GIS Data Creation & Management

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Workshop series: Certificate of Attendance

1. Introduction to GIS (101)
2. GIS Data Creation and Management (102)
3. Working with Tabular data (103)
4. Field Data Collection using GIS (104)
5. Introduction to Spatial Analysis (105)
6. Spatial Statistics with GIS (106)
7. Introduction to Cloud Mapping with ArcGIS Online and Story Maps (107)

Agenda

9:00am — Review
Data Models: Vector & Raster, Geodatabases vs. Shapefiles

9:15am — Projections
Coordinate systems: Projected vs. Geographic

9:30am — Georeferencing Raster Datasets
Scanned maps, aerial photography, satellite imagery

10:30am — Creating your own GIS Data
Vector data: points, lines, polygons

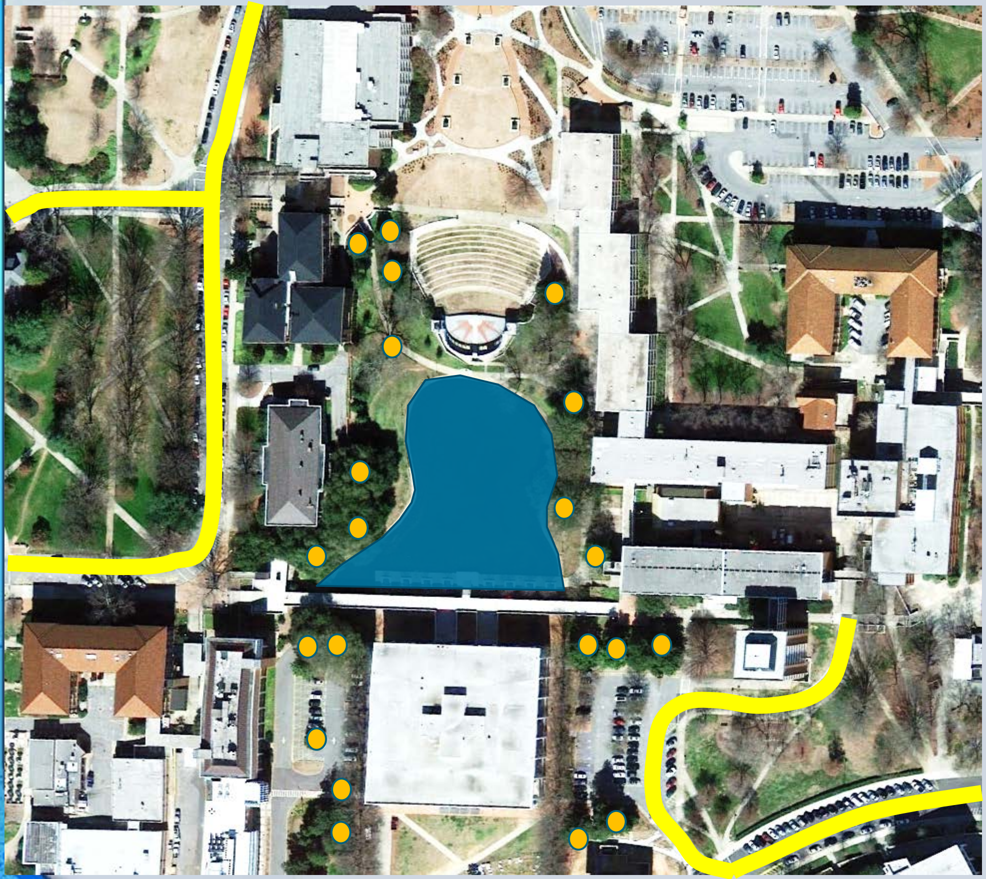
11:30am — Importing GPS & Excel Data
Lat/long, addresses (.txt, excel, .csv)

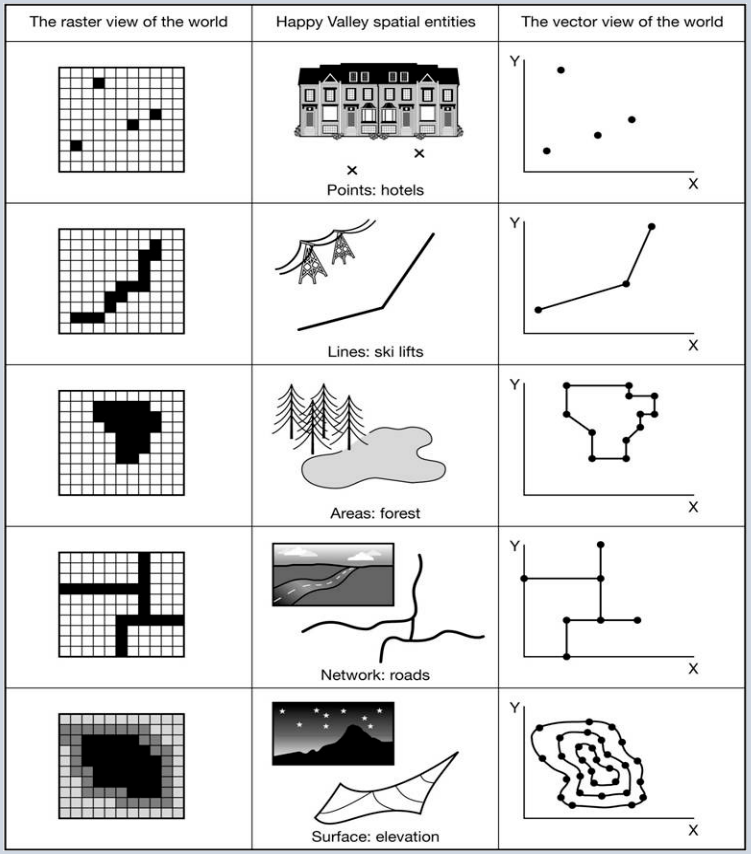
GIS Data Models: Vector Vs. Raster

There are 2 basic spatial data types representing the real world:

Raster

Vector





Vector and Raster Data Storage

Individual files

Shapefile

(polygon, line, point)

Raster

File Geodatabase

(no limit)

Feature Dataset

Feature Class

(polygon, line, point)

