learning diary

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This is the introduction to my document.

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4 Introduction

This is a book created from markdown and executable code.

See Knuth (1984) for additional discussion of literate programming.

5 Week1

5.0.1 Summary

- Remote sensing is defined as acquiring information from a distance. Remote sensing can collect data without physical contact with objects by sensors.
- Passive or active sensors. Active sensors have an energy source and will actively emit electromagnetic energy and then receive
- Electromagnetic energy

    1. Wavelength: long wavelength = low frequency = low energy
    2. Electromagnetic spectrum: total range of wavelengths of EM radiant
    3. Energy interaction: reflected, absorbed by the surface, transmitted through the surface, scattered by particles in the atmosphere.
    4. Blue light shorter wavelength and more easily scatters(450nm-blue(shortest visible light) 550nm-green 700nm-red(longest)).
    5. The spectral reflectance characteristics of surface materials are different. That is why sensors can identify materials. In the visible spectrum, chlorophyll in plant leaves strongly absorbs light in the blue and red regions, but reflects green light. This is why healthy vegetation appears green to our eyes.
    6. The sun is the primary source of EM energy

- Four resolutions

    1. Spatial resolution the size of the raster grid per pixel
    2. Spectral resolution the number of bands sensor records data
    3. Radiometric resolution identify differences in light or reflectance, in practice this is the range of possible values.
    4. Temporal resolution the time it revisits

5.0.2 Application

5.0.2.1 Sentinel-2

1. Spatial resolution of 10 m, 20 m and 60 m
2. Revisiting every 10 days
3. Multi-spectral data with 13 bands in the visible, near-infrared, and short-wave infrared part of the spectrum

- Application

1. Monitoring inland water bodies.

2. Watching coastal waters.

5.0.2.2 Landset

The below figures are my practical output

green rectangle = bare earth pink rectangle = vegetation purple rectangle = urban area red rectangle = water

It seems that the 7 bands.tif file is too large for my computer. I only export GeoTIFFS with bands 2,3,4.

spectral profiles density plot

5.0.3 reflection

This is the very beginning of remote sensing, for me, it is the first contact for me with the subject. Almost everything is new for me. The only thing that I am familiar with is electromagnetic waves. Different wavelength gives electromagnetic waves different properties, like the penetrative ability. I thought longer wavelengths were easier to penetrate, while shorter wavelengths were more difficult. However, longer wavelengths of electromagnetic radiation, such as infrared and microwaves, tend to penetrate certain substances more easily. This is because some materials have lower absorption rates for longer wavelengths, allowing radiation of these wavelengths to penetrate relatively easily.

For other substances and specific wavelength ranges, the situation may be different. For example, some materials have high absorption rates for certain wavelengths of electromagnetic radiation, making it difficult for radiation of these wavelengths to penetrate the material. This is common in the visible light range, as many substances have high absorption rates for visible light, making it difficult for visible light to penetrate them. That is how the sensor identifies different materials. Also, remote sensing sensors can capture electromagnetic signals reflected or emitted from the Earth's surface and divide them into multiple different bands. For example, a sensor for visible light and infrared might be divided into several different bands, each corresponding to a specific part of the visible light or infrared spectrum. Different bands capture information about different types of features on the Earth's surface, so the choice of bands is crucial for the success of specific applications. That's why when I do practicals there are so many bands that make me confused initially.

Another question I met that could take much time for me to figure out is what are the differences between satellites. I know they have different resolutions and bands, but what do

the differences refer to, what advantages do they have, and Why are so many types of satellites needed?

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References

Knuth, Donald E. 1984. “Literate Programming.” *Comput. J.* 27 (2): 97–111. https://doi.org/10.1093/comjnl/27.2.97.