



**LAND MANAGEMENT, ENVIRONMENT & SOLID-WASTE:  
INSIDE EDUCATION AND BUSINESS IN CENTRAL ASIA  
ERASMUS-EDU-2023-CBHE Project Number: 101129032**

**MICRO-CREDENTIAL**

**LAND MANAGEMENT IN CENTRAL ASIA**

**14.- Radar and Laser Remote Sensing**

***Quiz***

***Week 14 – Radar and LiDAR***



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## Quiz: Week 14 – Radar and LiDAR

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### Student Worksheet

Name:

Group:

Date:

Score:

#### Instructions

Answer all questions. Use complete sentences where required. This quiz covers radar remote sensing, active sensing systems, SAR backscatter, radar geometry, LiDAR principles, point clouds, DEM/DSM products, and practical land and water applications.

*Suggested scoring: Part A = 10 points, Part B = 5 points, Part C = 9 points, Part D = 6 points. Total = 30 points.*

### Part A. Multiple-Choice Questions

**1. Which statement best describes active remote sensing?**

- A. It records only reflected sunlight from the Earth surface
- B. It uses only photographs taken by aircraft
- C. It emits its own energy and measures the returned signal
- D. It works only during cloud-free daytime conditions

**2. In radar remote sensing, SAR mainly records:**

- A. Surface color in the visible spectrum
- B. Backscatter intensity and phase information from microwave signals
- C. Air temperature at weather stations
- D. Only optical reflectance from vegetation

**3. Why are microwave radar systems useful for land and water studies in cloudy regions?**

- A. Microwaves can often pass through clouds and haze better than optical wavelengths
- B. Radar images are always easier to interpret than optical images
- C. Radar does not require any geometric correction
- D. Microwaves measure chlorophyll directly in leaves

**4. Which pair correctly describes radar polarization notation?**

- A. NDVI and NDWI
- B. HH and VV
- C. DEM and DSM
- D. RGB and CMYK

**5. What does the incidence angle describe in radar imaging?**

- A. The number of spectral bands in an optical image
- B. The angle between the radar beam and the local vertical or surface normal
- C. The percentage of cloud cover in the image
- D. The height of the satellite above sea level only

**6. Speckle in radar images is best described as:**



- A. A random-looking granular effect caused by coherent signal interference
- B. A type of cloud shadow in optical images
- C. A GPS coordinate error
- D. A vegetation index used for crop mapping

**7. What is the basic measurement principle of LiDAR?**

- A. Measuring the time taken for laser pulses to return after interaction with surfaces
- B. Measuring passive thermal radiation from soil
- C. Counting image pixels in a satellite photograph
- D. Estimating vegetation greenness from red and near-infrared bands

**8. A LiDAR point cloud is:**

- A. A printed topographic map with contour lines
- B. A collection of 3D points with x, y, z coordinates and often return/intensity attributes
- C. A radar image converted to black and white
- D. A table of weather station measurements

**9. Which product usually represents the elevation of the bare ground surface?**

- A. DSM
- B. DEM/DTM
- C. RGB composite
- D. Cloud mask

**10. When is radar often preferable to optical imagery?**

- A. When continuous monitoring is needed under frequent cloud cover or at night
- B. When only true-color photographs are required
- C. When the target is underwater coral in clear shallow water only
- D. When no geometric correction is needed

## Part B. True or False

- 11. Radar can collect useful data during day and night because it sends its own microwave pulses. True / False
- 12. LiDAR is a passive sensor that depends only on natural sunlight. True / False
- 13. Smooth open water often appears dark in SAR images because much of the radar energy reflects away from the sensor. True / False
- 14. LiDAR normally penetrates dense clouds in the same way as microwave radar. True / False
- 15. Interferometric SAR can use phase differences between radar observations to support elevation or deformation analysis. True / False

## Part C. Short-Answer Questions

**16. Explain two surface or system factors that influence radar backscatter.**

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**17. Describe the difference between a DEM/DTM and a DSM in LiDAR-derived elevation products.**

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18. Why can combining radar or LiDAR data with optical images improve land-cover interpretation?

