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Remote Sensing of the Environment
GEOG/GEOL 4093/5093
Fall Semester 2009
Lab Exercise #2 09/10/2009
Due: 09/17/2009

Part I: Concepts

(1) a. Define refraction? (2)

b. What is the difference between scattering and reflection? (1)

c. Define the terms reflectance, and transmittance? (2)

(2) What kind of scattering (Rayleigh, Mie or Non-selective) would you expect to be the most important when radiation of a given wavelength encounters the given (below) natural or anthropogenic particles? (10)

	Wavelength	O_2 molecules (size 10^{-10} m)	Smoke particles (size 0.3 μm)	Cloud droplets (size 20. μm)	Rain droplets (size 3. mm)
a.	200. nm	_____	_____	_____	_____
b.	0.6 μm	_____	_____	_____	_____
c.	10. μm	_____	_____	_____	_____
d.	1.0 mm	_____	_____	_____	_____
e.	1.0 km	_____	_____	_____	_____

(3) What is the emissivity of a target with an apparent temperature of 20°C, and a true physical temperature of 30°C? (Show your work) (4)

(4) Calculate the orbit time, T_o, and orbital velocity , V_{orbit} for the following satellites, and explain in words why the relationship between altitude, velocity is what it is. Assume the mass of the Earth is 5.9742×10^{24} kilograms (6)

	Satellite	Altitude	Orbital Time	Orbital Velocity
a.	Landsat 5	705 km	_____	_____
b.	SPOT 3	832 km	_____	_____
c.	Landsat 3	920 km	_____	_____
d.	GOES-N	35,786 km	_____	_____

Part II: Introduction to ENVI

Review the ENVI (Environment for Visualizing Images) Classic Quick Start manual. You can access this manual at any time by going to *http://www.ittvis.com/tutorials/support_files/ENVI_Classic_QS.pdf* . You may return to this manual at any time to learn more about the use of ENVI.

Using ENVI

To start ENVI, go to *Start>Programs>RSI ENVI 4.2>ENVI.* Two windows should open, an IDL window (minimized) and the ENVI Main Menu (see Fig.1 below). You will not be using IDL during this session (DO NOT CLOSE) this window.

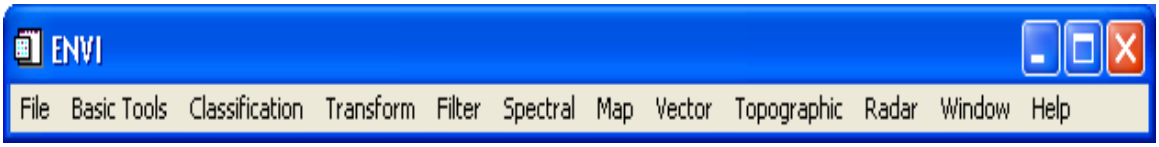

Figure 1: ENVI Main Menu.

From the ENVI Main Menu, choose *File>Open Image File*. A dialog box appears asking you to *Enter Data Filenames*. From the *Look in:* pull-down menu choose the "*C:*" drive. Below, in the file selection area, navigate to *RSI\IDL62\Products\\Envi42\data*. Select the file "*can_tmr.img*" and click *OK*.

A dialog appears titled *Available Bands List*. Choose *TM Band 4* and click *Load Band*. A group of windows will appear with different views of your image. This group of windows is known as the "Display Group" and consists of:

(1) *Main Display Window*: this is where all or part of your image is displayed at full resolution,

(2) *Scroll Window*: if your image does not fit in the Main Window, the Scroll Window will appear. The scroll window displays a reduced-size version of the entire image, which allows you to select the portion that is displayed in the Main Window. A colored box in the Scroll Window indicates the spatial location and coverage of the full-resolution Main Display Window. A number in the title bar tells you what reduction factor has been applied,

(3) *Zoom Window*: displays an enlarged version of a selected portion of the Main Window. A colored box in the Main Display Window indicates the spatial location and coverage of the Zoom Window. A number in the title bar tells you what zoom factor has been applied.

Experiment with these three windows, changing the coverage in each display.

Part III: Basic image display and navigation

Launch Internet Explorer and type *\\nyx\rs4093* into address bar and hit enter, that takes you to the remote sensing class folder "*rs4093*" in CIRES server. Copy the folder "*Lab_2*" to "*C:*" drive.

Launch ENVI. From the ENVI Main Menu, choose *File > Open Image File*. A dialog box appears asking you to *Enter Data Filenames*. From the *Look in:* pull-down menu choose the "*C:*" drive. Below, in the file selection area, navigate to "*Lab_2*". Select the file "*po_38132_blu_0000000.tif*" and click *OK*.

A dialog appears titled *Available Bands List*. Choose *Band 1* and click *Load Band*. You should now be looking at the northeast corner of a 5m-resolution Ikonos image of Boulder. You may wish to make the *Main Display Window* larger by dragging the bottom left corner out.

In the *Scroll Window*, navigate toward the center of the image. Try to center the *Main Display Window* on Folsom Field (the bright white U on campus). In the *Main Display Window*, click on the center of Folsom Field to center the *Zoom Window* on it. We will now find the coordinates for the stadium.

In the *ENVI Main Menu* select *Window > Cursor Location/Value*. A window should appear which displays information for the pixel that your cursor is over. This information includes the sample (x-location), line (y-location), screen (the brightness it is displayed at), and the data (the raw data value). The satellite image has been geo-

referenced to the UTM coordinate system (zone 13). Often in remote sensing we utilize the UTM coordinate system that gives geographic positions in meters easting and meters northing. Giving positions in meters is often more convenient than in degrees, minutes and seconds of latitude and longitude.

I. In the *Zoom Window*, position your cursor over the center of the stadium. Record the UTM coordinates: (3)

_____ m Easting _____ m Northing

II. Next, using the *Scroll Window*, navigate to the vicinity of your home or apartment. If you do not live in Boulder, choose a friend's house or business that you frequent. Using the techniques outlined above, record the location in UTM coordinates: (2)

_____ m Easting _____ m Northing