator. The external transmitter could be used only in the central induction loop configuration because the receiver pre-amplifier cannot withstand the voltages across the loop during the current pulse and the initial phase of turn-off. An 8-turn square loop 125 feet on a side was used as the receiving loop for the central loop measurements. At all

sites at least one set of data was collected using the single loop configuration and the central loop configuration with the internal transmitter. Three or four sets of data were collected at each site using the external transmitter.

Data processing

Data stored on the SIROTEM casette magnetic tapes were transferred to an HP-85 microcomputer through a special interface (Bradley and Raab, 1983). The data were plotted, and noisy or bad points at late-times were edited out when the signal to noise ratio was judged by visual examination to be unacceptable. Also, the first point at 0.4 ms, which is not accurate when using large loops, was rejected. Next, individual data sets or runs were averaged together for each site in order to produce a single data set for each configuration. Apparent resistivities were also calculated using an HP-85 program (Raab and Frischknecht, 1983). The final averaged voltage and resistivity data as selected were then transferred to a VAX-11/780 computer for inversion. Agreement between central loop and single loop data was generally good, so that except for station 9, only central induction loop data were used in producing the results given here. A serious discrepancy between the two sets of data was noted for station 9: the problem may be related to leakage from the transmitting loop, which at one locality, lay in a wet snow bank; we believe that the single loop data are correct, but both data sets are included (see STA.9 and STA.9** in the Appendix).

Inversion of TDEM soundings

Computer inversion of the final edited TDEM soundings, taken at nine different sites in the Medicine Lake area (see locations in Figure 1), was processed on a VAX-11/780 computer. The inversion programs used a nonlinear least-squares technique described in detail in Anderson (1982a, and 1982b). Results from the inversion output are summarized numerically and graphically in the Appendix of this report. Program NLSTCO (Anderson, 1982a) was used for inversion of the single loop data, and program NLSTCI (Anderson, 1982b) was used for inversion of the central loop data.

Results

In general, the results of computer inversion of the TDEM data agree well with the results of inversion of Schlumberger soundings (Zohdy and Bisdorf, 1982). However, for the time range of the equipment and the loop size used here, the response of high resistivity layers is small, and hence the TDEM method is not effective in resolving high resistivity layers. Therefore our models show much less detail in the near surface than the results given by Zohdy and Bisdorf (1982). Also, the near surface TDEM resistivities tend to be lower, but we do not attach much significance to this observation, due to the lack of resolution.

The models presented in the Appendix represent the best fits that were obtained. However, it must be recognized that in most models, some of the parameters are not well resolved, and that there may exist other solutions which would fit the data equally well. For instance, the first two layers in the model for STA. 4 could be combined, and a 3-layer model used. Fortunately, resolution is best for the resistivity and depth of the most conductive layers. [Note that we purposely used 4-layer models for all stations so that direct comparisons between TDEM soundings would be possible over the entire survey area.]

At several sites, such as STA.1, there appear to be variations in the conductive layer. Of particular interest is the fact that several of the TDEM soundings indicate the presence of a high resistivity layer beneath the conductive layer. At STA.3, two conductive layers are seen, where the deeper conductor is found at a depth of about 959 meters and has a resistivity of about 3 ohm-meters. [See the Appendix for further details on all the results.]

Acknowledgments

The external transmitter used in central induction loop measurements was designed by James Cooke and built by Don Rohret. Charles Mitchell developed the generator system.

References

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Frischknecht, F.C., 1967, Fields about an oscillating magnetic dipole over a two-layer earth, and application to ground and airborne electromagnetic surveys: Colorado School of Mines Quart., V. 62, no. 1, 326 p.

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Appendix

The heading on each of the attached output sheets (and corresponding plots) identifies the station and TDEM configuation. As mentioned above in the Results section, a 4-layer model was chosen as the final model to fit to the given data sets. The print-out sheet is a partial extract taken from the master print output file (FOR016.DAT) described in the program documentations for NLSTCO (Anderson, 1982a) and NLSTCI (Anderson, 1982b).

The print-out extract is arranged as follows: PARAMETERS HELD FIXED (in all cases, parameter IB=8 is held fixed to B(8)=1.0, which is an apparent resistivity SHIFT or multiplier factor); type of nonlinear CONVERGENCE (see Dennis and others, 1979, p.11-14 for a discussion on convergence types); the observed transient apparent resistivity (OBS.Y(I)); the theoretical or calculated (CAL) transient; the residual (RES=Y(I)-CAL); percent residual error (%RES.ERR=100*RES/CAL); and the observed time (X(I,1)) given in seconds. The root-mean-square error (RMSERR) is given next, and is the standard error of the residual vector. The parameter CORRELATION MATRIX is printed only if the corresponding covariance matrix is positive-definite (see Dennis and others, 1979, p. 14, and p. 31). If the correlation matrix is given, then the measure of error of each determined layer nonlinear parameter (PARM.SOL.) is listed under STD.ERROR, and is a "linear statistic" based on the square-root of a scaled error variance times the diagonal of the covariance matrix. In addition, the STD.ERROR is also used to compute the relative

error (REL.ERROR=STD.ERROR/PARM.SOL), which is a magnitude related ratio. The percent error (%ERROR) is simply 100 times the REL.ERROR. [Note that the latter is not as useful here as the STD.ERROR, since conductivities and thicknesses are given in different units.] If the covariance matrix is not positive-definite (i.e., an INDEFINITE COVARIANCE MATRIX), then the CORRELATION MATRIX, STD.ERROR, and related linear statistics are not given (e.g., see STA. 9 results).

The least-squares FINAL SOLUTION vector is listed next, giving each defined nonlinear parameter name, where SIGMA(I) is defined as the conductivity of layer-I (in mhos/meter), RESISTIVITY is 1/SIGMA (in ohm-meters), THICK(I) is the thickness of layer-I (in meters), and DEPTH(I) is the accumulated layer thicknesses to the bottom of layer-I.

