GRID-COORDINATE GENERATION PROGRAM

By

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and

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Prepared in cooperation with the
Virginia State Water Control Board
Bureau of Water Control Management

Open-file report
1974

¥/1.1018
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GRID COORDINATE GENERATION PROGRAM

by

Oliver J. Cosner and Esther Horwich

ABSTRACT

This program description of the grid-coordinate generation program is written for computer users who are familiar with digital aquifer models. The program computes the coordinates for a variable grid used in the "Finder Model" (a finite-difference aquifer simulator), for input to the CalComp GPCP (general purpose contouring program). The program adjusts the y-value by a user-supplied constant in order to transpose the origin of the model grid from the upper left-hand corner to the lower left-hand corner of the grid. The user has the options of, (1.) choosing the boundaries of the plot, (2.) adjusting the z-values (altitudes) by a constant, (3.) deleting superfluous z-values and (4.) subtracting two simulated surfaces from each other to obtain the decline. Output of this program includes the fixed format CNTL data cards and the other data cards required for input to GPCP. The output from GPCP then is used to produce a potentiometric map or a decline map by means of the CalComp plotter.
INTRODUCTION

This program description is written for individuals involved in the use of digital aquifer models. The grid-coordinate generation program itself is designed specifically for the "Pinder Model" (Pinder, 1970) but can be adapted to other models. The program computes the x and y coordinates of the nodes of a variable grid from an aquifer model. The output includes the data cards and parameter cards required as input into the CalComp GPCP*, a program recently acquired by the U.S. Geological Survey. The output from the GPCP is fed into the CalComp plotter to produce a contour map.

Geological Survey scientists commonly use an aquifer simulation program written by George F. Pinder, (1970) or a revised and updated version by P.C. Trescott, (1972). The model simulates the change in the potentiometric surface due to man-made stresses with the results printed on the line printer and punched on cards. When the simulation period is to be continued, this punch card deck may serve as the initial surface for the next run of the model. It is by comparing this simulated potentiometric surface with a measured surface that a model is calibrated.

*GPCP is a general purpose contouring program which contains proprietary information. Further information about GPCP can be obtained by contacting California Computer Products, Inc.
In the past it has been necessary to manually plot altitudes from the printed output and then contour them to make simulated potentiometric maps which then form the main body of a report on the model. For most models somewhere between 500 and 2,500 values have to be plotted and then contoured. By using the grid-coordinate generation program in conjunction with GPCP the hand plotting and contouring is eliminated. Thus, simulated potentiometric maps can be produced with relative ease. Figure 1 is a plotter-generated map.

Cooperation

This program was written as part of a digital model study by the U.S. Geological Survey in cooperation with the Virginia State Water Control Board, E.T. Jensen, Jr., Executive Secretary.

APPLICATION

Figure 2 is a sample grid from an aquifer model. The reader should refer to it for a better understanding of the discussions that follow. The grid-coordinate generation program converts grid dimensions of an aquifer model whose node reference is in the upper left-hand corner to a coordinate system whose origin is in the lower left-hand corner, (a requirement of GPCP) and generates the x and y coordinates of each node, in feet. To accomplish this, the user must supply a constant from which each y value is subtracted. Selection of this value is discussed below. Meters can be used in place of feet throughout the program, if one wishes to use the metric system.
Options are:

1. Adjusting the z-value (altitude); some models use altitudes which have been adjusted by a constant; at the time of plotting it may be desirable to remove this constant.

2. Subtracting two different sets of z-values (altitudes) from each other to obtain a decline value.

3. Specifying which rows and columns of nodes will form the boundaries of the plot, thus eliminating peripheral altitudes which are generally not wanted in the plot. (See figure 2)

4. Deleting entire rows and (or) columns within the main body of the model. (See figure 2)

5. Replacing individual node values which are needed but are wiped out by the deletion in item 4, above. (See figure 2)
6. If the user wishes to store the output as a data set on a disk, the grid-coordinate generation program offers the option of adding the parameter cards for GPCP, thus, eliminating the necessity of updating the data set before running GPCP. This feature also makes it feasible for the user to combine runs of the grid-coordinate generation program and GPCP by use of a temporary data set for the output of the grid-coordinate generation program.

