



Applied Remote Sensing Training (ARSET) Program

Landslide Monitoring and Risk Assessment Using NASA Earth System Data (2025)

Homework Questions

Question 1

Which of these factors causes landslides?

- I. Long duration rainfall
- II. Short duration intense rainfall
- III. Seismic shaking
- IV. Tree roots

Answers: (bold correct)

- a. I only
- b. II only
- c. I, II and III**
- d. I, II, III and IV

Feedback:

Earthquake shaking and rainfall are the most important triggers for landslides. Short, intense rainfall can be a major trigger, but long-duration rainfall can also increase hillslope saturation until eventual failure. Tree roots typically help stabilize hillslopes and mostly reduce landslide likelihood.

Question 2

Which of the following are true statements about the effects of landslides?

Answers: (bold correct)

- a. Landslides cause thousands of fatalities per year.
- b. Linear infrastructure, such as roads and power lines, are particularly vulnerable to landslides in mountainous regions.

- c. Debris flow can have significant impacts on downstream communities for many years following a landslide event.
- d. All of the above**

Feedback:

Landslides can have devastating effects on people and the environment. Landslides cause thousands of fatalities each year. Linear infrastructure, such as roads and power lines, are particularly vulnerable to landslides in mountainous regions. Debris flow can have significant impacts on downstream communities for many years following a landslide event.

Question 3

Which kind of satellite observations have recently been used to observe landslides even through clouds?

Answers: (bold correct)

- a. Synthetic Aperture Radar (SAR) – e.g., Sentinel-1 C-band SAR**
- b. High resolution Commercial optical imagery – e.g., Planet imagery
- c. Hyperspectral Imagery – e.g., PACE OCI
- d. Optical multispectral imagery – e.g., Landsat 8 OLI
- e. none of the above

Feedback:

One of the most important benefits of SAR data is the ability to penetrate through clouds to observe surface changes.

Question 4

What is one problem with raster-based, or gridded analysis of landslide susceptibility?

Answers: (bold correct)

- a. It is not possible to use rasters globally
- b. If landslides are smaller than the resolution of the raster, interpretation may be challenging**
- c. Rasters are not a widely used data type for satellite observations

Feedback:

Rasters are critical for large scale landslide analysis since they are available globally and are an important data output for most satellite observations. However, if landslides are very small in comparison to the grid cell size, it may be impossible to draw detailed conclusions about the factors that led to the landslide.

Question 5

Which of these options is true about slow-moving landslides?

- I. Slow-moving landslides can only move slowly.
- II. Slow-moving landslides are mostly small.
- III. Slow-moving landslides can only be seen from ground-based analysis.

Answers: (bold correct)

- a. I only**
- b. II only
- c. I, II and III
- d. II and III only

Feedback:

Many slow-moving landslides are enormous, as large as entire mountainsides. Surface deformation analysis using, for example, SAR data can identify even very slow-moving landslides from satellites. Slow-moving landslides may accelerate abruptly, sometimes due to precipitation changes, meaning they can move quickly at times. This is one element that makes them hazardous.

Question 6

Why is it important to distinguish between landslide source areas (i.e., headscarp) and landslide deposits?

Answers: (bold correct)

- a. Source regions can block rivers, forming landslide dams
- b. Understanding source areas helps us define where future landslides may initiate**
- c. Landslide deposits are bigger, meaning they are easier to map

Feedback:

The relative size of source areas and deposits depends greatly on the geometry of the landscape or the length of runout areas, so deposits are not always larger. Deposits can block rivers, forming dams, but this is not the case for source regions. Mapping source areas separately can help build a dataset of the parameters associated with source areas, allowing researchers to model these locations in future.

Question 7

Which of these factors is needed to run the Semi-Automatic Landslide Detection (SALaD) model?

- I. Specific proprietary commercial software
- II. A Digital Elevation Model (DEM)
- III. Optical Imagery from diverse sources
- IV. A subset of landslides mapped as training data

Answers: (bold correct)

- a. I and II
- b. I, II and III
- c. II and III
- d. II, III and IV**

Feedback:

SALaD runs in an open-source python environment and is highly reproducible. The inputs required include a DEM and a manually mapped landslide training dataset. SALaD can use a variety of optical satellite data as inputs, ranging from Landsat to Sentinel-2 to commercial datasets.

Question 8

True or false: Topographic factors are critical to determine landslide susceptibility.

Answers: (bold correct)

- a. True**
- b. False

Feedback:

As described in the training, topographic factors such as slope, topographic roughness, and aspect are critical to determine landslide susceptibility.

Question 9

Which types of data help with understanding landslide susceptibility?

- I. Lithological and geomorphological information
- II. Satellite derived Digital Elevation Model data
- III. Land cover and land use data
- IV. Soil thickness and type data
- V. Air quality data

Answers: (bold correct)

- a. I and II
- b. I, II, III and IV**
- c. III, IV and V
- d. I, II, III, IV and V

Feedback:

A variety of different datasets have been used during landslide susceptibility analysis. All of these are associated with the land surface or subsurface, however, and air quality information has not been employed in landslide susceptibility analysis.

Question 10

Which of the following are associated with landslide susceptibility?

Answers: (bold correct)

- a. Where and when the landslide is likely to occur
- b. Who/what is in the hazard zone
- c. Where is the landslide is likely to occur**
- d. How likely the damage/injury will be

Feedback:

Landslide susceptibility pertains specifically to where landslides are likely to occur. Other factors pertain to hazard (where and when is the landslide likely to occur), exposure (who/what is in the hazard zone), and vulnerability (how likely is damage/injury).