A Comparison of Raster and Vector Data Models

Developments in GIS are now at a stage where all sophisticated GIS packages are able to handle both raster and vector processing and it likely that the vast majority of data inputs in the future will be in raster format. The advantages and disadvantages of each data structure are shown here below.

RASTER MODEL

Advantages

1. It has a simple data structure.

2. Overlay operations are easily and efficiently implemented.

3. Scanning technologies can supply huge quantities of data cheaply.

4. Image processing techniques produce data for integration to GIS in a raster format.

5. Area and polygon analysis is simple.

6. Overlaying and merging are easily performed.

7. The technology is cheap and in the future it will have greater cost advantages.

8. It is well suited to subdividing spatially continuous variables.

Disadvantages

1. The sheer volume **of data to be stored and handled can be very high.**

2. There can be a serious loss of detail with larger pixel sizes (poor resolution).

3. Final maps can be fairly crude, especially those produced on cheaper GIS software.

4. Linear type analysis is more difficult.

5. Topological relationships are difficult to represent.

VECTOR MODEL

Advantages

1. It has a relatively compact data structure so storage requirements are less.

2. Features can be accurately located.

3. The topology can be completely described with network linkages.

4. Very small features can be shown and all features can be accurately drawn.

5. Data about individual features can easily be retrieved for updating or correction.

6. Linear type analyses are easily performed.

Disadvantages

1. It has a more complex data structure.

2. Overlay operations are difficult to implement.

3. The representation of high spatial variability is inefficient.

4. Manipulation and enhancement of digital images cannot be effectively performed.

5. Data capture can be very slow.

6. Area or polygon analyses are difficult.

7. This is generally a more expensive data structure in terms of data capture and software purchase.

We should conclude this **discussion on the structuring of spatial data by mentioning the third** dimension. To build up a structured database which contains "altitude", or for marine applications "depth", then triangulated irregular networks (TIN's) are used. These consist of a series of non-overlapping polygons, each defining a flat surface, which completely covers the topographic surface (Figure 4. 10). Each vertex of a triangle is encoded with its location and it has a height associated with it. Given this information, the TIN can be reproduced as a digital elevation model in 2.5-13, the detailed resolution of which depends upon the accuracy of the original TIN. To model volumes in a structured way, a geo-referencing system is needed which encodes in x, y and z axes. A way of doing this is to extend the raster concept of using an array of cellular pixels so as to model the added dimension, i.e. a 2-13 square becomes a 3-D cube. These cubes have been called voxels (volume elements). Geo-referencing and attributes can be assigned as in the raster data structuring. Gargantini (1989) describes the work which is in place on "octrees", i.e. as quadtrees are a way of compressing pixel data, these are ways of structuring data which is in voxels. Clearly, the use of voxels will eventually be essential in much marine fisheries GIS work, but as of the present they have been mostly used in the geological GIS field.