After the x and y coordinates for each node are computed, the program then tests to see if the user-supplied GPCP parameter cards are to be read in. After the GPCP cards are processed the data set for input to GPCP is either punched out or written on a storage device. A flow chart and a listing of the grid-coordinate generation program are included in appendix A.

**Restrictions and Dimensions**

All of the parameters used in the following discussion are diagrammatically defined on figure 2 and all are described in table 2 except YH and the GPCP parameters YMIN, YMAX, XMIN and XMAX.

1. DELX(I), DELY(I); Model grid up to 65 by 65 nodes (see notes on model size, pg 10).
2. NN; Number of individual nodes to be replaced in plot, up to 20.
3. NX; Number of rows to be eliminated from main body of the plot, up to 20.
4. NY; Number of columns to be eliminated from main body of the plot, up to 20.
5. YADJ; the value supplied for YADJ must be slightly greater than the height of the plot. This will place the origin of the coordinates outside of the plot. To determine a suitable value for YADJ the user should first determine the value for the height of the plot, YH on figure 2. YH can be computed as follows:

\[
YH = \frac{1}{2} \text{DEL'}_{i=1}^{INL} - \frac{1}{2} (\text{DEL}'_{INL} + \text{DEL}'_{IOUTL})
\]

The user should then pick an acceptable value for YMIN. (In the example the value of 22,500 was selected as being approximately equal to 1 inch on the plot). The value for YADJ can then be determined by the following equation:

\[
YADJ = YH + YMIN + \frac{1}{2} \text{DEL'}_{INL}
\]

6. XMIN, XMAX, YMIN and YMAX; The values for XMIN, XMAX, YMIN and YMAX can be obtained by inspection of the printed output from the grid-coordinate generation program. However, if the user wishes to write the output from the grid-coordinate generation program on a disk for use as input to GPCP, he will need to know these values beforehand. They can be obtained by the following equations:

\[
XMIN = \frac{1}{2} \text{DEL'}_{INW}
\]

\[
i = \text{INW}
\]

\[
XMAX = \left( \sum_{i=1}^{OUTW} \text{DEL'}_i \right) - \frac{1}{2} \text{DEL'}_{IOUTW}
\]

\[
i = \text{IOUTW}
\]

YMIN = is selected by user as described under 5 above.

YMAX = YADJ-1/2 DELY_{INL}
Input Requirements for the Program

There are two parameter cards and a maximum of six data sets for the grid-coordinate generation program. The parameters to be read into the program are listed in alphabetical order in table 1 along with their format and location on the cards. The format of the two parameter cards and the data sets are listed below with an explanation of each, (see table 2).

Sample listings included in the attached tables and appendix are the input to the grid-coordinate generation program in table 3; input to the CalComp GPCP in table 4; and the grid-coordinate generation Fortran program and flow chart in appendix A.

Some Remarks on the CalComp GPCP

The CalComp GPCP is a very comprehensive program and offers many options. Although the GPCP manual covers all of these options this manual may be a little difficult for a user to interpret at first glance.

One of the most important concepts that the user must grasp is that of the CalComp grid. The size of this grid is chosen by the user. The optimum grid size is related to the spacing of the random data set (input data points). However, economics governs the selection at the small limit and accuracy governs the selection at the large limit. The grid size is selected on the "SIZE" parameter card. It is given in the same units as the coordinates which are in feet in the example given here.
The program allows the user to select the number of units per inch (feet per inch in this case) on the plot. The user can select this parameter with a standard map scale in mind (in this case, 20,833 feet per inch for a 1 to 250,000 map scale; see SIZE card, table 4).

In the example given in table 4 two LINE cards are included. These cause the plotter to draw two lines which correspond to latitude and longitude lines on the base map, figure 1. They are used to register the plot over the base. The use of line cards is optional.

The more familiar the user is with the CalComp GPCP manual the easier it will be for him to obtain suitable plots. The use of the grid-coordinate generation program is a good starting point for mastering the use of GPCP. The sample input listing given in table 4 will help the user become familiar with GPCP.
Notes on Problem Size

If the maximum array size in the grid-coordinate generation program, 65 by 65, is smaller than the array size of the user's model, the dimension cards (cards 650 and 660; see listing in appendix A) can be changed to fit the program.

