Surface Models (TINs)

GIS 270

What is a TIN?
- Triangulated Irregular Network
- Surface Model
- Vector version of an elevation model

DEM vs. TIN

Main TIN components
- Mass points (nodes)
  - Triangle corners with elevation data
- Edges (arcs)
  - Represent slope breaks across triangles
- Facet (polygon)
  - One triangle with constant slope and aspect
  - Represents one facet of the entire surface

How TINs are created
- ArcGIS uses Delaunay Triangulation
- Matches (from the mass points) the three nearest neighbors
- Wants to form triangles as close to equilateral as possible
- No control over the process of triangulation
  - Only control is from input data (mass points, breaklines, and polygons)

TIN considerations
- Beware of flat triangles, particularly if the mass points come from contour lines
Data for building a TIN

- Mass points: containing height data (X, Y, and Z)
  - Topo map
  - DEM
  - Another TIN
  - Contours
- Break Lines: define required edges where the slope must change along facets
  - E.g. Streams, Ridgelines

Breaklines

- Hard Breaklines: major disruption where triangulated surface not valid
  - Streams
  - Shorelines
  - Ridgelines
  - Dams
- Soft Breaklines: ensure a particular location is included
  - Highway cuts
  - Boundaries
  - Railroad beds

Breaklines

- Hard lines: cannot be cut across, edge must be followed
- Soft lines: can be cut across by triangles, but a general guideline

Why use Breaklines?

- Enforce surface reality
- Keep important surface features in model
- Can have different elevations along the line or same elevation

Polygons in TINs

- Replace polygons
  - Represent level areas
  - Interior lakes
- Clip polygons
  - Define edges of the TIN
- Erase polygons
  - Remove areas from inside the TIN
- Value Fill Polygons
  - Like a replace polygon, with a constant value

Why use TINs?

- Higher precision depending on mass points chosen
- Calculations
  - Surface area
  - Volume
- Disadvantages
  - Time-consuming
  - Expensive
Topology and TINs

- Tins have complete topology
  - Triangle numbers
  - Three neighboring triangle numbers
  - Three nodes and their values
  - Edge types