Raster

Shapefile Vs. Geodatabase

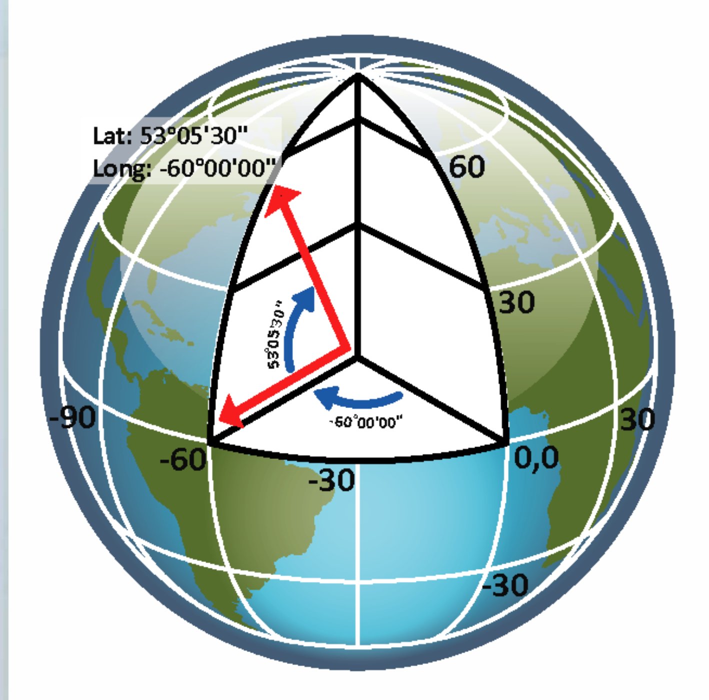
Shapefile	Geodatabase
Attribute table < 2GB	No limit
Geometry < 2GB	No limit
Max number of fields: 255	No limit
Field names < 10 characters	Field names > 10 characters
No update on area, perimeter	Automatic updates
No x,y tolerance	x,y tolerance
3-5 times bigger	3-5 times less space
Spatial Index inefficient	Faster query performance
No date and time in a field, no null values, no raster values	Date and time, null values, raster values

When to use Shapefiles?

- Exporting to other software
- Emailing, sharing
- Simple geometry files

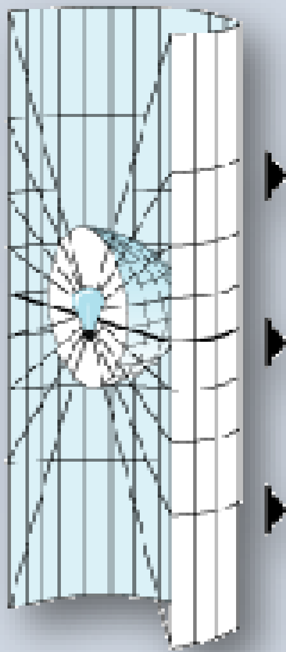
Spatial Reference Systems

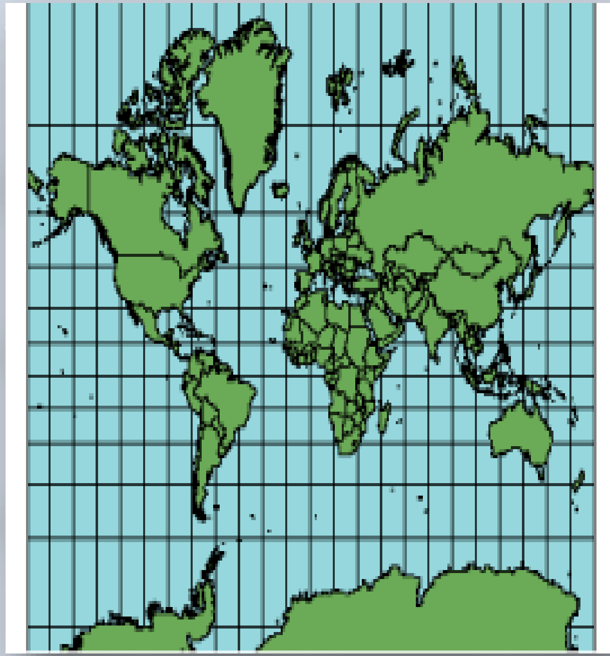
Geographic Coordinate Systems



Latitude, Longitude:
Always ask for the Datum!

