2021 ML4EO Bootcamp
Lecture 2: Projections, Tiling, GeoJSON

KEVIN BOOTH
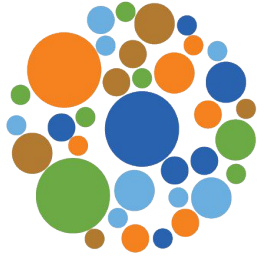
GEOSPATIAL SOFTWARE ENGINEER
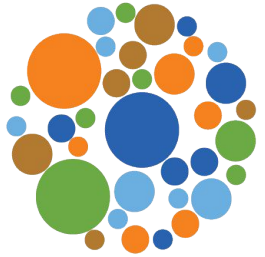
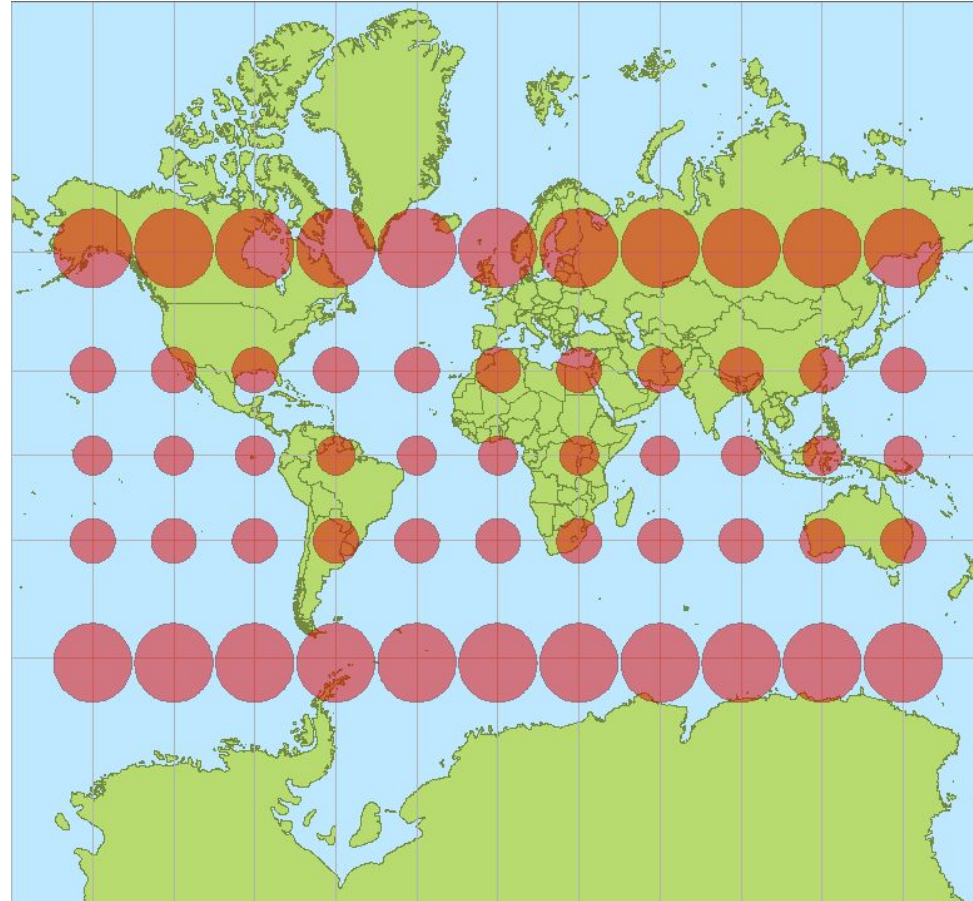Radiant Earth Foundation