The summary plots have the observed Y(I) data denoted by a symbol "O", and the solid line represents a smooth curve drawn through the theoretical calculated (CAL) points at each observed time X(I,1). The final interpreted layered earth model solution is plotted in block form, and shows each layer solution resistivity and depth.

```
<NLSTCI>:     MEDICINE LAKE STA.1 CI-LOOP 4-LAYERS REF:[NLSTCI.F*]
 PARAMETERS HELD FIXED: IB=  8
***** X-CONVERGENCE *****
   I     OBS.Y(I)       CAL            RES         %RES.ERR       X(I,1)
   1  0.336500E+03  0.335767E+03  0.733E+00  0.218407E+00  0.800000E-03
   2  0.264500E+03  0.266453E+03 -0.195E+01 -0.732850E+00  0.120000E-02
   3  0.229200E+03  0.230545E+03 -0.135E+01 -0.583605E+00  0.160000E-02
   4  0.209900E+03  0.207395E+03  0.251E+01  0.120790E+01  0.200000E-02
   5  0.182100E+03  0.182629E+03 -0.529E+00 -0.289604E+00  0.260000E-02
   6  0.157400E+03  0.158083E+03 -0.683E+00 -0.432291E+00  0.340000E-02
   7  0.140100E+03  0.139871E+03  0.229E+00  0.163397E+00  0.420000E-02
   8  0.128100E+03  0.125559E+03  0.254E+01  0.202355E+01  0.500000E-02
   9  0.114600E+03  0.113809E+03  0.791E+00  0.695247E+00  0.580000E-02
  10  0.100600E+03  0.100198E+03  0.402E+00  0.400908E+00  0.700000E-02
  11  0.865600E+02  0.872801E+02 -0.720E+00 -0.825063E+00  0.860000E-02
  12  0.770800E+02  0.778136E+02 -0.734E+00 -0.942810E+00  0.102000E-01
  13  0.705100E+02  0.705857E+02 -0.757E-01 -0.107222E+00  0.118000E-01
  14  0.647700E+02  0.649164E+02 -0.146E+00 -0.225498E+00  0.134000E-01
  15  0.583600E+02  0.584049E+02 -0.449E-01 -0.768427E-01  0.158000E-01
  16  0.516900E+02  0.521401E+02 -0.450E+00 -0.863287E+00  0.190000E-01
  17  0.462200E+02  0.475168E+02 -0.130E+01 -0.272912E+01  0.222000E-01
  18  0.436900E+02  0.439481E+02 -0.258E+00 -0.587203E+00  0.254000E-01
  19  0.408600E+02  0.411170E+02 -0.257E+00 -0.625027E+00  0.286000E-01
  20  0.374700E+02  0.378387E+02 -0.369E+00 -0.974314E+00  0.334000E-01
  21  0.348400E+02  0.345800E+02  0.260E+00  0.751808E+00  0.398000E-01
  22  0.328300E+02  0.321158E+02  0.714E+00  0.222369E+01  0.462000E-01
  23  0.310600E+02  0.301789E+02  0.881E+00  0.291971E+01  0.526000E-01
  24  0.292600E+02  0.286149E+02  0.645E+00  0.225454E+01  0.590000E-01
  25  0.264800E+02  0.267487E+02 -0.269E+00 -0.100469E+01  0.686000E-01
 ** RMSERR=  0.11916333E+01
 CORRELATION MATRIX
  1  0.1000E+01
  2 -0.4654E+00  0.1000E+01
  3  0.2913E+00 -0.8370E+00  0.1000E+01
  4 -0.3690E+00  0.6379E+00 -0.6054E+00  0.1000E+01
  5 -0.3514E+00  0.9547E+00 -0.8146E+00  0.5577E+00  0.1000E+01
  6  0.3303E+00 -0.5478E+00  0.6406E+00 -0.3541E+00 -0.5849E+00  0.1000E+01
  7 -0.2295E-01 -0.5712E+00  0.5777E+00 -0.4162E+00 -0.5471E+00 -0.5287E-01  0.1000E+01
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  1  0.5455E-03  0.1169E-03  0.2143E+00  0.2143E+02
  2  0.1838E-01  0.7165E-03  0.3898E-01  0.3898E+01
  3  0.3361E-01  0.1603E-02  0.4770E-01  0.4770E+01
  4  0.9319E-01  0.1292E-02  0.1386E-01  0.1386E+01
  5  0.2879E+03  0.2873E-02  0.9979E-05  0.9979E-03
  6  0.2336E+03  0.4253E-02  0.1820E-04  0.1820E-02
  7  0.1161E+03  0.5900E-02  0.5083E-04  0.5083E-02
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    1    SIGMA( 1) =  0.54552953E-03    1  0.18330813E+04
    2    SIGMA( 2) =  0.18380590E-01    2  0.54405220E+02
    3    SIGMA( 3) =  0.33605959E-01    3  0.29756628E+02
    4    SIGMA( 4) =  0.93189158E-01    4  0.10730862E+02
    5    THICK( 1) =  0.28788940E+03                       1  0.28788940E+03
    6    THICK( 2) =  0.23364096E+03                       2  0.52153040E+03
    7    THICK( 3) =  0.11607116E+03                       3  0.63760156E+03
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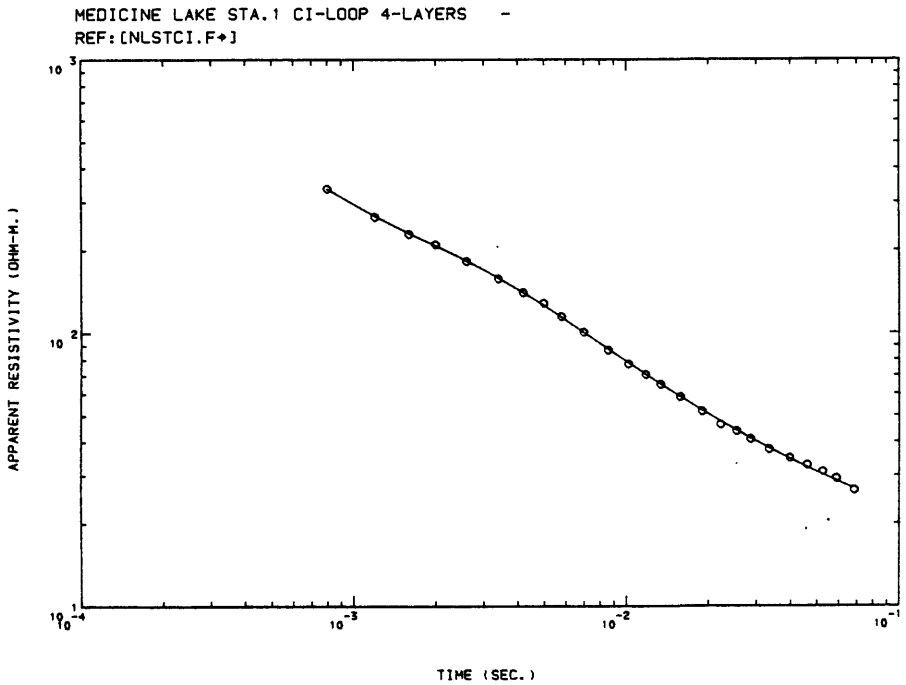
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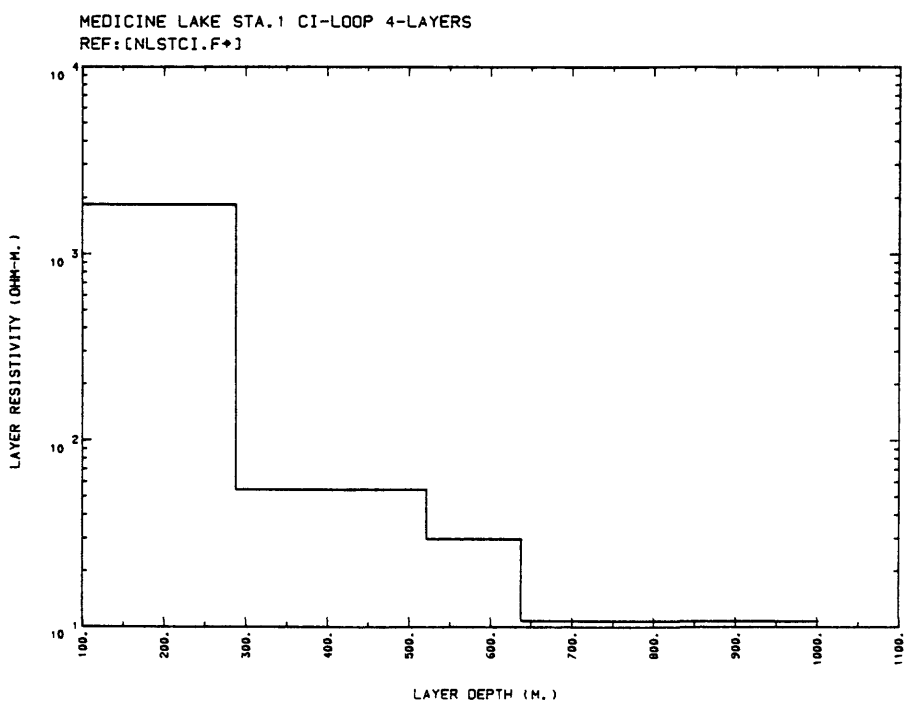
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LAYER DEPTH (M.)

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2	0.449250E+02	0.453126E+02	-0.388E+00	-0.855391E+00	0.120000E-02
3	0.403410E+02	0.403951E+02	-0.541E-01	-0.133946E+00	0.160000E-02
4	0.359930E+02	0.364328E+02	-0.440E+00	-0.120715E+01	0.200000E-02
5	0.318110E+02	0.317601E+02	0.509E-01	0.160184E+00	0.260000E-02
6	0.274670E+02	0.270950E+02	0.372E+00	0.137282E+01	0.340000E-02
7	0.244360E+02	0.240072E+02	0.429E+00	0.178613E+01	0.420000E-02
8	0.221770E+02	0.218349E+02	0.342E+00	0.156690E+01	0.500000E-02
9	0.203660E+02	0.202490E+02	0.117E+00	0.577904E+00	0.580000E-02
10	0.185130E+02	0.185707E+02	-0.577E-01	-0.310956E+00	0.700000E-02
11	0.170680E+02	0.172415E+02	-0.174E+00	-0.100655E+01	0.860000E-02
12	0.161150E+02	0.164069E+02	-0.292E+00	-0.177896E+01	0.102000E-01
