EOSC 114 Homework: Landslides

Instructions:

1. Skim all the questions to find out what to expect
2. Some references are long so we will point you to specific sections of those readings. Links to the articles will be provided within the worksheet.
3. Complete the worksheet during or after reading the articles.
4. THEN, after you have completed the worksheet, go online to our course website to submit your work.
    a. Time available for online submission is limited. Do the reading and worksheet BEFORE going online.
    b. Online questions are automatically gradable versions of SOME of these worksheet questions.
    c. Each student will get a different sub-set of these questions.
5. Important notes
    a. Re**garding older versions of eosc114 exercises**: This homework exercise AND its online data entry questions are different from earlier versions of eosc114 homework.
    b. THE MOST COMMON ERROR is not reading ONLINE questions carefully. Their order may differ from the work-sheet, answer options are randomized, AND each student gets a different **subset** of questions. Please work online carefully, with your worksheet beside you.
    c. Working with colleagues on homework is OK, but copying the work of others is cheating and will not help you succeed. See the Code of Conduct on our course's Canvas website and UBC's strict rules regarding academic integrity at http://www.calendar.ubc.ca/vancouver/?tree=3,54,111,959.
    d. Note there may be one or more questions about this assignment in future tests, quizzes, or exams.
    e. Questions have checkboxes instead of numbers to avoid confusion with different numbering online.
    f. Please recall this course has 1st year students in non-science disciplines, 4th year science students, and everyone in between. Some tasks may seem "easy" for some students but will be challenging for others.

Links:

These are links to articles/reports to answer the questions:

https://climate.nasa.gov/news/2951/climate-change-could-trigger-more-landslides-in-high-mountain-asia/

https://eos.org/features/a-slippery-slope-could-climate-change-lead-to-more-landslides

https://assets.lloyds.com/media/b9e21148-cb11-46b4-82f5-75c4bd2adcf7/Landslide%20Report%20May%202011%2029%20Nov%20combined.pdf

Questions:

PART 1: Follow this link: https://eos.org/features/a-slippery-slope-could-climate-change-lead-to-more-landslides Read the entire article carefully before answering the following questions.

Read the first four paragraphs AND section: A Climate Connection. Based on this, please answer the following questions.

- How many days did the Grizzly Creek Fire cause a shut down of major interstate through the Rocky Mountains? *Enter your answer as a NUMBER without words or units*.
- After the Grizzly Creek Fire, how long did it take for rocks to start falling down slopes?
    - Hours
    - Days
    - Months
    - Years
    - decades

- What does Santi NOT say about the importance of tree roots or slope stability?
    - Removing tree roots causes slope instability
    - Tree roots hold rocks in place
    - Tree roots are removed during forest fires
    - Slope instability can cause movement of particles
- After the Grizzly Creek Fire, how long does Santi say we see increased risk of debris flows?
    - Hours
    - Days
    - Months
    - Years
    - Decades
- How many people were killed by debris flows after the 2018 wildfires near Montecito, California? *Enter your answer as a NUMBER without words or units*.
- How many people were injured by debris flows after the 2018 wildfires near Montecito, California? *Enter your answer as a NUMBER without words or units*.
- How many homes were damaged by debris flows after the 2018 wildfires near Montecito, California? *Enter your answer as a NUMBER without words or units*.
- What combination of things does Santi say will see a higher frequency of debris flows?
    - More intense fires and more precipitation
    - Longer fires and more precipitation
    - More precipitation and more intense weather events
    - Longer fires and more intense weather events
- Scientists are discovering changes in types of landslide activity due to climate change. Which of the listed is not one of these landslide types?
    - Rockfalls
    - Debris flows
    - Rotational slides
    - Earthflows
- In what area have researchers recorded more rockfalls as average temperatures rise? *Please select all that apply.*
    - Chile
    - Alaska
    - Europe
    - Canada
- Choose the statement that is NOT correct regarding climate change effects on landslide activity.
    - Having more information about slope stability impacted by climate change will not be helpful for future planning
    - Knowing where landslides are likely to occur will help to determine where to build infrastructure
    - Scientists have begun studying climate change effects on slope stability in North America and Asia
    - Having more information on climate change effects will help to know what areas may be threatened in future years

Read the section: From Rock Climbs to Rockfalls. Please answer the following questions based on this section.

- In the French Alps, what year had a series of huge rockfalls? *Enter your answer as a NUMBER without words or units*.
- In the French Alps, there was a series of huge rockfalls. At what elevation did they occur (in meters)? *Enter your answer as a NUMBER without words or units*.

