Science Olympiad Division C
Fayetteville Manlius Invitational
December 17th, 2016

Remote Sensing Written Exam

Name: _____ Team #: ___
Team Members: _____

Score: ___/73

Part 1- Match the following Remote Sensing terms to their descriptions. (10 pts.)

___ 1. Nadir
___ 2. Albedo
___ 3. Diffraction
___ 4. Refraction
___ 5. Spatial Resolution
___ 6. Temporal Resolution
___ 7. Radiometric Resolution
___ 8. Panchromatic
___ 9. Specular Reflection
___ 10.Diffuse Reflection

a. Produces black and white images
b. Energy is deflected in a single direction
c. Ability to discriminate small differences in energy
d. Time between two images of the same area
e. Bending radiation around a corner/boundary
f. Bending of radiation through a medium
g. Reflectivity of a surface
h. Describes the area on the Earth represented by a pixel
i. Energy is reflected in all directions
j. Point on Earth's surface in line with the RS system and the
   center of the Earth

Part 2- Ride the A-Train! (16 points)

_____ 1   .   At what altitude do the A-Train satellites orbit Earth?
_____ 2.   What's the orbital inclination of the A-Train Satellites?
_____ 3.   What time each day do they begin to cross the equator?   .
_____ 4.   This NASA satellite studies Earth's precipitation and evaporation by using
    the AMSR-E, the MODIS, and 4 other instruments(!)?
_____ 5.   Which place in the A-Train order is this satellite?
_____ 6.   This Canadian Space Agency and NASA satellite uses infrared and
    LIDAR to measure aerosols and clouds.
_____ 7.   Which place in the A-Train order is this satellite?
_____ 8.   A JAXA sat. that carries the Advanced Microwave Scanning
    Radiometer-2 that measures earth's water cycle.
_____ 9.   Which place in the A-Train order is this satellite?
_____ 10.   This NASA satellite was launched with another satellite in 2006, and is
    equipped with the CPR, a 94-Ghz nadir looking Radar developed by JPL.
_____ 11.   Which place in the A-Train order is this satellite?
_____ 12.   This replacement satellite, that measures in 3 spectral bands, has the
    name of the chemical structure of the thing that it measures.
_____ 13.   Which place in the A-Train order is this satellite?
_____ 14.   This satellite measures air quality, ozone, and the climate with the TES,
    the OMI, and the MLS. It is the 3rd component of the EOS.
_____ 15.   Which place in the A-Train order is this satellite?
_____ 16.   This French satellite has dropped out of the A-Train exactly 9 years after
    it was launched into space.

Part 3- Satellite History (8 points)

_____ 1.   This French built system for observing the Earth currently has 2 active Satellites (the 6th and 7th). With the civil/military Pleiades system they form a 2x2 constellation.

_____ 2.   The first Earth-orbiting satellite designed for remote sensing of the Earth's oceans. Launched in 1978, it lasted for 106 days, (until it was discovered that data from the program could be used to identify US submarines, and a "power failure" occurred.)

_____ 3.   Japan's first earth observation satellite launched in 1987. It had Multi-Spectral Electronic Self-Scanning Radiometer (MESSR) 50m resolution over 2 100 km swathes

_____ 4.   Run by United States' National Environmental Satellite, Data, and Information Service (NESDIS). It supports weather forecasting, storm tracking, and meteorology research. Currently three geostationary satellites: 13, 14, and 15 are in operational use.

_____ 5.   The flagship of the EOS, launched in 1999 it has completed 87867 revolutions of its namesake. Five remote sensors.to monitor the environment and climate.

_____ 6.   Launched in 1997, it monitored chlorophyll-a concentration and water clarity, until 2010. Able to tilt 20 degrees to avoid sunlight from the sea surface.

_____ 7.   Oldest program of satellite imagery of Earth, launched in 1972. Sats 6 and 7 still operate. Seven has eight spectral bands with spatial resolutions from 15 to 60 meters.

_____ 8.   The US$424 million satellite was lost on March 4, 2011, when a second Taurus XL carrier rocket malfunctioned, destroying its second satellite in 2 years.

Part 4- Multiple Choice. Choose the BEST answer. (12 points)
_____ 1. In aerial photos, the phenomena used to create depth is:
a. Stereoscopic effect   b. Parallax effect   c. Photosynthetic effect   d. 3D effect

_____ 2. Remote sensing can not measure which of the following?
a. Ocean floor topography   b. Water temperature c. Wind speed and direction   d. None of the above

_____ 3. All of the planet's weather takes place in the
a. Troposphere   b. Mesosphere   c. Stratosphere   d. Ionosphere

_____ 4. Remote Sensing unofficially started in _____ when pictures were taken from hot air balloons
a. United States   b. France   c. England   d. China

_____ 5. Which of the following is not monitoring the atmosphere as part of EOS?
a. ICESat   b. Terra   c. ROCSat   d. SORCE