If the user's model is much extended in the Y direction, it probably would be advisable to rotate the plot. This option is available with GPCP.

Notes on Time

The grid-coordinate generation program when run on the 360/65 takes about 3 seconds CPU time to compile and about 8 seconds CPU time on the go step with a 1600 node problem.

The GPCP program on the 360/65 takes about 30 seconds CPU time to run a problem with 361 random data points and a 20 x 20 GPCP plot grid of 1-inch squares. Plotting time was 20 minutes.

These times will vary depending on the size of the problem and the options selected.
Table-1. Alphabetical list of Parameters for grid-coordinate generation program

<table>
<thead>
<tr>
<th>DATA or PARAMETER NAME</th>
<th>DATA SET NUMBER PARAMETER CARD</th>
<th>FORMAT</th>
<th>CARD COLUMNS</th>
</tr>
</thead>
<tbody>
<tr>
<td>A, B</td>
<td>Data Set 2</td>
<td>20I3</td>
<td>1-60</td>
</tr>
<tr>
<td>ALTADJ</td>
<td>Parameter Card 2</td>
<td>F10.0</td>
<td>20-29</td>
</tr>
<tr>
<td>C, D</td>
<td>Data Set 3</td>
<td>2I3</td>
<td>1-3, 4-6</td>
</tr>
<tr>
<td>DECL</td>
<td>Parameter Card 2</td>
<td>F10.0</td>
<td>30-39</td>
</tr>
<tr>
<td>DELX, DELY</td>
<td>Data Set 1</td>
<td>8F10.0</td>
<td>1-80</td>
</tr>
<tr>
<td>GPCRDR</td>
<td>Data Set 6</td>
<td>20A4</td>
<td>1-80</td>
</tr>
<tr>
<td>INL</td>
<td>Parameter Card 1</td>
<td>I10</td>
<td>41-50</td>
</tr>
<tr>
<td>INW</td>
<td>Parameter Card 1</td>
<td>I10</td>
<td>21-30</td>
</tr>
<tr>
<td>IOUTL</td>
<td>Parameter Card 1</td>
<td>I10</td>
<td>51-60</td>
</tr>
<tr>
<td>IOUTW</td>
<td>Parameter Card 1</td>
<td>I10</td>
<td>31-40</td>
</tr>
<tr>
<td>IPARAI</td>
<td>Parameter Card 2</td>
<td>I2</td>
<td>42-43</td>
</tr>
<tr>
<td>IPARA2</td>
<td>Parameter Card 2</td>
<td>I2</td>
<td>44-45</td>
</tr>
<tr>
<td>LIML</td>
<td>Parameter Card 1</td>
<td>I10</td>
<td>11-20</td>
</tr>
<tr>
<td>LIMW</td>
<td>Parameter Card 1</td>
<td>I10</td>
<td>1-10</td>
</tr>
<tr>
<td>NFILE</td>
<td>Parameter Card 2</td>
<td>I2</td>
<td>40-41</td>
</tr>
<tr>
<td>NN</td>
<td>Parameter Card 2</td>
<td>I3</td>
<td>1-3</td>
</tr>
<tr>
<td>NX</td>
<td>Parameter Card 2</td>
<td>I3</td>
<td>4-6</td>
</tr>
<tr>
<td>NY</td>
<td>Parameter Card 2</td>
<td>I3</td>
<td>7-9</td>
</tr>
<tr>
<td>PHI</td>
<td>Data Set 4</td>
<td>8F10.4</td>
<td>1-80</td>
</tr>
<tr>
<td>PHI1</td>
<td>Data Set 5</td>
<td>8F10.4</td>
<td>1-80</td>
</tr>
<tr>
<td>YADJ</td>
<td>Parameter Card 2</td>
<td>F10.0</td>
<td>10-19</td>
</tr>
</tbody>
</table>
Table 2. Explanation of the parameters for grid-coordinate generation program

