GEPL 4500/5500
Lab 2 Working with Erdas' Model Maker

In this lab you will learn how to use the Model Maker in Erdas. It is a very powerful part of the software package. To give you experience using Model Maker, you will calculate NDVI for the summer and fall 2002 images and then make a difference image. You will also convert the DN's to temperature for the thermal channel. For this lab, you will be able to look at the change in NDVI between two images showing when crops were on the fields and then harvested. You will then have the chance to explore the relationship between NDVI and temperature.

Subset Image
Landsat images are very large. First, subset the images to the same size and location.   I would like you to subset to Fulton County with a small buffer around it. Be careful they cover exactly the same area. The bounding box is approximately –84 25 50 W by 41 44 23 N for the Upper Left corner and –83 45 30 W by 41 27 11 N for the Lower Right corner.

First, you must have an area of interest drawn on your image. Open your image in an Erdas viewer by going under File ® Open ® Raster Layer. Utview on GISAG99/drcrms_class/10112002xbc/10112002stacked.img. Open the AOI tool from the viewer menu (AOI → Tools). Choose the box and make the AOI fit the coordinates above.

Once you have selected the area that you would like to cut out, you must go to Data Prep under the Main Menu and click on Subset Image. Choose your 10112002stacked.img as the input file and make sure that you put your output file into the GEPL 5500 directory that you created. Click on "From Inquiry Box to get the coordinates for the subset. Make sure that these are the same values as those in your AOI. Click on OK. When the subsetter is done, open the image in a viewer to inspect it. Repeat the process for 08082002stacked.img. Open it in the same viewer leaving the AOI in place. This will allow you to get the same area for your subset.

Calculate NDVI for the August image

Opening the Modeler
Open the Modeler by left-clicking on the **Modeler** icon in the main menu.
   ® The Spatial Modeler dialog will appear.
   Left-click on **Model Maker** to open a New_Model.
   ® A new model window will open.

Making the Model
Use the Model Maker tool palette to draw the model that you will make. For your first model, calculate an NDVI image from channels 3 and 4 of your August image.   You will need to put one input raster icon and one output raster icon into your model. Also, put a function icon, the circle, in between the input and output object icons. Now, use the

connection arrow to connect the two input raster icons with the function circle and the function circle with the output icon.

The model will have question marks near each of the icons. Fill those question marks in with information to make the model complete.

Double click on the input raster icon. ⑧ The input Raster dialog box will open. Select your image for the file. ** You must specify the input file as a float or it will not calculate a float as your output.** This is a terrible limitation of Erdas.

Double click on the function circle that you put in the model. Once in the function window, click on the Functions arrow and scroll down to Other. Then, click on Float and a basic equation should pop up in the window below. Delete the <arg1…> in the statement.

The equation of NDVI will be = (ch4-ch3)/(ch4+ch3)

The equation that you will use will look like:

FLOAT(($n1_subset(4)-$n1_ subset(3)) / ($n1_ subset(4)+$n1_ subset(3)))

Note, your bands will have different names than these!

You must define the output as a FLOAT or it will produce only 0's and **make sure that you have the correct parentheses**.

Save NDVI in the new image as a float single as the data type. You should call the image something like NDVI_08082002. Make sure that you choose the correct directory to save the file in. Save your model so you can use it again if needed and click the lightning bolt to run your model. Once the model is done running, open the image in a viewer and check the values using Inquire Cursor. If the values are all 0, something is wrong.

1.
   a. Print your graphical model. You must have your graphical model open. From the Model Maker viewer, select **File|Show Page Breaks** ⑧ the model will open showing where the page breaks will be. Your model should fit on one page. If it does not, you can go to **File|Page Setup** to change the magnification of the model. To print, click on **File|Print** and then **OK** or select the printer icon from the menu bar.

   b. Convert the model to text
         Select **Tools|Edit Text Files**
      It will allow you to do conditional branching and looping to repeat a process. Once you have saved a model, it will then be available from the Model Librarian.