EARTH IMAGERY FOR IMPACT

Map Projections

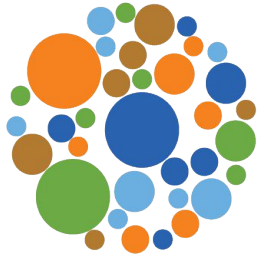- Converts 3 dimensional position on earth to point on a flat surface
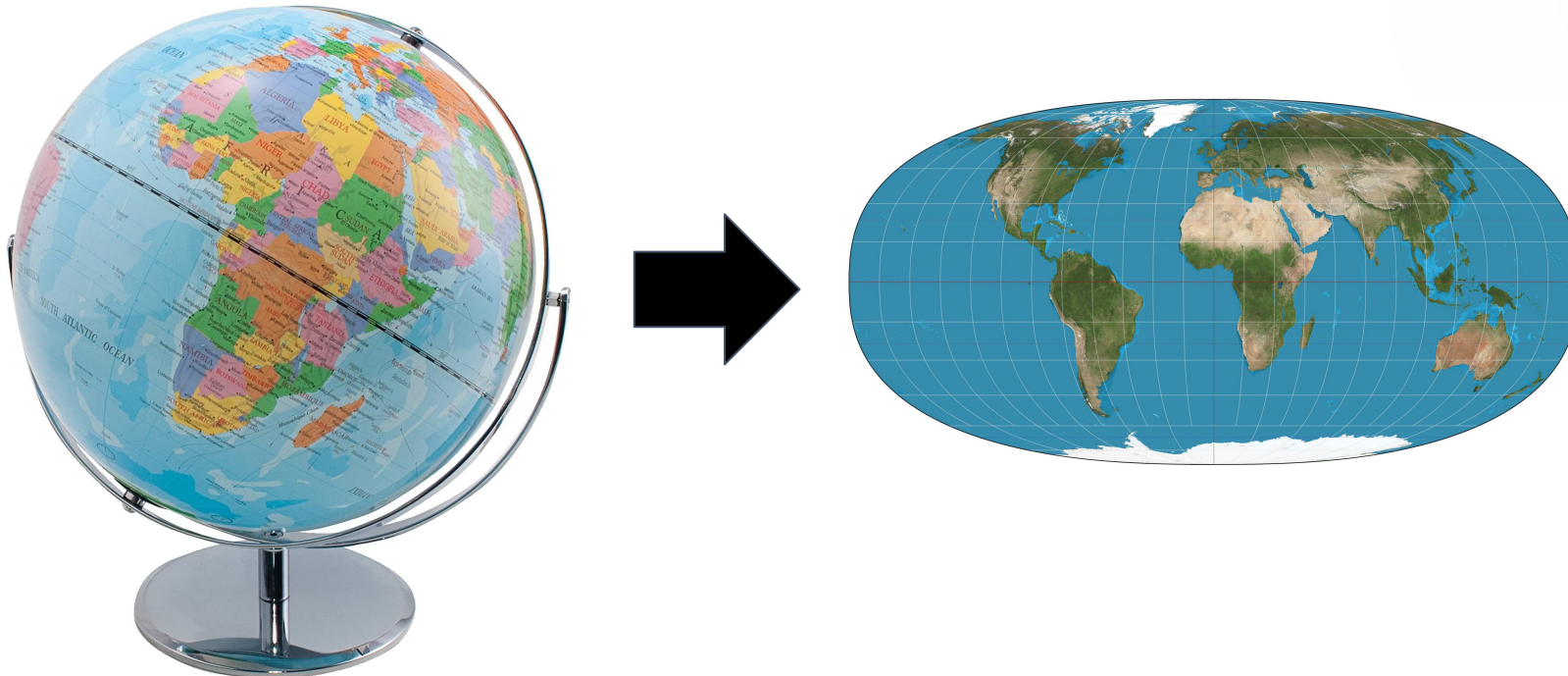
