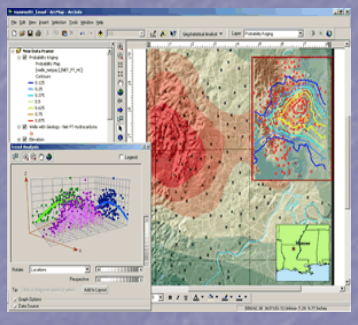
Geostatistical Analyst

What GA Is



- An extension to ArcGIS (ArcInfo, ArcEditor, and ArcView)
- Solves spatial problems such as improving the estimating of temperature values, assessing environmental risks, or predicting the existence of any geophysical element
- Anyone who has spatial data can analyze and create surfaces using advanced statistical methods.

What GA Does

- Finds out the probability of certain variables occurring over an area where identifying every possible location would be impossible
- Uses interpolation methods to develop surfaces from measured samples to predict values for each location in a landscape
- Example:
  - California - air quality monitoring stations
  - Can determine the approximate amount of particulates in the specified area and where these particulates may be moving by creating an optimal interpolated surface

GA's Users

Environmental fields, agriculture, exploration, geology, meteorology, hydrology, archaeology, forestry, health care, mining, and real estate make use of Geostatistical Analyst.

Reasons for GA's Use

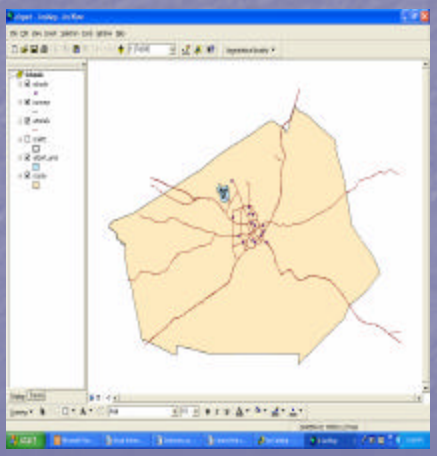
- Can save lives
  - Can evaluate potential environmental hazards
  - Example: Approximate the severity of the Chernobyl accident on nearby areas
- Can increase efficiency
  - Can provide users with the capability to predict optimal conditions for effective and more reliable production
  - Example: Find out why crop yields in a certain area of his farm are below potential

Using GA

Four steps to creating an interpolated surface:

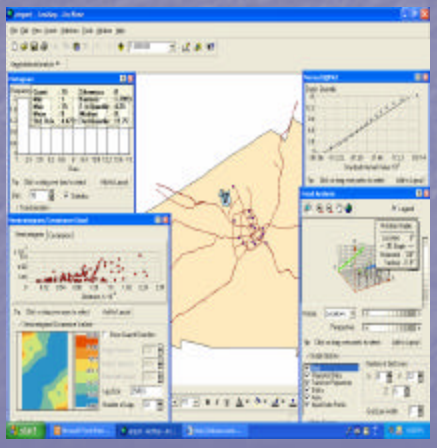
- Represent data
- Explore data
- Fit a model (create a surface)
- Perform diagnostics

Represent Data



- Evaluate the accuracy of the data and identify external factors that may, in the long run, play a part in the distribution of data
- Useful inferences from the oceans, elevation, roads, and polygon edges can be obtained

Explore Data

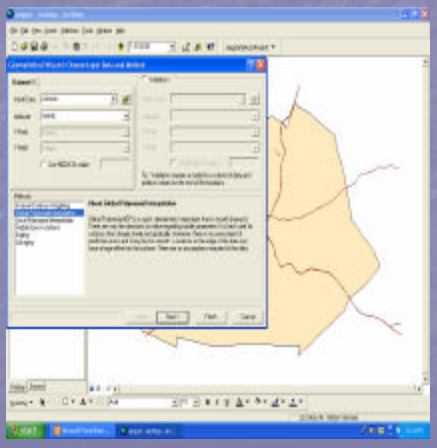


- Includes visualizing the distribution of the data and searching for data trends and global and local outliers
- Exploratory Spatial Data Analysis (ESDA) Tools