13	0.156280E+02	0.158578E+02	-0.230E+00	-0.144925E+01	0.118000E-01
14	0.152400E+02	0.155375E+02	-0.298E+00	-0.191484E+01	0.134000E-01
15	0.150500E+02	0.153352E+02	-0.285E+00	-0.186009E+01	0.158000E-01
16	0.151560E+02	0.153123E+02	-0.156E+00	-0.102096E+01	0.190000E-01
17	0.154460E+02	0.154099E+02	0.361E-01	0.234013E+00	0.222000E-01
18	0.159510E+02	0.155686E+02	0.382E+00	0.245595E+01	0.254000E-01
19	0.165310E+02	0.157721E+02	0.759E+00	0.481192E+01	0.286000E-01
20	0.165800E+02	0.161742E+02	0.406E+00	0.250863E+01	0.334000E-01
21	0.173480E+02	0.166819E+02	0.666E+00	0.399270E+01	0.398000E-01
22	0.168870E+02	0.168857E+02	0.125E-02	0.740992E-02	0.462000E-01
23	0.172410E+02	0.169045E+02	0.336E+00	0.199053E+01	0.526000E-01
24	0.162920E+02	0.169622E+02	-0.670E+00	-0.395090E+01	0.590000E-01
25	0.162090E+02	0.169443E+02	-0.735E+00	-0.433960E+01	0.686000E-01
26	0.155590E+02	0.164791E+02	-0.920E+00	-0.558337E+01	0.814000E-01
27	0.157340E+02	0.157297E+02	0.428E-02	0.271920E-01	0.942000E-01
28	0.154760E+02	0.150621E+02	0.414E+00	0.274785E+01	0.107000E+00
29	0.148420E+02	0.144551E+02	0.387E+00	0.267687E+01	0.119800E+00

** RMSERR= 0.46684602E+00

CORRELATION MATRIX

1	0.1000E+01						
2	0.5070E+00	0.1000E+01					
3	0.5258E+00	0.2101E+00	0.1000E+01				
4	0.2403E+00	0.3122E+00	-0.1257E+00	0.1000E+01			
5	0.6524E+00	0.7939E+00	0.5377E+00	0.2118E+00	0.1000E+01		
6	-0.4893E+00	-0.8514E+00	-0.4023E+00	0.1249E+00	-0.7475E+00	0.1000E+01	
7	-0.4249E+00	-0.3228E+00	-0.1654E+00	-0.9133E+00	-0.3228E+00	-0.3380E-01	0.1000E+01

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2	0.1328E+00	0.1715E-02	0.1292E-01	0.1292E+01
3	0.3135E-01	0.1344E-02	0.4288E-01	0.4288E+01
4	0.3385E+00	0.1949E-01	0.5758E-01	0.5758E+01
5	0.1839E+03	0.3782E-02	0.2057E-04	0.2057E-02
6	0.2046E+03	0.1357E-01	0.6631E-04	0.6631E-02
7	0.5702E+03	0.3486E-01	0.6114E-04	0.6114E-02

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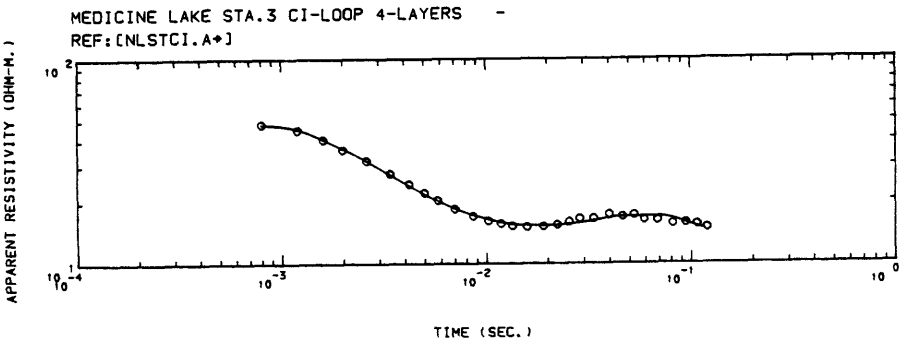
2	SIGMA(2)	=	0.13276637E+00	2	0.75320282E+01		
3	SIGMA(3)	=	0.31349394E-01	3	0.31898542E+02		
4	SIGMA(4)	=	0.33845764E+00	4	0.29545794E+01		
5	THICK(1)	=	0.18385492E+03			1	0.18385492E+03
6	THICK(2)	=	0.20463657E+03			2	0.38849149E+03
7	THICK(3)	=	0.57021625E+03			3	0.95870776E+03
8	SHIFT	=	0.10000000E+01				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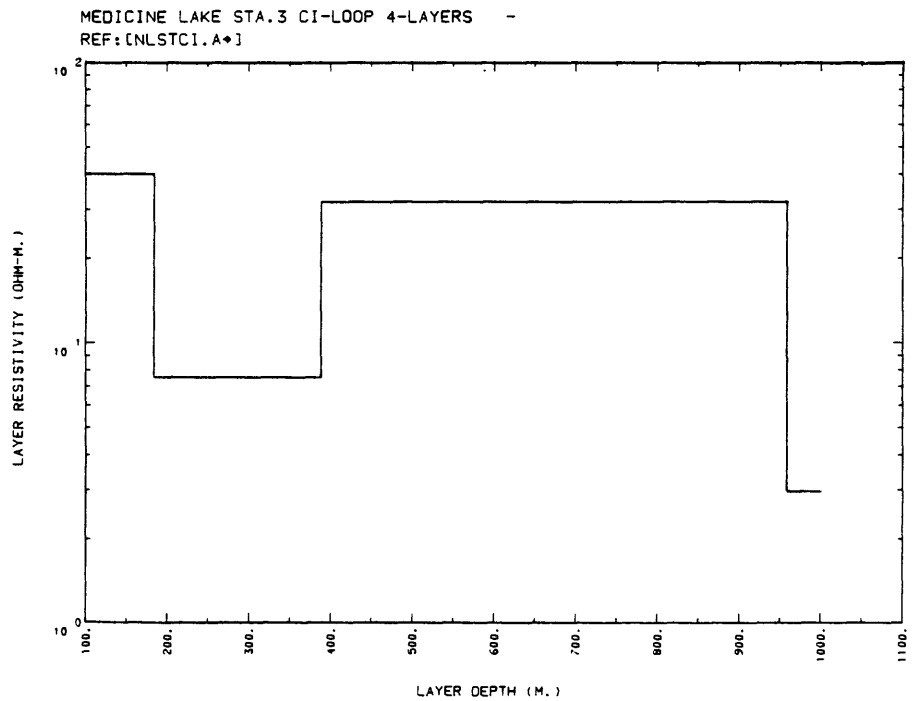
TIME (SEC.)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LAYER RESISTIVITY (OHM-M.)
LAYER DEPTH (M.)

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PARAMETERS HELD FIXED: IB= 8
***** VARIABILITY CONVERGENCE *****

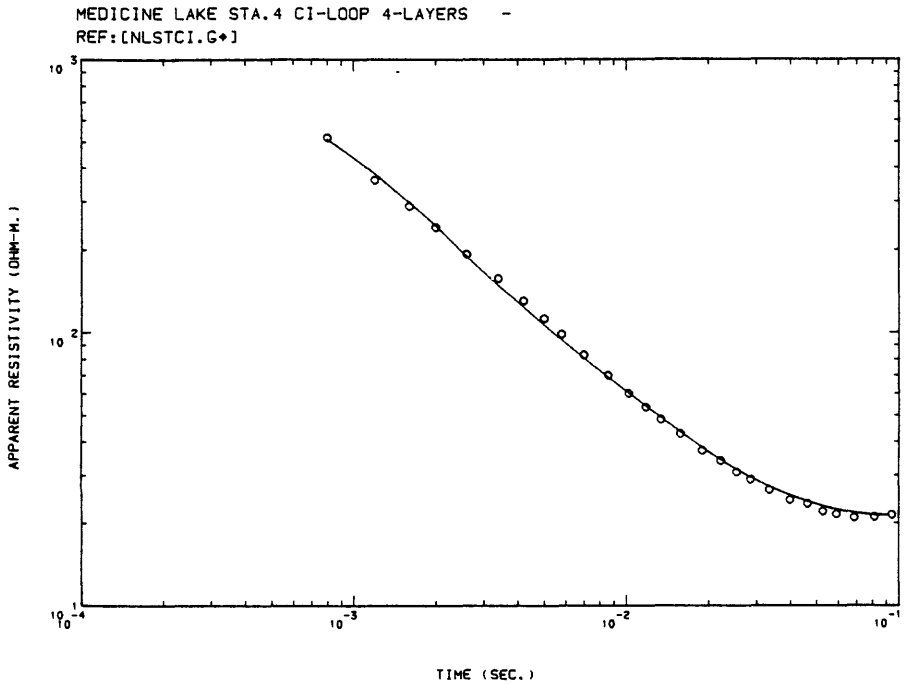
I	OBS.Y(I)	CAL	RES	%RES.ERR	X(I,1)
1	0.517830E+03	0.510161E+03	0.767E+01	0.150322E+01	0.800000E-03
2	0.359390E+03	0.378336E+03	-0.189E+02	-0.500771E+01	0.120000E-02
3	0.287800E+03	0.296591E+03	-0.879E+01	-0.296411E+01	0.160000E-02
4	0.240810E+03	0.243712E+03	-0.290E+01	-0.119090E+01	0.200000E-02
5	0.192570E+03	0.188887E+03	0.368E+01	0.194969E+01	0.260000E-02
6	0.157180E+03	0.148117E+03	0.906E+01	0.611912E+01	0.340000E-02
7	0.130480E+03	0.123535E+03	0.695E+01	0.562228E+01	0.420000E-02
8	0.112380E+03	0.106281E+03	0.610E+01	0.573900E+01	0.500000E-02
9	0.985340E+02	0.938684E+02	0.467E+01	0.497039E+01	0.580000E-02
10	0.829360E+02	0.806660E+02	0.227E+01	0.281409E+01	0.700000E-02
11	0.698810E+02	0.687449E+02	0.114E+01	0.165263E+01	0.860000E-02
12	0.601130E+02	0.602845E+02	-0.172E+00	-0.284530E+00	0.102000E-01
13	0.535160E+02	0.539614E+02	-0.445E+00	-0.825335E+00	0.118000E-01
14	0.481890E+02	0.490417E+02	-0.853E+00	-0.173865E+01	0.134000E-01
15	0.427120E+02	0.434045E+02	-0.692E+00	-0.159537E+01	0.158000E-01
16	0.370970E+02	0.380461E+02	-0.949E+00	-0.249462E+01	0.190000E-01
17	0.339630E+02	0.342760E+02	-0.313E+00	-0.913031E+00	0.222000E-01
18	0.308440E+02	0.315451E+02	-0.701E+00	-0.222259E+01	0.254000E-01
19	0.289940E+02	0.295013E+02	-0.507E+00	-0.171962E+01	0.286000E-01
20	0.265350E+02	0.272858E+02	-0.751E+00	-0.275152E+01	0.334000E-01
21	0.243650E+02	0.253390E+02	-0.974E+00	-0.384392E+01	0.398000E-01
22	0.235830E+02	0.240404E+02	-0.457E+00	-0.190271E+01	0.462000E-01
23	0.221050E+02	0.231199E+02	-0.101E+01	-0.438963E+01	0.526000E-01
24	0.215890E+02	0.224543E+02	-0.865E+00	-0.385345E+01	0.590000E-01
25	0.209480E+02	0.218216E+02	-0.874E+00	-0.400345E+01	0.686000E-01
26	0.210850E+02	0.214219E+02	-0.337E+00	-0.157277E+01	0.814000E-01
27	0.214570E+02	0.213808E+02	0.762E-01	0.356218E+00	0.942000E-01

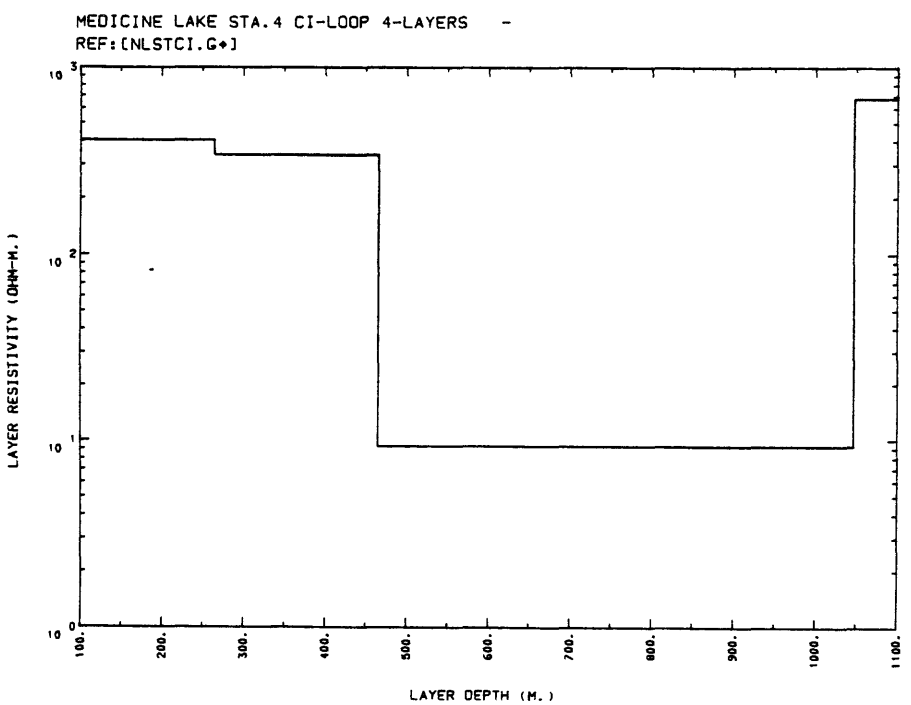
** RMSERR= 0.60016584E+01
CORRELATION MATRIX

1	0.1000E+01						
2	-0.5758E+00	0.1000E+01					
3	-0.2821E+00	0.2367E+00	0.1000E+01				
4	0.3633E+00	-0.6641E+00	-0.6647E+00	0.1000E+01			
5	0.5351E+00	0.9503E-01	-0.2901E+00	0.7905E-01	0.1000E+01		
6	-0.5048E+00	-0.8366E-01	0.3227E+00	-0.1194E+00	-0.9939E+00	0.1000E+01	
