ERODING LANDSCAPES EXERCISE 1

DOWNLOADING UK DEMS FROM DIGIMAP AND IMPORTING THEM INTO ARCMAP

Overview

This tutorial teaches you how to retrieve topographic data from digimap, convert the raw data into something ArcMAP can read, and extract some information from the map you retrieved.
The assignment is at the bottom, it is due Wednesday 2pm 21st of February.

Digimap is a set of online maps and spatial data for all of the UK, which you can access via your university login. The service includes many different map styles including OS, geological and historical maps, but most noticeably for geomorphologists, digital elevation models (DEMs) (or digital terrain models (DTMs) as they are referred to by Digimap.

Downloading DEMs from Digimap

Section 1: Logging in to Digimap

Step 1: Go to http://edina.ac.uk/digimap/

Step 2: Click Login

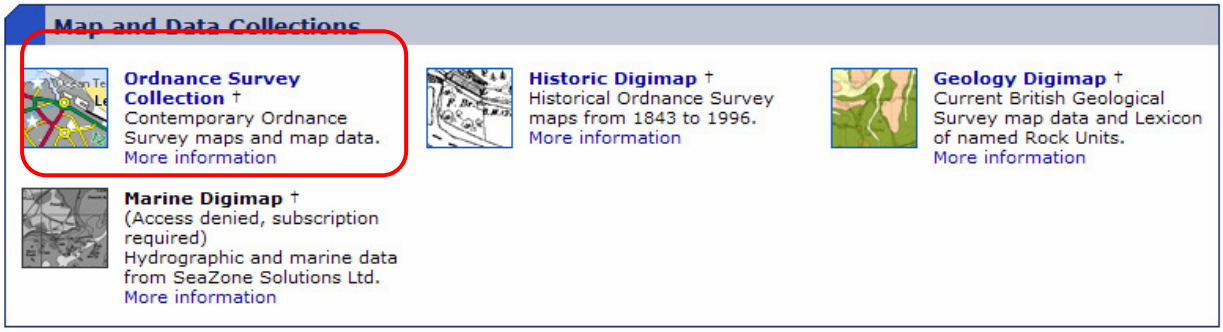
Step 3: Select the University of Edinburgh from the drop-down selection window

Step 4: Enter your UUN and password when prompted

Congratulations, you should now be logged into Digimap

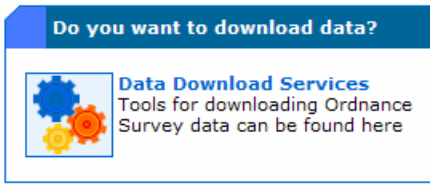
Section 2.Downloading DEMs

Step 1: Click on the Ordinance Survey Collection in which the DEM data is stored



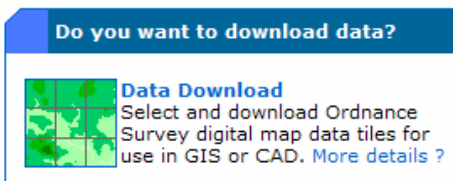
Step 2: Agree with the terms of conditions, once you have thoroughly read them of course!

Step 3: Once in the Ordinance Survey collection click on the Data Download Services

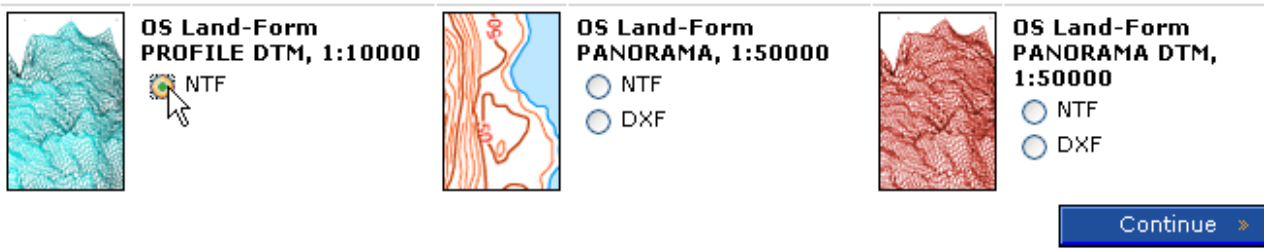


Step 4: On the next screen click on the data download icon

Step 5: Okay, now we are getting somewhere. You want to load data of elevations, this data is called, by ordinance survey, a **DTM (digital terrain model)**. You will also see