- Data collected from Mont Blanc massif from the end of the 1800s to present times, has shown (a)____% of the rockfalls occurred between (b)_____ and (c)_____. *Enter your answer as a NUMBER without words or units*.
    - (a)
    - (b)
    - (c)
- What does Deline say about rockfall frequency?
    - Rockfall frequency is connected to warming temperatures
    - Rockfall frequency has increased over the past 3 years
    - Nearly half of all the rockfalls in the two areas of the Mont Blanc massif have occurred after 2010
    - Mont Blanc has not seen an increase in rockfalls
- Select the FALSE statement:
    - Melting permafrost is a reason for an increase in rockfalls
    - Permafrost works to weaken rock faces
    - Increasing temperatures have led to increasing rockfalls
    - In certain mountainous regions, rocks are glued together by ice in cracks and crevices
    - It is difficult to prove that changes in permafrost lead to rockfalls
- What seasonal conditions did scientists find saw an increase in rockfalls?
    - Cold summers
    - Hot summers
    - Cool winters
    - Warm winters
- Scientists used carbon dating which supports that permafrost degradation is due to climate change. (**True**/False)

After reading these sections AND A Tangled Web, answer the questions below.

- Which is NOT a component of climate change linked to an increase in landslides?
    - Precipitation
    - Temperature
    - Permafrost
    - Tsunami
- Which cascade of events leading to a landslide is INCORRECT?
    - Increasing temperatures, wildfires, precipitation, landslide
    - Increasing temperature, thawing permafrost, landslide
    - Increasing temperature, drought, landslide
    - Earthquake, landslide

PART 2: Follow this link: https://climate.nasa.gov/news/2951/climate-change-could-trigger-more-landslides-in-high-mountain-asia/ . Read the entire article carefully before answering the following questions.

Refer to paragraph 1 to answer the questions below.

- Why could climate change cause more landslides in the High Mountain Asia region?
    - Increasing temperatures melting glaciers
    - More frequent and intense rainfall
    - Rising sea levels
    - Increasing temperatures melting glaciers AND more frequent and intense rainfall
    - More frequent and intense rainfall AND rising sea levels

- Climate change could cause more landslides in High Mountain Asia. Which location is not mentioned?
  - Tibet
  - China
  - India
  - Nepal

Refer to the first figure to answer the questions below.

- What general location of Nepal has a higher likelihood of seeing changes in landslide activity?
  - North-west
  - North-east
  - South-west
  - South-east
- There will be a greater change in potential landslide activity during this season.
  - Summer
  - Fall
  - Winter
  - Spring

Refer to paragraphs 5-7 and answer the questions below.

- Heavy rain during the monsoon season from June-September can trigger landslides, which cause a range of disasters. Which of these disasters is not listed in the article?
  - Destruction of towns
  - Cutting off transportation networks
  - Cutting off drinking water
  - Power outages
- Monsoon seasons in (a)_____ contributed to landslides in Nepal, India, and Bangladesh, displacing more than (b)__ million people. *Enter your answer as a NUMBER without words or units*.
  - (a)
  - (b)
- What are some ways to predict landslides that the article does NOT mention?
  - Past records of landslides
  - Precipitation estimate models
  - Knowing future rainfall events
  - Knowing the steepness of mountain slopes
- The NASA model that estimates potential landslide activity triggered by rainfall in real-time is called Landslide Natural Disaster Assessment (LNDA). (True/False)
- What does the NASA model do?
  - It generates potential landslide activity occurring near cities and towns
  - It generates the amount of rainfall expected over the next 7 days
  - It generates potential landslide activity using historical rainfall data
  - It generates potential landslide activity using real-time rainfall data
- What is NOT used to inform the NASA model?
  - Nearby population size
  - Roadway information
  - Types of bedrock
  - Steepness of slopes
- The NASA model integrates precipitation data. If the precipitation is high for an area in the preceding (a)___ days, then the potential of landslides (b) increases/decreases. *Write the answer as a number*.

- (a)
- (b)

Refer to the final six paragraphs and answer the following questions.

- What did the predictive NASA models using NOAA's model data NOT find?
  - Extreme rainfall events will be common as the climate warms
  - Frequency of flash floods will remain stable
  - Higher frequency of landslide activity in some areas
  - The border of China and Nepal could see an increase in landslides
- Evaluating model projections in the context of five potential population scenarios found that all residents in the area will be exposed to landslide activity increases greater than 20%. (True/False)

Consider this article while answering the following questions.