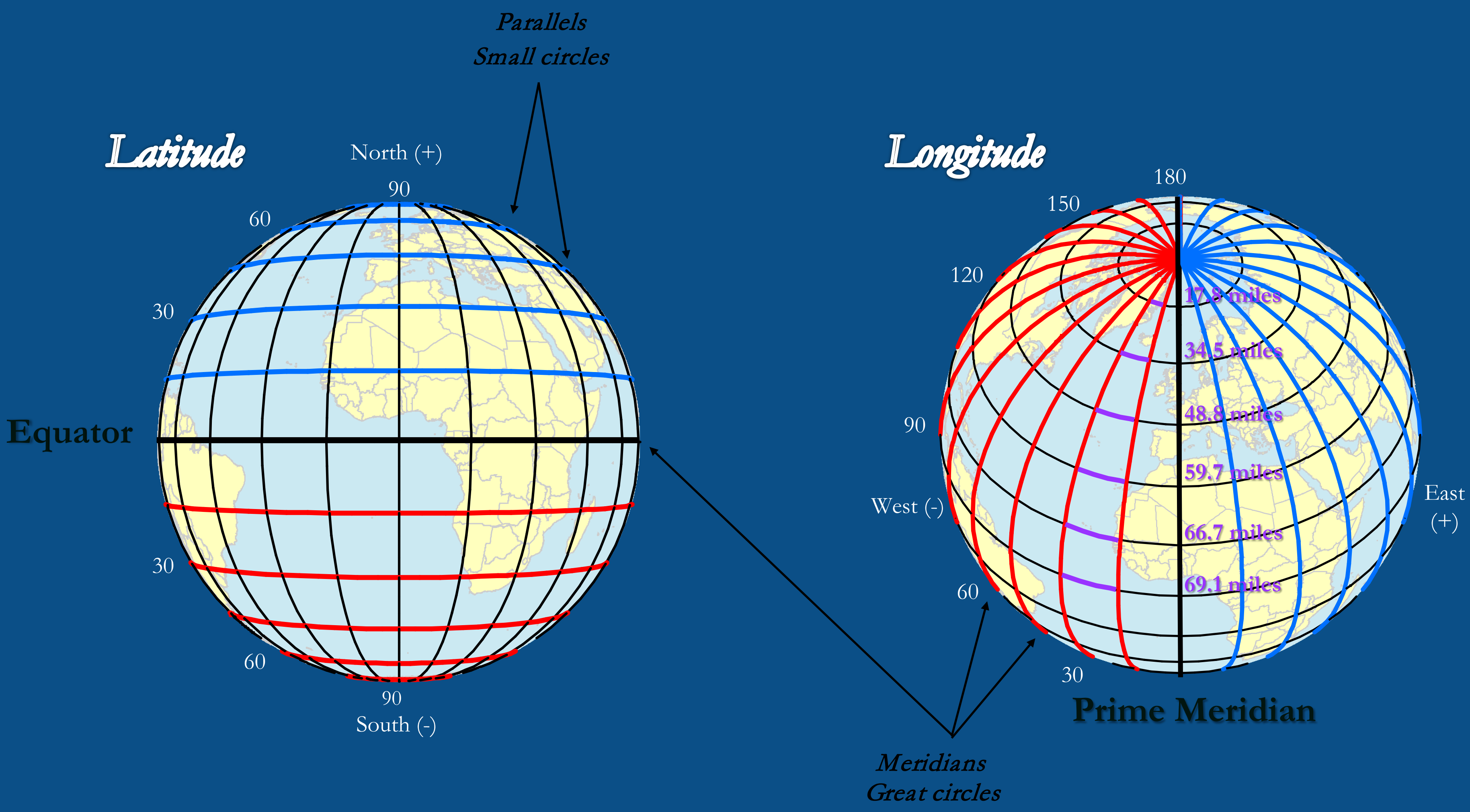
Projected Coordinate Systems





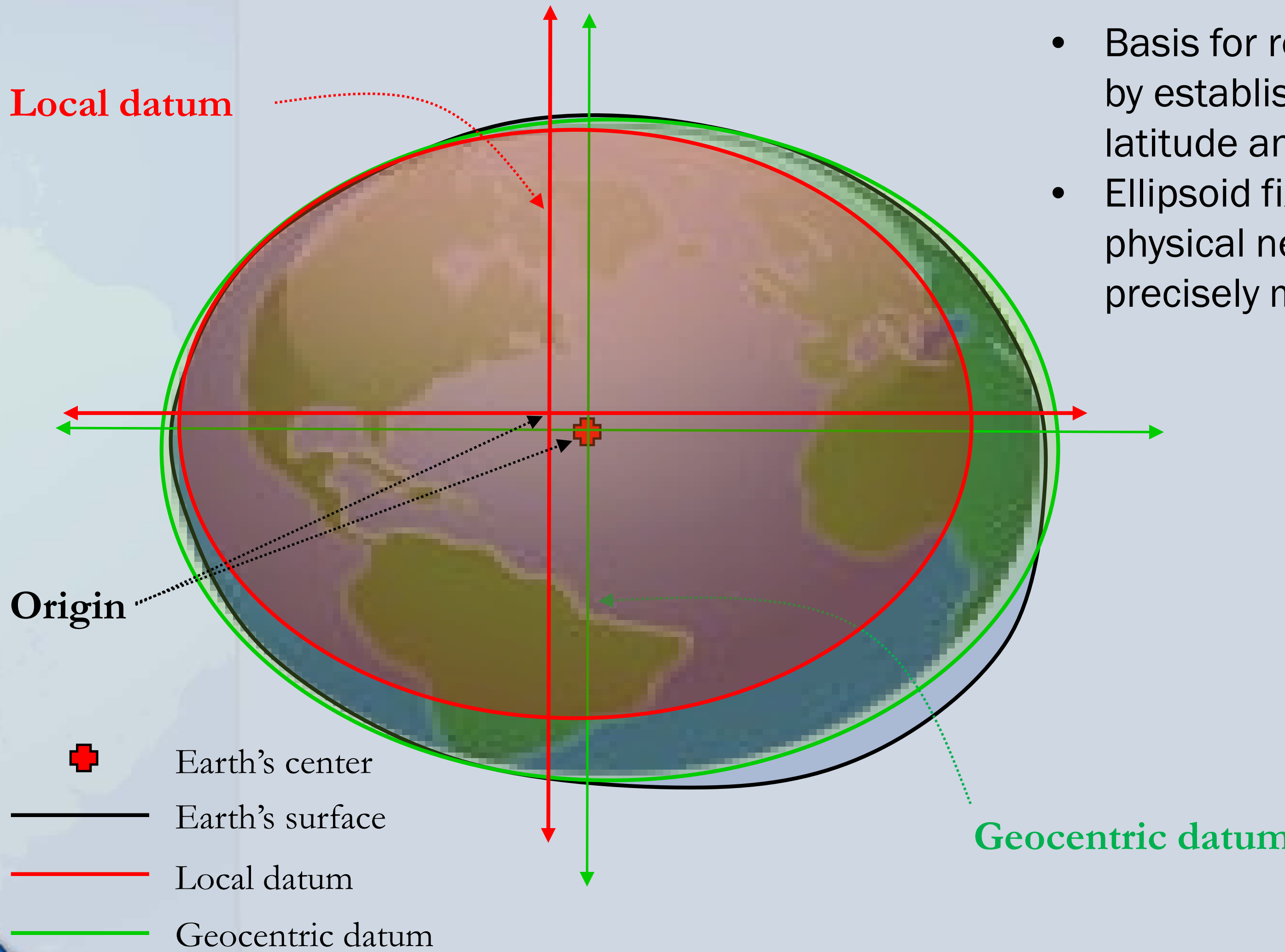
Mercator, UTM, State Plane, Albers Equal Area, Equidistant

