CASA0023 - Personal Diary

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1 About

Hello to all. I am Ana :)

First of all, I am a proud Colombian woman, very interested in understanding socio-cultural, economic and environmental behaviors around me, and commited to improving livelyhoods and conditions for people and communities around the world.

I studied anthropology for my undergrad and later finished an MSc in Sustainable Development, currently I am studying an MSc in Social and Geographic Data Science. I have more than 8 years of experience working in rural development in Colombia, analyzing and developing different economic activities that contribute to both cultural and environmental conservation, as well as coordinating efforts with regional governments, NGO's and the environmental sector.

My expectation with this masters, and this specific course, is to adquire as many tools and skills in social and environmental data collection and analysis, that will permit me to continue designing, implementing and evaluating development projects and programs.

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Week 1

Introduction to Remote Sensing

NASA defines remote sensing as “acquiring information from a distance”. This information is acquired through sensors mounted on different platforms such as satellites, planes, drones, etc… Currently there are more than 150 satellites and more than 27,000 other devices orbiting the earth.

There are various types of sensors and data sources, as well as applications. Data can come from Sentinel, LANDSAT or SAR satellites, and can be used to monitor various phenomenons such as land covered areas, urban or green space coverage, natural and climate phenomenons, and other atmospheric characteristics.

Types of sensors

There are two types of sensors:

Passive sensors use and detect energy that is available from the sun, but dont emit their own. Examples of this type are the human eye or a camera.

Active sensors have proper sources of illumination and actively emit eletromagnetic waves. Some examples are X-rays and Lidar sensors. These are appropriate for difficult climatology and atmospheric conditions such as clouds and storms or air pollution, or to see during the night sky.

Reflection and Resolutions

Natural or unnatural phenomenon, such as clouds or volcanic ash, can interrupt or affect the reflection and dispersion of electromagnetic waves. The earth absorbs some energy, the other is randomly dispersed in the atmosphere. Different sensors (as mentioned above) are used to identify and capture different electromagnetic wave lengths and types.

Independent of the sensor used, 4 resolutions are needed:

Spectral: The number of bands recorded (red, green, blue for visible light).

Spatial: The size of each pixel (from cm to km depending on the scope of analysis).

Temporal: The frequency with given geographical area is monitored.

Radiometric: The range of reflectance values that are registered.

Practical application and use

Remote sensing, as it name implies, is used to monitor and register spatial data from a remote sensor such as satellites; it is a great compliment to more traditional and smaller-scale on-site monitors which only recover very localized information. I make an enphasis on “compliment” because it also has limitations that are worth mentioning, such as its cost, resolution limitations in some cases, and the need for a more robust data processing and analysis.

Remote sensing can be used in various sectors such as agriculture, climate change mitigation and environmental conservation, monitoring of natural hazzards, meteorology, as well as urban planning and development. Personally, I find it fascinated how it can be used to visualize and monitor natural resource management (conservation of hydric resources, of forest coverage, etc.).

In my view, the most exciting applications for remote sensing data are in situations where traditional forms of data collection -- such as a national census -- are unreliable or out of date. This is true of South Africa, where obtaining up-to-date demographic or economic information is very difficult. I’ll discuss that a bit more in week 4, when I get into policy.

All though there are many applications, the ones that were covered in class are:

Sentinel Data - It comes from the European Earth observation satellite program, specifically from satellites that capture high-resolution optical and radar imagery. They use various sensors such as MSI for optical imagery and SAR for radar data; the data recollected is mostly used for environmental monitoring, disaster management and agricultural monitoring.

Landsat Data - It comes from the NASA and the United States Geological Survey, specifically from satellites that have been orbiting for more than 50 years. These sensors capture different types of spectral data (visible, infrared and thermal, for example). This data is used for land cover monitoring, land use management and environmental monitoring. Due to its long-term archive, it’s data has been very useful for studying environmental and urban developments and evolution.

