Applied Remote Sensing Training (ARSET) Program

Earth Observations for Humanitarian Applications (2024)

Homework Questions

Question 1

Which type of data is essential for conducting Flood Risk Assessments (FRAs)?

Answers: (bold correct)

a. Economic data
b. Social media usage data
c. Flood hazard, exposure, and vulnerability data
d. Country-wide health statistics

Feedback:
Flood hazard, exposure, and vulnerability data are essential for effective FRAs.

Question 2

Which of the following improvements have significantly enhanced global data availability for flood risk assessments?

Answers: (bold correct)

a. Increase in computing power
b. Advances in remote sensing
c. Increase in sensor resolution
d. Increase in data sharing
e. **All of the above**

Feedback:
The correct answer is all of the above: advances in remote sensing, increase in computing power, sensor resolution and data sharing have significantly improved global data availability for flood risk assessments.

Question 3

Which are some of the roles that Earth observation (EO) data plays in flood risk assessments for refugee camps?

I. Validating flood hazard models
II. Monitoring ongoing floods
III. Replace local ground-based measurement instruments
IV. Providing high resolution flood hazard models in data scarce regions

Answers: (bold correct)

a. Statement I only
b. Statements II & III
c. Statements I, II and IV
d. Statements I, II, III, and IV

Feedback:
The correct answers are statements 1, 2, and 4: validating flood hazard models, monitoring ongoing floods, and providing high resolution flood hazard models in data scarce regions. EO data is crucial for these tasks as well as others such as model build data.

Question 4

What is a key benefit of using global flood risk datasets in refugee camp assessments?

Answers: (bold correct)

a. They eliminate the need for any local data
b. They provide a consistent and high-resolution understanding of flood risks
c. They increase the number of refugees
d. They replace the need for ground-based assessments

Feedback:
Global flood risk datasets provide a consistent and high-resolution understanding of flood risks in refugee camps. This is essential for comprehensive assessments.

Question 5

What was a key finding of the 2023 study on global flood risk data for refugee camps in Ethiopia?

Answers: (bold correct)

a. Global population data alone is sufficient
b. Local data is not necessary
c. Global data needs to be supplemented with local data
d. Flood risk data is irrelevant

Feedback:
The study found that global data needs to be supplemented with local data to effectively understand flood risks in refugee camps. This was a key finding of the 2023 study on flood risk data for refugee camps in Ethiopia.

Question 6

Over 75% of refugees are hosted near their countries of origin in countries that are:

Answers: (bold correct)

a. Low income
b. Middle income
c. Low and middle income
d. High income

Feedback:
The correct answer is low- and middle-income countries. Over three quarters of refugees are hosted in low- and middle-income countries near their countries of origin.

Question 7

What is the percentage of refugees living in camps according to the 2023 Global Compact on Refugees?

Answers: (bold correct)

a. 10%
b. 20%
c. 30%
d. 40%

Feedback:
20% of refugees live in camps as reported by the 2023 Global Compact on Refugees.

Question 8

Which of the following factors contribute to the heightened vulnerability of refugee populations to floods?

Answers: (bold correct)

a. High mobility
b. Advanced infrastructure
c. Limited mobility and inadequate drainage systems
d. Permanent structures

Feedback:
Limited mobility and inadequate drainage systems, amongst other factors, contribute significantly to the heightened vulnerability of refugee populations.

Question 9

Which organization is primarily responsible for flood risk management coordination in refugee camps?

Answers: (bold correct)

a. Local government only
b. UNHCR alone
c. Coordinating platforms involving multiple stakeholders
d. Refugees themselves

Feedback:
There is no one organization which is primarily responsive for flood risk management coordination in refugee camps. Effective flood risk management requires collaboration among various entities.

Question 10

What challenge do camp managers face in performing effective Flood Risk Assessments (FRAs)?

I. Inadequate funding
II. Overabundance of local data
III. Data scarcity
IV. Lack of flood hazard modeling
V. Too many staff members

Answers: (bold correct)

a. Statement I
b. Statements II and III
c. Statements I, III and IV
d. Statements III, IV and V

Feedback:
The correct answers are statements I, III and IV: Inadequate funding, data scarcity, and lack of flood hazard modeling are major challenges in performing effective FRAs in camps.

Question 11

Which of the following present challenges to addressing extreme heat in refugee settings?

Answers: (bold correct)

a. Asylum policies may restrict refugee ability to move away from a camp or settlement
b. Refugees may be unfamiliar with the local climate and unaware of risks present
c. There are currently no widely accepted policies or standards to guide humanitarian response to extreme heat in refugee settings
d. All of the above

Feedback:
The correct answer is all of the above: refugee movement may be restricted by asylum policies, refugees may be unfamiliar with the local climate and risks, and there are no widely accepted policies to guide humanitarian response to extreme heat.