7	-0.5661E+00	0.3408E+00	0.6471E+00	-0.5618E+00	-0.3317E+00	0.3528E+00	0.1000E+01

	**PARM.SOL.	STD.ERROR	REL.ERROR	% ERROR **
1	0.2474E-02	0.4819E-03	0.1948E+00	0.1948E+02
2	0.2960E-02	0.1410E-02	0.4765E+00	0.4765E+02
3	0.1076E+00	0.2699E-02	0.2507E-01	0.2507E+01
4	0.1475E-02	0.1233E-01	0.8357E+01	0.8357E+03
5	0.2645E+03	0.3674E-01	0.1389E-03	0.1389E-01
6	0.2006E+03	0.3966E-01	0.1977E-03	0.1977E-01
7	0.5819E+03	0.4091E-01	0.7031E-04	0.7031E-02

	PARAMETER NAME	FINAL SOLUTION		RESISTIVITY	LAYER	DEPTH
1	SIGMA(1) =	0.24736857E-02	1	0.40425510E+03		
2	SIGMA(2) =	0.29600598E-02	2	0.33783102E+03		
3	SIGMA(3) =	0.10764176E+00	3	0.92900753E+01		
4	SIGMA(4) =	0.14750116E-02	4	0.67796075E+03		
5	THICK(1) =	0.26451260E+03			1	0.26451260E+03
6	THICK(2) =	0.20061903E+03			2	0.46513165E+03
7	THICK(3) =	0.58192059E+03			3	0.10470522E+04
8	SHIFT =	0.10000000E+01				


MEDICINE LAKE STA.4 CI-LOOP 4-LAYERS -
REF:[NLSTCI.G+]
APPARENT RESISTIVITY (OHM-M.)
TIME (SEC.)


MEDICINE LAKE STA.4 CI-LOOP 4-LAYERS -
REF:[NLSTCI.G+]
LAYER RESISTIVITY (OHM-M.)
LAYER DEPTH (M.)

<NLSTCI>: MEDICINE LAKE STA.5 CI-LOOP 4-LAYERS REF:[NLSTCI.H*]
PARAMETERS HELD FIXED: IB= 8
***** X-CONVERGENCE *****

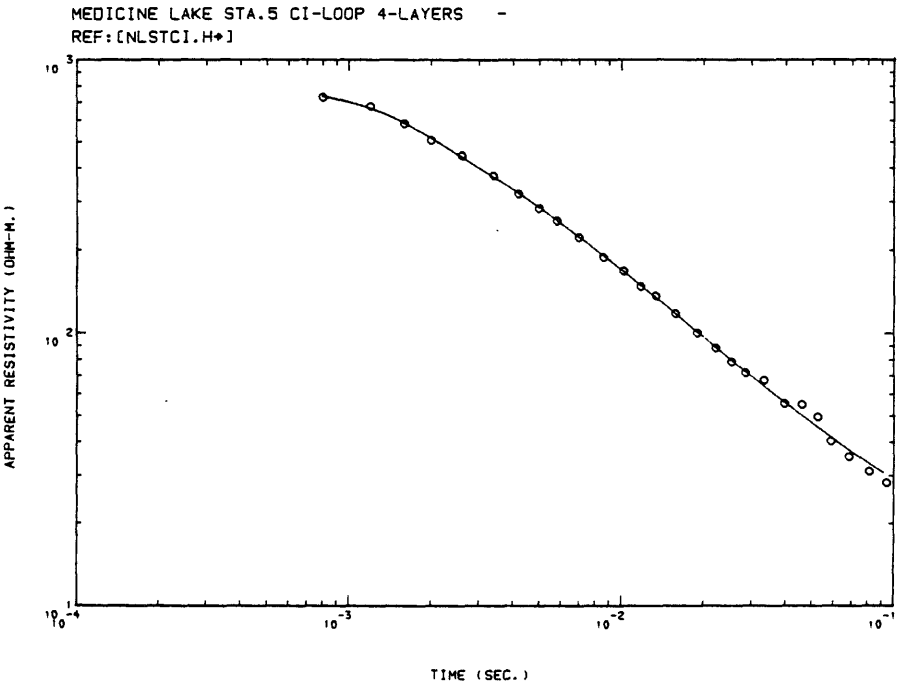
I	OBS.Y(I)	CAL	RES	%RES.ERR	X(I,1)
1	0.728200E+03	0.733964E+03	-0.576E+01	-0.785289E+00	0.800000E-03
2	0.673030E+03	0.659958E+03	0.131E+02	0.198074E+01	0.120000E-02
3	0.581890E+03	0.583479E+03	-0.159E+01	-0.272351E+00	0.160000E-02
4	0.505720E+03	0.514635E+03	-0.892E+01	-0.173231E+01	0.200000E-02
5	0.442860E+03	0.436507E+03	0.635E+01	0.145552E+01	0.260000E-02
6	0.373790E+03	0.368621E+03	0.517E+01	0.140225E+01	0.340000E-02
7	0.320450E+03	0.322156E+03	-0.171E+01	-0.529404E+00	0.420000E-02
8	0.282970E+03	0.285396E+03	-0.243E+01	-0.850077E+00	0.500000E-02
9	0.255220E+03	0.256026E+03	-0.806E+00	-0.314705E+00	0.580000E-02
10	0.222190E+03	0.222928E+03	-0.738E+00	-0.331270E+00	0.700000E-02
11	0.188250E+03	0.190704E+03	-0.245E+01	-0.128690E+01	0.860000E-02
12	0.167830E+03	0.166936E+03	0.894E+00	0.535395E+00	0.102000E-01
13	0.147680E+03	0.148766E+03	-0.109E+01	-0.729719E+00	0.118000E-01
14	0.136460E+03	0.134321E+03	0.214E+01	0.159259E+01	0.134000E-01
15	0.117540E+03	0.117406E+03	0.134E+00	0.114396E+00	0.158000E-01
16	0.100080E+03	0.100882E+03	-0.802E+00	-0.794780E+00	0.190000E-01
17	0.883400E+02	0.887758E+02	-0.436E+00	-0.490924E+00	0.222000E-01
18	0.787200E+02	0.796113E+02	-0.891E+00	-0.111958E+01	0.254000E-01
19	0.717620E+02	0.724304E+02	-0.668E+00	-0.922780E+00	0.286000E-01
20	0.674940E+02	0.641492E+02	0.334E+01	0.521414E+01	0.334000E-01
21	0.554880E+02	0.560844E+02	-0.596E+00	-0.106333E+01	0.398000E-01
22	0.550910E+02	0.500994E+02	0.499E+01	0.996344E+01	0.462000E-01
23	0.497390E+02	0.454439E+02	0.430E+01	0.945143E+01	0.526000E-01
24	0.403590E+02	0.417289E+02	-0.137E+01	-0.328291E+01	0.590000E-01
25	0.353990E+02	0.374552E+02	-0.206E+01	-0.548975E+01	0.686000E-01
26	0.311540E+02	0.332881E+02	-0.213E+01	-0.641108E+01	0.814000E-01
27	0.283070E+02	0.302128E+02	-0.191E+01	-0.630782E+01	0.942000E-01

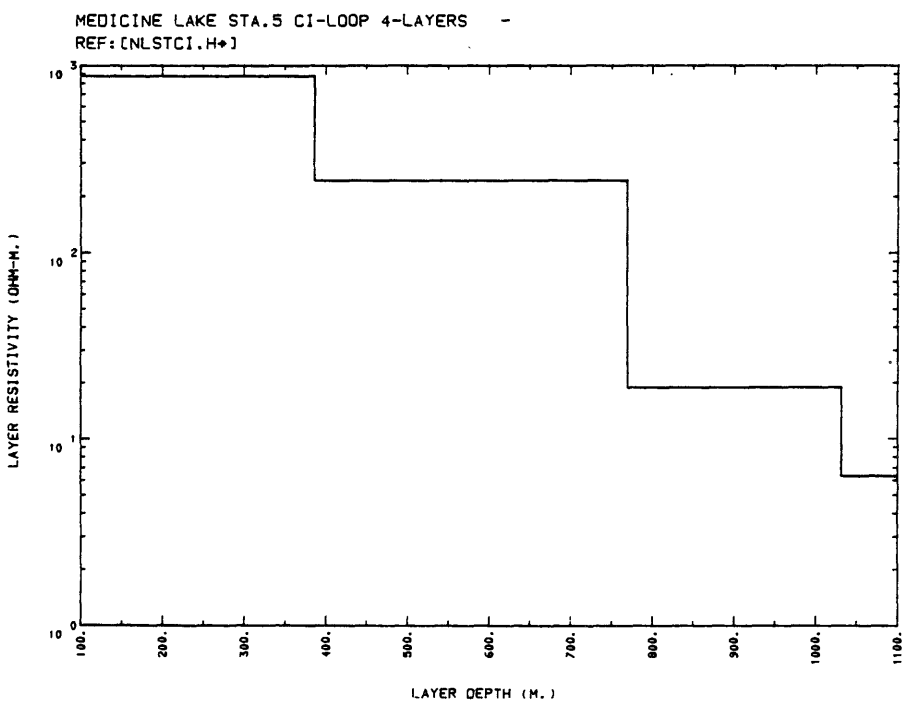
** RMSERR= 0.47278066E+01
CORRELATION MATRIX

1	0.1000E+01						
2	-0.7668E+00	0.1000E+01					
3	-0.4208E-01	0.2985E+00	0.1000E+01				
4	-0.3807E-01	0.1862E+00	0.1905E+00	0.1000E+01			
5	0.4864E-01	0.4409E+00	0.4482E+00	0.6759E-01	0.1000E+01		
6	0.1319E+00	-0.2627E+00	0.1485E+00	-0.4102E+00	-0.3923E+00	0.1000E+01	
7	-0.2059E+00	-0.3171E+00	-0.5626E+00	-0.6440E+00	-0.6387E+00	0.3177E+00	0.1000E+01

**PARM.SOL.	STD.ERROR	REL.ERROR	% ERROR **
1 0.1142E-02	0.1119E-03	0.9794E-01	0.9794E+01
2 0.4143E-02	0.2876E-03	0.6942E-01	0.6942E+01
3 0.5315E-01	0.9047E-03	0.1702E-01	0.1702E+01
4 0.1592E+00	0.3452E-02	0.2169E-01	0.2169E+01
5 0.3858E+03	0.4757E-02	0.1233E-04	0.1233E-02
6 0.3831E+03	0.4240E-02	0.1107E-04	0.1107E-02
7 0.2627E+03	0.1529E-01	0.5822E-04	0.5822E-02

PARAMETER	NAME		FINAL SOLUTION		RESISTIVITY	LAYER	DEPTH
1	SIGMA(1)	=	0.11423007E-02	1	0.87542627E+03		
2	SIGMA(2)	=	0.41431203E-02	2	0.24136398E+03		
3	SIGMA(3)	=	0.53151120E-01	3	0.18814280E+02		
4	SIGMA(4)	=	0.15916061E+00	4	0.62829614E+01		
5	THICK(1)	=	0.38576047E+03			1	0.38576047E+03
6	THICK(2)	=	0.38310947E+03			2	0.76886993E+03
7	THICK(3)	=	0.26267462E+03			3	0.10315446E+04
8	SHIFT	=	0.10000000E+01				


MEDICINE LAKE STA.5 CI-LOOP 4-LAYERS -
REF:[NLSTCI.H+]
APPARENT RESISTIVITY (OHM-M.)
TIME (SEC.)


MEDICINE LAKE STA.5 CI-LOOP 4-LAYERS -
REF:[NLSTCI.H+]
LAYER RESISTIVITY (OHM-M.)
LAYER DEPTH (M.)

<NLSTCI>: MEDICINE LAKE STA.6 CI-LOOP 4-LAYERS REF:[NLSTCI.C*]
PARAMETERS HELD FIXED: IB= 8
***** X-CONVERGENCE *****

I	OBS.Y(I)	CAL	RES	%RES.ERR	X(I,1)
1	0.336600E+03	0.335203E+03	0.140E+01	0.416800E+00	0.800000E-03