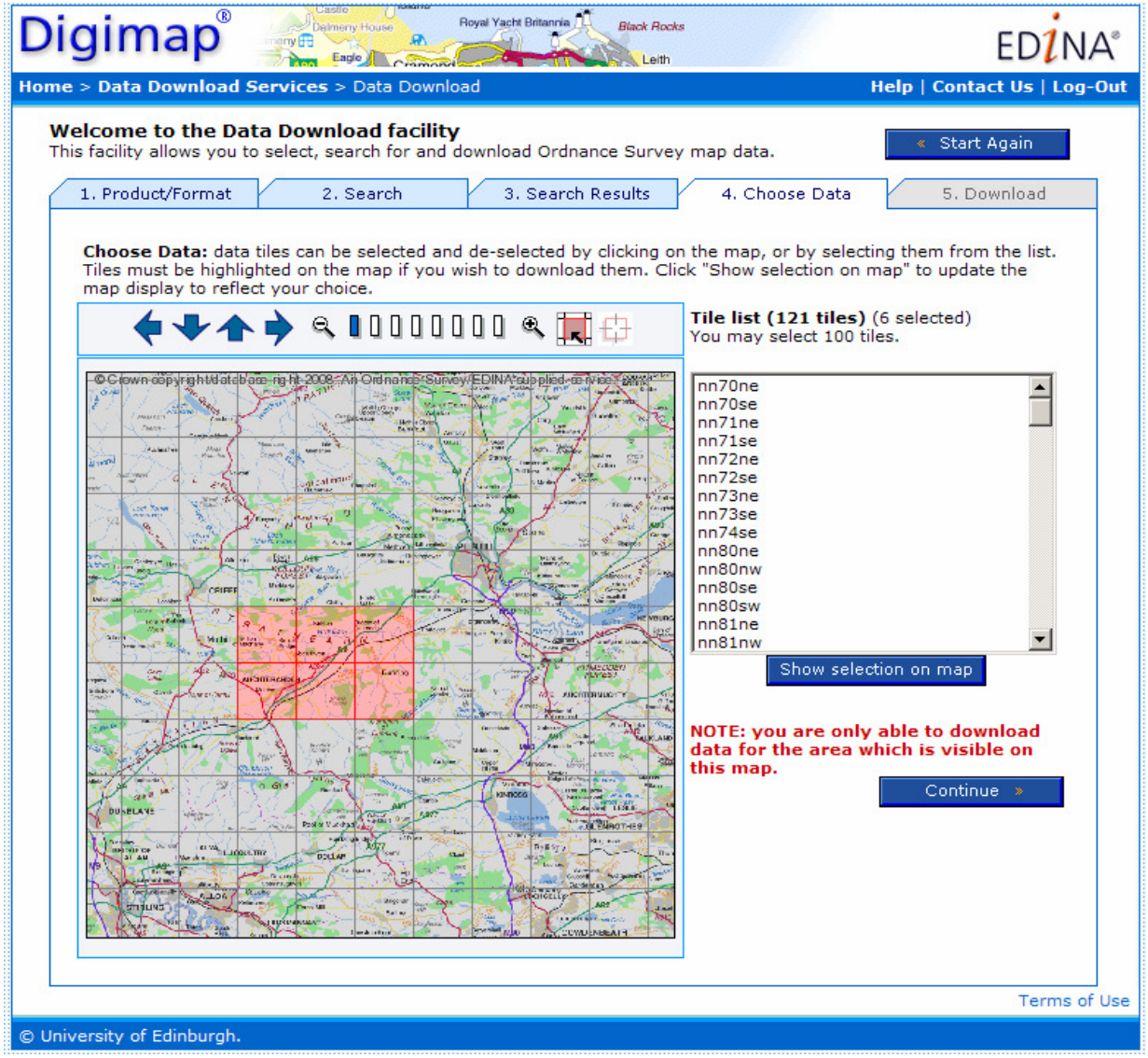


this kind of data called a **DEM (digital elevation model).** On the ordinance survey site there are two kinds of DTM data, the OS Land-form PROFILE DTM 1:10000 and the OS Land-Form PANORAMA DTM, 1:50000. The 1:50000 DEM is at lower resolution; we will work with 1:10000 data. Click on the button for this data and then hit continue.



