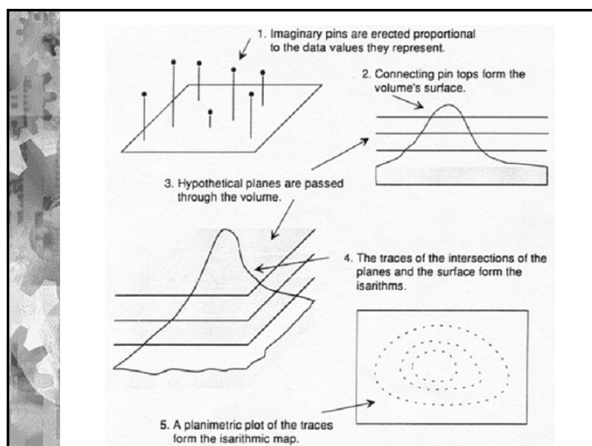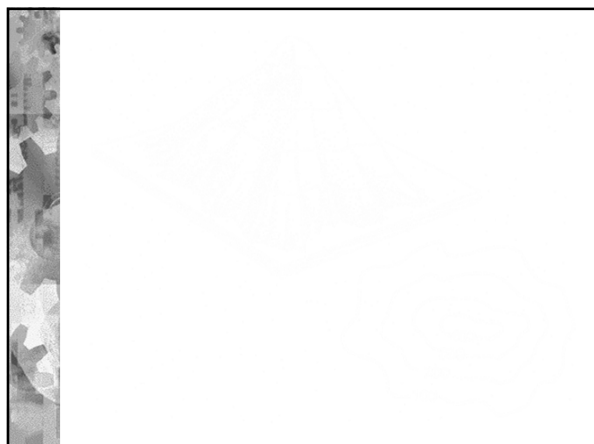Geography 38/42:376
GIS II

Topic 8:
Isarithmic Mapping
Chapter 9: Dent

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What is an Isarithmic Map?

* Portrays continuous surfaces using isolines
    * quantitative line features
    * represent constant value

* Located with reference to control points

* Surfaces may be:
    * real (e.g. a topographic, or barometric surface)
    * or conceptual (e.g. population or tortoise density)

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1. Imaginary pins are erected proportional to the data values they represent.
2. Connecting pin tops form the volume's surface.
3. Hypothetical planes are passed through the volume.
4. The traces of the intersections of the planes and the surface form the isarithms.
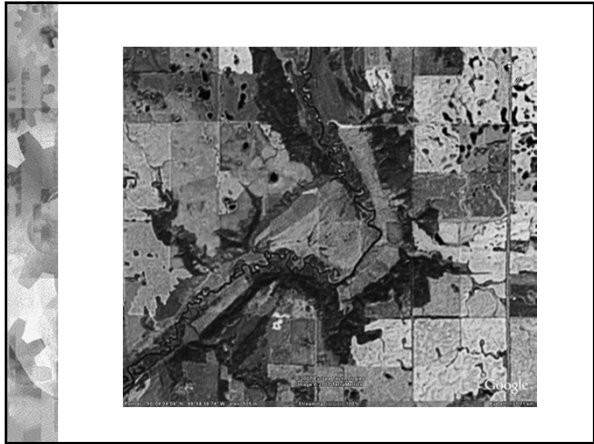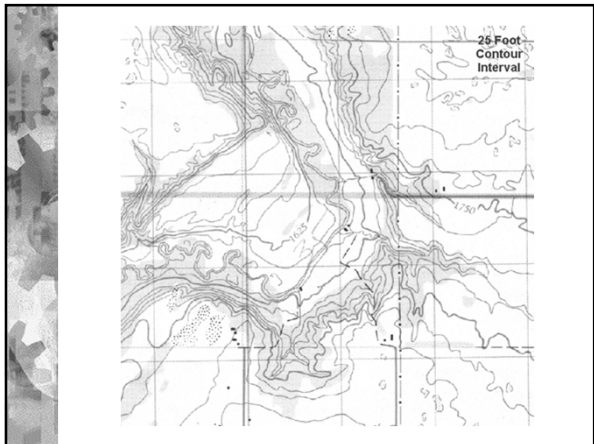5. A planimetric plot of the traces form the isarithmic map.

