GRAPHICAL REPRESENTATION OF SURVEY DATA

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In this paper I shall attempt to explain the relative merits of the three different methods of obtaining graphical output from resistivity and contour data used at the Greater Manchester Archaeological Unit.

First of all, however, I would like to briefly mention two other graphics facilities that we utilise. The first of these is a program which runs on the PDP 11/45 at the Computer Graphics Unit, University of Manchester Regional Computer Centre, and is used for the rectification of aerial photographs. It is adopted from Rog Palmer's 'Vertplot' at Cambridge University. At the present time it will only accurately rectify features in a single plane, that is on flat ground, but I intend, in the near future, to alter the program to take into account uneven ground. It remains to be seen, though, just how successful this will turn out to be as the program will then require the position of six control points on the photograph to be known accurately on a map of the area photographed.

We also produce distribution maps which plot a selection of sites in Greater Manchester County, on a base map of G.M.C.

Using the Joint System, which is a CDC 7600 computer front-ended by an ICL 1906A, a search job is carried out on a data base containing the Greater Manchester Sites and Monuments record, which produces a file on the 1906A filestore containing the Ordnance Survey grid references of the sites which satisfy the search request. This file is then transferred to the PDP 11 in the Computer Graphics Units. A program is then run on the PDP 11 which produces an outline of GMC, plots the appropriate sites using their grid references, and then gives the user various choices of adding other pieces of optional information. These include such things as Local Authorities and their boundaries, rivers, drift geology etc.

The output from this program can, as with all output from the Graphics Unit, be produced on either paper, thin card or drafting film up to AO size, or on either microfiche or 35mm film.

The accuracy of the distribution map produced is dependent only upon the accuracy of the OS grid reference given in the Sites and Monuments record, as the program will read either four, six or eight-figure grid references.

Returning, now, to the subject of output from resistivity data, the first form is produced by a package available on the Joint System at UMRCC. The package used is called SYMAP. Symap actually stands for Synagraphic Mapping System, and produces maps on the line printer as opposed to the graph plotter. This could be considered to be a slight advantage if only because the output will be returned to the user sooner, as the plotter tends to be

slower than the line printer and so usually has a backlog of jobs from other users.

To run this program you must first create a data file either on punched cards or, more preferably, stored in the 1906A filestore. This should contain the following information:-

(1) is optional, and is:

(1) A list of the co-ordinates of the required outline vertices. This would be needed in three different cases, the first being to select a subset of the data points as Symap only allows 1000 data points for any one map. For instance, if you had, say, 1500 points you would need to split them into two groups and run the program twice, each time specifying the outline required. Secondly, if your work area is not rectangular then you must specify the outline by giving the co-ordinates at each point the direction of the outline changes. The third case would be if you had more than one outline to define (maybe two rectangular areas which are non-adjacent). In this case you would specify the vertices of the two areas. Up to 100 vertices may be given, so quite a complex shaped map can be produced. If, however, there are less than 1000 data points, and the grid is rectangular, an outline need not be specified.

(2) A list of the co-ordinates corresponding to each data point to be plotted is required. This might seem quite a tedious task to perform, but I have written a Fortran program which produces the required data points when given the necessary outline, and the distance between the points.

(3) The third section of the data file contains the data values.

(4) The final section contains instructions telling the program how the output should be produced. In this section you can specify such things as a title, size of the output map, the number of levels the overall data range should be subdivided into etc.

The output produced is in the form of a dot-density map. Having specified the number of levels and the data value range for each level, a map will be produced with heavier shading for higher values and lighter shading for lower values. The heavier shading is obtained by overprinting of various characters. A histogram can also be produced to show the number of points occurring in each level.

The two other forms of output are both produced using a program written by Mr. Bill Sowerbutts, from the Department of Geology, University of Manchester, which runs interactively on the PDP 11/45 in the Computer Graphics Unit at UMRCC.

This program reads in the set of data values, which must be from a rectangular grid, and the distance between the rows of points and the distances between the points on each row. You are then given the choice of producing a contour map or a 3-dimensional view of the surface created by your data.

If the contour map is specified, you then type in the minimum and maximum values from your data that you wish to be considered in the map. You are also able to specify the vertical distance between the contour lines to be drawn. An option is then given of producing a contour map with only the contour lines or, alternatively, you can have each contour line labelled with its numerical value.

If the final presentation of the output is only going to consist of contour maps, it is more convenient to produce them with these labels included otherwise there is no way of differentiating where high values occur and where low values occur. Unfortunately, if there is a large number of contour lines drawn, due to the contour interval being relatively small usually, the map may turn out rather cramped. Alternatively, if a contour map is produced without labels along with a 3-dimensional plot, then by looking at the two plots together it can be clearly seen just which are high areas and which are low.

The contour map, or the 3-D view, whichever was selected, is displayed on a VDU screen and, if desired, can be plotted out on either paper, card, or drafting film up to AO size, microfiche or 35mm film.

The plots may also be stored on the PDP 11 filestore for plotting at a later date if required. When the 3-D view is displayed on the Vector General VDU screen it can be viewed from any position in space, as the picture can be rotated through any of the three principal axes and it can also be shifted along any of them. This is achieved by turning dials on the controls of the Vector General until the required viewing position of the map is achieved.

Provision is also made for altering both horizontal and vertical scales independently. When the desired viewing position and size has been obtained (this normally takes about 10 to 20 seconds) a hard copy plot can be produced. (This again takes approximately 20 seconds on the high speed Benson 5342 plotter).

Therefore, if a dot-density type map is required with no interactive facilities, the Symap package is used, although this gives a relatively slow job turnaround time; something in the order of 20 minutes depending on how heavily loaded the machine is at the time.

I have found, by experimenting with the different methods, that this type of output is better for detecting and analysing linear features, whereas the best way to produce maps of circular features is to use the Sowerbutt's program with one straightforward contour map and no labelling of the contour lines, together with three or four 3-D views from various viewing positions.

The method of just producing a contour map with contour values labelled on the plot is rarely used, as we are usually more concerned with detecting surface trends rather than the actual values of the points plotted.