Step 6: Select the scale you require in the file format NTF, click Continue

Step 7: You are now presented with search fields by which to look for your area of interest. You can also search by clicking on the map of the British Isles. One very annoying feature of this interface is that if you move the map view (by, say, zooming out), you lose your selection, so be careful about moving the map view once you have selected tiles.



Step 8: Once your search is complete you will be presented with a map and a list of tiles. You can now select the tiles/grid squares you want to download simply by clicking on them. Selected tiles will be highlighted in red.
Step 9: Once you have selected the area you require, click continue

Step 10: Select a delivery method (default is a .zip archive) and click 'Extract Data'

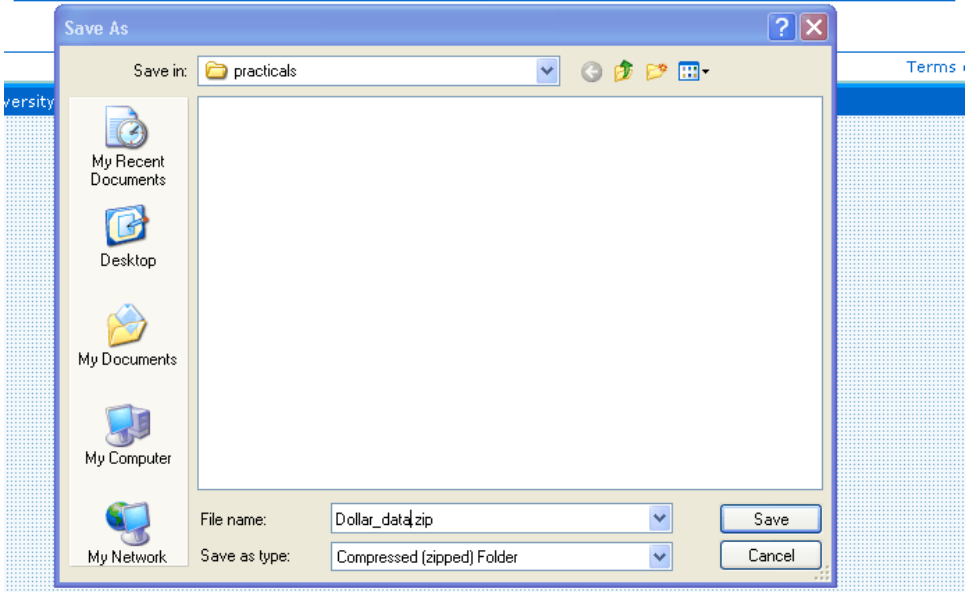
Compression Options	Recommended for...
○ no archiving or compression	Mac, Fast internet connection
○ zip compression, separate files	Windows systems
◉ zip archive	Windows systems
○ Tar archive, no compression	Unix/Linux/Mac OSX systems, fast internet connection
○ Tar archive, gzip compression	Unix/Linux/Mac OSX systems
○ gzip compression, separate files	Unix/Linux/Mac OSX systems

File Sizes

WARNING: SOME DATA ARE VERY LARGE. IT CAN TAKE UP TO 30 MINUTES FOR YOUR DATA TO BE RETURNED. PLEASE BE PATIENT. DO NOT ATTEMPT TO RETRIEVE YOUR DATA AGAIN WITHIN 30 MINUTES.

Step 11. Wait. The data get retrieved from some hard disk somewhere, so you'll have to wait a bit. Click on the 'click here' link after a little while to see if your data has been retrieved. If your data has been retrieved, you'll be able to download the files. Right click on the file 'Data.zip' and click 'save link as,' then save it to one of your directories.

File name	Description	Size
conditions.txt	Conditions of use	7 KB
contents.txt	List of files requested	1 KB
Data.zip	ZIP Data File	1 MB



Step 12. Now unzip the file (you should be able to just double click on it). The data is in files with the .ntf extension. You should have as many of these files as the number of tiles you selected. Make sure you have unzipped the files…some .zip programs let you just look at the contents of a .zip folder without extracting the files.