Geographic Coordinate Systems

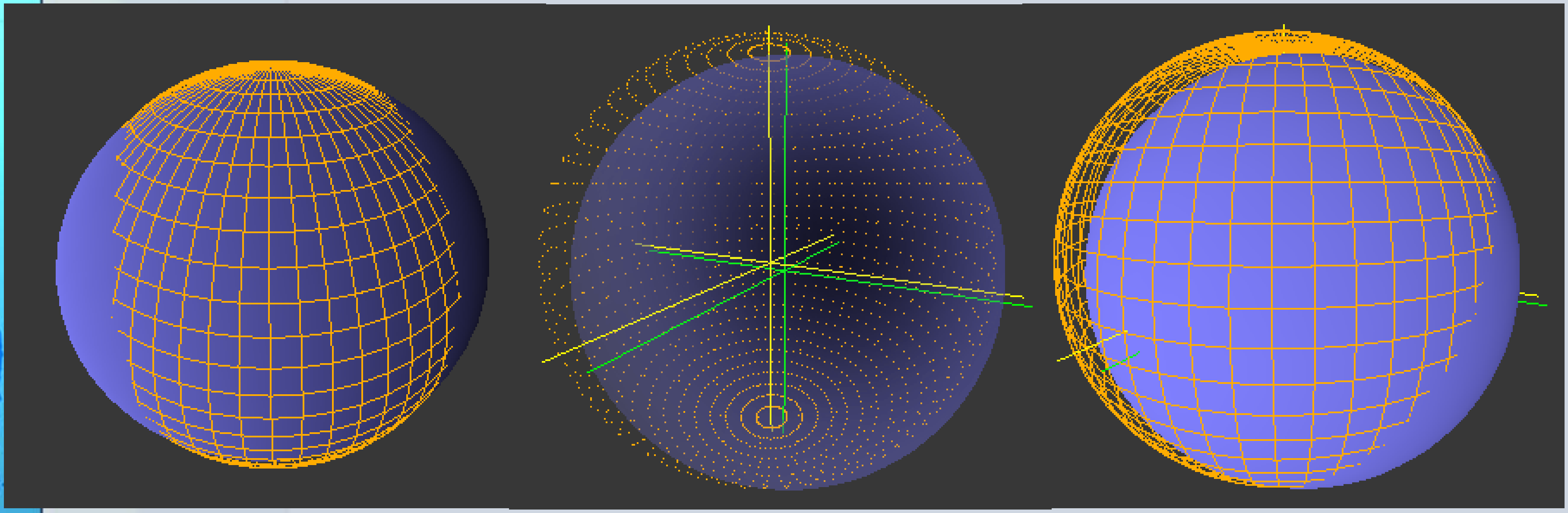


Datum

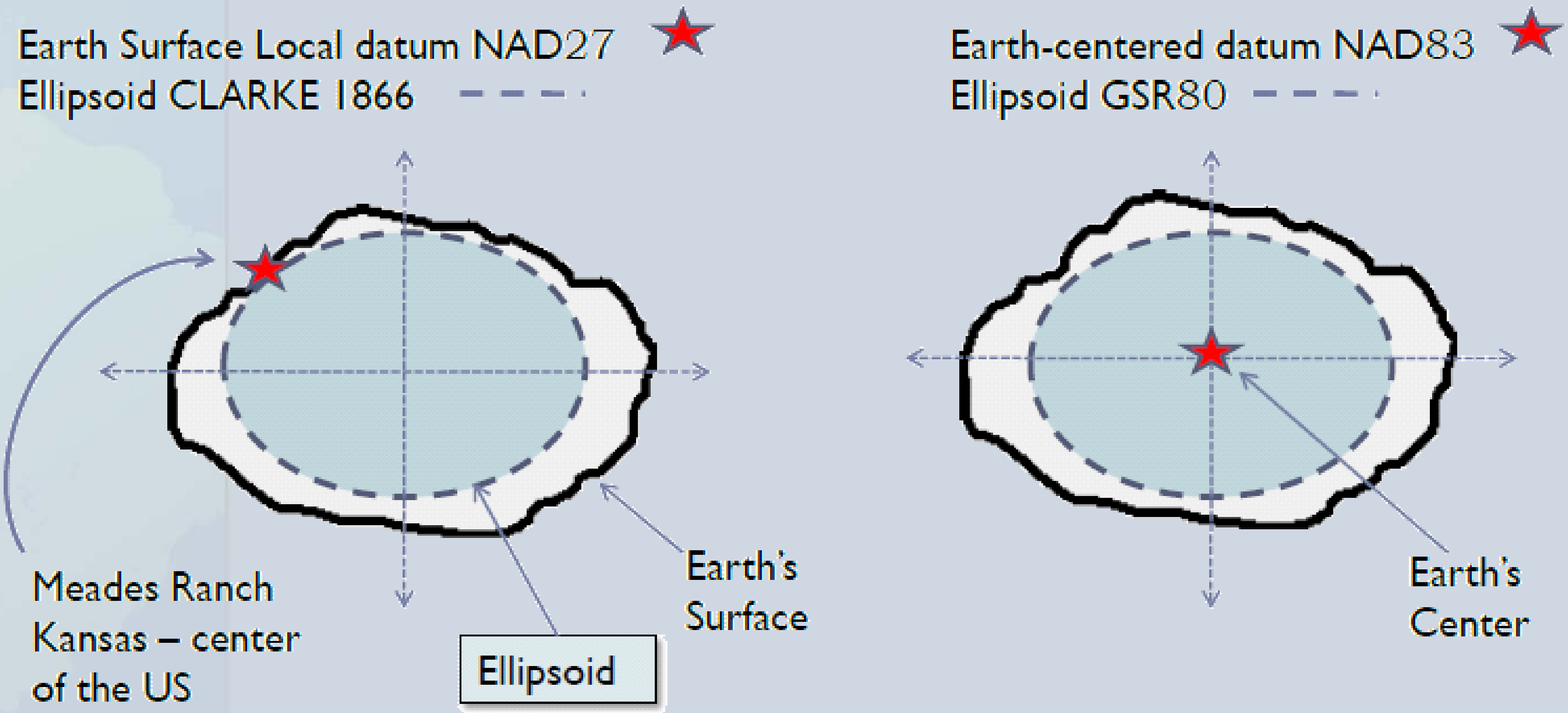
- Basis for reference systems by establishing origin of latitude and longitude
- Ellipsoid fixed through a physical network of precisely measured points