Interpreting an Isarithmic Map?

* Isolines depict:
  *
  *
  *
  *

* Interpreted by observing:
  *
  *
  *
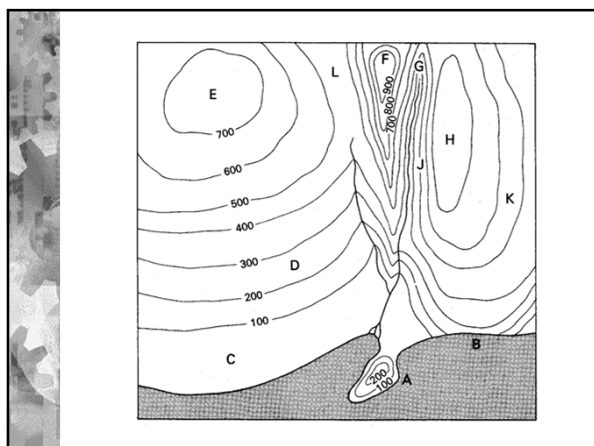
Spatial Data Characteristics

* Two types of isarithmic maps based on spatial data characteristics

  * Isometric

  * Isoplethic

Asaptial Data Characteristics

* For Isometric type:
  * Raw or derived values may be used:

    * Raw values measured/sampled by instruments at discrete pt. locations

    * Derived values include means, ratios, or proportions based on sampled data

Asaptial Data Characteristics

* For Isoplethic form:
  * Derived values used; never raw

    * Account for differences in relative area or relative population of areal units

Requirements?

✴ Feature to be mapped is continuous in nature
✴ Or can be visualized as a surface

✴ Isometric requires:
  ✴ sufficient number/distribution of control points

✴ Isoplethic requires:
  ✴ size, shape, of AUs is reasonably consistent so that there are not significant variations in the density or distribution of control points

When Is It Used?

✴ Only choice for mapping continuously distributed data as a surface
  ✴
  ✴
✴ Several alternatives to isoplethic form:
  ✴
  ✴
  ✴

Advantages

✴ Total form of distribution portrayed

✴ Method is commensurable and graphic

✴ Adaptable to different levels of generalization and degrees of precision

Considerations:
Location of Control Points

* Isometric:
  * Location of control points are precise
  * Distribution and density are sufficient
* Isoplethic
  * IF areal units are regularly shaped
  * AND phenomenon is evenly distributed
  * Geographic center is acceptable control point

  * IF areal units are irregularly shaped
  * OR phenomenon are clustered/skewed
  * Centre of actual distribution should be chosen

Isoplethic Considerations:
Size & Number of Areal Units

* Accuracy and hierarchical level of units
  * As size of AUs increases
  * and number decreases
  * accuracy of isolines and surface decreases

  * As size of AUs decreases
  * and number increases
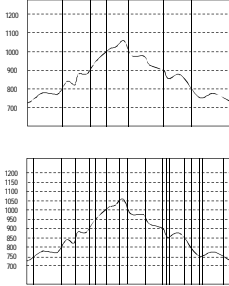 * accuracy of isolines and surface increases

Considerations:
Datum and Interval

* Once location of control pts have been established must select:

  1. Datum
     * Real or arbitrary zero value
     * Exogenous data value
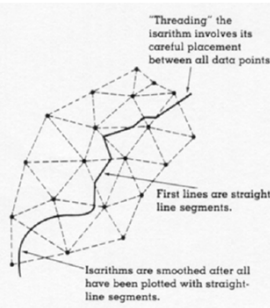   * Minimum value of data set
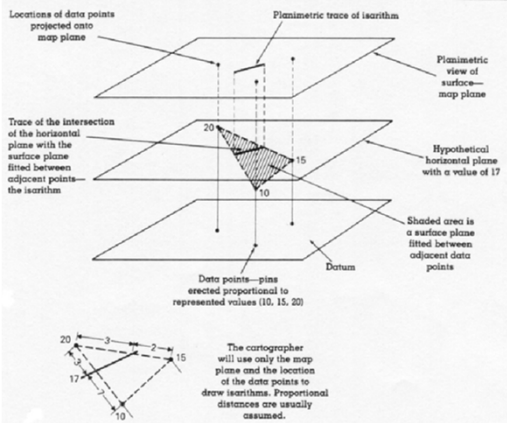
  2. Interval