<table>
<thead>
<tr>
<th>Columns</th>
<th>Format</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>CARD 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-10 (HO)</td>
<td>I-10</td>
<td>LIMW - Number of nodes in row of the model grid. Limited to 65 values.</td>
</tr>
<tr>
<td>11-20 (HO)</td>
<td>I-20</td>
<td>LIML - Number of nodes in column of the model grid. Limited to 65 values.</td>
</tr>
<tr>
<td>21-30 (HO)</td>
<td>I-20</td>
<td>INW - Column number, (J), of the model grid which is to be the left-hand border of plot.</td>
</tr>
<tr>
<td>31-40 (HO)</td>
<td>I-20</td>
<td>IOUTW - Column number, (J), of the model grid which is to be the right-hand border of plot.</td>
</tr>
<tr>
<td>41-50 (HO)</td>
<td>I-20</td>
<td>INL - Row number, (I), of the model grid which is to be the upper border of plot.</td>
</tr>
<tr>
<td>51-60 (HO)</td>
<td>I-20</td>
<td>IOUTL - Row number, (I), of the model grid which is to be the lower border of plot.</td>
</tr>
</tbody>
</table>

CARD 2

<table>
<thead>
<tr>
<th>Columns</th>
<th>Format</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-3 (I3)</td>
<td></td>
<td>NN - Number of individual nodes to be added to plot. Limited to 20.</td>
</tr>
<tr>
<td>4-6 (I3)</td>
<td></td>
<td>NX - Number of entire rows to be eliminated from main body of the plot. Limited to 20.</td>
</tr>
<tr>
<td>7-9 (I3)</td>
<td></td>
<td>NY - Number of entire columns to be eliminated from the main body of the plot. Limited to 20. Note: To save individual nodes of the rows or columns deleted see data set 3 below.</td>
</tr>
<tr>
<td>10-19 (F10.0)</td>
<td></td>
<td>YADJ - Variable with a value greater than the height of the plot (see figure 1). Its function is to transpose the origin of the plot.</td>
</tr>
<tr>
<td>Columns</td>
<td>Format</td>
<td>Comment</td>
</tr>
<tr>
<td>---------</td>
<td>--------</td>
<td>---------</td>
</tr>
<tr>
<td>20-29</td>
<td>(F10.0)</td>
<td>ALTADJ - Constant supplied by user to be subtracted from the altitude at each point. See DECL.</td>
</tr>
<tr>
<td>30-39</td>
<td>(F10.0)</td>
<td>DECL - Test parameter. If it is equal to zero, the job is standard output. If it has any numeric value, the program will read in another surface and subtract it from the first. IF ALTADJ has a given value, it will be subtracted from the second surface also.</td>
</tr>
<tr>
<td>40-41</td>
<td>(I2)</td>
<td>NFILE - File number for punched output. Usually = 7 for punched cards.</td>
</tr>
<tr>
<td>42-43</td>
<td>(I2)</td>
<td>IPARA1 - Number of GPCP parameter cards to precede the type 2 CNTL cards.</td>
</tr>
<tr>
<td>44-45</td>
<td>(I2)</td>
<td>IPARA2 - Number of GPCP parameter cards to follow the type 2 CNTL cards.</td>
</tr>
</tbody>
</table>

**DATA SET 1**

<table>
<thead>
<tr>
<th>Columns</th>
<th>Format</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-80</td>
<td>(8F10.0)</td>
<td>DELX - Grid dimensions of the model grid in the x direction. There must be LIMW values.</td>
</tr>
<tr>
<td>1-80</td>
<td>(8F10.0)</td>
<td>DELY - Grid dimensions of the model grid in the y direction. There must be LIML values.</td>
</tr>
</tbody>
</table>

**DATA SET 2**

<table>
<thead>
<tr>
<th>Columns</th>
<th>Format</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-60</td>
<td>(20I3)</td>
<td>A - Individual row numbers (I's) to be deleted. There should be NX entries. (See note below).</td>
</tr>
<tr>
<td>Columns</td>
<td>Format</td>
<td>Comment</td>
</tr>
<tr>
<td>---------</td>
<td>--------</td>
<td>---------</td>
</tr>
<tr>
<td>1-60</td>
<td>(20I3)</td>
<td>B - Individual column numbers (J's) to be deleted. There should be NY entries. Note: If either NX = 0 or NY = 0 that part of data set 2 should be omitted.</td>
</tr>
</tbody>
</table>