Section 3: Converting the DEM to be readable in ArcMap

The NTF format is not recognized by ArcMap, the files need to be converted to a useful format. "Map Manager" will do that, but only the version 6.2 or 9.1.

Step 1: Open Map Manager 6.2
Start → School Applications → Science & Engineering → Geosciences → ArcGIS → Map Manager 6

Step 2: When the interface opens click the open icon 

Step 3: Select the directory path in which your NTF files are stored. They should appear in a window on the right. Click *Select All*. Click *Ok*. Three windows should appear.

Step 4: In the *Output Format* window you can select the directory where the converted files will be put. There is no need to amend anything else.

Step 5: To convert to the files to ASC format, click the *convert icon.* Note that this icon is on the Mapmanager toolbar and not in one of the three windows. 

Section 4: Opening the DEM in ArcMap and stitching tiles

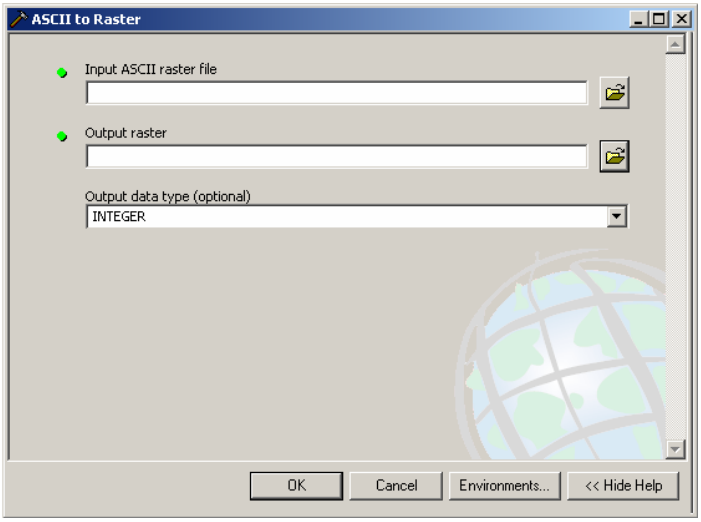
The ASC files you have created can not be read directly by ArcMap but need to be converted to a raster file within ArcMap first. There are two ways to do this:

Step 1: Open ArcMap
Start → School Applications → Science & Engineering → Geosciences → ArcGIS → ArcMap

Step 2: Click on the *Arc Toolbox* icon 

Step 3a: If you are dealing with a single file/grid square:

- Go to *Conversion Tools → To Raster → ASCII to Raster*

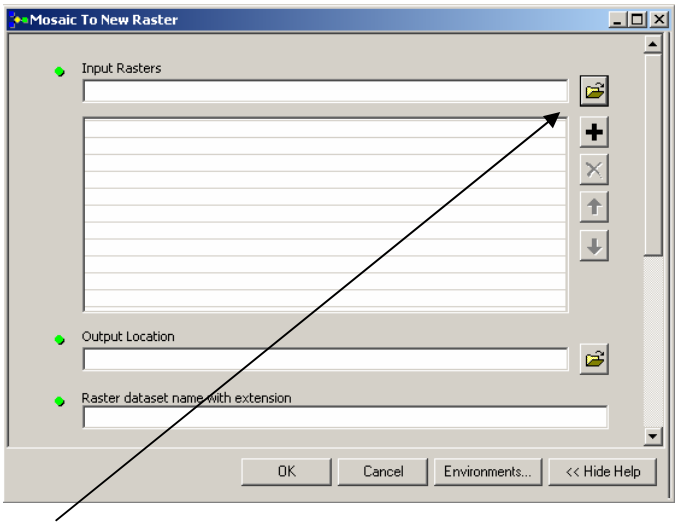


- Under *Input ASCII Raster file* select the file you want to convert/open
  Under *Output Raster* select the file path and name the file you are creating

Click *Ok* to convert

Step 3b: If you are dealing with multiple files/grids that you would like to amalgamate you can open the files as a mosaic:

Step 3b.1: Go to *Data Management Tools* → *Raster* → *Mosaic to New Raster*

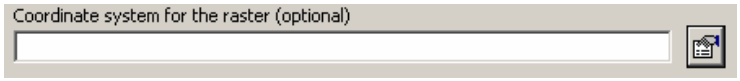


Step 3b.2: Click the *open* icon

Step 3b.3: Select all the ASC files you want to import (use ctrl to select multiple files)

Step 3b.4: Select an output location file path and file name

Step 3b.5: Scroll down and select the Co-ordinate reference system



Click *Select* then open *Projected Coordinate System* → *National Grids*
and select the file *British National Grid.prj*
Click *Ok*

Step 3b.6: Click *Ok* again. After a few seconds / minutes, your DEM is displayed and ready to be used. Note that the unit is metres.