Your graphical model must be open.
In the Model Maker Viewer menu, select **Process|Generate Script** ® the Generate Script dialog opens.

Enter the name of your new script. Make sure that you specify the directory that the script is to be saved in. Click **OK** to generate the script. The model will now be available from the Model Librarian option of the Spatial Modeler.

Check to see that this is the case by opening the Model Librarian from the Spatial Modeler menu. The Model Librarian will allow you to edit, run or delete the opened script. If you click on the edit button, the Text Editor will open with the model printed inside. **Do this to view your model. We will not go into the specifics of the modeling language at this time.

2. Calculate NDVI for your the October image.

Repeat the same process described above for the Oct. image. Do not print out the model or the script.

Make a difference image of NDVI using the two images.

In this step, create a model in Model Maker that uses input raster images from the Aug. and Oct. images. Take the difference of the two using subtraction in the function circle. Make sure that you specify the input raster, equation, and output raster as float.

Histograms

Go to **Utility|Layer Info…** in your viewer window. ® The Image Info dialog box will pop up. In the Image Info box, left-click on the histogram looking icon or choose **View|Histogram** from the menu or type **Cntrl-H**. A histogram will appear. The Image Info box will also show the statistics for the layer including min/max, mean, and median.

3.
a.   Print the difference image. Are there spatial differences between the images, i.e. are there parts of the images that always have large/small values?
b.   Make a histogram of the difference image. Print out the histogram for your information to hand in with the lab.
c.   Does the Aug. image have higher NDVI values on average or lower NDVI values on average? Please speculate on the reasons that there are changes in NDVI.

Calibrate channel 6 and convert it to temperature for the 2000 image

Going from DN to temperature is a two-step process. The first step is to use the gain and offset to convert the DN to radiance. This is the same for any channel that you would want to calibrate. You can find the gain and offset in chapater 11 (Data Products) the

Landsat 7 Handbook at:
http://ltpwww.gsfc.nasa.gov/IAS/handbook/handbook_toc.html#. You will have to convert the Lmin and Lmax to the gain (G) and offset (B). Refer to your class notes if you have trouble with this.

$$L = G*DN+B$$

Where L is the radiance in $W\ m^{-2}\ sr^{-1}\ \mu m^{-1}$

Using the equations for channel radiance (gain and offset) develop a model that calibrates channel 6 and saves it as a single float number.

The equation should look something like the following:

$$float(0.xxxxx*\$n1\_subset(1)+y.yyy)$$

Convert the radiance to temperature (K) using:

$$T = K2/(\ln((K1/L)+1$$

Where K1 is 666.09 W/m2 sr-1 μm-1 and K2 is 1282.71 K.

Run the model and check your output to make sure that the numbers make sense (are in K and range from 270-310 or so).

Now, combine your NDVI layer with your calibrated band 6 using the **Stacklayers** function that is under Data Generation listing on the right side of the Function Definition dialog box. The function that you create should look something like the following but the input layers will have different names from the ones in the example.

STACKLAYERS ($n3_memory,$n7_memory)

Extracting values

Now, we will extract temperature and NDVI values from your image and plot them in Excel. First, you will need to create an area of interest (AOI) of some are that you would like to observe. Try to make it at least 100 points. Save the AOI to your directory. Next, on the main menu bar, go to **Utilities® Convert Pixels to Ascii**. Specify your input image and then click on **ADD**. Click on the AOI for Type of Criteria: and enter the name of your AOI here. Then enter the output file. Import the values into Excel by just opening it. You will need to parse the data, Excel steps you through the process.

4.
   a.   Graph temperature vs. NDVI for your area of interest.

b. How do the NDVI and temperature correlate or don't they correlate?
c. What are the causes of changes in the NDVI and temperature relationship?

Hand in 1 a and b, 3 a, b and c and 4 a, b, and c.