**DATA SET 3**

<table>
<thead>
<tr>
<th>Columns</th>
<th>Format</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-3</td>
<td>(I3)</td>
<td>C - Row number (I) for replaced individual node.</td>
</tr>
<tr>
<td>4-6</td>
<td>(I3)</td>
<td>D - Column number (J) for replaced individual node. Include one card for each node. If NN=0 data set 3 is not included.</td>
</tr>
</tbody>
</table>

**DATA SET 4**

<table>
<thead>
<tr>
<th>Columns</th>
<th>Format</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-80</td>
<td>(8F10.4)</td>
<td>PHI(I,J) - Value of hydraulic head in aquifer at node I,J. (This data set is the punched output from the &quot;Pinder Model&quot;). The entire deck should be included as the program reads all values whether inside of plot or not.</td>
</tr>
</tbody>
</table>

**DATA SET 5**

<table>
<thead>
<tr>
<th>Columns</th>
<th>Format</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-80</td>
<td>(8F10.4)</td>
<td>PHIL (I,J) - Data set to be subtracted from PHI (I,J). (This data set is also the punched output from the &quot;Pinder Model&quot;).</td>
</tr>
</tbody>
</table>

**DATA SET 6**

<table>
<thead>
<tr>
<th>Columns</th>
<th>Format</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-80</td>
<td>(20A4)</td>
<td>GPCRD - The GPCP parameter cards are placed here in the order they will appear for input to the GPCP program.</td>
</tr>
</tbody>
</table>
Table 3. Sample input to grid-coordinate generation program.

Parameter card 1.

| 45 | 49 | 8 | 41 | 7 | 40 |

Parameter card 2.

| 3 | 12 | 12 | 437500.00 | 800.00 | 0.0 | 7 | 5 | 8 |

Data set 1.

| 200000. | 150000. | 100000. | 67000. | 45000. | 30000. | 20000. | 20000. |
| 20000. | 20000. | 15000. | 10000. | 10000. | 10000. | 10000. | 10000. |
| 10000. | 7500 | 5000. | 5000. | 5000. | 5000. | 5000. | 5000. |
| 5000. | 5000. | 5000. | 7500. | 10000. | 10000. | 10000. | 10000. |
| 10000. | 10000. | 15000. | 20000. | 20000. | 20000. | 20000. | 30000. |
| 45000. | 67000. | 100000. | 150000. | 200000. | . | . | . |
| 450000. | 300000. | 200000. | 150000. | 100000. | 100000. | 67000. | 45000. | 30000. |
| 20000. | 20000. | 20000. | 20000. | 15000. | 10000. | 10000. | 10000. |
| 10000. | 10000. | 10000. | 7500. | 5000. | 5000. | 5000. | 5000. |
| 5000. | 5000. | 5000. | 5000. | 5000. | 7500. | 10000. | 10000. |
| 10000. | 10000. | 10000. | 10000. | 15000. | 20000. | 20000. | 20000. |
| 20000. | 30000. | 45000. | 67000. | 100000. | 150000. | 200000. | 300000. |
| 450000. | . | . | . | . | . | . | . |

Data set 2.

| 12 | 14 | 16 | 18 | 20 | 22 | 24 | 26 | 28 | 30 | 32 | 34 |
| 14 | 16 | 18 | 20 | 22 | 24 | 26 | 28 | 30 | 32 | 34 | 36 |

Data set 3

| 12 | 29 |
| 14 | 30 |
| 15 | 18 |

18.
Table 3 cont'd.

Data set 4.