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### Part D. Applied Scenario Questions

19. A spring flood affects irrigated land in a Central Asian river valley. Optical images are limited because the area is cloudy for several days. Which radar data and interpretation steps would you recommend for rapid mapping?

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20. A local authority receives a LiDAR-derived elevation dataset for a hilly agricultural district. Explain how the data can be used to support terrain analysis, erosion-risk mapping, or drainage planning.

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## Instructor Answer Key and Marking Guide

*Quiz: Week 14 – Radar and LiDAR*

### Part A. Multiple-Choice Answers

| Question | Answer | Reason                                                                                             |
|----------|--------|----------------------------------------------------------------------------------------------------|
| 1        | C      | Active systems emit their own energy and measure the returned signal.                              |
| 2        | B      | SAR records microwave backscatter and phase information.                                           |
| 3        | A      | Microwave wavelengths are less affected by clouds and haze than visible/near-infrared wavelengths. |
| 4        | B      | HH and VV describe horizontal/vertical transmit and receive polarization combinations.             |
| 5        | B      | Incidence angle describes radar viewing geometry relative to the vertical or surface normal.       |
| 6        | A      | Speckle is a granular effect related to coherent interference in radar data.                       |
| 7        | A      | LiDAR measures distance using laser pulse travel time.                                             |
| 8        | B      | A point cloud stores 3D point positions and often return/intensity attributes.                     |
| 9        | B      | A DEM/DTM represents bare-earth elevation after removing surface objects where processing allows.  |
| 10       | A      | Radar is useful for monitoring when cloud cover or darkness limits optical imagery.                |

### Part B. True / False Answers

| Question | Correct answer |
|----------|----------------|
| 11       | True           |
| 12       | False          |
| 13       | True           |
| 14       | False          |
| 15       | True           |

### Part C. Suggested Short-Answer Points

16. Accept any two well-explained factors: surface roughness relative to wavelength, moisture/dielectric properties, vegetation structure, slope/aspect and local incidence angle, wavelength, polarization, and viewing geometry.

17. A DEM/DTM represents the bare-earth terrain surface, while a DSM represents the elevation of the first visible surface, including buildings, trees, and other objects.



18. Radar adds information about roughness, moisture, and structure; LiDAR adds precise 3D elevation and height information; optical imagery adds spectral/colour information. Combining them improves interpretation and reduces uncertainty.

## Part D. Suggested Scenario Answers

19. A strong answer should recommend SAR data such as Sentinel-1, compare pre-flood and post-flood images, mask likely water or low-backscatter zones carefully, check terrain and known river channels, validate with available field or map data, and explain that smooth open water may appear dark while urban or vegetated flooded areas may produce different backscatter patterns.

20. A strong answer should explain that LiDAR-derived DEM/DTM can support slope, aspect, drainage-network extraction, watershed delineation, flow accumulation, gully identification, flood-prone lowland mapping, and terrain-based erosion-risk analysis. Students should mention that the accuracy of results depends on point density, classification quality, vertical accuracy, and field validation.

## Quick Rubric for Written Answers

| Criterion          | Excellent                                                         | Adequate                                                   | Needs work                                                    |
|--------------------|-------------------------------------------------------------------|------------------------------------------------------------|---------------------------------------------------------------|
| Concept accuracy   | Uses correct radar/LiDAR concepts and terminology.                | Uses mostly correct terms with minor gaps.                 | Confuses active/passive, radar, LiDAR, or elevation products. |
| Application logic  | Connects data choice to land/water problem clearly.               | Application is generally relevant but not fully justified. | Answer is generic or not linked to the scenario.              |
| Practical workflow | Mentions processing, interpretation, validation, and limitations. | Mentions some workflow steps.                              | No clear workflow or validation step.                         |

## References Used for Quiz Preparation

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European Space Agency (ESA). Copernicus Sentinel-1 mission information.

U.S. Geological Survey (USGS). 3D Elevation Program (3DEP) and LiDAR data resources.

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