



Workshop on :
GIS&RS Application in Simulation of Hydrological Process

Dr. ABOLGHASEM AKBARI

Faculty of Civil Engineering & Earth Resources, University Malaysia Pahang (UMP)

14-15 April 2016

Venue: Tehran, Iran



GIS&RS Application in Simulation of Hydrological Process

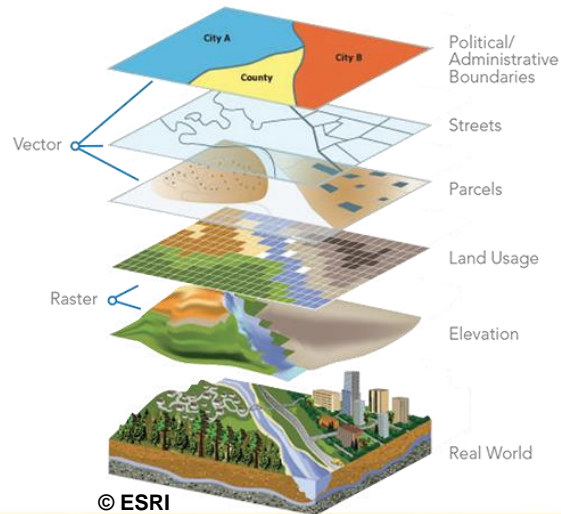


Spatial Data Models in GIS

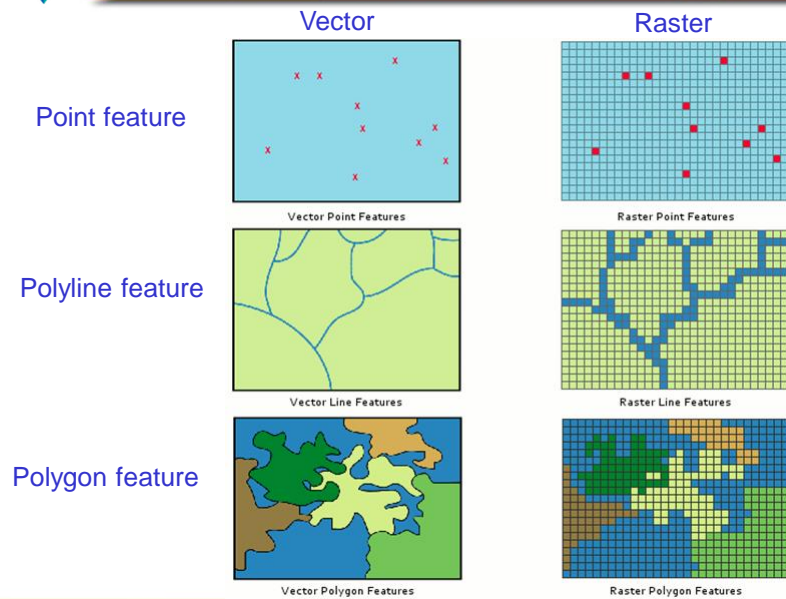


Data Layers

Layers are a central concept in GIS

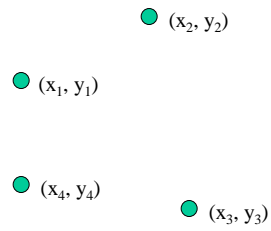


© ESRI





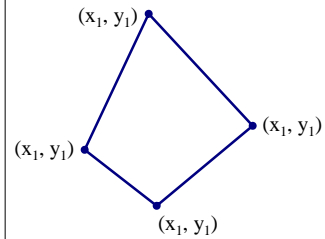
Spatial Data Models



Point – pair of (x,y) coordinates



Line – a sequence of points

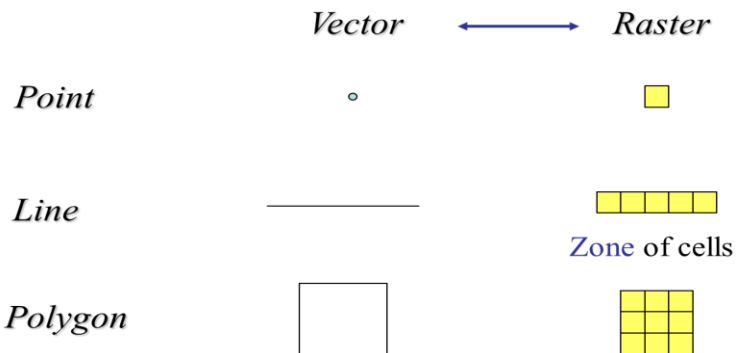


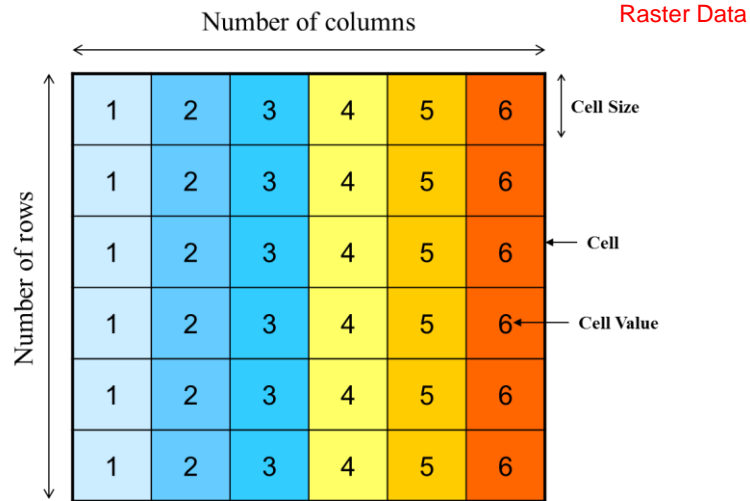
Polygon – a closed set of lines

All vector shapes (2D and 3D) are made from a set of points.



Raster \leftrightarrow Vector

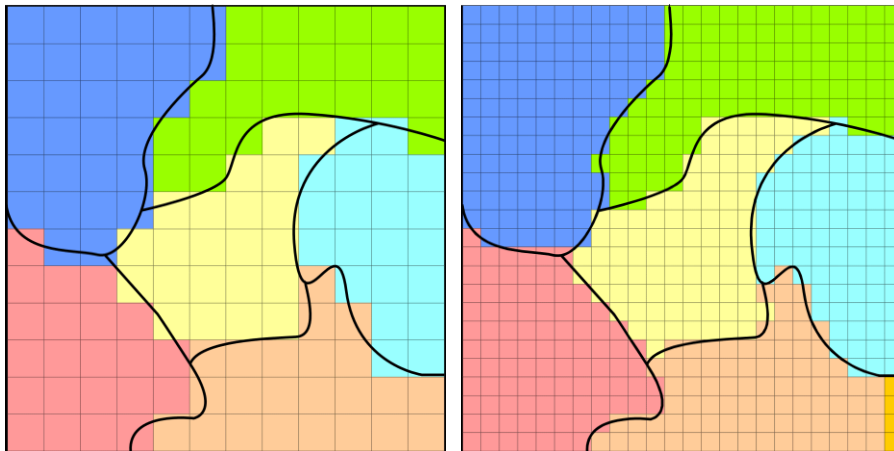




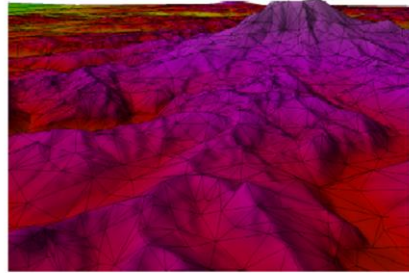
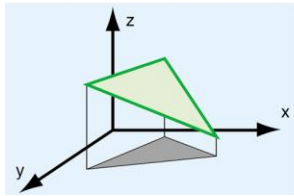
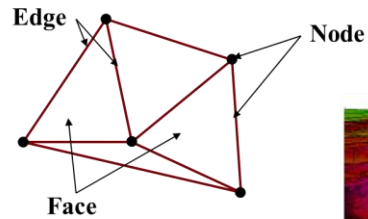
Example, Digital Elevation Model



Comparing Raster Resolution



Triangulated Irregular Network



Raster vs. Vector

Raster

- Data broken into cells
- “Layer” concept more explicit

Vector

- Data broken into points, lines, and polygons
- Easier to represent multiple themes in one layer



Two forms of raster data used in GIS

Digital images

The magnitude of response for each band stored as a layer

Generally three bands displayed simultaneously as red, green, and blue

Paper documents scanned with optical scanner are also images, but it is harder to assign meaning to the values of cells

Thematic data

Values of cells represent some other variable



Raster vs. Vector GIS

Modern GIS software will have capability for both models

Any GIS will still be more “comfortable” with one than another

For example, ArcGIS can perform many raster analyses, but not as well as a true raster GIS



Variables

In raster or vector GIS, any data must be encoded for use by a computer

Data with many possible values are variables

The *types* of variables determine how much storage space they take up, and what they can represent