<table>
<thead>
<tr>
<th>0.0</th>
<th>0.0</th>
<th>0.0</th>
<th>0.0</th>
<th>0.0</th>
<th>0.0</th>
<th>0.0</th>
<th>0.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>818.0000</td>
<td>818.0000</td>
<td>818.0000</td>
<td>817.0000</td>
<td>817.0000</td>
<td>817.0000</td>
<td>817.0000</td>
<td></td>
</tr>
<tr>
<td>816.0000</td>
<td>816.0000</td>
<td>816.0000</td>
<td>815.0000</td>
<td>814.0000</td>
<td>812.0000</td>
<td>810.0000</td>
<td></td>
</tr>
</tbody>
</table>

The central bulk of this data set is left out.

Data set 5.

Data set #5 is not used in this example.

Data set 6.

JOB SIMULATED POTENTIOMETRIC SURFACE FOR 2000 WITH 1.625 X 1972 PUMPAGE. JOB 63
FLEX
FCTR 1.
SIZE 2083320833 1. 1. 10000.15000 402500. 22500.15000 415000.
CNTL .05 .1 1 2
BEND
PRNT
BLNK
BLEV 20.
BRDR
LINE 010.18 1.0 2.4419.84 1
LINE 6.6519.8414.37 1
STOP
Table 4. Sample output from grid generation program. This is the input to the CalComp GPCP program.

JOB       SIMULATED POTENTIOMETRIC SURFACE FOR 2000 WITH 1.625 X 1972 PUMPAGE. JOB 63
FLEX                   
FCTR 1.                      
SIZE 2083320833 1. 1. 1000.0.15000 402500. 22500.15000 415000. 6 6
CNTL  .05 .1 1 2
CNTL 10000. 415000. -22.76
CNTL 30000. 415000. -40.24
CNTL 50000. 415000. -59.16
CNTL 67500. 415000. -75.79
CNTL 90000. 415000. -91.24
CNTL 110000. 415000. -100.37
CNTL 130000. 415000. -111.01
CNTL 145000. 415000. -122.45
CNTL 155000. 415000. -130.56
CNTL 165000. 415000. -139.55
CNTL 175000. 415000. -152.29
CNTL 185000. 415000. -136.73
CNTL 200000. 415000. -119.58
CNTL 220000. 415000. -104.31
CNTL 240000. 415000. -93.54

<table>
<thead>
<tr>
<th>CNTL</th>
<th>200000.</th>
<th>22500.</th>
<th>-50.59</th>
</tr>
</thead>
<tbody>
<tr>
<td>CNTL</td>
<td>300000.</td>
<td>22500.</td>
<td>-47.91</td>
</tr>
<tr>
<td>CNTL</td>
<td>320000.</td>
<td>22500.</td>
<td>-45.02</td>
</tr>
<tr>
<td>CNTL</td>
<td>340000.</td>
<td>22500.</td>
<td>-41.82</td>
</tr>
<tr>
<td>CNTL</td>
<td>365000.</td>
<td>22500.</td>
<td>-37.40</td>
</tr>
<tr>
<td>CNTL</td>
<td>402500.</td>
<td>22500.</td>
<td>-30.59</td>
</tr>
</tbody>
</table>

HEFUD
PRNT
BLNK
BLEV 20.
BKOR
LINE 010.18 1.0 2.4419.84 1
LINE 0 1.0 6.6519.8414.37 1
STOP
Selected References


APPENDIX A

Flow Chart and Source Listing of

Grid-Coordinate Generation Program
GRID COORDINATE GENERATION PROGRAM


PURPOSE

TO COMPUTE THE GRID COORDINATES FOR AN EXPANDING GRID SUCH AS IS IN THE 'PINDER MODEL.' FOR THE CALCULATING ROUTINE AND TO PUNCH OUT DATA CARDS FOR INPUT.

DESCRIPTION OF PARAMETERS

PARAMETER CARD #1

LIMW = NUMBER OF NODES IN A ROW IN THE MODEL GRID
LIML = NUMBER OF NODES IN A COLUMN IN THE MODEL GRID
INW = THE COLUMN NUMBER IN THE MODEL GRID THAT IS TO BE THE LEFT BORDER OF PLOT
IOUTW = THE COLUMN NUMBER IN THE MODEL GRID THAT IS TO BE THE RIGHT BORDER OF PLOT
INL = THE ROW NUMBER IN THE MODEL GRID THAT IS TO BE THE UPPER BORDER OF PLOT
IOUTL = THE ROW NUMBER IN THE MODEL GRID THAT IS TO BE THE LOWER BORDER OF PLOT