Map Projection Distortions
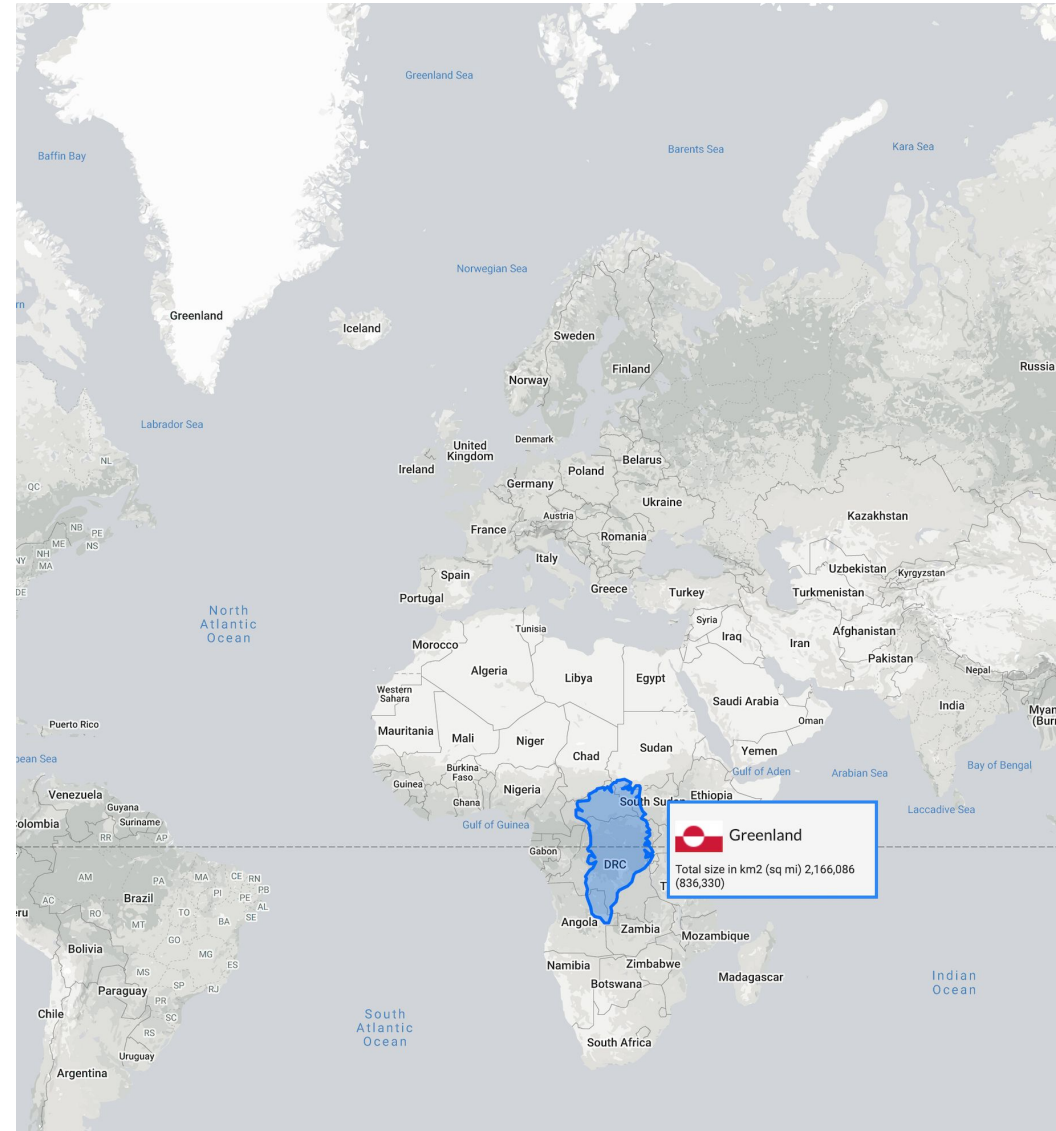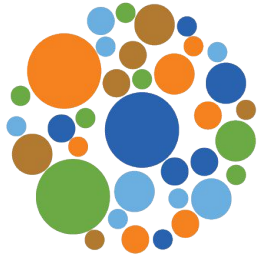
- ► Distance
- ► Direction
- ► Area
- ► Shape