Considerations: Datum and Interval

* Why are intervals used?
* Affects number of isolines
  * significantly affects appearance
* How are intervals selected
* Interval are always constant

Isoline Placement – Manual

* Construct Delaunay triangles
* Created by drawing lines b/w adjacent neighbours
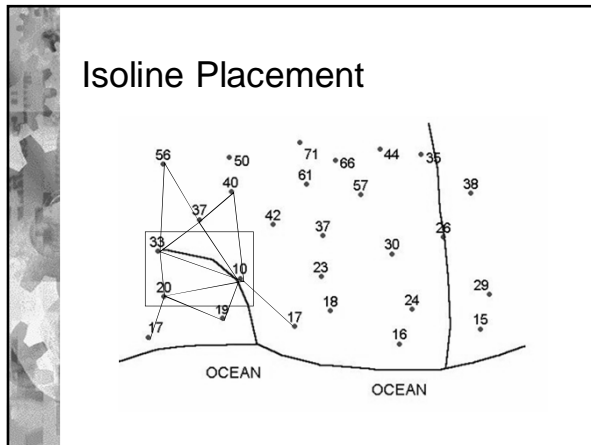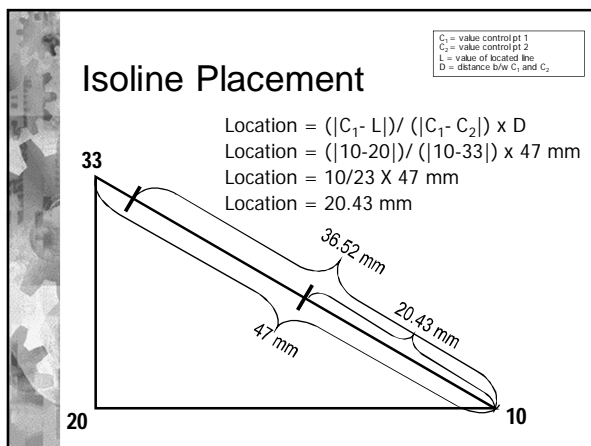* Most equilateral set of triangles

Isoline Placement

* Assumes that values b/w control points change in a linear fashion
* Location where isoline crosses edge of triangle can be calculated as:

$$\text{Location} = (|C_1 - L| / |C_1 - C_2|) \times D$$

C_1 = value control pt 1
C_2 = value control pt 2
L = line value
D = linear distance b/w C_1 and C_2

Isoline Placement

Isoline Placement

C_1 = value control pt 1
C_2 = value control pt 2
L = value of located line
D = distance b/w C_1 and C_2

$$\text{Location} = (|C_1 - L|) / (|C_1 - C_2|) \times D$$
$$\text{Location} = (|10-20|) / (|10-33|) \times 47 \text{ mm}$$
$$\text{Location} = 10/23 \times 47 \text{ mm}$$
$$\text{Location} = 20.43 \text{ mm}$$

Isoline Placement Guidelines

* Isolines:
  *
  *
  *
  *
  *

    * Let's practice drawing some isolines

Map Design – Line Style

* Should appear as figure within map area

* Graduated colours can be used for lines

* Shading <u>between</u> isolines can be used

Map Design - Labeling

* Isolines should be labeled to indicate value by:
  * interrupting the isoline

  * placing labels at the end of isolines

  * not every isoline needs to be labeled

Legend Design

* Legend should indicate:
    * data type/theme
    * units of isolines
    * and interval between isolines

* Often presented as a statement

Consideration: Map Projection

* What geometric property should be preserved?

Not an Isarithmic Map

Mean Annual Precipitation in Georgia

Average Maximum Air Temperature in Ohio 1971-2000