Personal reflection

This is the first time that I work with this type of data. To be honest, it is quite an overwhelming process. It is very technical, I have had to review basic physics that I had not used in many years to remember the electromagnetic spectrum, the different types of wave lengths, colors, etc. It has also been a bit difficult to download data that works and then visualizing it on QGis or Rstudio, for me it is a work in progress as I learn how to be more efficient and accurate.

It is quite amazing to see how these large satellites, that I have always seen as very scientific and foreign to me, can produce images and data that is super important and useful for my “real world” applications such as conservation monitoring. Coming from Colombia, a country with unreliable and incomplete environmental and demographic data, I feel that these tools can be amazingly useful to have real-time ecological and social monitoring.

I am excited to see how the course progresses and all that I can learn and later apply.

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Week 2

I share with you this presentation I made on Landsat satellites: their great importance to modern science, the methodologies and technology they use, their different applications and improvements over time:

:::: xaringan source: C:/Users/USUARIO/Documents/UCL/Term 2/CASA0023/week 2/xaringan_presentation.Rmd

Enjoy!

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Week 3

Geometric and Atmospheric Correction:

- Satellite images are assigned a coordinate reference system (CRS) in GIS.
- Image distortions can result from factors like off-nadir view angles, topography, wind (in aerial data collection), and Earth's rotation.
- Geometric correction aims to rectify these distortions for accurate spatial analysis.
- Ground Control Points (GPS) are used to match known points in the image with a reference dataset or map.
- Coordinates from GPS points are used to model geometric transformation coefficients.
- Various transformation algorithms are available for modeling the actual coordinates.
- The correction process involves both forward and backward mapping to ensure alignment.
- Root Mean Square Error (RMSE) is used to assess the accuracy of the correction.
- Lower RMSE values indicate a better fit of corrected data.
- Resampling methods like Nearest Neighbor, Linear, Cubic, and Cubic spline may be applied.
- Environmental factors, including atmospheric scattering and topographic attenuation, can affect remote sensing data.
- Atmospheric correction is essential when precise reflectance values are required for analysis.
- It involves normalizing intensities of different bands within an image or across multiple dates.
- Methods for atmospheric correction include relative, pseudo-invariant features (PIFs), and absolute correction.
- Absolute correction requires atmospheric measurements and radiative transfer models.
- Tools like ACORN, FLAASH, QUAC, and ATCOR are available for atmospheric correction.

- Radiometric calibration converts digital brightness values (DN) to scaled surface reflectance.
- Landsat data is often distributed as a surface reflectance product.
- Atmospheric correction aims to remove the effects of atmospheric scattering and absorption.
- The corrected data provides more accurate information for analysis and interpretation.

Practical Application and Use:

- These correction techniques are crucial for obtaining accurate and reliable data in remote sensing.
- They ensure that imagery can be effectively utilized for various applications.
- Corrected data is essential for tasks like land cover classification and change detection.
- It enables the extraction of valuable information from remote sensing imagery.
- Practical applications include agriculture, urban planning, environmental monitoring, and disaster management.
- Atmospheric correction is particularly important for tasks involving precise reflectance values.
- It supports the assessment of biophysical parameters like temperature, leaf area index, and NDVI.
- Corrected data enhances the quality and usefulness of remote sensing products.
- They are integral in providing decision-makers with valuable insights for informed choices.

Personal Reflection:

- The understanding and application of geometric and atmospheric correction are fundamental in the field of remote sensing.
- These correction processes ensure that the data accurately represents the Earth's surface.
- As technology advances, new tools and algorithms continue to improve the correction accuracy.
- Remote sensing offers a powerful means of gathering information about our planet.
- The application of these techniques to urban environments can have a profound impact on decision-making and urban planning.
- The combination of practical skills and theoretical knowledge in remote sensing is crucial for professionals in the field.

- I recognize the importance of continually learning and adapting to new advancements in remote sensing technology.
- Geometric and atmospheric correction lay the foundation for reliable and insightful remote sensing analysis.