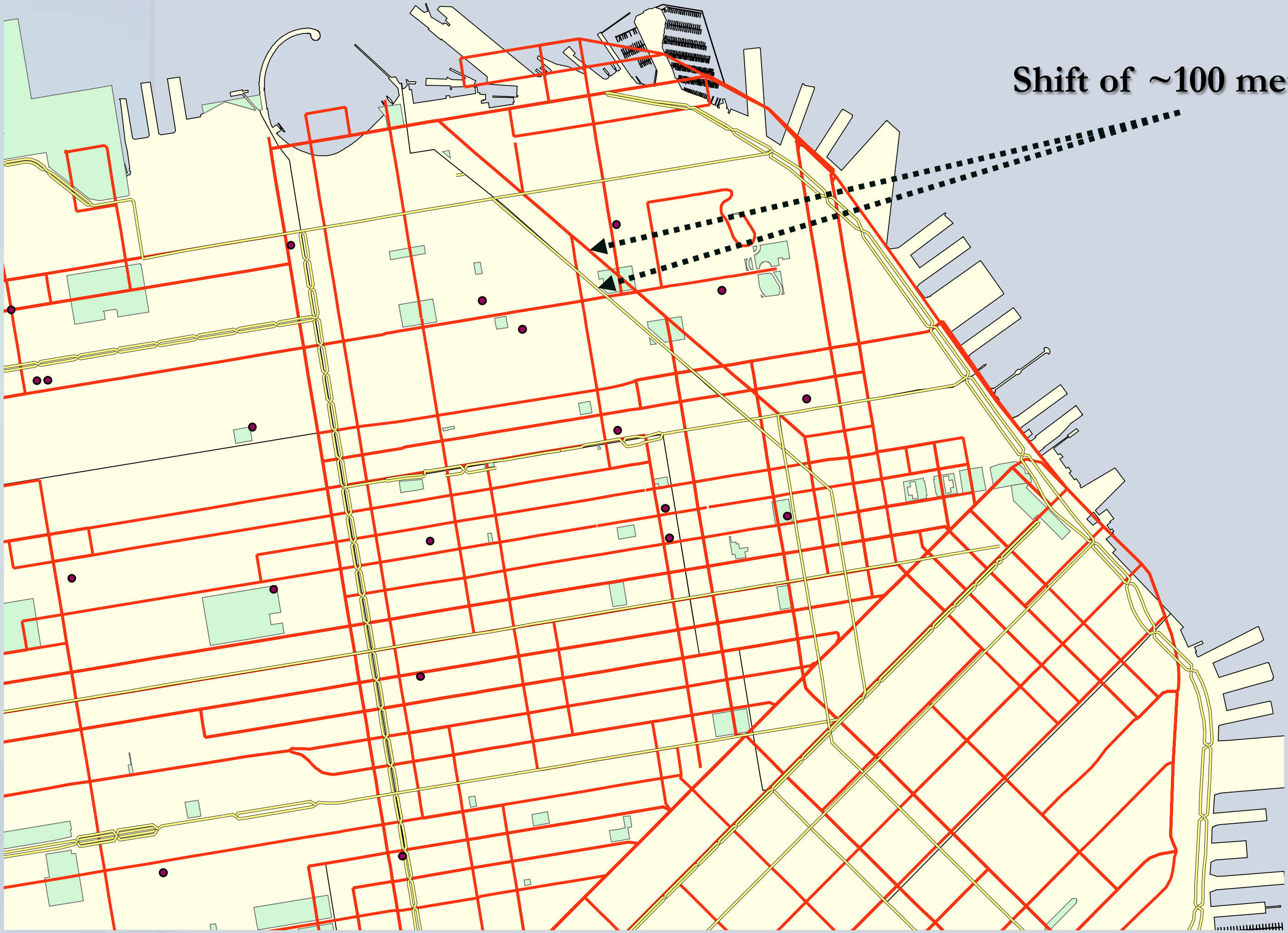
Datum



Common Datum used in the US

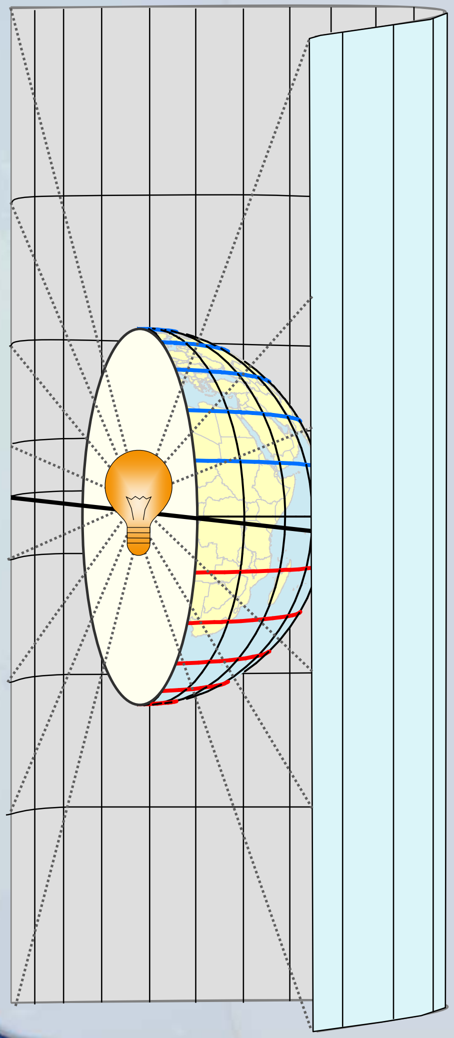


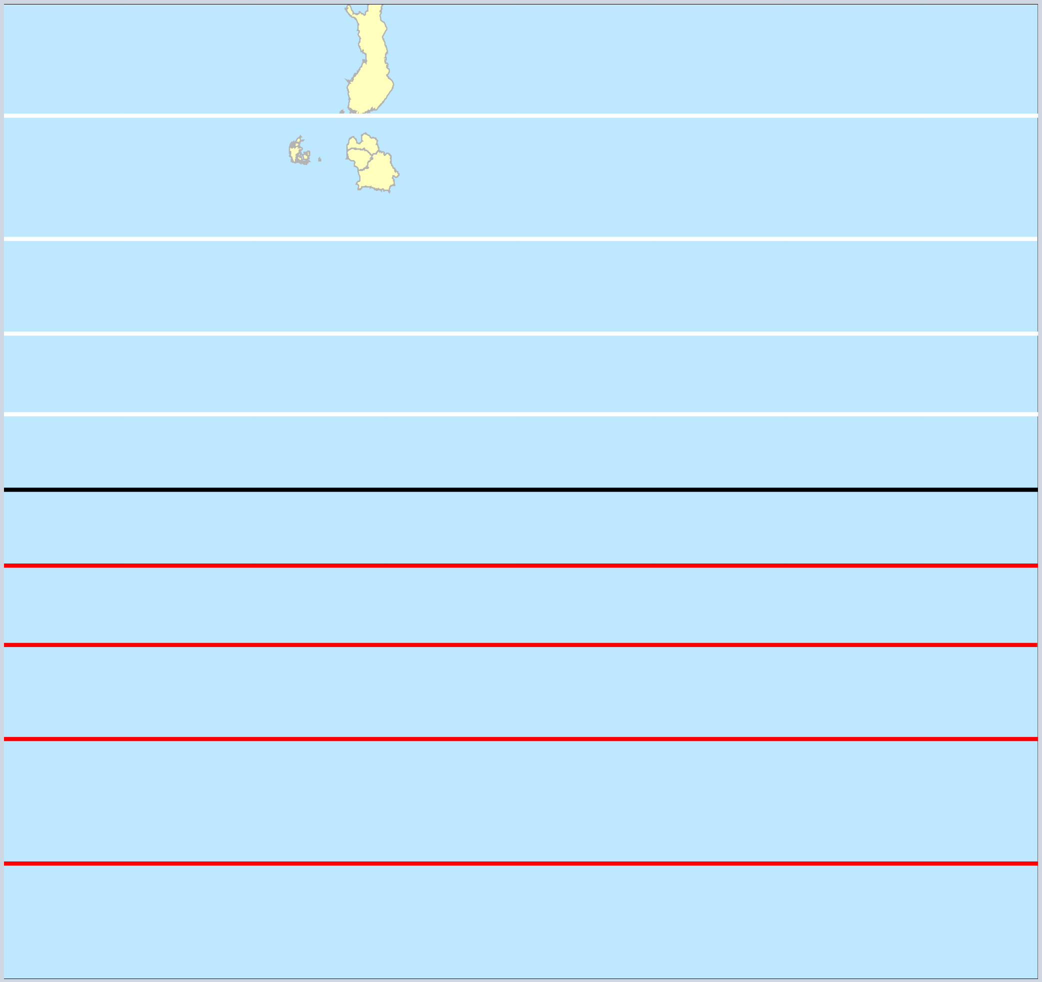
Datum Shift