Analyzing Data

GIS allows the relation of data by attributes and spatially

Examples

- Proximity analysis
- Overlays
- Networks
- Environmental modeling



Overlay

Fundamental operation

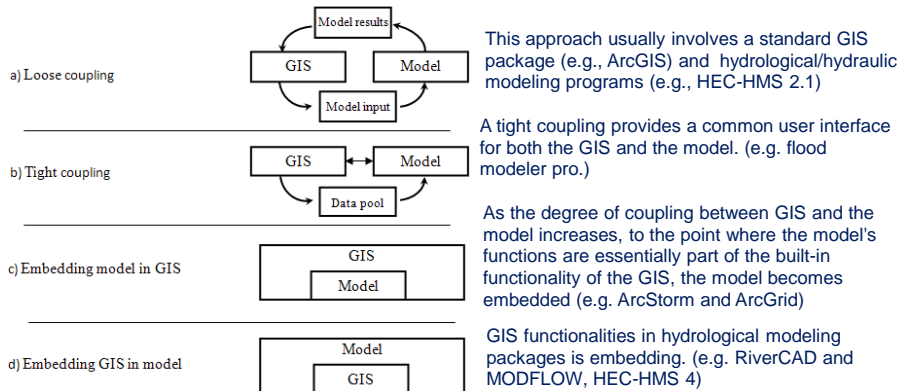
Relates data in different layers

Handled differently in vector and raster

In vector, much of the overlay takes place in the attribute table

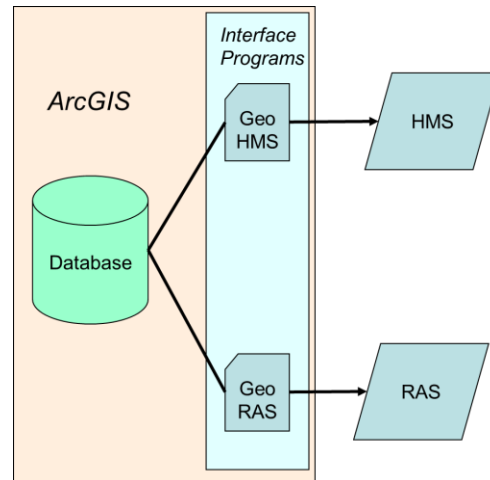


Integration of GIS with Hydrological Model



Integrating GIS with hydrological models (Adapted from Sui and Maggio (1999))

Integration of GIS with Hydrological Model



Some integrated Hydrological models with GIS

WetSpass

WetSpass is a steady state spatially distributed water balance model for simulating yearly or seasonal averages of groundwater recharge, evapotranspiration (soil evaporation and transpiration also as separate outputs), runoff, and interception.

Vflo

Vflo is a gridded, physics-based hydrologic model that can simulate stormwater runoff based on geospatial data to model interior locations in the drainage network. It is used to simulate runoff from major river basins to small catchments.

SWMM

EPA's Storm Water Management Model (SWMM) is used throughout the world for planning, analysis and design related to stormwater runoff, combined and sanitary sewers, and other drainage systems in urban areas.



Most common GIS-based Hydrological model

Flood Modeller Pro

Flood Modeller Pro combines all the functionality of flood modelling software into one integrated package, with cost-effective modules and extensive training and support.

TUFLOW

TUFLOW is a computational model which links to flood modelling software.

Delft-FEWS

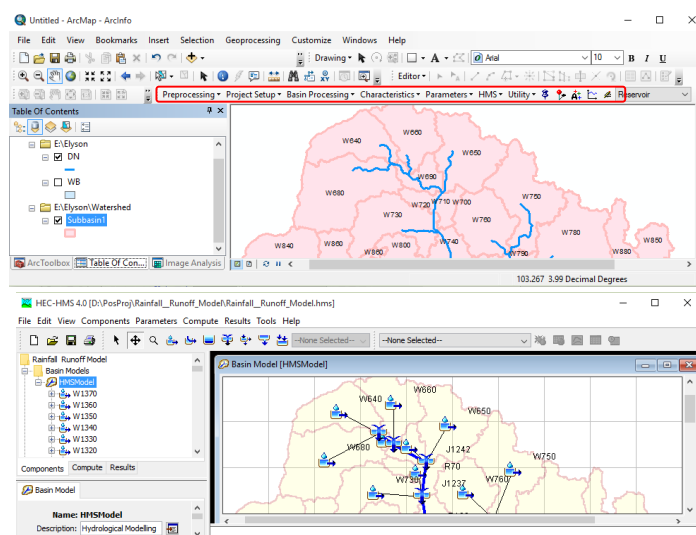
The flood modelling software integrates with Deltares' flood early warning system (FEWS) to provide a state-of-the-art hydrological forecasting and warning system.

HEC-HMS

CE 394K.2 Surface Water Hydrology. David R. Maidment
Hydrological Modeling System (HEC-HMS) provide a deterministic framework for rainfall-runoff simulation coupled with GIS link of GeoHMS.



Most common GIS-based Hydrological model





Thank you
akbariinbox@yahoo.com