2	0.226150E+03	0.229875E+03	-0.373E+01	-0.162052E+01	0.120000E-02
3	0.171010E+03	0.172453E+03	-0.144E+01	-0.836965E+00	0.160000E-02
4	0.137660E+03	0.137290E+03	0.370E+00	0.269566E+00	0.200000E-02
5	0.105460E+03	0.104896E+03	0.564E+00	0.537327E+00	0.260000E-02
6	0.803470E+02	0.793081E+02	0.104E+01	0.130995E+01	0.340000E-02
7	0.647570E+02	0.633637E+02	0.139E+01	0.219883E+01	0.420000E-02
8	0.545770E+02	0.524570E+02	0.212E+01	0.404136E+01	0.500000E-02
9	0.463230E+02	0.446316E+02	0.169E+01	0.378979E+01	0.580000E-02
10	0.374370E+02	0.364969E+02	0.940E+00	0.257580E+01	0.700000E-02
11	0.302070E+02	0.295416E+02	0.665E+00	0.225244E+01	0.860000E-02
12	0.254090E+02	0.250607E+02	0.348E+00	0.138964E+01	0.102000E-01
13	0.219990E+02	0.220031E+02	-0.411E-02	-0.186807E-01	0.118000E-01
14	0.195750E+02	0.198205E+02	-0.245E+00	-0.123858E+01	0.134000E-01
15	0.169000E+02	0.175368E+02	-0.637E+00	-0.363110E+01	0.158000E-01
16	0.146440E+02	0.155547E+02	-0.911E+00	-0.585482E+01	0.190000E-01
17	0.132100E+02	0.142695E+02	-0.106E+01	-0.742515E+01	0.222000E-01
18	0.122220E+02	0.134086E+02	-0.119E+01	-0.884974E+01	0.254000E-01
19	0.115550E+02	0.128039E+02	-0.125E+01	-0.975403E+01	0.286000E-01
20	0.109140E+02	0.121857E+02	-0.127E+01	-0.104359E+02	0.334000E-01
21	0.105530E+02	0.117221E+02	-0.117E+01	-0.997339E+01	0.398000E-01
22	0.105100E+02	0.115115E+02	-0.100E+01	-0.869992E+01	0.462000E-01
23	0.105820E+02	0.114338E+02	-0.852E+00	-0.745021E+01	0.526000E-01
24	0.107630E+02	0.114270E+02	-0.664E+00	-0.581050E+01	0.590000E-01
25	0.113560E+02	0.115556E+02	-0.200E+00	-0.172700E+01	0.686000E-01
26	0.123090E+02	0.118717E+02	0.437E+00	0.368396E+01	0.814000E-01
27	0.135220E+02	0.122315E+02	0.129E+01	0.105502E+02	0.942000E-01
28	0.148930E+02	0.125979E+02	0.230E+01	0.182178E+02	0.107000E+00
29	0.158420E+02	0.130061E+02	0.284E+01	0.218044E+02	0.119800E+00

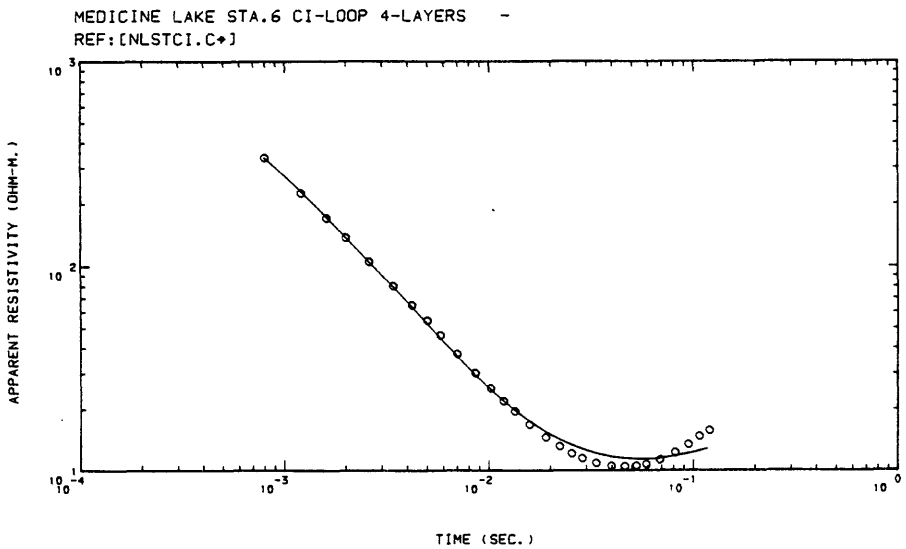
** RMSERR= 0.15945286E+01

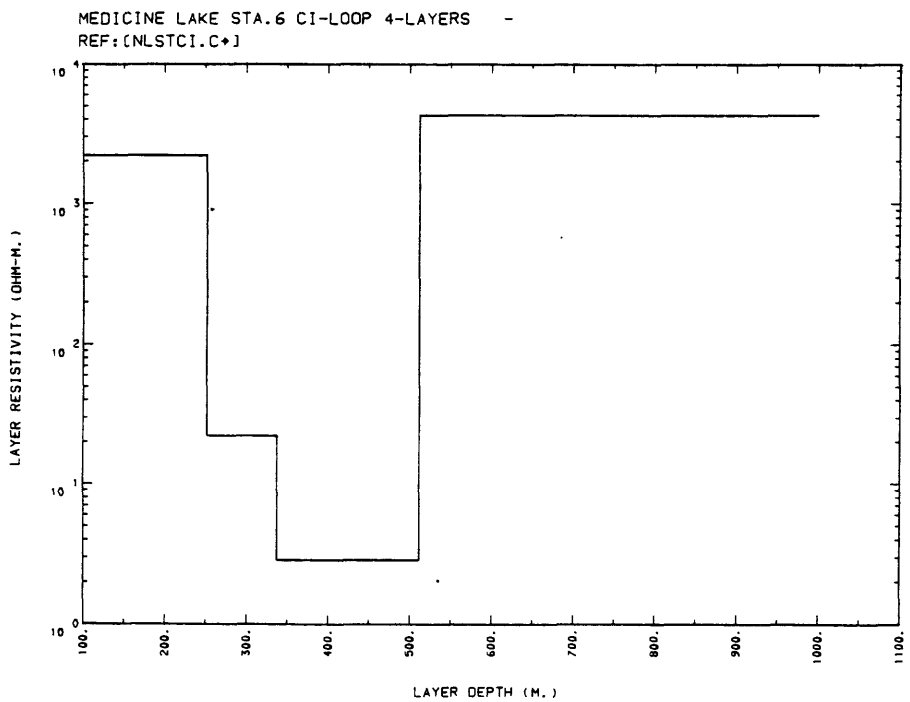
CORRELATION MATRIX

1	0.1000E+01						
2	-0.7705E+00	0.1000E+01					
3	-0.3749E-01	-0.1478E+00	0.1000E+01				
4	-0.5853E+00	0.4097E+00	-0.6714E-01	0.1000E+01			
5	-0.6435E+00	0.9425E+00	-0.3810E+00	0.4337E+00	0.1000E+01		
6	0.4568E+00	-0.8159E+00	0.4911E+00	-0.3275E+00	-0.9297E+00	0.1000E+01	
7	0.1382E+00	-0.4289E-01	-0.8932E+00	-0.1345E+00	0.1710E+00	-0.3287E+00	0.1000E+01

	**PARM.SOL.	STD.ERROR	REL.ERROR	% ERROR **
1	0.4550E-03	0.2548E-03	0.5601E+00	0.5601E+02
2	0.4527E-01	0.3960E-02	0.8747E-01	0.8747E+01
3	0.3483E+00	0.3106E-02	0.8917E-02	0.8917E+00
4	0.2334E-03	0.1148E-02	0.4918E+01	0.4918E+03
5	0.2515E+03	0.1106E-01	0.4399E-04	0.4399E-02
6	0.8593E+02	0.1716E-01	0.1997E-03	0.1997E-01
7	0.1743E+03	0.1755E-01	0.1007E-03	0.1007E-01

	PARAMETER NAME		FINAL SOLUTION		RESISTIVITY	LAYER	DEPTH
1	SIGMA(1)	=	0.45501188E-03	1	0.21977449E+04		
2	SIGMA(2)	=	0.45274168E-01	2	0.22087650E+02		
3	SIGMA(3)	=	0.34827119E+00	3	0.28713257E+01		
4	SIGMA(4)	=	0.23338862E-03	4	0.42846992E+04		
5	THICK(1)	=	0.25152522E+03			1	0.25152522E+03
6	THICK(2)	=	0.85927582E+02			2	0.33745282E+03
7	THICK(3)	=	0.17432574E+03			3	0.51177856E+03
8	SHIFT	=	0.10000000E+01				


MEDICINE LAKE STA.6 CI-LOOP 4-LAYERS -
REF:[NLSTCI.C+]
APPARENT RESISTIVITY (OHM-M.)
TIME (SEC.)


MEDICINE LAKE STA.6 CI-LOOP 4-LAYERS -
REF:[NLSTCI.C+]
LAYER RESISTIVITY (OHM-M.)
LAYER DEPTH (M.)

<NLSTCI>: MEDICINE LAKE STA.7 CI-LOOP 4-LAYERS REF:[NLSTCI.I*]
PARAMETERS HELD FIXED: IB= 8
***** VARIABILITY CONVERGENCE *****

I	OBS.Y(I)	CAL	RES	%RES.ERR	X(I,1)
1	0.228480E+03	0.227400E+03	0.108E+01	0.475103E+00	0.800000E-03
2	0.203450E+03	0.199580E+03	0.387E+01	0.193896E+01	0.120000E-02
3	0.167190E+03	0.170843E+03	-0.365E+01	-0.213808E+01	0.160000E-02
4	0.143280E+03	0.146759E+03	-0.348E+01	-0.237035E+01	0.200000E-02
5	0.118680E+03	0.119773E+03	-0.109E+01	-0.912195E+00	0.260000E-02
6	0.992140E+02	0.987073E+02	0.507E+00	0.513288E+00	0.340000E-02
7	0.860890E+02	0.850841E+02	0.100E+01	0.118106E+01	0.420000E-02
8	0.786030E+02	0.747291E+02	0.387E+01	0.518397E+01	0.500000E-02
9	0.689520E+02	0.672105E+02	0.174E+01	0.259111E+01	0.580000E-02
10	0.600180E+02	0.592339E+02	0.784E+00	0.132373E+01	0.700000E-02
11	0.518270E+02	0.515366E+02	0.290E+00	0.563389E+00	0.860000E-02
12	0.458830E+02	0.460515E+02	-0.168E+00	-0.365884E+00	0.102000E-01
13	0.417500E+02	0.419904E+02	-0.240E+00	-0.572436E+00	0.118000E-01
14	0.386490E+02	0.388853E+02	-0.236E+00	-0.607571E+00	0.134000E-01
15	0.350500E+02	0.354438E+02	-0.394E+00	-0.111116E+01	0.158000E-01
16	0.320000E+02	0.323625E+02	-0.363E+00	-0.112027E+01	0.190000E-01
17	0.300450E+02	0.303174E+02	-0.272E+00	-0.898369E+00	0.222000E-01
18	0.286500E+02	0.289239E+02	-0.274E+00	-0.946854E+00	0.254000E-01
19	0.277390E+02	0.279293E+02	-0.190E+00	-0.681397E+00	0.286000E-01
20	0.263970E+02	0.268910E+02	-0.494E+00	-0.183697E+01	0.334000E-01