Map Projection Distortions

Map Projection Distortions

Greenland
Total size in km2 (sq mi) 2,166,086 (836,330)

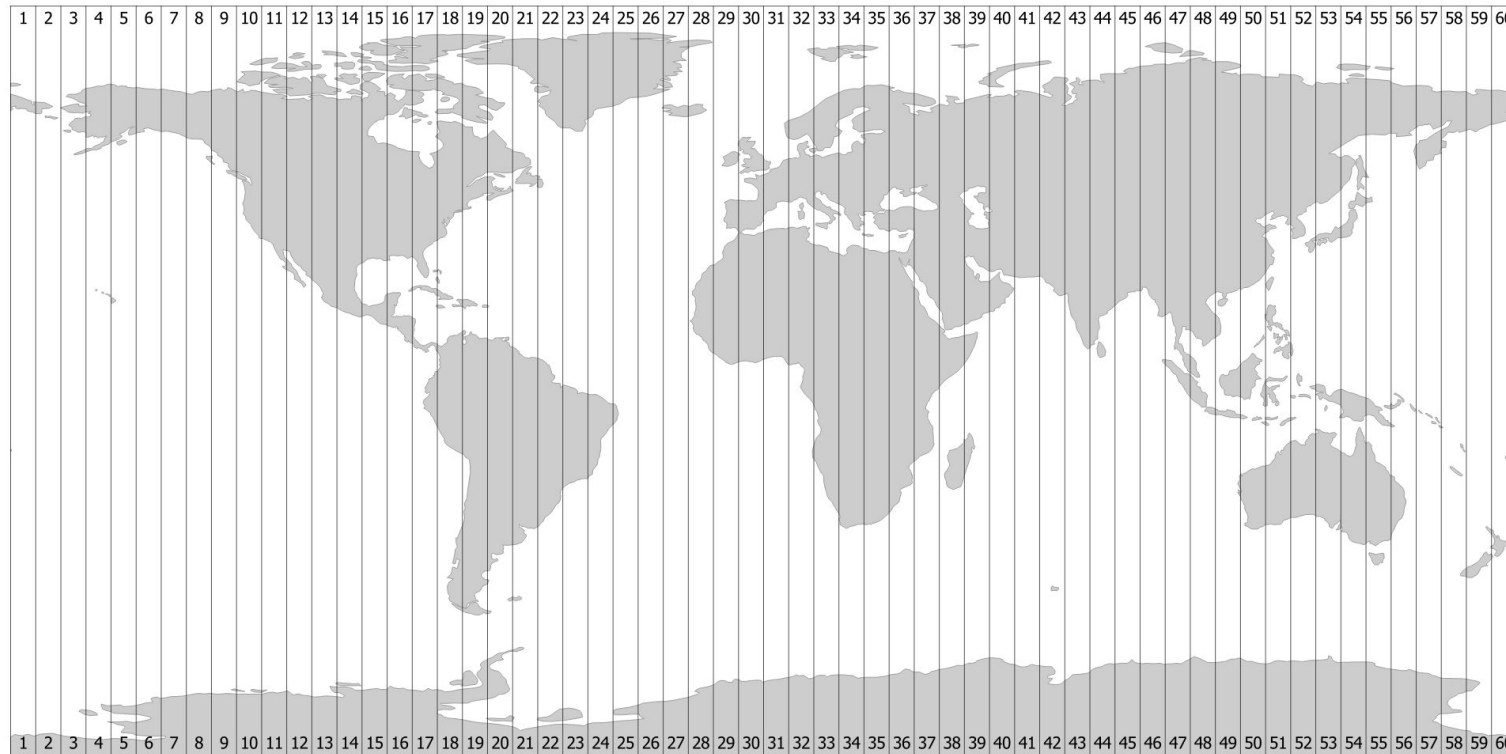# UTM Projection

- ► Splits Earth into 60 zones, each 6° longitude wide
- ► Starts at UTM Zone 1 from 180°W to 174°W
- ► Ends at UTM Zone 60 from 174°E to 180°E
- ► Can be divided into Northern/Southern hemisphere zones