Fit a Model

- Deterministic Method
- Geostatistical Method

Fit a Model: Deterministic Method

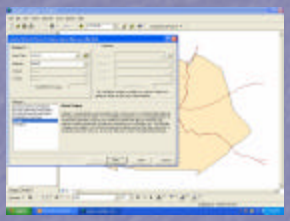


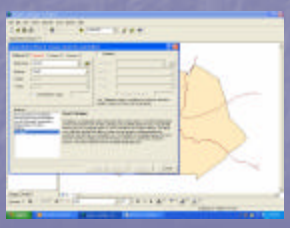
- Used for creating surfaces from measured points based either on the extent of similarity or the degree of smoothing
- Divided into two groups:
  - Global
  - Local

Deterministic Method Continued

- Global technique: calculate predictions using the entire data set
- Local technique: calculate predictions from the measured points within specified neighborhoods
- Example: Determining purchasing power of distant retail locations

Fit a Model: Geostatistical Method





- Based on statistics and is used for more advanced prediction surface modeling that also includes errors or uncertainty of predictions
- Divided into two groups:
  - Kriging
  - Cokriging

Geostatistical Method Continued

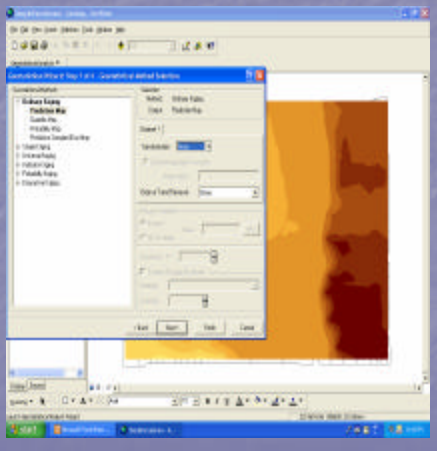
Kriging

- Divided into two tasks:
  - Quantifying the spatial structure of the data
  - Producing a prediction
- Example: environmentalist sampling aquifers and discovering spatial correlation between sample points

Cokriging

- Uses multiple data sets
- Allows users to investigate graphs of crosscorrelation and autocorrelation
- Can use transformations and remove trends

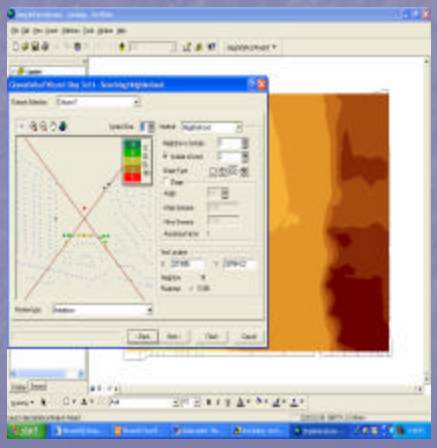
Geostatistical Method Continued



Output Surfaces

- Prediction map: produced from the interpolated values to display random variables at locations where data has not been collected
- Error of prediction map: produced from the standard errors of interpolated values or the standard error of interpolated indicator values to display the uncertainty of the predictions
- Quantile map: produced when the user specifies a probability and wants a map of the values where predictions exceed (or do not exceed) the values at the specified probability
- Probability map: produced when the user specifies a threshold and wants a map of probabilities that the values exceed (or do not exceed) the specified threshold

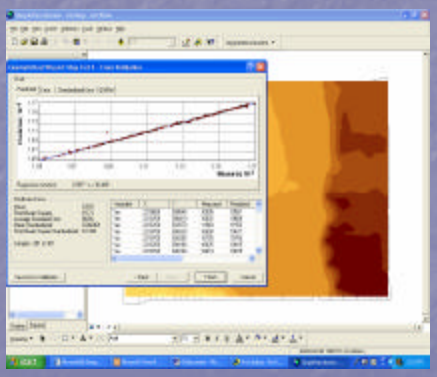
Perform Diagnostics



Provides cross-validation and validation tools

- Cross-validation: compares the measured and predicted values for all points
- Validation: checks whether a “protocol” of decisions is valid, e.g. choice of search neighborhood

Perform Diagnostics Continued



Cross Validation

- Uses all of the data to estimate the trend and autocorrelation models
- Removes each data location, one at a time and predicts the associated data value

Validation

- Uses part of the data to develop the trend and autocorrelation models to be used for prediction
- Predictions to the known locations compared with the measured data

Conclusion: Geostatistical Analyst

- Offers a dynamic environment with a wide variety of tools and a friendly wizard interface to explore data, analyze anomalies, and optimally display an interpolated surface with associated uncertainties.
- Bridges the gap between geostatistics and GIS