Topoff Mining Company Assignment

Modeling areas to be mined and estimating overburden to be removed

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Modified from a lab of B. Ralston

BGSU

Class Composition

- This is one of the last labs in an introductory GIS course
- The class is mixed: undergrad/grad
  - Undergrad: about half geology, half environmental science, with a couple of students from other departments like public health, biology, political science, economics
  - Grad: most from geology, with a few students from biology (ecology)
- We are changing all this! We are currently revamping the whole GIS & RS curricula

Lab Goals

- Students should be able to apply the interpolation techniques discussed in the lecture
  - Grad students should evaluate and appraise the different interpolation techniques
- Students should be able to show how to input data from a GPS file

- Skill goals from all labs
  - Further development of computer skills
  - Improved ability to write clearly

Lab Exercise Setup

- Introduction stating the specific outcome of the lab
  - Your job is to estimate the amount (in cubic meters) of overburden that must be removed before the coal surface is exposed
- Instructions on how to carry out the different steps needed
  - As this is one of the last labs, basic operations needed are omitted
- Question sheet (at the end) to complete and turn in at the next lab section (one week) for grading
  - Extra questions for graduate students
  - Also includes basic definitions discussed in class and software specific (ArcGIS) questions

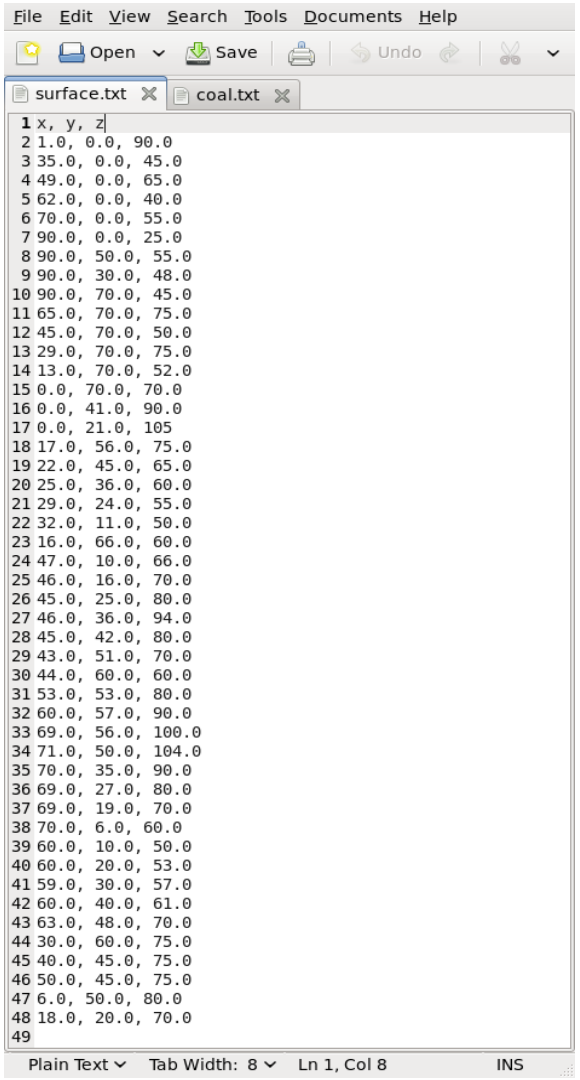
Lab Exercise Setup (cont'd)

- The lab is posted several days before the lab meeting
  - I ask the students to read the lab at least once before they start working on it
  - During the lab meeting I only answer questions on the lab

Lab Description (steps)