Tiling
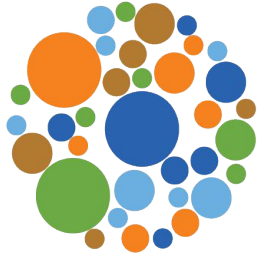
- ► Breaks up Earth into equal-sized chunks
- ► When downloading Sentinel-2 or Landsat imagery you download a tile at a time
- ► Typically some overlap is present in tiles
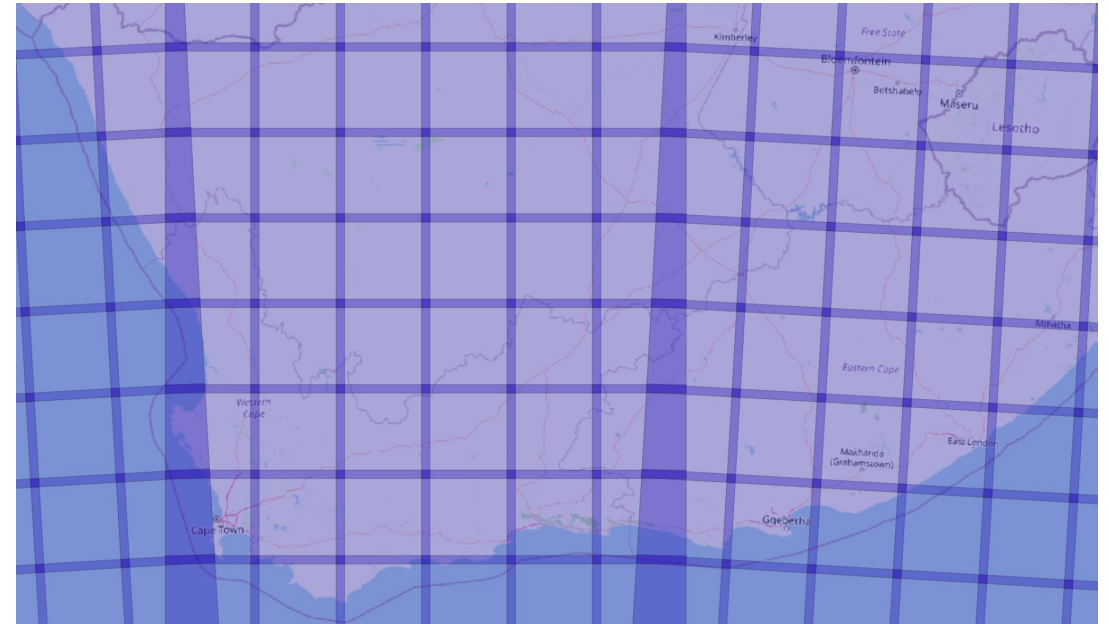
Sentinel-2 Tiles