Congratulations! You should now be able to see your DEM.

Section 5: Manipulating your DEM in ArcMAP, and extracting data from it

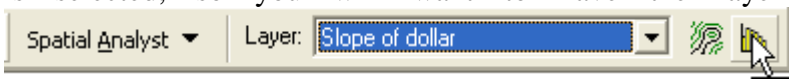
Step 1: You'll need to load some extensions if you want to examine topographic data in any useful way. Go to *tools* → *extensions...* and select the extensions '3D analyst' and 'spatial analyst'

Step 2: If you don't see the toolbars for these two extensions, you can right click on the grey area above the window and select them from a long list of options.

Step 3: Once you have the extensions loaded, you can use spatial analyst to look at a slope map. Click on *Spatial analyst* → *surface analysis* → *slope…* . In the dialog box you can save this as a new map, or you can just have a temporary file. Slope maps really highlight topographic

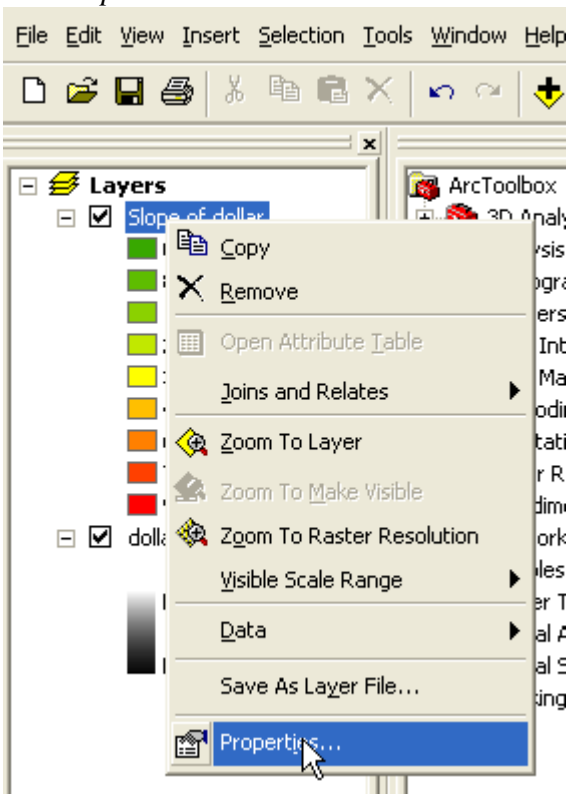
features on landscapes, as you will see. Use the 'percent' option. As you will see later in the course, this is more useful in determining sediment transport.

Step 4: Now you will extract a histogram of the slope data. Just click on the button that looks like a histogram on the Spatial analyst toolbar (note, the histogram will be built from whatever '*Layer*' is selected, so you will want to have the layer selected as the slope layer:

