KEY

Remote Sensing (C)

Nebraska Science Olympiad
Nebraska State Competition
University of Nebraska-Lincoln
Saturday, April 21st 2012
100 points total

Show all mathematical operations using significant figures and proper units. Answer all questions with complete sentences unless noted.

1) What are some advantages/disadvantages to using a remote sensing based system (e.g. Figure 1a) verses a system of point measurements (e.g. Figure 1b).

Multiple Answers which include:

Adv: More spatial information. Costs usually cheaper (4pts)

Dis: Accuracy based on ground truth models (4pts)

2) The Gravity Recovery and Climate Experiment (GRACE) mission has provided a better estimation of the actually measured ocean currents (Figure 1) compared to the original models based on previous estimates of the Earth's geoid (Figure 2). Why are good estimates of geoids critical to predicting ocean currents? Identify at least one area that remains the same and one that differs between Figure 1a and Figure 2. Label the two points accordingly. Provide a description of how they are the same/different

Geoids represent the shape of the earth in terms of density. Since the density of water is heavily influence by sea temperature, the water flow/currents are based on changes in density. (4 pts)

Description (2pts)

Labeling (2pts)

3) The greenhouse gas CO_2 receives more press than other common greenhouse gases. Why? Compare CO_2 to these other greenhouse gases in your explanation.

Wide range of answers are acceptable.

Why CO2 press must be justifiable (2pts) if mentioning that is the easiest to control human outputs (2pts)

Comparison of other greenhouse gases (4 pts)

KEY

4) What is the distribution of chlorophyll *a* (Chl) in Asov Sea on May 22nd 2009 (Figure 3)? What are some possible reasons the image does not have a smooth gradient outside of the north eastern portion of the map?

Chl is higher in the NE corner of the ASOV sea (3 pts) If they claim it his high in the center of the sea (1pt)

Justifiable response to scattering (2pts). The roughness is caused to noise (2pts)

5) Why do lakes, rivers, streams, etc. have near zero reflectance > 0.8 µm (Figure 4)? How does this lack of reflectance in the NIR range affect vegetation indices like the Normalized Difference Vegetation Index?

Water absorbs most light > 0.8 µm (3pts)

NDVI becomes negative (3pts)

Mention of any additional VI (2pts)

6) Using Figure 5, describe and compare the changes in glacial fields over time. What are some factors that may cause these changes?

Description of both fields including both growth and decrease (2pts)

Comparison between fields (2pts)

Rational for changes: If only 'climate change/temperature' (1pt). Description of changes in weather patterns (e.g. snowfall, etc.) (3pts)

7) From Figure 6, calculate the % loss of mangrove cover in the image between 1985 and 2010. Which time period indicated had the greatest loss per year? (Part of this question will be used as a tie-breaker).

Total = 1219.4+59.9+32.2+381.1 = 1692.6
Total Loss = 59.9+32.2+381.1 = 473.2
100-[(1692.6-473.2)/1692.6*100]=72.0% (5pts)

59.9/10 = 5.99 ha/yr
32.2/8 = 4.03 ha/yr
381.1/7 = 54.4 ha/yr 1985-1992 (5pts)

KEY

8) Figure 6 shows changes in a mangrove forest, specifically fragmentation of the original forest. How does fragmentation change the forest edge? What are the implications of changing the forest edge on other species?

Fragmentations increases the forest edge. (4pts)

Discussion of both positive and negative effects of increasing forest edge (4pts)

9) In Figure 7, which image was taken before the tsunami (Top/Bottom)? What are some of the clues used to come to this conclusion? The tsunami took place in March; however, the other image was collected in August. Can one accurately compare images taken on different dates? If not, why? If so, how much time must pass between the images that one cannot make a comparison? Why?

Top (2pts)

Clues: Standing water, reduced 'Red' color (2pts)

Compare: Yes (1pt)

Time: Varies based on the types of events of change. (2pts)
Seasonal (1pt)

10) Many archeological remote sensing studies use vegetation indices (e.g. Figure 8). Why would these scientists be interested in looking at vegetation, when their target areas of interest are man-made structures? Also, why would are some vegetation indices used to identify water?

Mask vegetation to make other points of interest stand out (4pts)

VIs like NDVI have very different values for water (4pts)

11) Using Figure 9, when can you estimate that the leak from Horizon oil well was plugged? Why did you select this date? Did the oil plume expand in the same direction throughout the oil spill? Why or why not?

~80 days (7/11) into the spill although a wide window was acceptable. (3pts)

Direction: No (1 pt)

Explanation why (4pts)

KEY

12) Estimate the percent change in area of the Aral Sea (Figure 10) between 1989 and 2003, and 1989 and 2009. Which time period is this rate of change faster? (Part of this question will be used as a tie-breaker).

Necessary to make a grid or ruler measurements.
Original measurements (2pts)
Calculation of % change (6pts) ~58%, ~92% A wide range was accepted.
Rate (2pts) 2003-1989 is faster