Raster GIS Overview

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Why do we have two GIS formats?

Vector GIS datasets usually contain sociopolitical data.

Vector formats make sense because human locations are vectors:

- Country, county and city borders
- Roads, airline routes and bike lanes
- Physical addresses

Raster GIS datasets usually contain physical data.

Raster formats are a **consequence** of how the data is collected:

- Satellite imagery
- Weather stations
- Road side air quality measurements

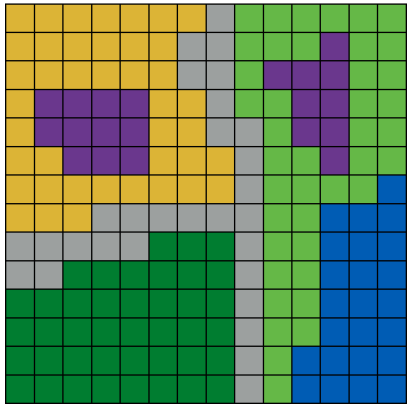
Do I have vector or raster GIS data?

GIS raster layers

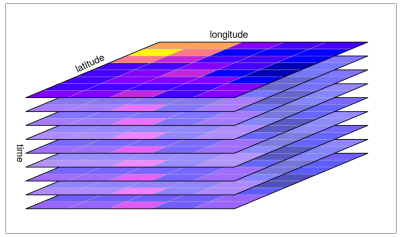
GIS raster datasets can contain multiple layers.

For **single** layer raster datasets use these packages:

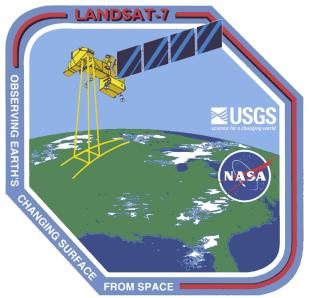
- `{raster}`
- `{terra}`



For raster datasets containing **multiple** layers use the `{stars}` package.



Why would my data contain multiple layers?



The Landsat program has been continuously studying observing Earth from space since 1972.

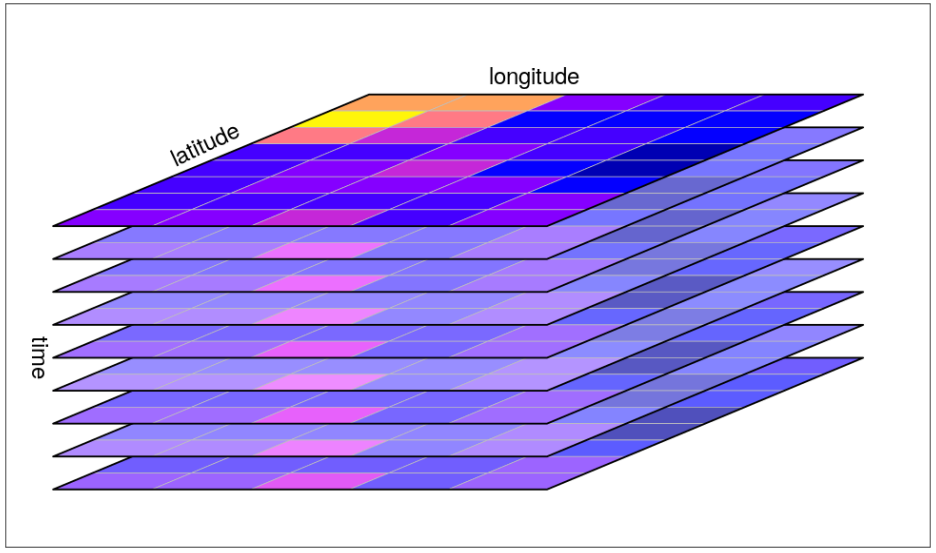
We'll be using data from the Landsat 7 satellite multiple times in this course.

All Landsat satellites collects raster data with multiple layers because:

- they survey the same areas **over time**.
- they're equipped with **multiple sensors**
- sensors typically collect data at **multiple wavelength bands**

Raster data cubes

Data cubes are raster datasets with 3 dimensions.

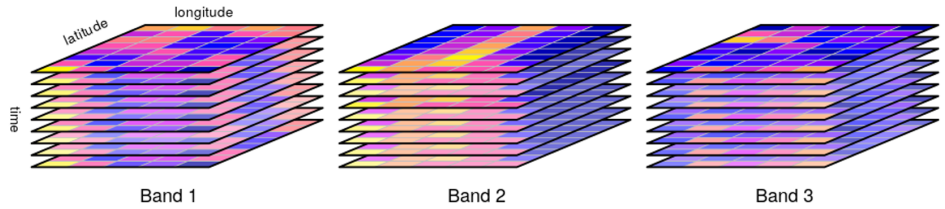


All satellite data has at least 3 dimensions:

- longitude
- latitude
- time

Hypercubes and higher dimensional raster data

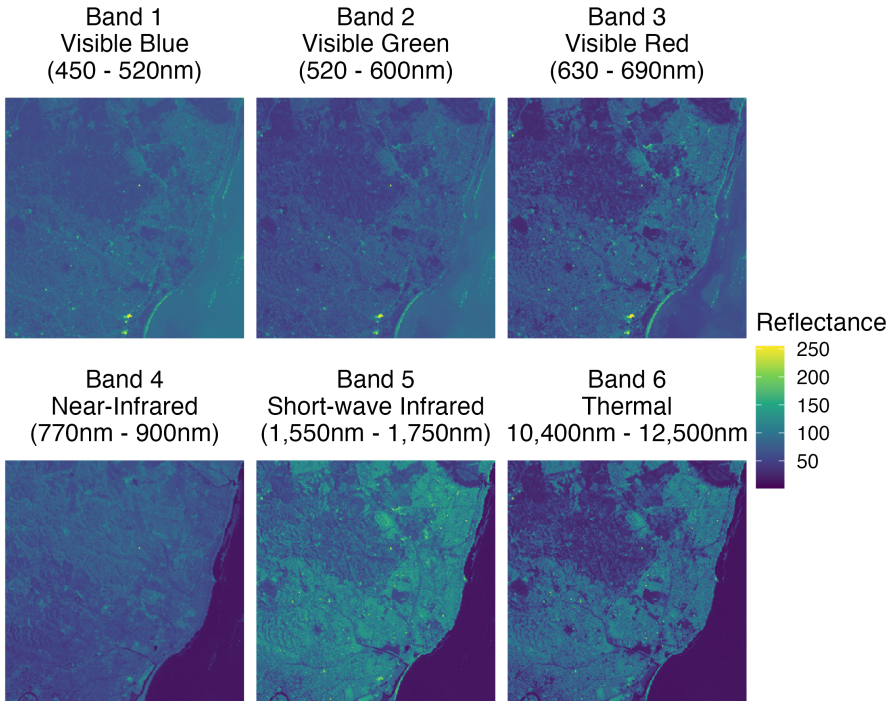
Hypercubes are 4-dimensional datasets... but often raster GIS datasets have even more dimensions.



This hypercube is from Landsat 7 and contains the following dimensions:

- longitude
- latiutude
- time
- wavelength band

Raster data cubes



This is another view of a data cube from Landsat 7.

The dimensions of this data cube are:

- longitude
- latitude
- wavelength band