21	0.262420E+02	0.260563E+02	0.186E+00	0.712582E+00	0.398000E-01
22	0.255260E+02	0.256284E+02	-0.102E+00	-0.399638E+00	0.462000E-01
23	0.249710E+02	0.254845E+02	-0.513E+00	-0.201483E+01	0.526000E-01
24	0.255290E+02	0.255561E+02	-0.271E-01	-0.106062E+00	0.590000E-01
25	0.266370E+02	0.259215E+02	0.715E+00	0.276015E+01	0.686000E-01
26	0.261260E+02	0.264597E+02	-0.334E+00	-0.126121E+01	0.814000E-01

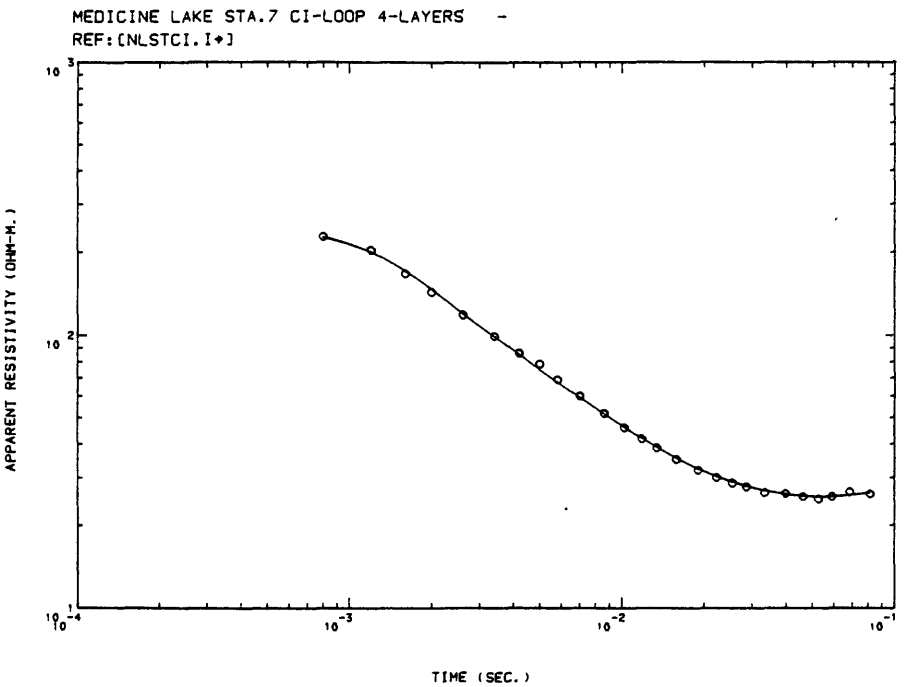
** RMSERR= 0.18435729E+01

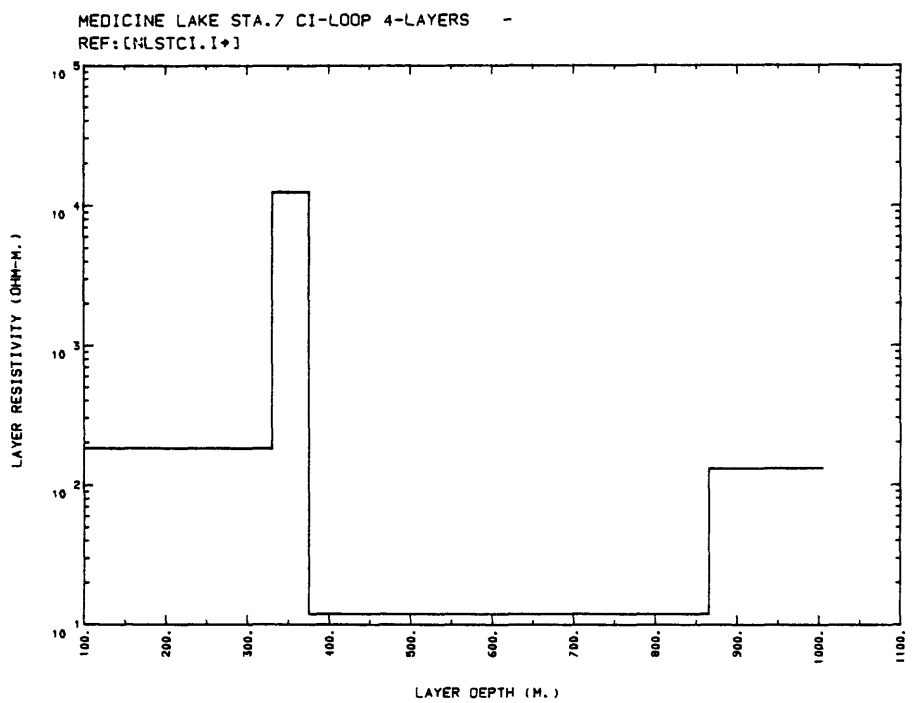
CORRELATION MATRIX

1	0.1000E+01						
2	-0.4118E+00	0.1000E+01					
3	0.5012E+00	-0.1686E+00	0.1000E+01				
4	0.3217E+00	-0.4857E+00	-0.1139E+00	0.1000E+01			
5	-0.1339E+00	0.4299E+00	0.8358E-01	-0.3747E+00	0.1000E+01		
6	0.4720E+00	-0.5474E+00	0.2906E+00	0.3985E+00	-0.8407E+00	0.1000E+01	
7	-0.5839E-01	0.3493E-01	-0.1971E+00	-0.3094E+00	-0.9080E-01	0.3229E-01	0.1000E+01

	**PARM.SOL.	STD. ERROR	REL. ERROR	% ERROR **
1	0.5503E-02	0.1378E-03	0.2504E-01	0.2504E+01
2	0.7978E-04	0.2103E-03	0.2636E+01	0.2636E+03
3	0.8383E-01	0.8829E-03	0.1053E-01	0.1053E+01
4	0.7679E-02	0.1243E-02	0.1619E+00	0.1619E+02
5	0.3303E+03	0.4197E-02	0.1271E-04	0.1271E-02
6	0.4506E+02	0.1066E-01	0.2366E-03	0.2366E-01
7	0.4907E+03	0.2041E-01	0.4160E-04	0.4160E-02

	PARAMETER NAME	FINAL SOLUTION		RESISTIVITY	LAYER	DEPTH
1	SIGMA(1) =	0.55033811E-02	1	0.18170648E+03		
2	SIGMA(2) =	0.79778270E-04	2	0.12534741E+05		
3	SIGMA(3) =	0.83825901E-01	3	0.11929487E+02		
4	SIGMA(4) =	0.76789223E-02	4	0.13022661E+03		
5	THICK(1) =	0.33026041E+03			1	0.33026041E+03
6	THICK(2) =	0.45056892E+02			2	0.37531729E+03
7	THICK(3) =	0.49069415E+03			3	0.86601147E+03
8	SHIFT =	0.10000000E+01				


MEDICINE LAKE STA.7 CI-LOOP 4-LAYERS -
REF:[NLSTCI.I*]
APPARENT RESISTIVITY (OHM-M.)
TIME (SEC.)


MEDICINE LAKE STA.7 CI-LOOP 4-LAYERS -
REF:[NLSTCI.I*]
LAYER RESISTIVITY (OHM-M.)
LAYER DEPTH (M.)

<NLSTCI>: MEDICINE LAKE STA.8 CI-LOOP 4-LAYERS REF:[NLSTCI.J*]
PARAMETERS HELD FIXED: IB= 8
***** X-CONVERGENCE *****

I	OBS.Y(I)	CAL	RES	%RES.ERR	X(I,1)
1	0.749780E+03	0.792171E+03	-0.424E+02	-0.535124E+01	0.120000E-02
2	0.643440E+03	0.622740E+03	0.207E+02	0.332402E+01	0.160000E-02
3	0.537360E+03	0.518894E+03	0.185E+02	0.355865E+01	0.200000E-02
4	0.431010E+03	0.417909E+03	0.131E+02	0.313492E+01	0.260000E-02
5	0.340610E+03	0.334609E+03	0.600E+01	0.179346E+01	0.340000E-02
6	0.285240E+03	0.281396E+03	0.384E+01	0.136597E+01	0.420000E-02
7	0.245620E+03	0.244180E+03	0.144E+01	0.589629E+00	0.500000E-02
8	0.217350E+03	0.216596E+03	0.754E+00	0.348211E+00	0.580000E-02
9	0.183070E+03	0.186334E+03	-0.326E+01	-0.175182E+01	0.700000E-02
10	0.155260E+03	0.158226E+03	-0.297E+01	-0.187473E+01	0.860000E-02
11	0.135060E+03	0.138524E+03	-0.346E+01	-0.250072E+01	0.102000E-01
12	0.121190E+03	0.123985E+03	-0.279E+01	-0.225397E+01	0.118000E-01
13	0.111330E+03	0.112859E+03	-0.153E+01	-0.135497E+01	0.134000E-01
14	0.971040E+02	0.100365E+03	-0.326E+01	-0.324956E+01	0.158000E-01
15	0.863310E+02	0.886183E+02	-0.229E+01	-0.258112E+01	0.190000E-01
16	0.789390E+02	0.801981E+02	-0.126E+01	-0.156994E+01	0.222000E-01
17	0.698140E+02	0.738067E+02	-0.399E+01	-0.540972E+01	0.254000E-01
18	0.664870E+02	0.687590E+02	-0.227E+01	-0.330434E+01	0.286000E-01
19	0.606200E+02	0.629207E+02	-0.230E+01	-0.365655E+01	0.334000E-01
20	0.582350E+02	0.572228E+02	0.101E+01	0.176892E+01	0.398000E-01
21	0.512180E+02	0.529629E+02	-0.174E+01	-0.329461E+01	0.462000E-01
22	0.491990E+02	0.496140E+02	-0.415E+00	-0.836475E+00	0.526000E-01
23	0.464950E+02	0.469144E+02	-0.419E+00	-0.893991E+00	0.590000E-01
24	0.448810E+02	0.437549E+02	0.113E+01	0.257376E+01	0.686000E-01
25	0.454600E+02	0.407118E+02	0.475E+01	0.116628E+02	0.814000E-01
26	0.441430E+02	0.384852E+02	0.566E+01	0.147012E+02	0.942000E-01
27	0.403620E+02	0.366334E+02	0.373E+01	0.101781E+02	0.107000E+00

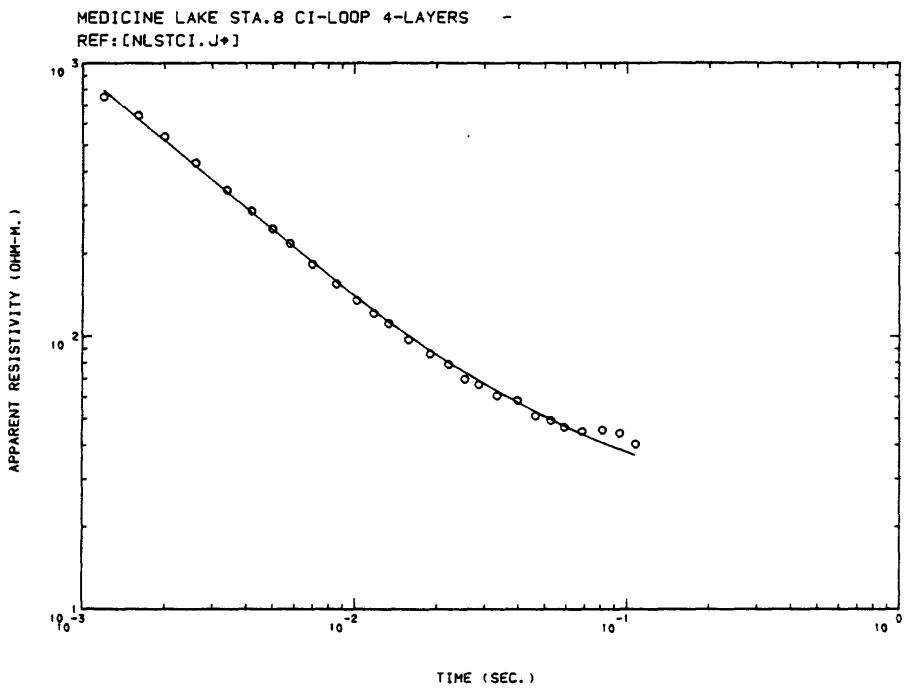
** RMSERR= 0.12147288E+02

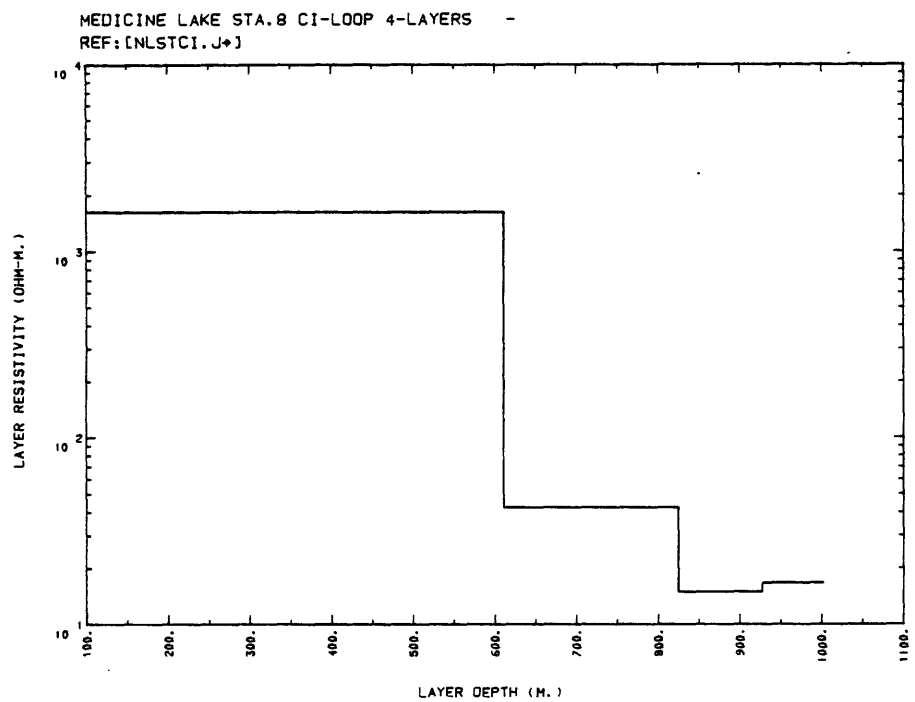
CORRELATION MATRIX

1	0.1000E+01						
2	-0.6550E+00	0.1000E+01					
3	-0.4704E+00	0.1892E+00	0.1000E+01				
4	0.1567E+00	-0.5976E-01	-0.3623E+00	0.1000E+01			
5	-0.1239E+00	0.6141E+00	-0.3847E+00	-0.7049E-01	0.1000E+01		
6	0.3882E+00	-0.5167E+00	-0.4657E-01	0.1305E+00	-0.4408E+00	0.1000E+01	
7	-0.9166E-01	-0.2762E+00	0.1026E+00	-0.1052E+00	-0.4391E+00	-0.3189E-01	0.1000E+01

	**PARM.SOL.	STD.ERROR	REL.ERROR	% ERROR **
1	0.6133E-03	0.2097E-03	0.3419E+00	0.3419E+02
2	0.2358E-01	0.1381E-02	0.5856E-01	0.5856E+01
3	0.6707E-01	0.2593E-02	0.3866E-01	0.3866E+01
4	0.5965E-01	0.2075E-02	0.3479E-01	0.3479E+01
5	0.6107E+03	0.9532E-02	0.1561E-04	0.1561E-02
6	0.2137E+03	0.9761E-02	0.4567E-04	0.4567E-02
7	0.1030E+03	0.8346E-02	0.8103E-04	0.8103E-02

PARAMETER	NAME	FINAL SOLUTION		RESISTIVITY	LAYER	DEPTH