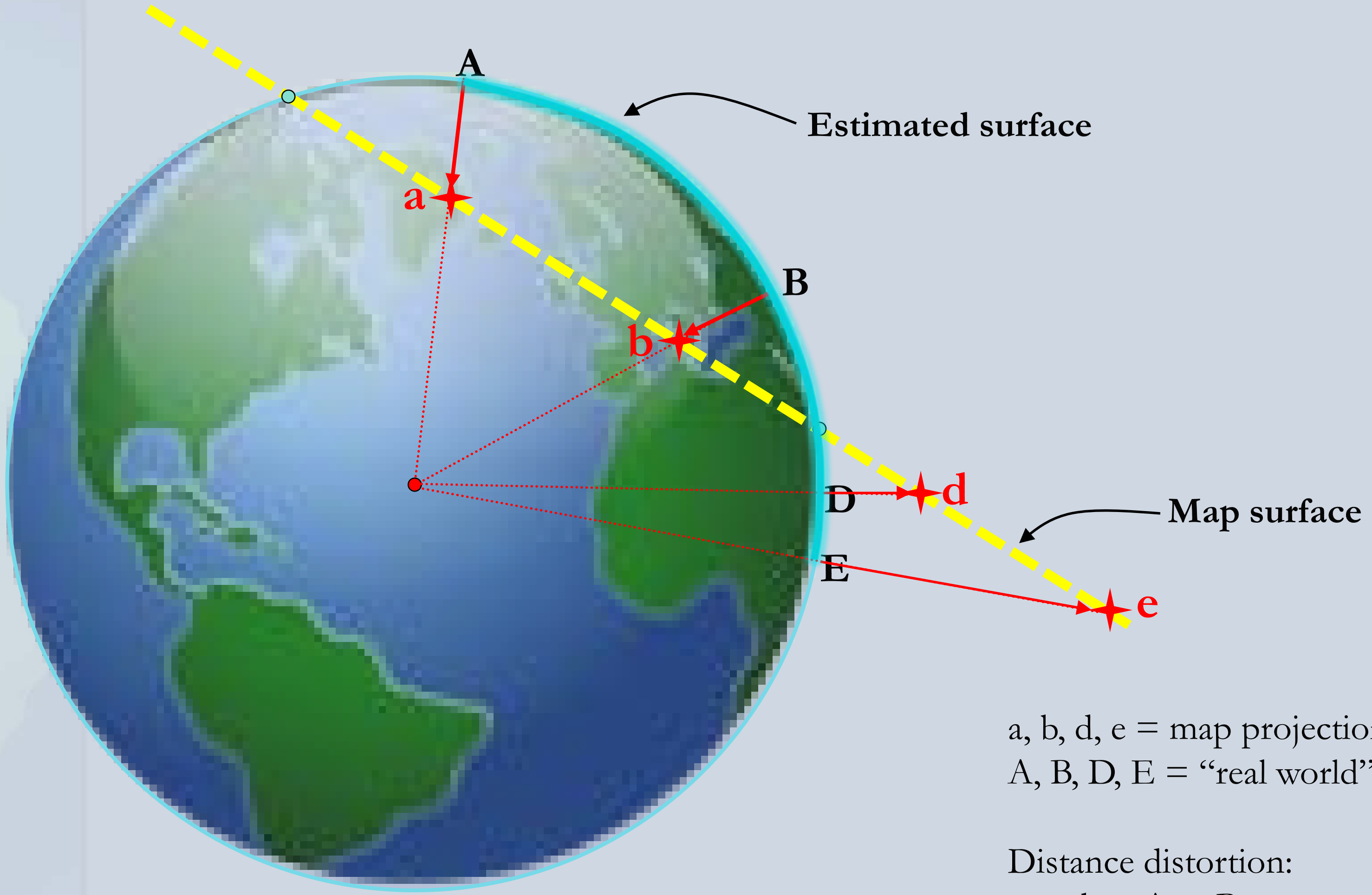
Shift of ~100 meters

Map Projections





Map Projections

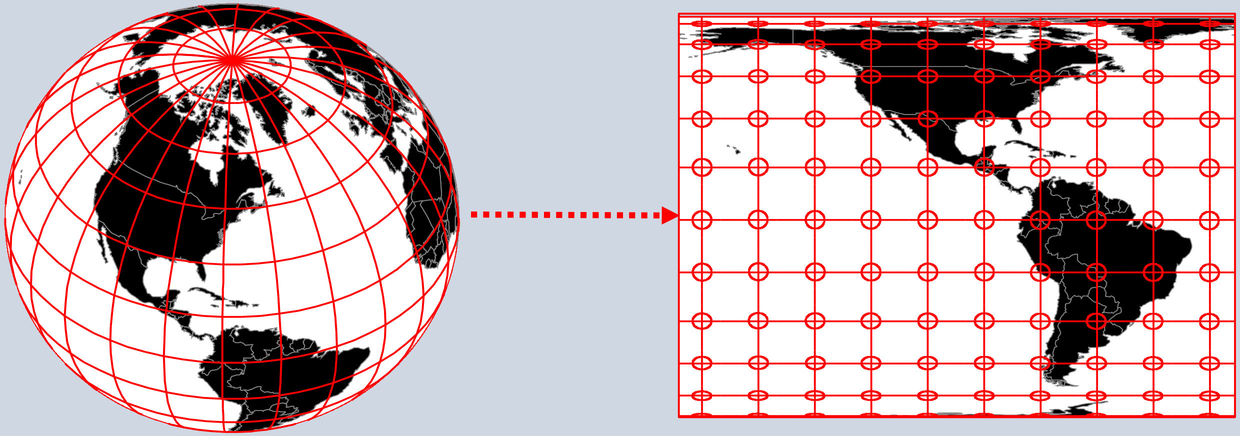


a, b, d, e = map projection
A, B, D, E = "real world"