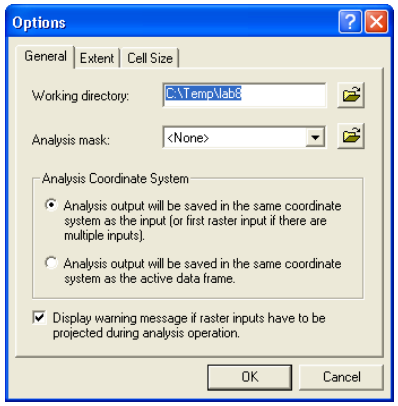
- Introduction

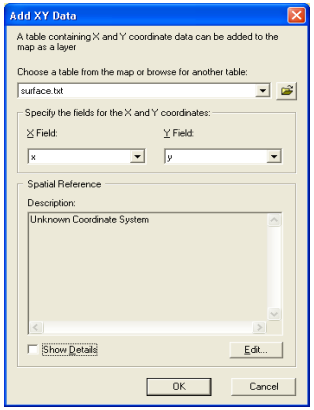
  The Topoff Mining Company has recently selected an area for mining. They have sent out a survey team with GPS equipment. The team has constructed a data set consisting of a set of points with X, Y, and Z coordinates. All readings are in meters. The Z values are meters above sea level. The team has also done some test cores which indicate the depth to which the firm must excavate to reach coal. These values are in a X-Y-Z-format file, too.

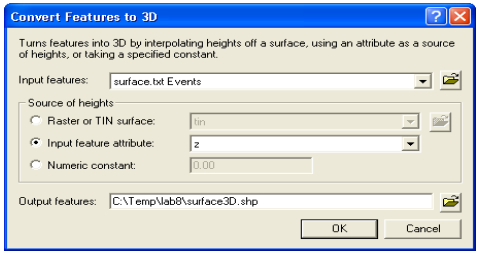


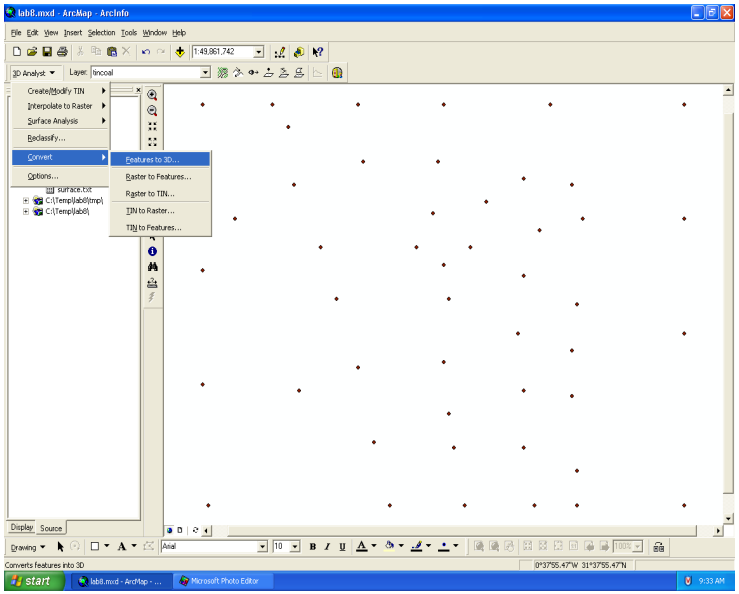
Lab Description (steps)

- Reading in GPS Points
  - Add the 3D Analyst Extension
  - Set up the working directory under options
  - Click on Tools->Add X-Y Data to create a point layer map from the X-Y coordinates of the text files
  - Click on 3D Analyst->Convert-> Features to 3D. This option creates a 3D map using the Z attribute as the source of heights







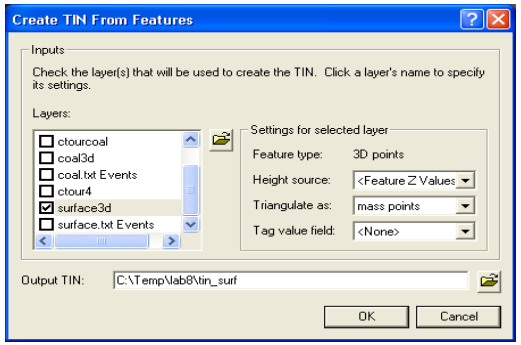


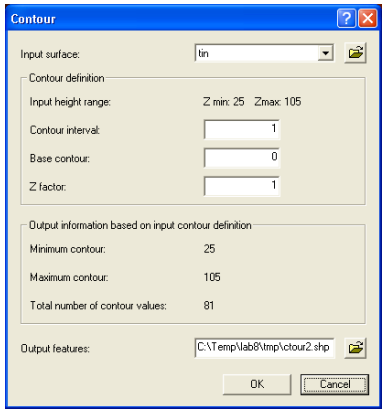
Lab Description (steps)

