intro

Learning Objectives

After completing this tutorial, you will be able to:

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What you need

You will need a computer with internet access to complete this lesson and the data for week 5 of the course.

About Spectral Remote Sensing

In the previous weeks of this course, we talked about lidar remote sensing. If you recall, a lidar instrument is an active remote sensing instrument. This means that the instrument emits energy actively rather than collecting information about light energy from another source (the sun). This week we will work with spectral remote sensing. To better understand spectral remote sensing we need to review some basic principles of the electromagnetic spectrum.

The electromagnetic spectrum is composed of a range of different wavelengths or "colors / types" of light energy. A spectral remote sensing instrument collects light energy within specific regions of the electromagnetic spectrum. We call each region in the spectrum a band.

Above: a video overview of spectral remote sensing.

Key Metadata for Spectral Remote Sensing Data

Bands and Wavelengths

A *band* represents a segment of the electromagnetic spectrum. You can think of it as a bin. For example, the wavelength values between 800nm and 850nm might be one band as captured by an imaging spectrometer. The imaging spectrometer collects reflected light energy in a pixel for light in that band. Often when you work with a multispectral dataset, the band information is reported as the center wavelength value. This value represents the center point value of the wavelengths represented in that band. Thus in a band spanning 800-805 nm, the center would be 825).

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<a href="{{ site.baseurl }}/images/course-materials/earth-analytics/week-6/spectrumZoomed.png">
<img src="{{ site.baseurl }}/images/course-materials/earth-analytics/week-6/spectrumZoomed.png" alt="Sp
<figcaption>Imaging spectrometers collect reflected light information within defined bands or regions o
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Spectral Resolution

The spectral resolution of a dataset that has more than one band, refers to the width of each band in the dataset. In the example above, a band was defined as spanning 800-805nm. The width or Spatial Resolution of the band is thus 5 nanometers. To see an example of this, check out the band widths for the Landsat sensors.

While a general spectral resolution of the sensor is often provided, not all sensors create bands of uniform widths. For instance bands 1-9 of Landsat 8 are listed below:

Band	Wavelength range (microns)	Spatial Resolution (m)	Spectral Width (microns)
Band 1 - Coastal aerosol	0.43 - 0.45	30	0.02
Band 2 - Blue	0.45 - 0.51	30	0.06
Band 3 - Green	0.53 - 0.59	30	0.06
Band 4 - Red	0.64 - 0.67	30	0.03
Band 5 - Near Infrared (NIR)	0.85 - 0.88	30	0.03
Band 6 - SWIR 1	1.57 - 1.65	30	0.08
Band 7 - SWIR 2	2.11 - 2.29	30	0.18
Band 8 - Panchromatic	0.50 - 0.68	15	0.18
Band 9 - Cirrus	1.36 - 1.38	30	0.02

Above: Source - http://landsat.usgs.gov

MODIS Bands

Band	Wavelength range (microns)	Spatial Resolution (m)	Spectral Width (microns)
Band 1 - red	.62 - .67	250	0.02
Band 2 - near infrared	.841 - .876	250	0.06
Band 3 - blue/green	459 - 479	500	0.06
Band 4 - green	.545 - .565	500	0.03
Band 5 - near infrared	1.23 – 1.25	500	0.08
Band 6 - mid-infrared	1628–1652	500	0.18
Band 7 - mid-infrared	2105 - 2155	500	0.18

About Modis bands

copy the band descriptions on this page:

http://biodiversityinformatics.amnh.org/interactives/bandcombination.php here:

Then cite the page Band 1: This is similar to Landsat TM band 3.

Something about rasters can have a few bands...

In the previous weeks, we've worked with rasters derived from lidar remote sensing instruments. These rasters consisted of one layer or band. However raster data can have multiple bands. an image that you take with your camera ...

Additional resources:

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