NATS 1750 A (Fall 2017): Assignment 1, Version 1.0 - September 14, 2017

Due: October 15, 2017 by 11 pm EDT via Moodle

(Late Penalty: 25% per day - including weekends. Strictly enforced.)

Instructions:

- You are expected to provide answers for *every* question. You are encouraged to show all of your work so that marks can be awarded for partially correct answers.
- Although you are encouraged to collaborate with your classmates, each of you is expected to submit a separate and distinct assignment - a point that will require acknowledgement upon submission.

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1. **The Hypsometric Curve and a 2017 Atlantic Hurricane.**

    a. Obtain a credible, journalistic account of coastal flooding caused by a 2017 Atlantic Hurricane storm surge at a **specific, geographic location**. The account you obtain ***must*** include a quantitative estimate of the flooding. Cite the specific, geographic location and the source for the account you obtained.
    *(Note: The markers **must** be able to validate your source.)*
    b. Provide an elevation estimate (relative to MSL) for your specific, geographic location. Include a citation for the source of this elevation estimate.
    c. Using just your elevation estimate (your answer 1(b) above), indicate your specific, geographic location on an annotated version of the **Coastal Hypsographic Curve** available here. (Note that this curve is an enlarged representation of the course textbook's hypsometric curve, namely Figure 2.7 of Marshak.)
    d. On the same annotated version of the Coastal Hypsographic Curve (your answer 1(c) above), indicate the extent of flooding at the specific, geographic location identified through the journalistic account you obtained (your answer 1(a) above).
    e. Suppose now that this extent of flooding represents a global change in relative sea level, instead of just flooding at a specific, geographic location.
        i. Estimate the affected land area in km^2.
        ii. Estimate the percentage loss of land area in km^2. (Note: Assume that the total surface of the planet is 510,082,000 sq. km.)

f. Geggel identifies various factors that affect the height of the storm surge. For the specific, geographic location identified through the journalistic account you obtained (your answer 1(a) above), *attempt* to extract statements that suggest how each of the following factors might have affected storm surge:
    i. The slope of the adjacent Continental Shelf. (Note that the map here or Google Earth might be of use in this context.) Why *doesn't* the Continental Shelf appear in the histogram of elevation groupings?
    ii. Changes in the hurricane's intensity.
    iii. The forward speed of the hurricane.
    iv. The radius of hurricane.
    v. The angle with which the hurricane approached the coast.
    vi. The coastline's unique landscape.
    vii. Storm tides - i.e., when an enormous tide combines with a storm surge.
g. Create a process flow diagram that includes:
    i. The source of the storm surge.
    ii. At least three sinks for the storm surge - and the associated processes.

2. The Hawaiian Islands and the Pacific Plate

a. Using a map (e.g., Google Maps or Google Earth), measure the distance in km from the center of the big island of Hawaii to the center of the island of Kauai to the northwest. The age of the island of Kauai is 5.1 million years. The hotspot is underneath the big island of Hawaii; therefore, use the distance you measured and the age of the island of Kauai to determine the rate of movement of the Pacific Plate over the Hawaiian hotspot in cm/yr.
b. The island of Lanai in the Hawaiian Island chain is 1.28 million years. Measure the distance from the center of the big island of Hawaii to Lanai to determine the rate of movement of the Pacific Plate between the Hawaiian hotspot and Lanai in cm/yr.
c. Based on the rates of movement that you calculated above, has the Pacific Plate rate of movement (i.e. speed) increased, decreased, or stayed the same from the past to the more recent? Explain how you determined your answer.
d. Based on Rubin's representations of age-distance data, a distinct trend emerges.
    i. Describe this trend in your own words. Ensure your statements are factual and supported by making reference to quantitative data.
    ii. Suppose a newly discovered Hawaiian island or seamount has an estimated age of 15.5 Ma. Estimate its distance in km from Kilauea.
    iii. Suppose a newly discovered Hawaiian island or seamount is located at a distance of 5320 km from Kilauea. Estimate its age in Ma.
e. Suppose you are in charge of locating a geothermal plant on one of the Hawaiian Islands. On which island is it logical to find an excellent source of geothermal energy?

Resources

Please refer to the Library Resources: Course Guide for instructions on citing sources; although APA is the default format, you may make use of any format - as long as you are consistent.

Eakins, B.W. & G.F. Sharman. Hypsographic Curve of Earth's Surface from ETOPO1, NOAA National Geophysical Data Center, Boulder, CO, 2012. Visited online on October 10, 2016, at https://www.ngdc.noaa.gov/mgg/global/etopo1_surface_histogram.html.

Geggel, L. Hurricane Matthew: Why Are Storm Surges So Deadly? Live Science. October 7, 2016. Visited online on October 10, 2016, at http://www.livescience.com/56424-hurricane-matthew-storm-surges.html.

Lumb, I. “A Process-Flow Diagram for Burning Wood”. Published on September 17, 2014. Youtube video available online at https://youtu.be/75PuNVpAfLQ.

Marshak, S. **Earth: Portrait of a Planet 5/e.** W.W. Norton Publisher. February 2015.

National Oceanic and Atmospheric Administration, National Hurricane Center. Storm Surge Overview. Visited online on October 10, 2016, at http://www.nhc.noaa.gov/surge/.

Rubin, K., Hawaii Center for Volcanology. The Formation of the Hawaiian Islands. Visited online on October 12, 2016, at http://www.soest.hawaii.edu/GG/HCV/haw_formation.html.

United States Geological Survey. The long trail of the Hawaiian hotspot. Visited online on October 12, 2016, at http://pubs.usgs.gov/gip/dynamic/Hawaiian.html.

United States Geological Survey. Hawaiian Volcanoes. Visited online on October 12, 2016, at http://hvo.wr.usgs.gov/volcanoes/.

Wenner, J. M. & E. M. Baer. How do I read the hypsometric curve? The Math You Need, When You Need It: Math tutorials for students in introductory geosciences. Visited online on October 10, 2016, at http://serc.carleton.edu/mathyouneed/hypsometric/index.html.