_____ 6. If a satellite-based pushbroom sensor has a row of 5,000 CCD cells aligned perpendicular to the satellite's motion, and the swath width is 600 kilometers, what is the ground sampling distance (spatial resolution)?
a. 120 kilometers   b. 30 meters   c. 120 meters   d. 1.2 meters

_____ 7. What range of colors are used is for the sensing, representation, and display of images in modern electronic systems and photography.
a. cyan, magenta, yellow   b. red, green, blue   c. cyan, green, yellow
d. cyan, magenta, yellow, black   e. red, green, yellow

_____ 8. Glaciers need fresh snow to survive because the snow
a. Feeds them with fresh ice   b. Provides a protective shield against the sunlight
c. Insulates them from the warmer air   d. All of the above   e. None of the above

_____ 9. The size and number of detector elements in a CCD determine the device's:
a. Wavelength   b. Frequency   c. Resolution   d. All of the above

_____ 10. Which of the following type of waves have the longest wavelength?
a. X-rays   b. hertzian waves   c.gamma waves   d. radio waves
e. near infrared waves

_____ 11.What is remote sensing?
a. Ability to gather information about a distant or unseen target using paranormal means or extrasensory perception
b. Small or large-scale acquisition of information of an object or phenomenon not in physical or intimate contact
c. Electrical impedance measuring technique that uses separate pairs of current-carrying and voltage sensing electrodes to make more accurate measurements
d. Allowing graphical applications to be run remotely on a server, while being displayed locally
e. Any system that captures, stores, analyzes, manages, and presents data that are linked to location.

_____ 12. What color does living vegetation appear as on false-color IR images?
a. green   b. red   c. black   d. blue   e. yellow

Part 5- Image Interpretation   (27 points)

_____   1. In figure 1, what is area of this image in square kilometers?
           (3 points each, show work and units)

_____   2. In figure 1, what is the length of the golf hole fairway running directly next to
               Troop K Rd in meters? (3 points each, show work and units)

_____   3. What is the area of the Stickley furniture factory, the large building on the right
               side of figure 1 in square meters? (3 points each, show work and units)

_____   4. What type of image is figure 1? (1 point)
_____   5. In what season was this image captured? (1 point)

6. In Figure 2, what would cause to streams to appear darker in the November photo on the right based on the timing of this photo? (2 points- use complete sentences)

August 2012   After Sandy: November 2012

7. What would make the edges of the inland waterways more defined in the November photo on the right? (2 points- use complete sentences)
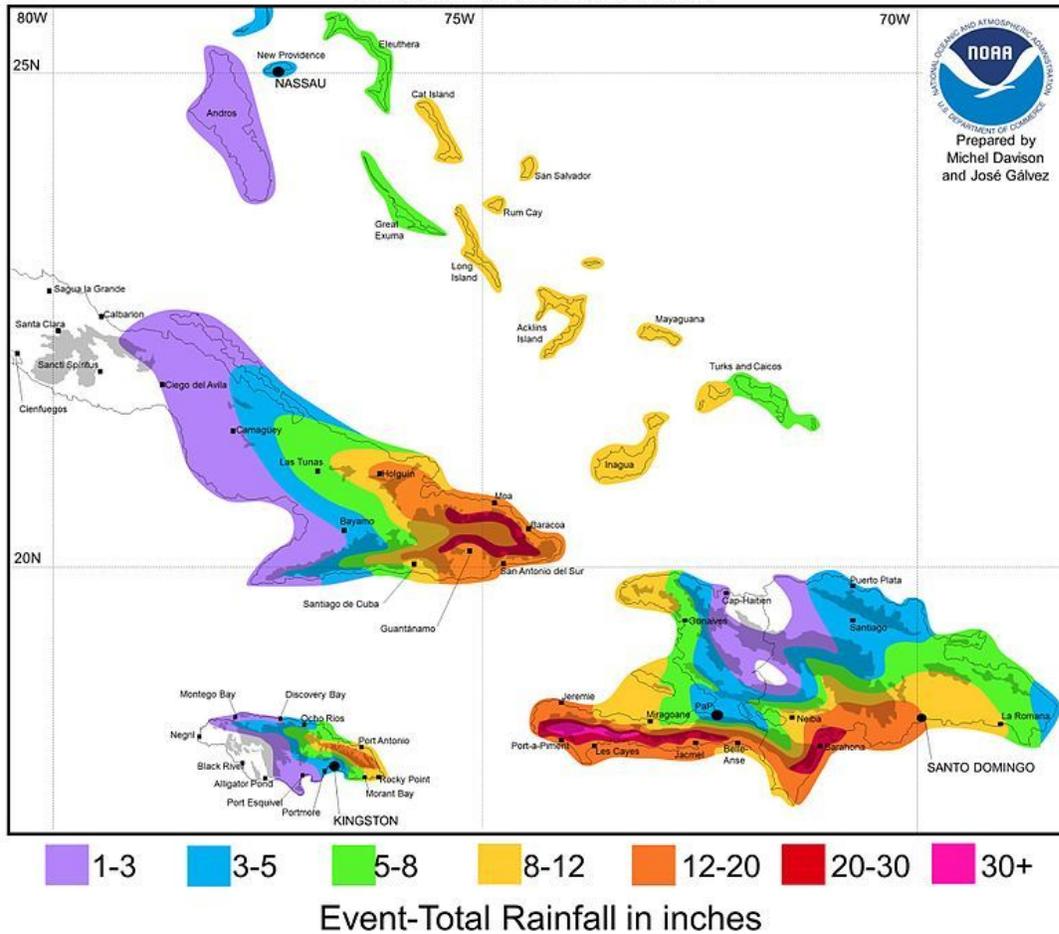
8. What is the cause of the dark markings on the tan colored patches of land next to the ocean, in the November photo on the right? [1 point complete sentences, 1 point reasonable answer]