1	SIGMA(1) =	0.61329908E-03	1	0.16305259E+04		
2	SIGMA(2) =	0.23577902E-01	2	0.42412594E+02		
3	SIGMA(3) =	0.67066729E-01	3	0.14910522E+02		
4	SIGMA(4) =	0.59649490E-01	4	0.16764603E+02		
5	THICK(1) =	0.61065710E+03			1	0.61065710E+03
6	THICK(2) =	0.21370996E+03			2	0.82436707E+03
7	THICK(3) =	0.10300260E+03			3	0.92736969E+03
8	SHIFT =	0.10000000E+01				


MEDICINE LAKE STA.8 CI-LOOP 4-LAYERS -
REF:[NLSTCI.J*]
APPARENT RESISTIVITY (OHM-M.)
TIME (SEC.)

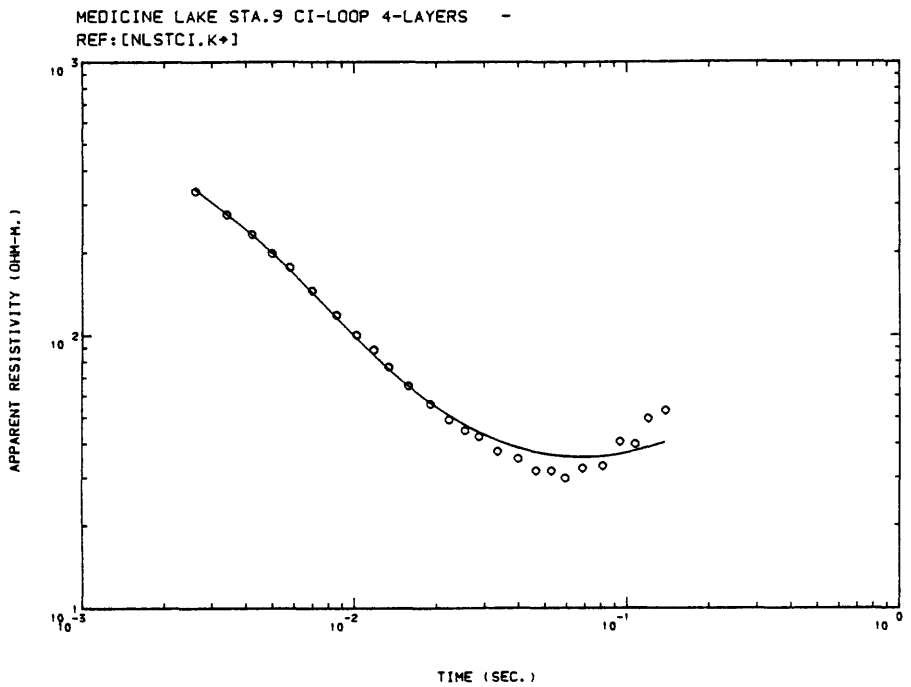

MEDICINE LAKE STA.8 CI-LOOP 4-LAYERS -
REF:[NLSTCI.J*]
LAYER RESISTIVITY (OHM-M.)
LAYER DEPTH (M.)

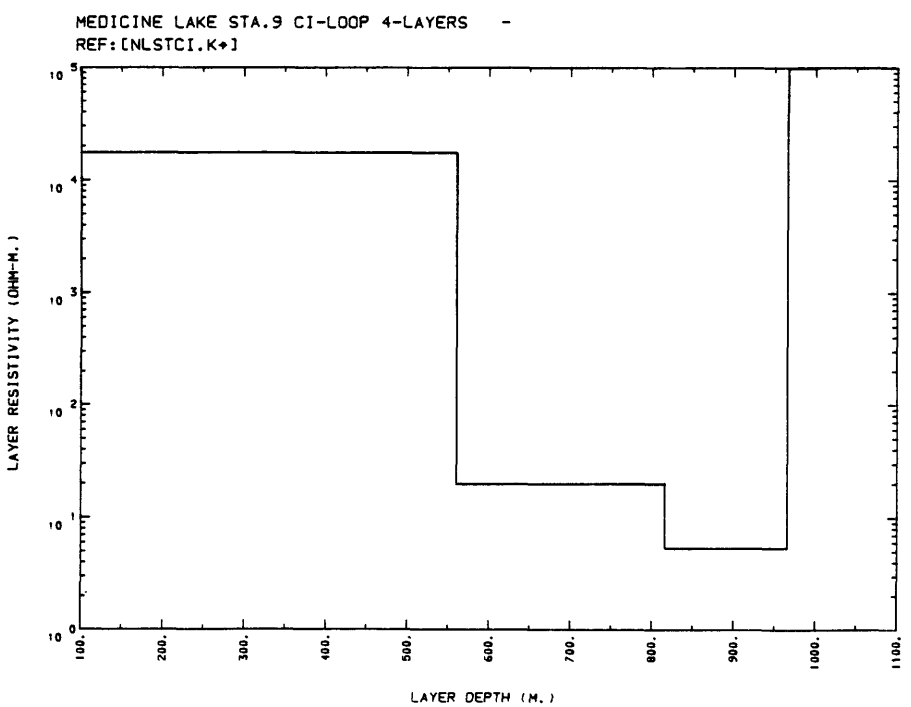
<NLSTCI>: MEDICINE LAKE STA.9 CI-LOOP 4-LAYERS REF:[NLSTCI.K*]
PARAMETERS HELD FIXED: IB= 8
***** X-CONVERGENCE *****
++++++ INDEFINITE COVARIANCE MATRIX ++++++

I	OBS.Y(I)	CAL	RES	%RES.ERR	X(I,1)
1	0.334950E+03	0.339449E+03	-0.450E+01	-0.132545E+01	0.260000E-02
2	0.275150E+03	0.275353E+03	-0.203E+00	-0.737025E-01	0.340000E-02
3	0.232910E+03	0.231810E+03	0.110E+01	0.474483E+00	0.420000E-02
4	0.198440E+03	0.198902E+03	-0.462E+00	-0.232446E+00	0.500000E-02
5	0.176990E+03	0.172974E+03	0.402E+01	0.232183E+01	0.580000E-02
6	0.145490E+03	0.143176E+03	0.231E+01	0.161584E+01	0.700000E-02
7	0.118310E+03	0.115654E+03	0.266E+01	0.229625E+01	0.860000E-02
8	0.100250E+03	0.972744E+02	0.298E+01	0.305897E+01	0.102000E-01
9	0.883630E+02	0.843707E+02	0.399E+01	0.473182E+01	0.118000E-01
10	0.765070E+02	0.749517E+02	0.156E+01	0.207507E+01	0.134000E-01
11	0.652650E+02	0.650227E+02	0.242E+00	0.372595E+00	0.158000E-01
12	0.559110E+02	0.564619E+02	-0.551E+00	-0.975788E+00	0.190000E-01
13	0.489930E+02	0.508087E+02	-0.182E+01	-0.357369E+01	0.222000E-01
14	0.447180E+02	0.468454E+02	-0.213E+01	-0.454141E+01	0.254000E-01
15	0.424660E+02	0.440073E+02	-0.154E+01	-0.350244E+01	0.286000E-01
16	0.374820E+02	0.410950E+02	-0.361E+01	-0.879184E+01	0.334000E-01
17	0.352890E+02	0.386388E+02	-0.335E+01	-0.866952E+01	0.398000E-01
18	0.318470E+02	0.371515E+02	-0.530E+01	-0.142781E+02	0.462000E-01
19	0.317110E+02	0.363171E+02	-0.461E+01	-0.126831E+02	0.526000E-01
20	0.298230E+02	0.359021E+02	-0.608E+01	-0.169325E+02	0.590000E-01
21	0.325940E+02	0.357122E+02	-0.312E+01	-0.873141E+01	0.686000E-01
22	0.331630E+02	0.359896E+02	-0.283E+01	-0.785405E+01	0.814000E-01
23	0.407230E+02	0.367535E+02	0.397E+01	0.108004E+02	0.942000E-01
24	0.399180E+02	0.378205E+02	0.210E+01	0.554601E+01	0.107000E+00
25	0.495870E+02	0.389792E+02	0.106E+02	0.272139E+02	0.119800E+00
26	0.530180E+02	0.407537E+02	0.123E+02	0.300938E+02	0.139000E+00

** RMSERR= 0.51268539E+01

PARAMETER	NAME	FINAL SOLUTION		RESISTIVITY	LAYER	DEPTH
1	SIGMA(1) =	0.57421079E-04	1	0.17415207E+05		
2	SIGMA(2) =	0.50423831E-01	2	0.19831892E+02		
3	SIGMA(3) =	0.18776615E+00	3	0.53257737E+01		
4	SIGMA(4) =	0.10138787E-04	4	0.98631133E+05		
5	THICK(1) =	0.56024353E+03			1	0.56024353E+03
6	THICK(2) =	0.25572273E+03			2	0.81596625E+03
7	THICK(3) =	0.14977409E+03			3	0.96574036E+03
8	SHIFT =	0.10000000E+01				


MEDICINE LAKE STA.9 CI-LOOP 4-LAYERS -
REF:[NLSTCI.K+]
APPARENT RESISTIVITY (OHM-M.)
TIME (SEC.)


MEDICINE LAKE STA.9 CI-LOOP 4-LAYERS -
REF:[NLSTCI.K+]
LAYER RESISTIVITY (OHM-M.)
LAYER DEPTH (M.)

[NLSTCO]: MEDICINE LAKE STA.9** CO-LOOP 4-LAYERS REF:[NLSTCO.L*]
PARAMETERS HELD FIXED: IB= 8
***** X-CONVERGENCE *****

I	OBS.Y(I)	CAL	RES	%RES.ERR	X(I,1)
1	0.400560E+03	0.393512E+03	0.705E+01	0.179115E+01	0.120000E-02
2	0.330860E+03	0.345566E+03	-0.147E+02	-0.425563E+01	0.160000E-02
3	0.281830E+03	0.292016E+03	-0.102E+02	-0.348800E+01	0.200000E-02
4	0.230110E+03	0.234311E+03	-0.420E+01	-0.179280E+01	0.260000E-02
5	0.186300E+03	0.184083E+03	0.222E+01	0.120438E+01	0.340000E-02
6	0.156400E+03	0.148104E+03	0.830E+01	0.560122E+01	0.420000E-02
7	0.132410E+03	0.124508E+03	0.790E+01	0.634668E+01	0.500000E-02
8	0.114870E+03	0.108638E+03	0.623E+01	0.573692E+01	0.580000E-02
9	0.943300E+02	0.915260E+02	0.280E+01	0.306362E+01	0.700000E-02
10	0.785790E+02	0.757625E+02	0.282E+01	0.371748E+01	0.860000E-02
11	0.664130E+02	0.650786E+02	0.133E+01	0.205038E+01	0.102000E-01
12	0.581810E+02	0.574640E+02	0.717E+00	0.124774E+01	0.118000E-01
13	0.503710E+02	0.517229E+02	-0.135E+01	-0.261371E+01	0.134000E-01
14	0.443530E+02	0.452674E+02	-0.914E+00	-0.201994E+01	0.158000E-01
15	0.371200E+02	0.391645E+02	-0.204E+01	-0.522018E+01	0.190000E-01
16	0.325090E+02	0.348568E+02	-0.235E+01	-0.673559E+01	0.222000E-01
17	0.294560E+02	0.316470E+02	-0.219E+01	-0.692312E+01	0.254000E-01
18	0.273470E+02	0.291559E+02	-0.181E+01	-0.620432E+01	0.286000E-01
19	0.254560E+02	0.263088E+02	-0.853E+00	-0.324139E+01	0.334000E-01
20	0.226920E+02	0.235326E+02	-0.841E+00	-0.357188E+01	0.398000E-01
21	0.203200E+02	0.214987E+02	-0.118E+01	-0.548269E+01	0.462000E-01