Distance distortion:
a to b < A to B
d to e > D to E

Projection Distortion

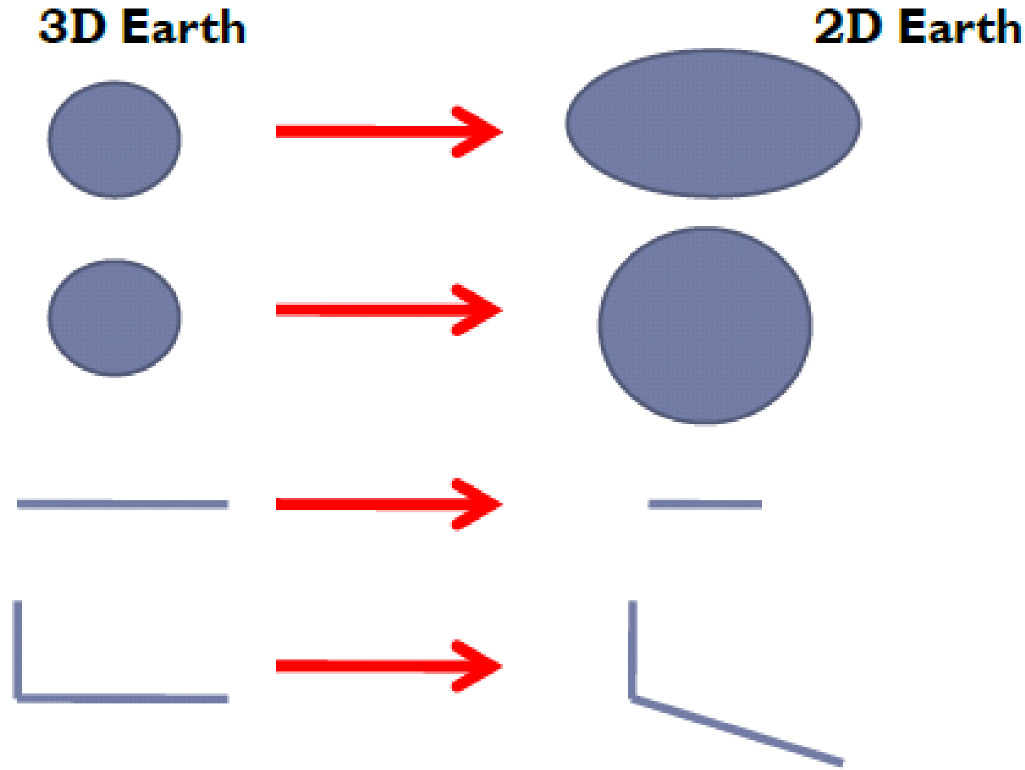
- All map projections involve some level of distortion
  - portions of the Earths surface will be compressed, others stretched
  - shape (angles), area, direction, and/or distance distort as a result
  - only a sphere can retain all four; sphere is NOT a map projection
- Projection chosen based on acceptable and unacceptable error