Hurricane Matthew Event-Total Rainfall Projection
## WPC Tropical Desk Perspective
Generated Oct. 02 2016 15:30UTC

Event-Total Rainfall in inches: 1-3, 3-5, 5-8, 8-12, 12-20, 20-30, 30+

9. What is the area of Jamaica on this map if a degree of latitude is 111 km. The one degree of longitude is simply the cosine of your longitude times this 111 km? [3 points, Show reasoning and calculations with units]

10. What was the average event-total rainfall in Jamaica after Hurricane Matthew? [2 points, use complete sentences describing your reasoning and assumptions]

11. How many litres of water fell on Jamaica during Hurricane Matthew? [3 points, Show reasoning and calculations with units, scientific notation is acceptable]
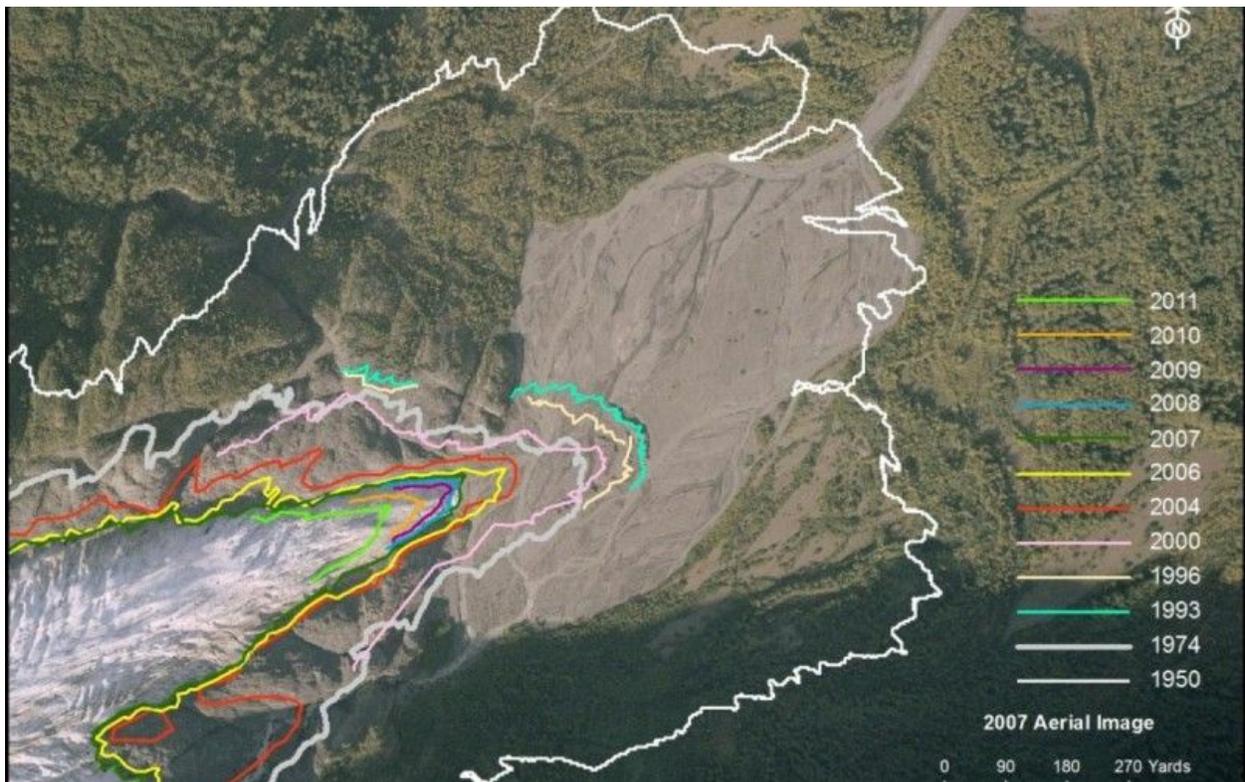
12. During which year did the greatest loss in Glacier ice occur?

13. Which direction does the glacial icemelt flow?