22	0.197810E+02	0.199417E+02	-0.161E+00	-0.805953E+00	0.526000E-01
23	0.194100E+02	0.187071E+02	0.703E+00	0.375759E+01	0.590000E-01

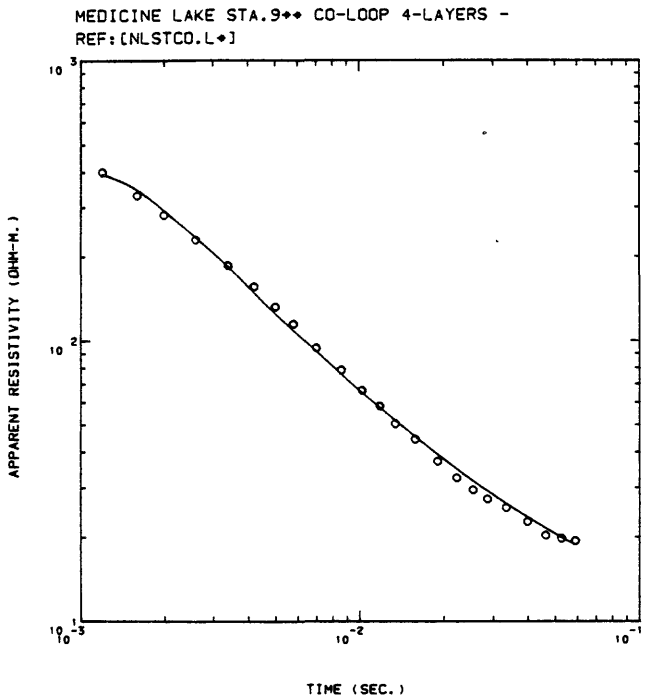
** RMSERR= 0.61452084E+01

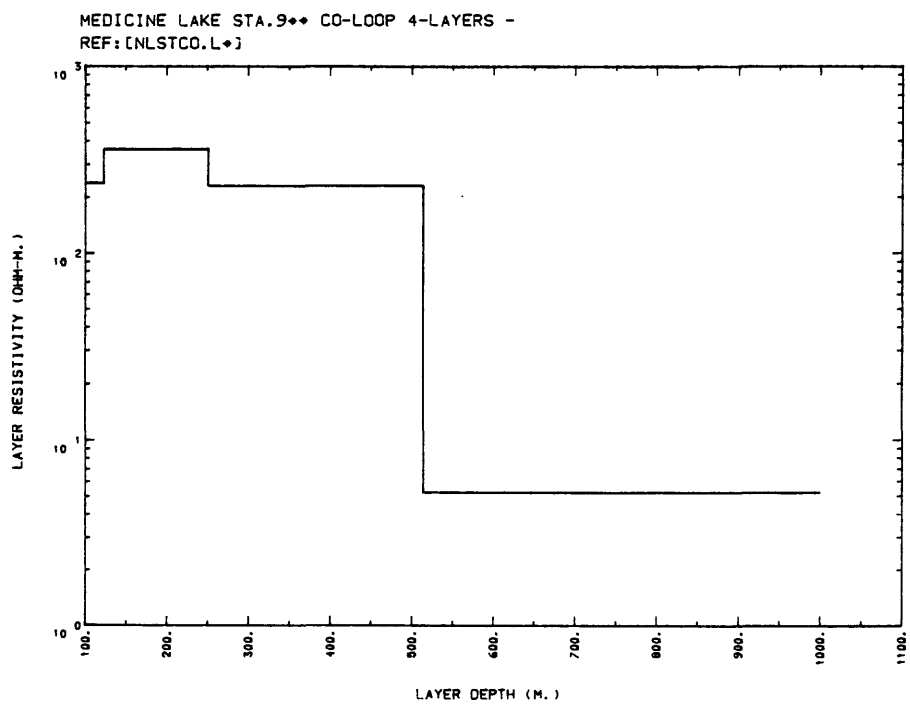
CORRELATION MATRIX

1	0.1000E+01						
2	-0.2782E+00	0.1000E+01					
3	-0.4318E+00	-0.6572E+00	0.1000E+01				
4	-0.1976E+00	0.7714E-01	0.9706E-01	0.1000E+01			
5	-0.2460E+00	-0.4837E+00	0.5273E+00	0.3960E-02	0.1000E+01		
6	-0.5877E-01	0.5668E+00	-0.4450E+00	0.4165E-02	-0.3686E+00	0.1000E+01	
7	0.2219E+00	-0.1099E+00	-0.1714E-02	-0.1650E-01	-0.4955E+00	-0.5919E+00	0.1000E+01

	**PARM.SOL.	STD.ERROR	REL.ERROR	% ERROR **
1	0.4187E-02	0.7504E-03	0.1792E+00	0.1792E+02
2	0.2758E-02	0.8795E-03	0.3190E+00	0.3190E+02
3	0.4348E-02	0.9633E-03	0.2216E+00	0.2216E+02
4	0.1917E+00	0.2561E-02	0.1336E-01	0.1336E+01
5	0.1227E+03	0.2223E-01	0.1811E-03	0.1811E-01
6	0.1284E+03	0.2027E-01	0.1578E-03	0.1578E-01
7	0.2626E+03	0.1601E-01	0.6098E-04	0.6098E-02

PARAMETER	NAME		FINAL SOLUTION		RESISTIVITY	LAYER	DEPTH
1	SIGMA(1)	=	0.41865502E-02	1	0.23886015E+03		
2	SIGMA(2)	=	0.27575355E-02	2	0.36264264E+03		
3	SIGMA(3)	=	0.43479414E-02	3	0.22999390E+03		
4	SIGMA(4)	=	0.19167155E+00	4	0.52172585E+01		
5	THICK(1)	=	0.12273915E+03			1	0.12273915E+03
6	THICK(2)	=	0.12842085E+03			2	0.25116000E+03
7	THICK(3)	=	0.26256549E+03			3	0.51372552E+03
8	SHIFT	=	0.10000000E+01				


MEDICINE LAKE STA.9** CO-LOOP 4-LAYERS -
REF:[NLSTCO.L*]
APPARENT RESISTIVITY (OHM-M.)
TIME (SEC.)


MEDICINE LAKE STA.9** CO-LOOP 4-LAYERS -
REF:[NLSTCO.L*]
LAYER RESISTIVITY (OHM-M.)
LAYER DEPTH (M.)

<NLSTCI>: MEDICINE LAKE STA.10 CI-LOOP 4-LAYERS REF:[NLSTCI.E*]
PARAMETERS HELD FIXED: IB= 8
***** VARIABILITY CONVERGENCE *****

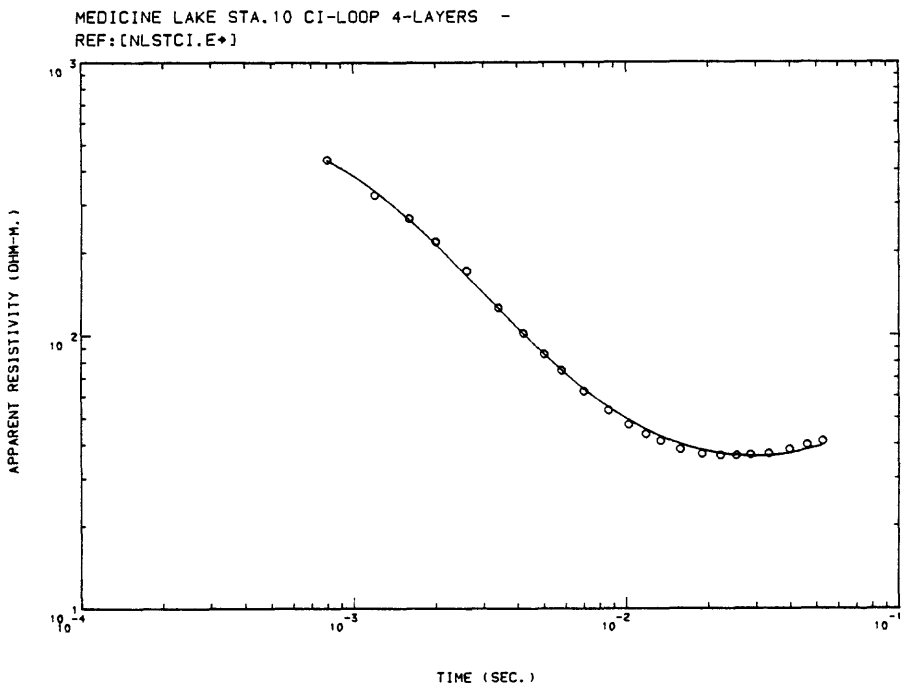
I	OBS.Y(I)	CAL	RES	%RES.ERR	X(I,1)
1	0.439600E+03	0.437708E+03	0.189E+01	0.432349E+00	0.800000E-03
2	0.323600E+03	0.335181E+03	-0.116E+02	-0.345508E+01	0.120000E-02
3	0.265900E+03	0.262550E+03	0.335E+01	0.127593E+01	0.160000E-02
4	0.218400E+03	0.213785E+03	0.462E+01	0.215884E+01	0.200000E-02
5	0.171300E+03	0.163521E+03	0.778E+01	0.475723E+01	0.260000E-02
6	0.125490E+03	0.124999E+03	0.491E+00	0.392672E+00	0.340000E-02
7	0.101550E+03	0.101013E+03	0.537E+00	0.531314E+00	0.420000E-02
8	0.853180E+02	0.852493E+02	0.687E-01	0.806351E-01	0.500000E-02
9	0.743730E+02	0.745064E+02	-0.133E+00	-0.179086E+00	0.580000E-02
10	0.624630E+02	0.636161E+02	-0.115E+01	-0.181258E+01	0.700000E-02
11	0.532580E+02	0.546940E+02	-0.144E+01	-0.262550E+01	0.860000E-02
12	0.472530E+02	0.491587E+02	-0.191E+01	-0.387667E+01	0.102000E-01
13	0.435950E+02	0.453642E+02	-0.177E+01	-0.389995E+01	0.118000E-01
14	0.410880E+02	0.426682E+02	-0.158E+01	-0.370344E+01	0.134000E-01
15	0.383100E+02	0.399968E+02	-0.169E+01	-0.421741E+01	0.158000E-01
16	0.368130E+02	0.380219E+02	-0.121E+01	-0.317939E+01	0.190000E-01
17	0.362930E+02	0.369129E+02	-0.620E+00	-0.167926E+01	0.222000E-01
18	0.362730E+02	0.363259E+02	-0.529E-01	-0.145527E+00	0.254000E-01
19	0.365230E+02	0.360931E+02	0.430E+00	0.119109E+01	0.286000E-01
20	0.368800E+02	0.362542E+02	0.626E+00	0.172620E+01	0.334000E-01
21	0.382580E+02	0.371385E+02	0.112E+01	0.301426E+01	0.398000E-01
22	0.397750E+02	0.383634E+02	0.141E+01	0.367951E+01	0.462000E-01
23	0.410850E+02	0.395665E+02	0.152E+01	0.383780E+01	0.526000E-01

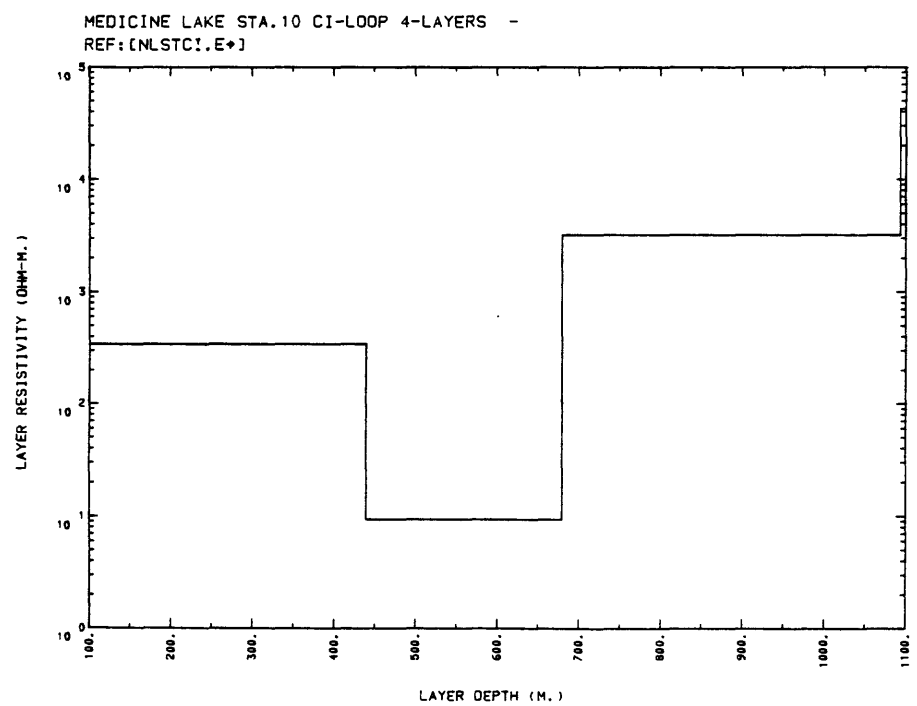
** RMSERR= 0.39902654E+01
CORRELATION MATRIX

1	0.1000E+01						
2	0.4263E+00	0.1000E+01					
3	-0.4176E+00	0.6258E-01	0.1000E+01				
4	0.5143E+00	0.3848E+00	-0.6386E+00	0.1000E+01			
5	0.6913E+00	0.4389E+00	-0.3423E+00	0.3419E+00	0.1000E+01		
6	-0.3830E+00	-0.8861E+00	-0.1053E+00	-0.1986E+00	-0.4512E+00	0.1000E+01	
7	-0.4317E+00	-0.2522E+00	0.1442E+00	-0.2505E+00	-0.4133E+00	0.1575E+00	0.1000E+01

	**PARM.SOL.	STD.ERROR	REL.ERROR	% ERROR **
1	0.2938E-02	0.1028E-03	0.3498E-01	0.3498E+01
2	0.1074E+00	0.1188E-02	0.1105E-01	0.1105E+01
3	0.3134E-03	0.2240E-02	0.7148E+01	0.7148E+03
4	0.2351E-04	0.1134E-01	0.4824E+03	0.4824E+05
5	0.4397E+03	0.2967E-02	0.6748E-05	0.6748E-03
6	0.2400E+03	0.1733E-01	0.7221E-04	0.7221E-02
7	0.4136E+03	0.9212E-01	0.2227E-03	0.2227E-01

PARAMETER	NAME		FINAL SOLUTION		RESISTIVITY	LAYER	DEPTH
1	SIGMA(1)	=	0.29376713E-02	1	0.34040570E+03		
2	SIGMA(2)	=	0.10744791E+00	2	0.93068352E+01		
3	SIGMA(3)	=	0.31338030E-03	3	0.31910110E+04		
4	SIGMA(4)	=	0.23509241E-04	4	0.42536465E+05		
5	THICK(1)	=	0.43972391E+03			1	0.43972391E+03
6	THICK(2)	=	0.23995210E+03			2	0.67967603E+03
7	THICK(3)	=	0.41358917E+03			3	0.10932653E+04
8	SHIFT	=	0.10000000E+01				


MEDICINE LAKE STA.10 CI-LOOP 4-LAYERS -
REF:[NLSTCI.E*]
APPARENT RESISTIVITY (OHM-M.)
TIME (SEC.)


MEDICINE LAKE STA.10 CI-LOOP 4-LAYERS -
REF:[NLSTC!.E*]
LAYER RESISTIVITY (OHM-M.)
LAYER DEPTH (M.)