Question 12

Why is extreme heat a significant concern for refugees compared to other populations?

Answers: (bold correct)

a. Refugees typically have more assets to adapt to extreme heat
b. Refugees are often concentrated in regions facing rapid warming with few resources to adapt
c. Refugee camps are usually short-lived and thus less affected by climate change
d. Refugees generally have lower exposure to extreme heat compared to non-refugee populations

Feedback:
Extreme heat is a significant concern because refugees are often concentrated in regions facing rapid warming with few resources to adapt.

Question 13

What is one proposed strategy to better understand heat risk in refugee camps?

Answers: (bold correct)

a. Relocating camps to urban areas with more resources available to refugees
b. Installing temperature sensors and weather stations within and around refugee camps
c. Increasing the number of food distribution points in refugee hosting regions
d. Implementing nightly curfews

Feedback:
Installing temperature sensors and weather stations within and around refugee camps is a proposed strategy to better understand heat risk in refugee camps.

Question 14

What type of data can be used to analyze long-term heat stress in refugee settings?

Answers: (bold correct)

a. Local weather forecasts
b. Global climate reanalysis products
c. Personal health records
d. Urban heat island effect studies

Feedback:
Global climate reanalysis products can be used to analyze long-term heat stress in refugee settings.

Question 15

What is a potential direct health impact of extreme heat on refugees?

Answers: (bold correct)

a. Improved physiological conditions
b. Increased risk of heat-related illnesses
c. Increased malnutrition and hunger
d. Decreased need for medical care

Feedback:
Increased risk of heat-related illnesses is a potential direct health impact of extreme heat for refugees.

Question 16

Which of the following methods can be used to estimate long-term heat stress?

Answers: (bold correct)

a. Maximum annual temperature
b. Number of days over a critical temperature threshold (i.e., days over 30C)
c. Mean annual temperature
d. Number of days over a percentile-based threshold (i.e. days over 95% of long-term average)

Feedback:
The number of days over a critical temperature threshold is used to estimate long-term heat stress.

Question 17

True or False: Extreme heat only poses a risk to refugees during the daytime.

a. True
b. False

Feedback:
The correct answer is false. Extreme heat poses a risk to refugees during the daytime and nighttime.

Question 18

Which statement correctly describes the relationship between leaf area, biomass generation, and the optical bands detected by sensors in crop productivity studies?

Answers: (bold correct)

a. Both leaf area and biomass have no direct relationship with light, so the sensor cannot be used to reliably estimate the leaf area or the biomass.
b. The consumable part of biomass is more closely related to the red and NIR bands compared to the relationship between leaf area and the red and NIR bands, so the biomass at the end of the growing period can be more reliably estimated using a multispectral sensor.
c. **Leaf area intercepts light, facilitating biomass accumulation through photosynthesis, and leaf interaction with light is detected by optical bands.**
d. Biomass generation is less related to leaf area during the vegetative stage, so it is harder to estimate biomass during the vegetative stage than the reproductive stage using a sensor.

Feedback:
Leaf area intercepts light, facilitating biomass accumulation through photosynthesis, which is detected by optical bands. Leaf area has a direct relationship with light. Biomass generation is directly related to leaf area. The consumable part of biomass is generally less directly related to the red and NIR bands than green leaf area. Although some crops, such as maize, may show that the NDVI at the end of the growing period, which is a proxy for leaf area, is more related to grain yield, this is not the general case.

Question 19

What are the main reasons for using MODIS data for some tasks despite its coarser spatial resolution compared to Sentinel-2?

Answers: (bold correct)

a. MODIS data provides better sensor calibration and more accurate ground truth data.
b. **MODIS data offers nearly daily observations and over 20 years of historical records, making it suitable for long-term trend analysis.**
c. MODIS data is easier to process and has no cloud contamination issues due to its near daily observation.
d. MODIS data has a better spatial resolution and can capture smaller field variations.

Feedback:
MODIS data offers nearly daily observations and over 20 years of historical records, making it suitable for long-term trend analysis. MODIS does not provide ground truth data, and there is no evidence that MODIS is noticeably better calibrated than Sentinel-2. MODIS has coarser spatial resolution compared to Sentinel-2 and cannot capture smaller field variations as effectively. MODIS may have cloud contamination issues despite its near-daily observations.

Question 20

Regarding the NDVI time-series construction, which statement is the most correct?

Answers: (bold correct)

a. The gap-filling is designed to reduce the noise in the time-series signals so it captures the real NDVI trajectories and thus seasonality.
b. The Savitzky-Golay (S-G) filter is designed to guess the missing values and the non-missing values will be untouched in this filter.
c. The Double Logistic model mimics the growth and decline trends that can be found in many natural phenomena, so it can be used to smooth and gap-fill the NDVI time series.
d. All of the above statements are incorrect.