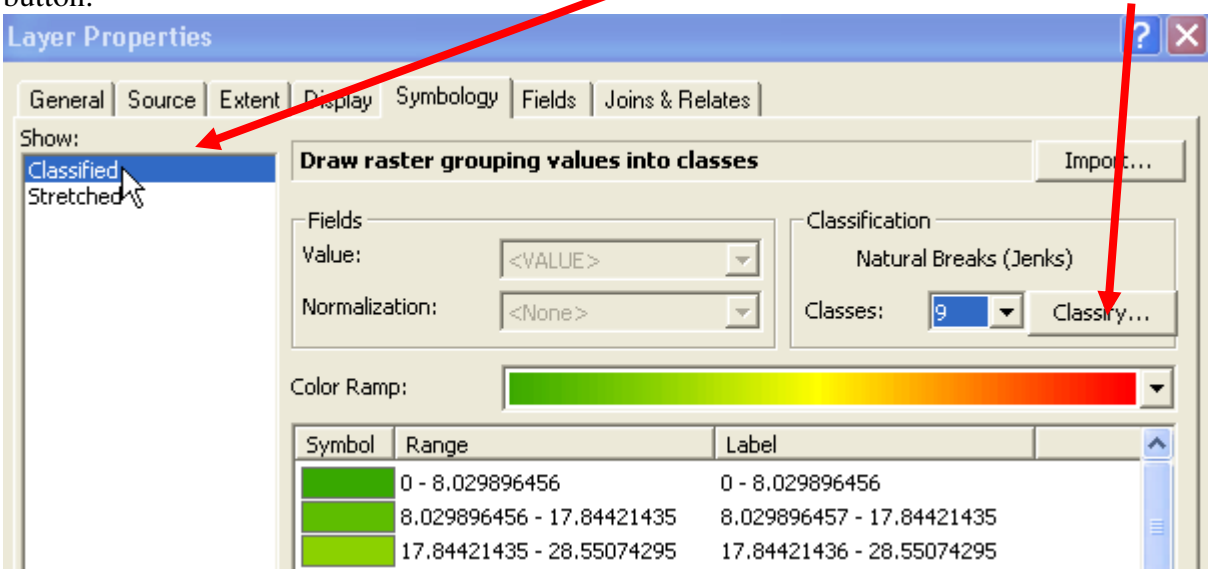


Step 5: You might not like the values on the abscissa (x-axis). The way to change these is:

Step 5a: Right click on the data layer (on the right of the ArcMAP window), and then click on '*Properties*'



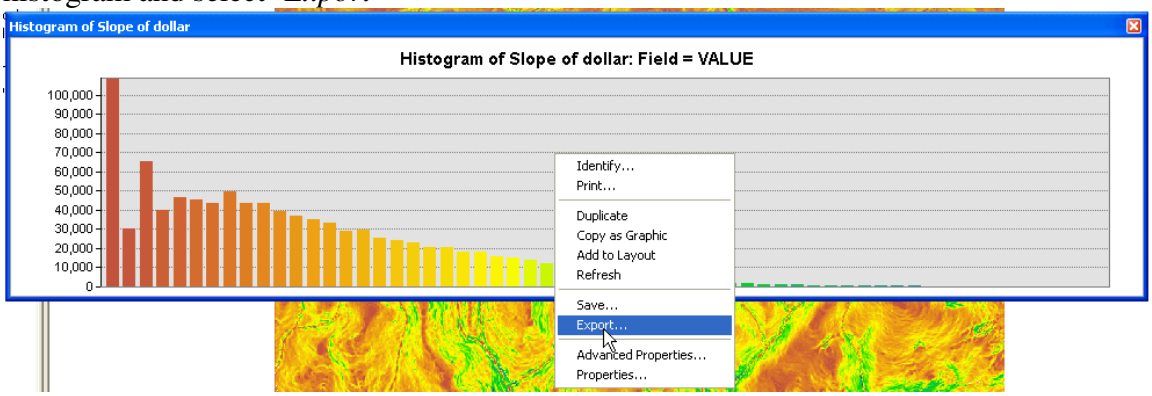
Step 5b: Make sure the layer is selected as 'classified', and then click on the 'Classify' button:



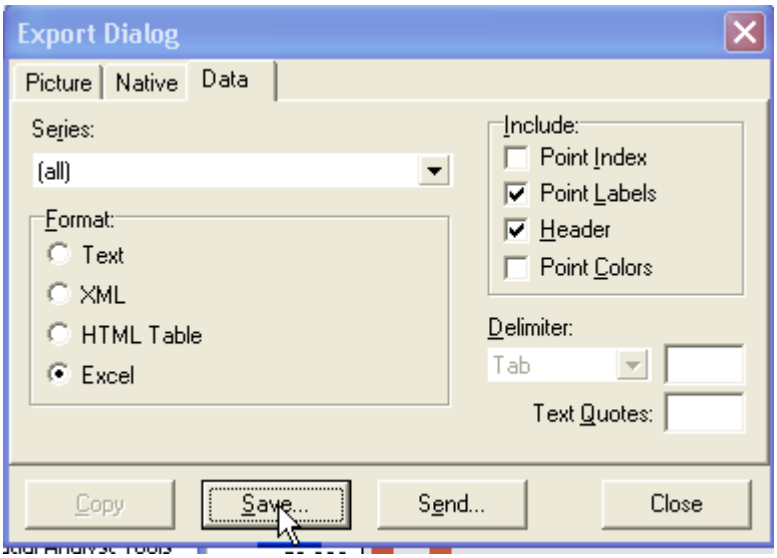
Step 5c: Play with the classification window a bit. In the end, you'll probably want to use the 'defined interval' button. I've found that if you type in the defined interval and hit

