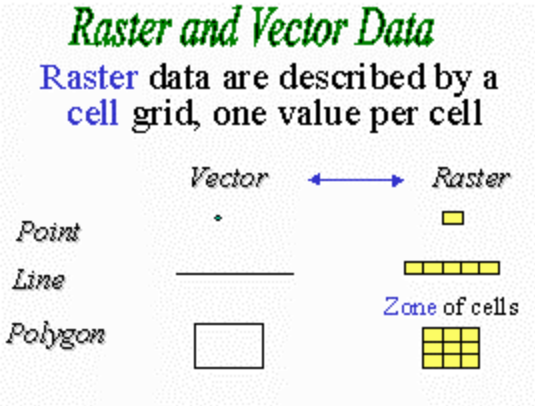
Vector and raster data models

(from David R. Maidment, "Introduction to Spatial Hydrology" – ESRI Campus)

Continuous surfaces can be represented using the grid or raster data Model in which a mesh of square cells is laid over the landscape and the value of the variable defined for each cell.

As shown in the graphic below, a point in a vector representation can be approximately transformed to a single cell in a raster representation. Likewise, a vector line can be approximately transformed to a sequence of raster cells lying along that line, and a vector polygon can be approximately transformed to a zone of raster cells overlaying the polygon area.



Spatial hydrology involves both spatial data development and hydrologic modeling, both of which require intensive computational functions. Those functions are usually offered by raster data models. However, most spatial data sources are in vector data format, which also provides unique visualization and geographic analysis benefits. Therefore, the connection between raster and vector data is critical in spatial hydrology, perhaps more so than in other applications of GIS.

Rivers are best represented as lines, and gaging stations and other control points on rivers like water right locations are best represented as points. However, the watershed areas draining to those points are best derived from Digital Elevation Models (DEM), which are raster representations of land surface terrain elevation considered as a continuous surface.

Moreover, precipitation, evaporation, and other climatic variables are defined continuously through space and measured at particular points where there are climate stations.

Being able to move back and forth smoothly between raster and vector representations of data is an important feature of spatial hydrology.

A well-constructed geospatial database for hydrology incorporates both vector and raster data in a tightly connected raster-vector data model, as illustrated in the graphic below. The features of the real world are depicted in vector data layers as points, lines, and polygons, and in the raster database as cells or zones of cells.