Remote Sensing (C)
Nebraska Science Olympiad
Regional Competition
Henry Doorly Zoo
Saturday, February 25th 2012
120 points total (10 pts each).
Show all mathematical operations using significant figures and proper units. Answer all questions with complete sentences unless noted.

1) In Figure 1 there are three examples of changing coast line. What changes are occurring in each of the boxes? What are some possible causes of these changes?

**Box 1– accretion or deposition of sediments**
**Box 2 – erosion of sediments**
**Box 3 – both accretion and erosion**

**Several acceptable answers, but the best answer is related to wave action and deposition of transported sediments by the river to the ocean.**

2) Using Figure 2, when is the ocean the warmest to swim in the Atlantic Ocean? Does this hold true farther off the coast where the ocean depth reaches 600 ft.? Why is this the case?

**October is the warmest for both cases (look at the maximum values of the legends, colors from both maps DO NOT MATCH). It is warmer because more heat is trapped in the ocean from the summer and fall months due to higher solar angles. During the winter, there is less direct light hitting the ocean in the N. Hemisphere, thus lower temperatures. Also acceptable is the description of deep sea currents**

3) Figure 3 shows the trend of $CO_2$. What are some possible causes of the differences in oscillations between latitudes?

**A wide range of acceptable answers are valid here. As long as an attempt to make a plausible answer is made they will receive credit.**

4) How does the $CO_2$ distribution change throughout the day in Figure 4? What are the likely sources of change documented in this figure?

**$CO_2$ increases throughout the day, with the highest increases over LA. While the power plants are indicated on the map and likely contribute some of the increase, a majority of the increase comes from burning other fossil fuels for transportation (e.g. cars/trucks, etc.)**

5) Phytoplankton causes the reflectance of clear water to decrease in the visible region (Figure 5). Why?

**Pigments in the phytoplankton absorb some of the light for photosynthesis. Naming these pigments and/or chloroplasts improved the score on this question.**

6) The Red Edge NDVI is defined as

(NIR-Red Edge)/(NIR + Red Red Edge)

Where the Red Edge is the region in the electromagnetic spectrum that is in between Red and NIR. Using Figure 5, explain why the Red Edge region might be better than red reflectance for healthy vegetation.

**Red edge values are higher than Red values. Thus the difference between NIR and Red Edge is less than NIR and Red. This is a poorly worded question and the knowledge needed to answer this question is above that what is really expected in this event.**

7) Using the equation in question 6 and Figure 5, determine the value of Red Edge NDVI for health vegetation and soil. Be sure to show your work. (Full sentences are not required for this question. Part of this question will be used as a tie breaker)

**Vegetation: NIR~= 40, RE ~=25 (40-25)/(40+25) = 15/65 = 0.23**

**Soil: NIR~= 35, RE ~=25 (35-25)/(35+25) = 10/60 = 0.17**

8) What is the distribution of Total Suspended Sediments (TSS) in Chesapeake Bay on June 30$^{th}$ 2006 (Figure 6)? Provide an explanation on why this distribution is occurring on this particular date.

**TSS is highest around the costal edges of the bay (primarily on the NE side). This was caused by a rain event cause soil to be eroded into the bay. Not snow (it is June 30$^{th}$, which is AFTER the summer's solstice).**

9) Upon examining Figure 7, which (left or right) image is likely before hurricane Katrina hit the Mississippi River Delta? Explain how remote sensing scientists can take these two images and create a land cover change

**Right (more wetlands/pink area). By examining the changes between the two maps (using conditional statements) one can isolate areas that changed. A more technical description yielded more points.**

10) Percent vegetation cover is a measure of vegetation biomass. Explain how it is determined and some limitations in using this metric.

**% Veg is calculated as the % of ground area covered by vegetation. While this is gives an indication of biomass, at high values of biomass, LAI, etc., % vegetation does not change due to layers within the canopy.**

11) Name at least one NASA EOS satellite sensor and describe its spectral characteristics. (Additional satellite sensors will be used as a tie-breaker)

**A large range of answers are valid here. For example MODIS Aqua with 19 spectral bands. More detailed description of the spectral bands yielded more points.**

12) What is remote sensing? Can remote sensing be conducted using hand-held equipment? Why or why not?

**Remote sensing is the monitoring of an object without 'touching' it. Yes it can be done since it is still 'remote' if there is no physical contact required (photographs are 'remote sensing').**