- Create a 3D surface with TINs

  Click on 3D Analyst->Create/Modify TIN->Create TIN from features

  Click on 3D Analyst->Surface Analysis->Contour to create contours of the surface data using the TIN just produce



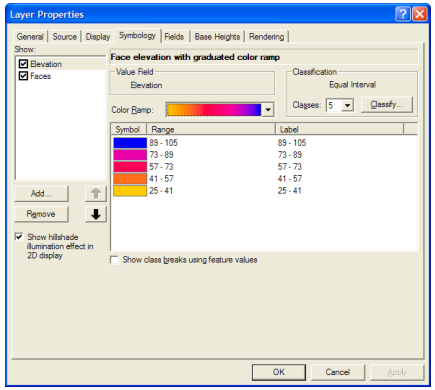


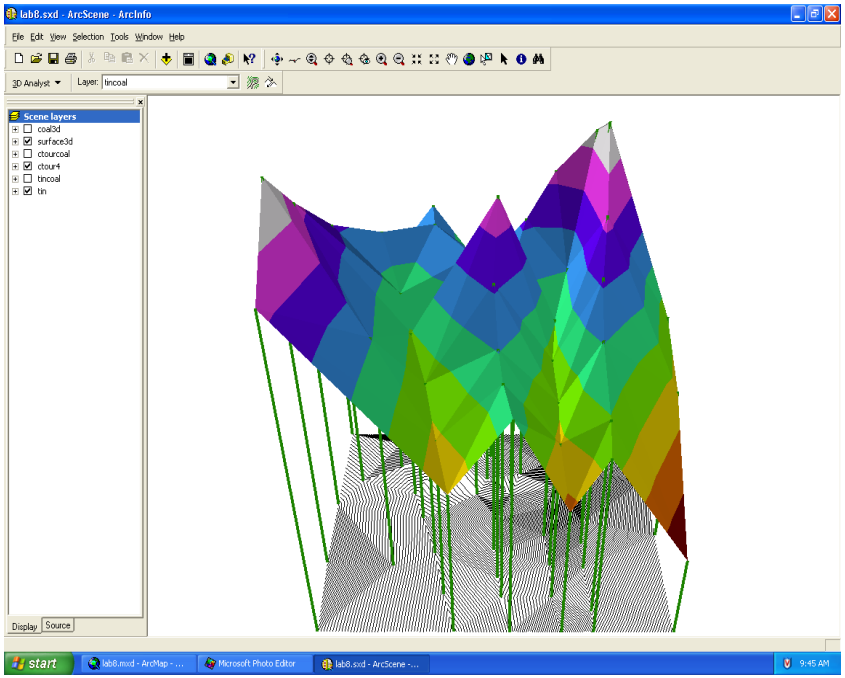
Lab Description (steps)

- Visualize it on ArcScene

  Open ArcScene and add the surface points, the TIN, and the contour layers.

  In ArcScene, select the TIN surface, right click then select Properties. Go to symbology and add "face elevation with graduated color ramp". Within properties click on the Base Heights tab and click on "Obtain heights for layer from surface"



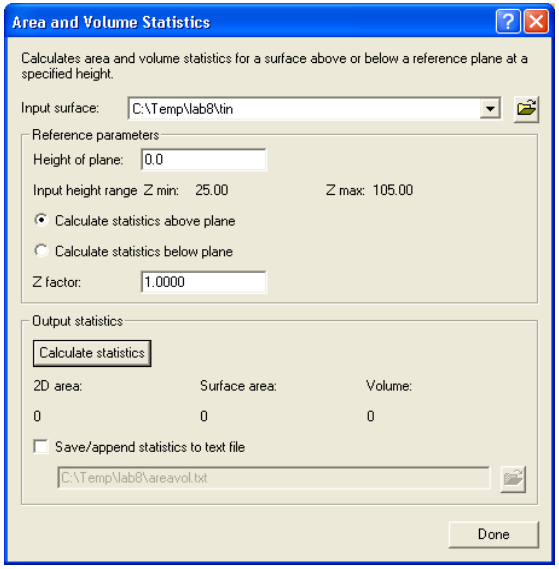


Lab Description (steps)