- 100x100 km2

- Each tile is in the Universal Transverse Mercator (UTM) projection

- Projected UTM Zone according to location on Earth

- 5km overlap between tiles on each edge

Sentinel-2 Tiles

► Example: 31TCJ

  ► First two numbers: UTM Zone

  ► First letter: UTM Latitude Band, Increases from South to North

  ► Second letter: West-East position in chunk

  ► Third letter: South-North position in chunk
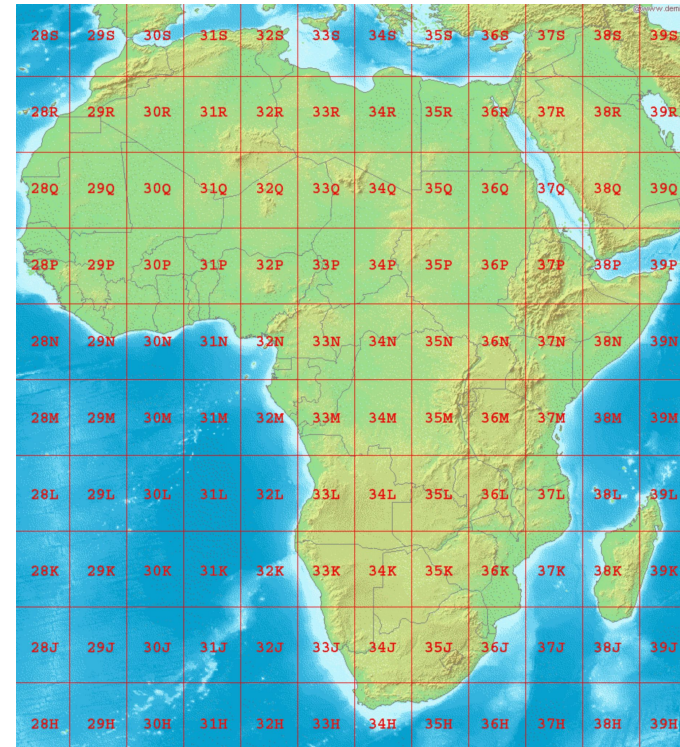
Example Tile
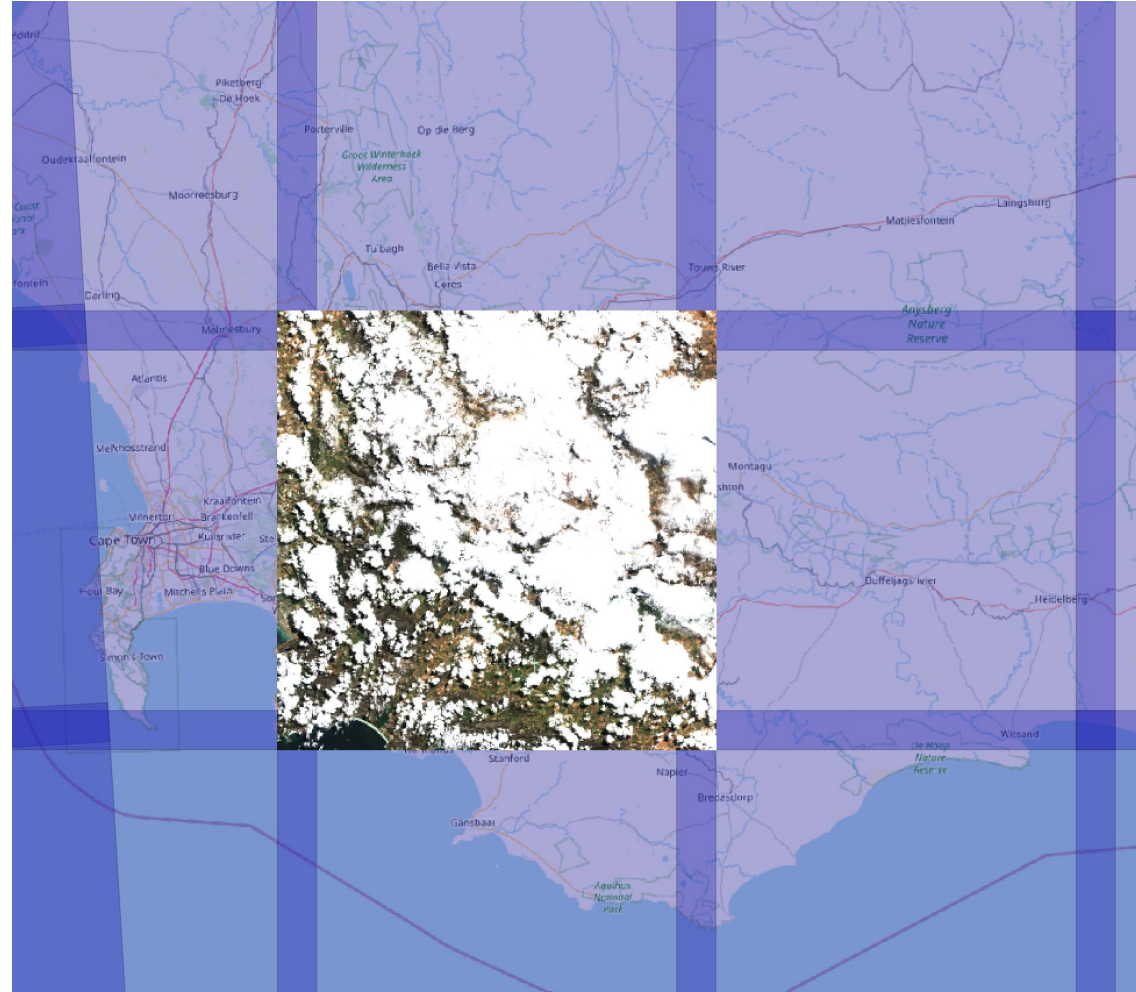
GeoJSON