Feedback:
The Double Logistic model indeed mimics the growth and decline trends found in many natural phenomena and can be used to smooth and gap-fill the NDVI time series. Gap-filling preserves the non-missing values and fills in the missing values to complete the time series. The Savitzky-Golay (S-G) filter can be used for gap-filling, but it is mostly used for noise reduction, and the raw values will be changed after filtering.

Question 21

Identify the most suitable situations to apply the de-trending analysis:

I. When we want to exclude the long-term climate change effect in crop productivity from short-term weather shocks such as drought.
II. When we want to exclude the long-term technology advancement effect in crop productivity from short-term weather shocks such as drought.
III. When we want to exclude the error and uncertainties in the crop productivity estimation of each year.
IV. When we want to compare the crop productivity stability of productivity in different historical periods.

Answers: (bold correct)

a. Statement IV

b. Statements I and III
c. Statements I, II, and III
d. Statements I, II and IV

Feedback:
The correct answers are statements 1, 2 and 4: De-trending is not designed to reduce the error or uncertainty of estimation in a time series. Its primary purpose is to separate long-term trends from short-term variations.

Question 22

What is one advantage of using a multivariate regression model when analyzing the impact of environmental factors on crop productivity?

Answers: (bold correct)
a. It simplifies the data by focusing on a single weather variable.
b. **It combines multiple weather variables to provide a more comprehensive analysis.**
c. It reduces the impact of missing data points by considering multiple factors.
d. It addresses the various data qualities across different regions.

Feedback:
When analyzing the impact of environmental factors of crop productivity, one advantage of using a multivariate regression model is that it combines multiple weather variables to provide a more comprehensive analysis. It does not reduce the impact of missing data points and is not relevant to data quality.

Question 23

What is the advantage of using Google Earth Engine (GEE) for image processing?

Answers: (bold correct)
a. GEE is the only source to access satellite imagery and open-sourced image processing functionalities.
b. GEE does not require programming skills, making it the most user-friendly and popular platform for a broader community.
c. GEE provides rich high-level and customized functionalities in its ee method for machine learning use, including gap-filling and curve-smoothing methods, so users can easily use these without implementing them themselves.
d. **It is a hub of satellite and vector data and has useful basic image processing functions with cloud computing.**

Feedback:

GEE is a hub of satellite and vector data and has useful basic image processing functions with cloud computing. Google is the data distributor but not the provider of the data. NASA, USGS, and ESA also have data portals. Popular geo-processing libraries such as GDAL also provide image processing functionalities. GEE does require programming skills in JavaScript, and the ee method provides basic functionality; users have to implement customized analytical functions or gap-filling and curve-smoothing functions themselves.

Question 24:

Which of the following is the most inaccurate statement regarding the use of EO to monitor crop productivity?

Answers: (bold correct)

a. The EO method provides large spatial coverage and long time records, making it the only method to track productivity and drought through long historical periods in some data-sparse regions.
b. **EO estimates crop productivity based on objective biophysical parameters, so the EO estimation of crop management and crop productivity is more reliable than field surveys or national statistics.**
c. Satellite imagery often has contamination from clouds or aerosols, so the imagery must go through a series of quality checks and gap-filling procedures before it is ready for analysis.
d. Earth Observation satellites cannot be used to retrieve the socio-economic attributes of the land surface, so we cannot determine if the cropland is cultivated by refugees or regular villagers using satellite imagery.

Feedback:
EO estimates crop productivity based on objective biophysical parameters, so the EO estimation of crop management and crop productivity is more reliable than field surveys or national statistics. This statement is inaccurate because it is overly optimistic, and such limitations of Earth Observation (EO) are well-known in the remote sensing community. EO estimation can be impacted by many factors, such as the non-stationary relationships between biomass and EO signals, and between biomass and crop yield. It is generally advisable to combine EO with field survey data for better accuracy.

Question 25

What is a major challenge in studying crop productivity in refugee agriculture using remote sensing-based methods?

Answers: (bold correct)

a. Limited availability of cloud-free images for small fields.
b. **The uncertainty in distinguishing refugee populations' cropland from non-refugee populations' cropland, which complicates the analysis.**

c. The lack of available remote sensing data for refugee settlement areas.
d. The inability to detect any seasonal variations in crop productivity.

Feedback:
A major challenge in studying crop productivity in refugee agriculture using remote sensing-based methods is the uncertainty in distinguishing refugee populations' cropland from non-refugee populations' cropland, which complicates the analysis. Remote sensing data is generally available for most areas, including refugee settlements and can detect seasonal variations in crop productivity. Cloud issues are not directly relevant to field size, and they are not a specific issue for studies in refugee settings.