- Estimate Area and Volume

  Highlight your TIN-surface and click on 3D Analyst->Surface Analysis->Area and Volume. Make the height of plane equal to 0.0 and click on calculate statistics

  Also estimate the volume under the coal surface



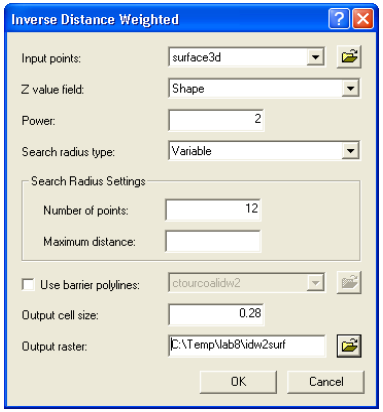
Lab Description (steps)

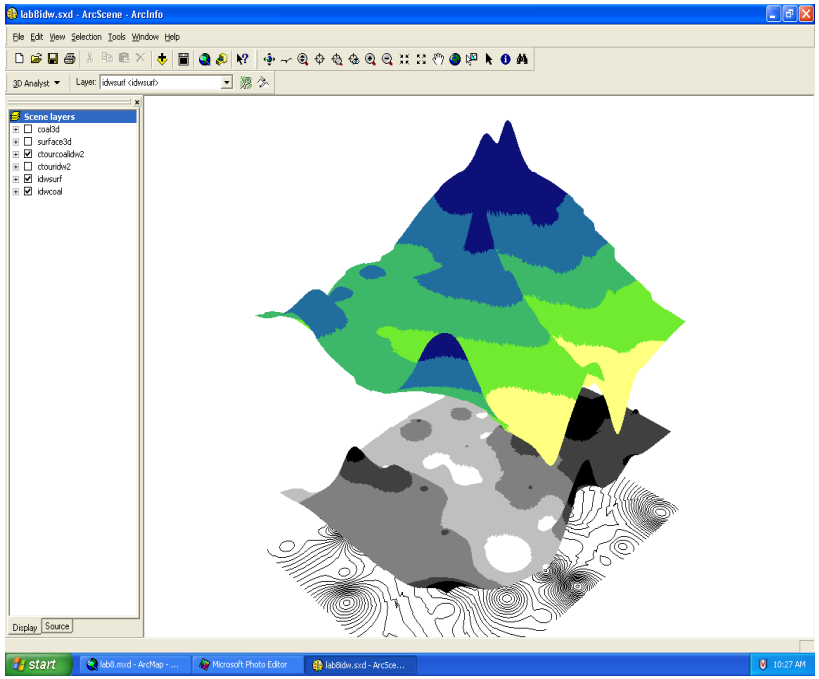
- Estimate Area and Volume
  (with a different surface estimation method)

  Click on 3D Analyst->Interpolate to Raster->Inverse Distance Weighted (IDW power=2). The Input Points come from the surface point geodatabase

  Do the same for the coal data using again IDW to estimate the surface

  Add them to ArcScene together with a contour layer created from the IDW layer





Lab Description (steps)

- Estimate Area and Volume (with a different surface estimation method)

  Estimate the volume of overburden obtained by this surface estimation method and repeat it for an IDW power of 1 and 6

  Notice that you can also use the Cut/Fill method in the Surface Analysis option of 3D Analyst

  All students have to use one more different surface estimation method: the spline

  Graduate students also have to use Kriging

Lab Description (steps)

- Overburden results (volume of earth between the coal and the terrain surfaces)

Estimation Method	Overburden (m^3)
TIN	$296x10^3$
IDW=1	$307x10^3$
IDW=2	$308x10^3$
IDW=6	$314x10^3$
Spline (regularized)	$347x10^3$

Question Sheet

- Sample questions
  - What does TIN stands for? What is the use of TIN data models
  - What is the 3D Analyst Extension? What capabilities does it add to ArcMap?
  - What is the volume under the coal surface (include units!)?
  - What is the estimate of the volume of overburden using IDW with a power of 1 (include units!)?
  - An alternative title for this lab could be: "The Subjectivity of Objective Methods - or How to Lie with Computers and be a Successful Consultant? Explain why this title would be appropriate or not