- Our article's main purpose is to present new previously unpublished methods, knowledge, or content, presented directly by those responsible for discovering it. (True/False)
- The central message of the article is constructed mainly by gathering work done from pre-existing literature and/or sources. (True/False)
- The article is mainly targeting a general non-scientific audience. (True/False)
- The content in the article is presented in a non-technical manner, without presenting a complete "chain of evidence" in the form of references and citations. (True/False)
- The article is published in a peer reviewed journal (disregarding comments from an editor). (True/**False**)
- Which one of these options most accurately characterizes the main purpose of this article?
  - A commentary or report aimed at making recommendations about priorities, policy, or decision making
  - Sensationalism to rally the public behind a cause
  - Communication to experts in the subject, about new scientific methods, procedures, or discoveries
  - A report written to address the needs of a client or other third party who may have asked for the report
  - A communication about science written to inform non-specialists and enhance their safety
- Review the brief summary of three reference source types at https://scwrl.ubc.ca/stem-writing-resources/academic-integrity-in-stem/identifying-sources/ THEN, based on your choices above and that summary of source types, what kind of reference is our article best described as?
  - Primary
  - Secondary
  - Tertiary

PART 3: Follow this link: https://assets.lloyds.com/media/b9e21148-cb11-46b4-82f5-75c4bd2adcf7/Landslide%20Report%20May%202011%2029%20Nov%20combined.pdf. Use this webpage to answer the next questions. Do NOT read the whole article. Go to Chapter 1, 5.4-5.6, and 7. Read carefully before answering any questions. You do NOT need to read the entire report or entire chapters.

Refer to Chapter 5.4 (paragraph 3 and Figure 5.1) and answer the questions below.

- Why is it useful to study the European Alps? Choose the answer that does NOT apply.
  - The European Alps have diverse environments
  - The European Alps cover a large area
  - Effects from small changes in climate are more noticeable in mountainous regions
  - The European Alps contain many processes impacted by climate change

- Which processes in the European Alps is not a concern regarding climate change?
  - Glaciers
  - Wildfires
  - Geomorphic processes
  - Permafrost
- What data has NOT been collected across the European Alps at a high spatial resolution?
  - Wind
  - Temperature
  - Air pressure
  - Cloudiness
- Why is it important to have a good temporal resolution of climate data in environments like the European Alps? *Select all that apply.*
  - To understand how short-term climate changes fit with global climate variability
  - To allow for investigations into seasonal climate variations and how they affect morphology of the land
  - To understand how global variability impacts localized environments
  - It is not important to have good temporal resolution in the European Alps
- Refer to Figure 5.1. Why are the mountains separated into four quadrants?
  - There is a higher likelihood of detecting smaller changes in climatic processes using smaller regions
  - They are separated based on their common climate variation
  - They are separated based on North-South and East-West boundaries as this is coherent worldwide
  - All of the above

Refer to Chapter 5.5 and answer the following question.

- Increased weathering can lead to an increase in landslides. Which one of these processes does NOT increase WEATHERING?
  - Freeze-thawing
  - Flash floods
  - Seasonal transition between wet and dry phases
  - Rainfall

Refer to Chapter 5.5.1-5.5.5 (and Figure 5.2) to answer the following questions.

- How does an increase in temperature increase the possibility of landslide activity?
  - It causes a reduction of rock strength
  - It causes an increase in strain
  - It increases permafrost stability
  - None of the above
- Using Figure 5.2, determine the compressive strength if temperature is 21°C. *Enter your answer as a NUMBER without words or units*.

- Using Figure 5.2, determine the tensile strength if temperature is 17°C. *Enter your answer as a NUMBER without words or units*.
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- According to Figure 5.2, when there is an increase in temperature, a rock's tensile strength decreases more rapidly than it's compressive strength. (True/False)
- According to Figure 5.2, at 25°C, a rock's comprehensive and tensile strength are equal. (True/False)
- Compared to temperature, precipitation has a far less complex effect on destabilization of slopes. (True/False)
- The only rainfall information needed to determine magnitude and frequency of landslide activity are rainfall frequency and intensity. (True/False)

- Using a period with glacial advance and retreat patterns, we can look at changes in landslide frequency and magnitude. (True/False)
- From the years 1972-2007, Switzerland had the most damaging landslides and floods during the winter. (True/False)

Refer to Chapter 5.6 to answer the following questions.

- A dataset from the Italian Dolomites showed that clusters of landslides occurred at the same time as climatic changes. Which time period does NOT exhibit an example of this landslide cluster evidence?
    - 4000 to 2100 cal B.P.
    - 8200 to 6900 cal B.P.
    - 14,800 to 13,200 cal B.P.
    - 10,700 to 8400 cal B.P.
- What was NOT found to coincide with landslide clusters?
    - Plate movements
    - Precipitation
    - Temperature
    - Storminess

Refer to Chapter 1 and 7 to answer the following questions.

- Which is NOT a purpose of this research?
    - To inform the insurance industry about the potential future risk of landslides on the European Alps
    - To determine how climate influences the magnitude/frequency of landslides
    - To determine links between climate and magnitude/frequency of landslides and apply to other mountainous regions
    - To determine which climate metric has the greatest influence on the magnitude/frequency of landslides
- This research affirms previous literature, finding that landslide frequency-area distribution curves represent the number of landslides occurring at different scales irrespective of landslide triggers. (True/False)