EE/GP140 - Homework Set No 6 **Handout 30**

Due: Friday, Feb. 22, in class, to TA, or box outside my office

1. You wish to monitor the percent coverage of the arctic ocean by sea ice.
   What characteristics of ice and water make it possible to make this
   measurement using thermal infrared images?

   What band of TM would be used for this measurement?

   Suppose you had available a <u>microwave radiometer</u> that could make a very
   similar temperature measurement of the surface to that made by TM, but
   using microwave wavelengths at about 1 cm - λ. What advantages would
   this scheme have relative to the optical instrumentation?

2. Ocean Chlorophyll:
   Why doesn't ocean-borne phytoplankton exhibit the same high IR
   reflectance peak in its spectrum as observed from space that we associate
   with land plants?

3. You are using TM images to study deforestation in the Amazon basin. You
   calculate NDVI from TM bands 4 and 2 according to the formula

   $$\frac{band4 - band2}{band4 + band2}$$

   You examine several areas in your image and make the following table:

Landform	Band 2	Band 4	NDVI
Bare Soil	50	100	
Partial Regrowth Area	60	140	
Pristine Forest	65	200	

   (a) Fill in the NDVI values in the table.

   (b) You want to classify the image to identify each of these three classes
       of terrain. To use a density-slice approach, what threshold values
       could you choose on the NDVI scale to separate these three classes?

(c) Suppose you were examining an area in which a great deal of slash and burn activity is present. Could this affect the accuracy of your classification? Why? (Hint: active burning of the fields is in progress when you acquire your images.)

4. Estimate how many TM images (each 100×100 km) are needed to cover the Amazon basin, if it is about $5 \times 10^6 \text{km}^2$ in area.

   How many 30×30 m pixels does this corresponds to?

   If we keep all 7 TM bands as one byte each for a total of 7 bytes/pixel, how many 600 Mbyte CD-ROM's are needed to store all the data?

5. You want to monitor the fragmentation as well as total deforestation for a large tropical forest. Suppose you use a set of TM images and a density slice procedure to identify clear-cut areas. Devise a measure, based on the image of clear-cuts, that is representative of fragmentation. That is, come up with a quantitative value that is large if fragmentation is great, and small if there is little fragmentation of ecosystems.

6. Download and open the files hw6prob6.1000.lhh, hw6prob.1000.lhv, and hw6prob6.1000.chv from the web page. Each of these is of an area in Thailand at the indicated polarization, and the line length in each is 1000 pixels.

   (a) Using matlab, combine the three files into an rgb image where red id lhh, green is lhv, and blue is chv.

   (b) Create an ndvi-style image to estimate vegetation density using the appropriate combination of available images, and display. Print and/or submit electronically, and indicate in your writeup the most likely areas with densest forest.