PARAMETER CARD #2

NN = NUMBER OF INDIVIDUAL NODES TO BE LEFT IN THE PLOT
NX = NUMBER OF ROWS AND COLUMNS TO BE ELIMINATED FROM THE MAIN BODY OF THE PLOT
YAOJ - VARIABLE SUPPLIED BY USER TO TRANSPOSE ORIGIN OF PLOT
ALTAOJ - CONSTANT TO BE SUPPLIED BY USER TO BE SUBTRACTED FROM THE ALTITUDE AT EACH NODE.
DECL IS A TEST PARAMETER. IF = 0.0 JOB IS STANDARD OUTPUT.
IF DECL HAS ANY NUMERIC VALUE THE PROGRAM WILL READ IN ANOTHER SURFACE AND SUBTRACT IT FROM THE FIRST. IF ALTAOJ HAS A GIVEN VALUE IT WILL BE SUBTRACTED FROM THE SECOND SURFACE ALSO.
NFILE = FILE NUMBER FOR WRITE STATEMENTS FOR PUNCHED OUTPUT.
IPARA1 = THE NUMBER OF GPCP PARAMETER CARDS THAT FOLLOW CNTL TYPE*2 CARDS.
IPARA2 = THE NUMBER OF GPCP PARAMETER CARDS THAT FOLLOW CNTL TYPE*2 CARDS.

DATA SET #1

DELX = GRID DIMENSIONS OF THE MODEL GRID IN THE X DIRECTION
DELY = GRID DIMENSIONS OF THE MODEL GRID IN THE Y DIRECTION

DATA SET #2

A = INDIVIDUAL ROW NUMBERS (I'S) TO BE DELETED.
B = INDIVIDUAL COLUMN NUMBERS (J'S) TO BE DELETED.

DATA SET #3

C = THE ROW (I) NUMBER FOR THE INDIVIDUAL NODE TO BE REPLACED.
D = THE COLUMN (J) NUMBER FOR THE INDIVIDUAL NODE TO BE REPLACED.
DATA SET 3 REQUIRES ONE CARD FOR EACH NODE LISTED.

DATA SET #4

PHII(J) = VALUE OF HYDRAULIC HEAD IN AQUIFER AT NODE (1,J) IN THE MODEL GRID
PHII(J) = VALUE OF HYDRAULIC HEAD IN AQUIFER AT NODE (I,J) IN THE MODEL GRID. THIS DATA SET IS SUBTRACTED FROM PHII(J).
GPCP = GPCP PARAMETER CARDS. THEY GO IN THIS DATA SET IN THE ORDER IN WHICH THEY WILL APPEAR IN THE INPUT TO GPCP.

THE FOLLOWING ARE COMPUTED IN THE PROGRAM.

AX(I) = COORDINATE IN THE X DIRECTION
AY(I) = COORDINATE IN THE Y DIRECTION
(I,J) KOUNT = NODE NUMBERS IN THE MODEL GRID AND SEQUENCE

NUMBER IN RANDOM DATA SET RESPECTIVELY

23.
DIMENSION DELX(65),DELY(65),PHI(65,65),X(65),Y(65),AX(65),AY(65)

DIMENSION A(20),B(20),C(20),D(20),PHI1(65,65)

INTEGER GPCRO(20),A,B,C,D

A(I)=0
B(I)=0
C(I)=0
D(I)=0
KOUNT=0

READ(5,140)LINW,LIML,INW,IOUTW,INL,IOUTL
READ(5,205)NN,NX,NY,YADJ,ALTAOJ,DECL,AFILE,IPARAl,IPARA2
READ(5,120)(DELX(I),J=1,LIMW)
READ(5,120)(DELY(I),I=1,LIML)

IF (NX.EQ.0) GO TO 4

READ (5,210) (A(I),I=1,NX)
GO TO 5

READ (5,210) (B(I),I=1,NY)

GO TO 6

READ (5,210) (C(I),D(I))