- Representation of geospatial geometries in JSON format
- If no projection is defined, WGS84 (Latitude/Longitude) is assumed
- Root objection is a "FeatureCollection" type which has an array of "Features"
- Feature
  - Properties which is a dictionary of arbitrary values
  - Geometry which is either a Point, MultiPoint, LineString, MultiLineString, Polygon, or MultiPolygon

GeoJSON Example

```json
{
    "type": "FeatureCollection",
    "features": [
        {
            "type": "Feature",
            "properties": {
                "crop": "pineapples"
            },
            "geometry": {
                "type": "Polygon",
                "coordinates": [
                    [
                        [
                            -2.2027587890625,
                            5.605052121404785
                        ],
                        [
                            -0.0823974609375,
                            5.605052121404785
                        ],
                        [
                            -0.0823974609375,
                            7.841615185204699
                        ],
                        [
                            -2.2027587890625,
                            7.841615185204699
                        ],
                        [
                            -2.2027587890625,
                            5.605052121404785
                        ]
                    ]
                ]
            }
        }
    ]
}
```
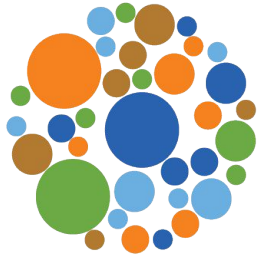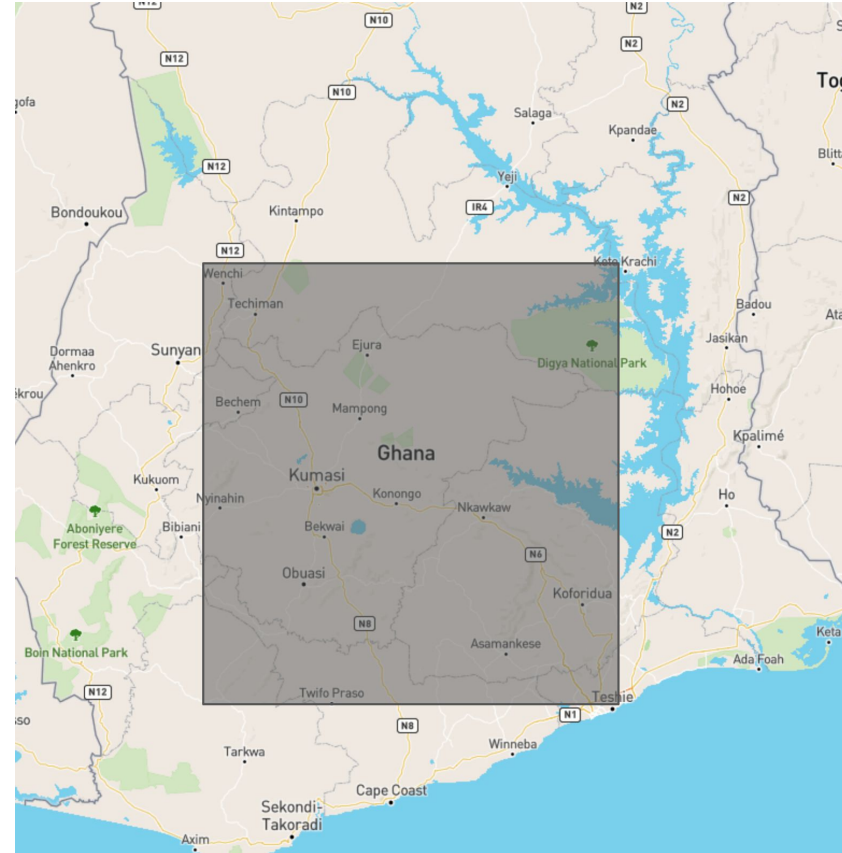
More Information and Tools

Map Projections
https://www.arcgis.com/apps/MapJournal/index.html?appid=31484c80dba54a058369dfb8e9ced549

The True Size Of (Distortion Visualization)
https://thetruesize.com/

Sentinel-2 Tiles
https://sentinels.copernicus.eu/web/sentinel/missions/sentinel-2/data-products

GeoJSON Visualization
https://geojson.io/

QGIS (Raster/Vector Visualization and Editing)
https://www.qgis.org/