'okay' the program sometimes crashes. What you want to do is type in the defined interval and then hit 'enter' on your keyboard.
Step 5d: Once you are satisfied with the spacing of the 'bins' for slope, exit the Layer properties window.

Step 6: Now that we have a histogram, we can extract the data from it. Right click on the histogram and select '*Export*'

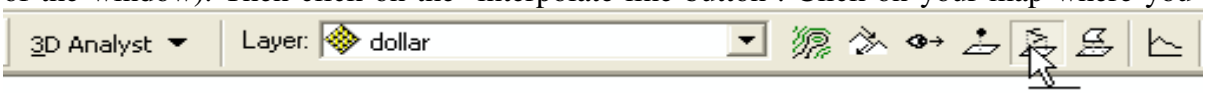


Step 7: Now click on the 'Data' tab, and save as an excel spreadsheet. This window has the annoying habit of not closing after you have saved the file. Once you have clicked on '*Save'*, just close this window and find the .xls file on your M drive. You can play with the data in Excel, by, say comparing different parts of the landscape. At this stage just try to plot the data with a bar graph in excel. You can also make nice figures in ArcMAP that you can export to jpeg or bitmap files….this can be done by right clicking on the Histogram window as before. You might want to spend some time playing with these features.



Step 8: Now we are going to extract curvature, another important property of the landscape. The command to get curvature is in the toolbox, the sample place where you found the too to mosaic the DEMs (**section 4**). Go into the toolbox and click on *Spatial Analyst Tools* → *Surface* → *Curvature.* For input raster select the DEM (not the slope). The default output is just the simple curvature (the change in slope). You can also output the planform curvature and the profile curvature. These are both important in geomorphic studies. Again, you can create some histograms, and export the data into excel.

Step 9: Finally, we will extract a profile using the 3d analyst. Like with spatial analyst, load the extension (*tools* → *extensions*) and get the toolbar (right click on the grey area at the top of the window). Then click on the 'interpolate line button'. Click on your map where you



want your profile to be, and then once you are finished click on the '*Create profile graph'* button (it is two buttons to the right of the '*interpolate line'* button). For reasons we'll go over later, you probably want to create the hillslope profiles along a line of steepest descent. A quick approximation of this would be to create a contour map (*spatial analyst* → *contour*, follow the instructions), and then, by sight, draw a profile that runs perpendicular to the contours. Once you have generated the profile, you can right click on the plot and export the data to excel, as you did with the histograms.

Summary: You now know how to get topographic data and extract some quantitative information from it. Essentially we'd just like you to spend some time exploring the software, but to ensure you spend a minimum amount of time we've assigned some tasks:

Tasks for the exercise:

1) You'll be making some plots and writing a few sentences. Put these into a Word document, and then print them to .pdf using cute .pdf writer (it is on all the schools computers). Upload this document to WebCT by Wednesday 2pm 21st of February.
2) Download data from two parts of Britain (don't Mosaic more than 4 in any one of the two locations. Try to pick places you are somewhat familiar with.
3) Calculate the slopes and curvature for these places, and plot histograms of the data. You will have 4 histograms. I recommend using the profile curvature for these plots.
4) In a few sentences, describe if the difference in the histograms indicates anything about the formation or nature of the landscape. Don't get too complicated, you haven't had lectures on this yet. Just 2-4 sentences on your impressions.
5) Create two profiles, one on a hillslope and one in a channel, and plot them. In a sentence state the difference.
6) The whole exercise should be no more than 2 pages of A4, and you could easily put it all on 1 page. You could also plot the slope maps and topography if you'd like, but even with these plots don't submit more than 2 pages.