DO 11 I=1,LIML
DO 11 J=1,LIMW

11 PHI(I,J)=PHI(I,J)-ALTAOJ

IF (DECL.EQ.0.0) GO TO 15

DO 14 I=1,LIML
READ (5,130) (PHI1(I,J),J=1,LIMW)

DO 14 J=1,LIMW

PHI1(I,J)=PHI(I,J)-ALTAOJ

PHI(I,J)=PHI1(I,J)

X(INW)=0.5*OELX(INW)

Y(INL)=0.5*OELY(INL)

IF (I.EQ.NC.NO.J.EQ.ND) GO TO 80

DO 70 I=INW,IOUTW
DO 70 K=INL,IOUTL

20 Y(I)=Y(I-1)+0.5*(DELY(I-1)+DELY(I))

DO 50 I=INW,IOUTW
DO 50 J=INL,IOUTL

30 X(I)=X(I-1)+0.5*(DELY(I-1)+DELY(I))

AY(I)=YADJ-Y(I)

IF (IPARAl.EQ.0) GO TO 65

DO 61 I=1,IPARAl
READ (5,110) (GPCRO(K),K=1,20)

61 WRITE (AFILE,110) (GPCRO(K),K=1,20)

65 CONTINUE

WRITE (6,200)

DO 85 I=INW,IOUTW
DO 85 J=INL,IOUTL

40 AX(I)=X(I)

50 AY(I)=YADJ-Y(I)

60 IF (I.EQ.NC.NO.J.EQ.ND) GO TO 80

DO 70 I=INW,IOUTW
DO 70 J=INL,IOUTL

70 CONTINUE

WRITE (6,160) AX(I),AY(I),PHI(I,J),I,J,KOUNT

WRITE (AFILE,175) AX(I),AY(I),PHI(I,J)

85 CONTINUE

READ (5,110) (GPCRO(K),K=1,20)
IF (IPARA2 .EQ. C) GO TO 95

DO 90 I=1,IPARA2

READ (5,110) (GPCRD(K),K=1,20)

WRITE (NFILE,110) (GPCRD(K),K=1,20)

CONTINUE

110 FORMAT (20A4)

120 FORMAT (8F10.0)

130 FORMAT (8F10.4)

140 FORMAT (6I10)

160 FORMAT (1H 5 'CNTL',2F10.4,F10.2,34X,215,3)

175 FORMAT (1H 5 'CNTL',2F10.0,F10.2)

200 FORMAT (1H 5 'CRT',5X,'X CORD',5X,'Y CORD',3X,'ALT.OR DEC',33X,'I',2X

..J',1X,'COUNT')

205 FORMAT (313,3F10.0,312)

210 FORMAT (213)

220 FORMAT (213)

STOP
1. START

2. INITIALIZE PARAMETERS

3. READ IN PARAMETER CARDS 1, 2, AND DATA SET 1

4. ARE ROWS OR COLUMNS TO BE DELETED
   - NO
   - YES
   - READ IN ROW AND COLUMN NUMBERS TO BE DELETED DATA SETS 1 AND 2

5. ARE ANY DELETED NODES TO BE RETURNED
   - NO

6. READ IN NODE NUMBERS TO BE RETURNED DATA SET 3

7. READ IN PHI(I,J) DATA SET 4

8. SUBTRACT ALTADJ FROM DATA SET 4

9. TEST FOR DECLINE MAP
   - NO
   - YES
   - READ IN PHI1(I,J) DATA SET 5

10. SUBTRACT ALTADJ FROM DATA SET 5

11. RETURN
SUBTRACT PHI1(I,J) FROM PHI(I,J): DATA SET 5 FROM DATA SET 4

COMPUTE X AND Y COORDINATES FOR EACH PHI(I,J)

PRECEDING GPCP PARAMETER CARDS

READ IN AND PUNCH OUT PRECEDING GPCP PARAMETER CARDS

PRINT OUT CNTL CARDS W/NODE NUMBERS AND SEQUENCE NUMBERS

PUNCH OUT CNTL CARDS

FOLLOWING GPCP PARAMETER CARDS

YES

READ IN AND PUNCH OUT FOLLOWING GPCP PARAMETER CARDS

STOP

NO