Projection Distortion

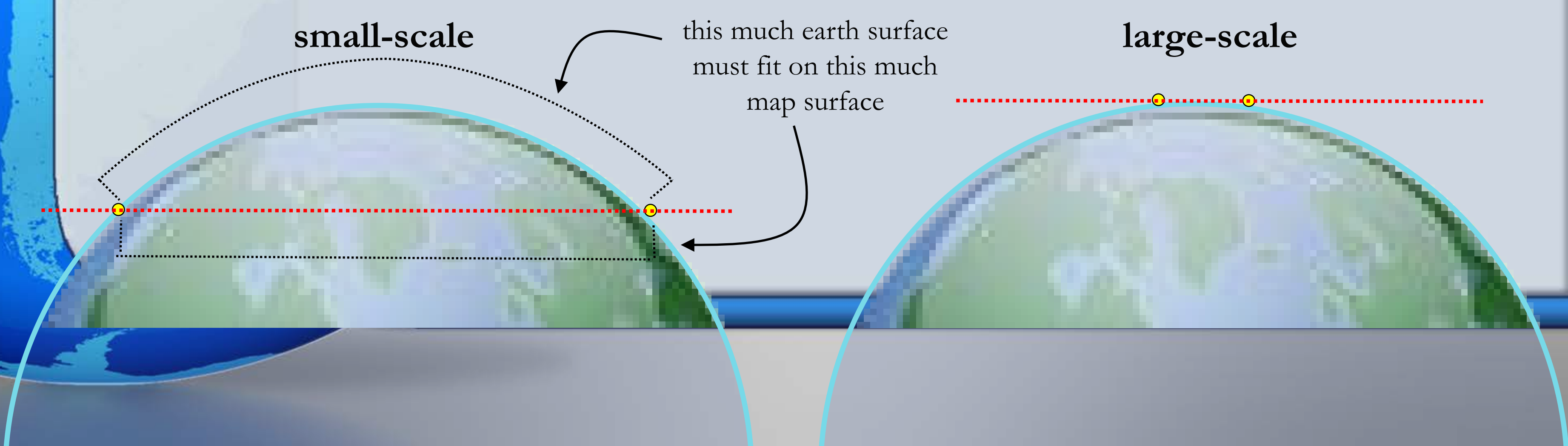
Projections make geographers SADD

- Shape
- Area
- Distance
- Direction

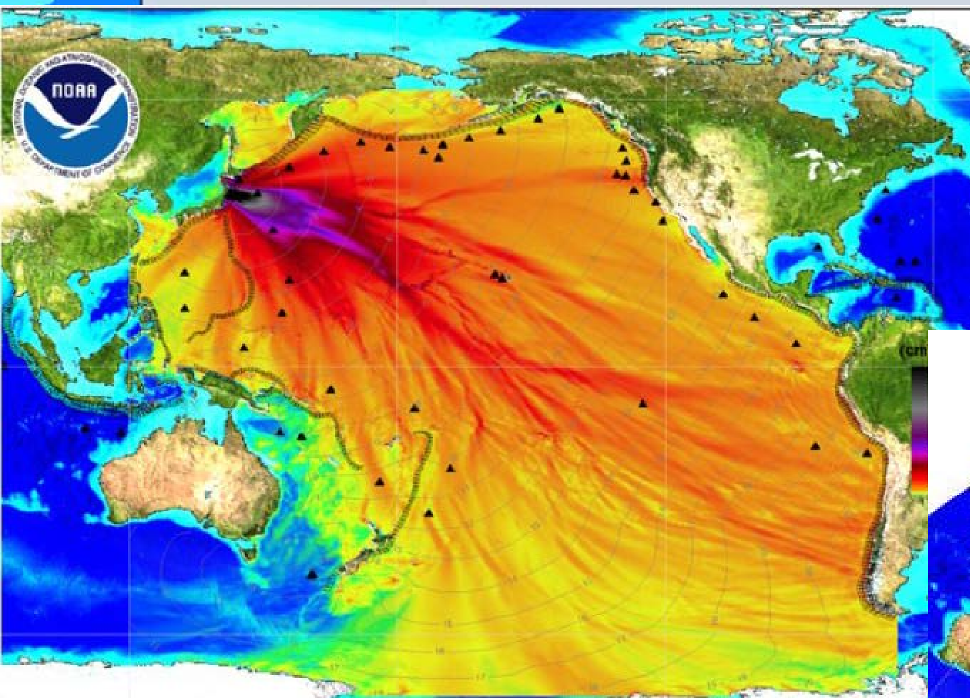


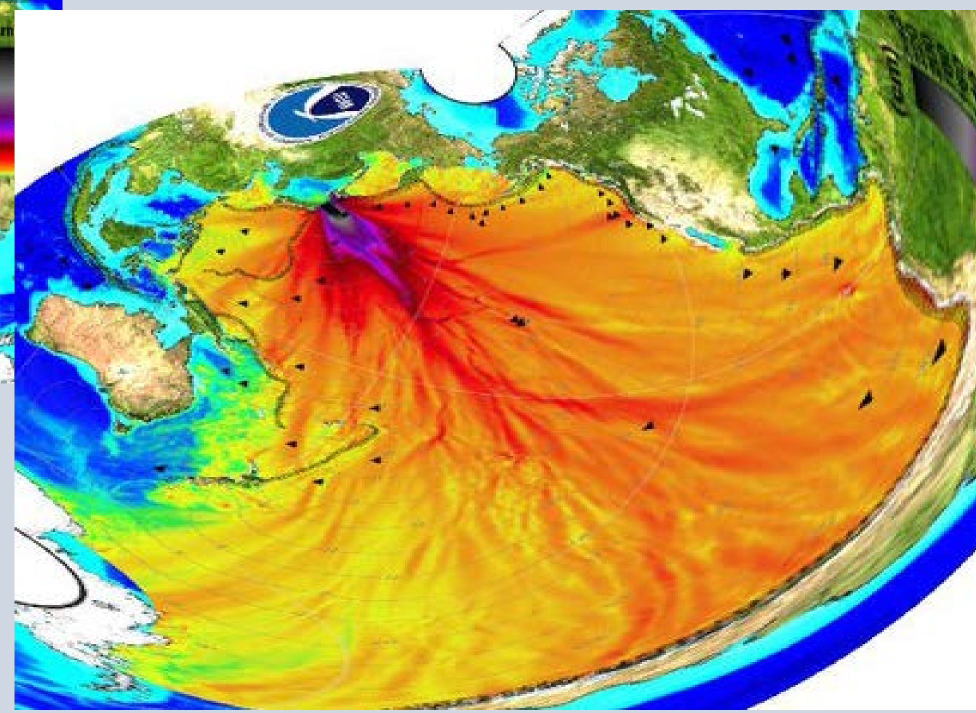
Projection Distortion

- Size of the mapped area influences map distortion
- Small-scale mapping
  - large geographic region
  - greater degree of distortion expected
  - function of projecting more of the curvature of the earth on a flat plane
- Large-scale mapping
  - small geographic region
  - minimum degree of distortion expected
  - function of minimal to no curvature of the earth being projected

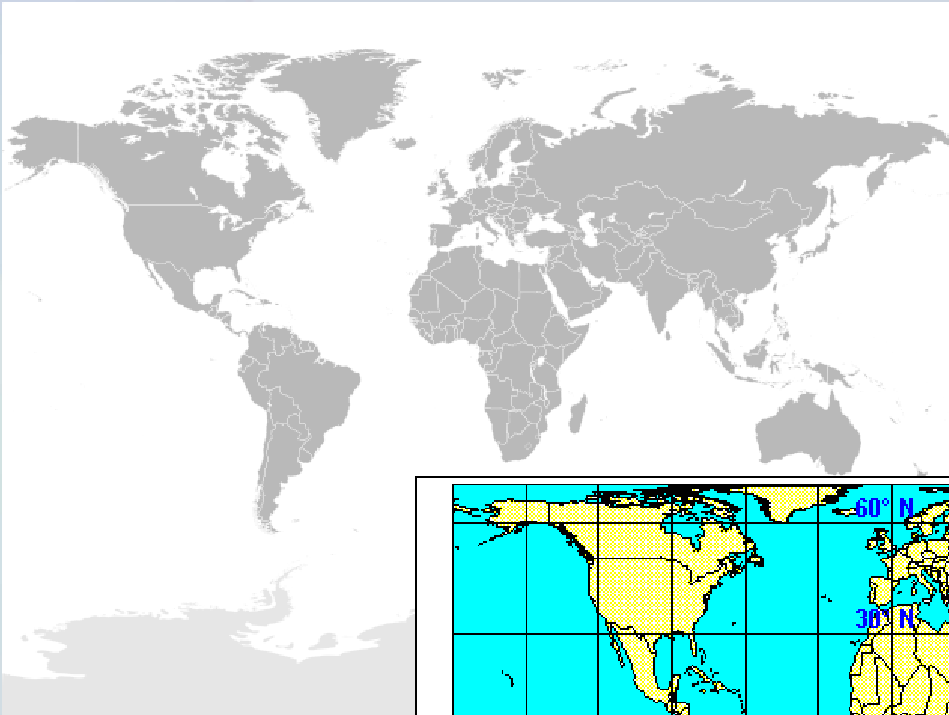


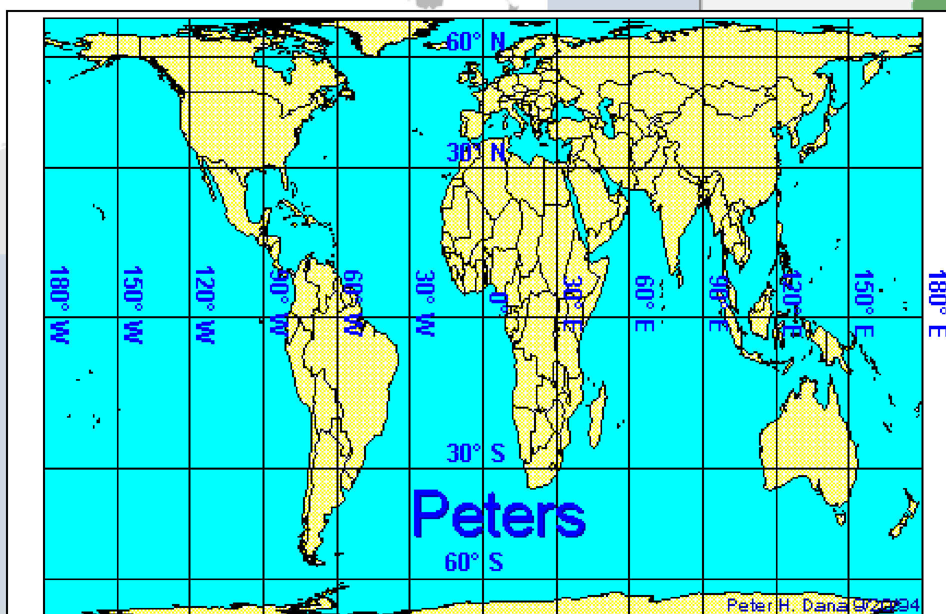
The Importance of Projections



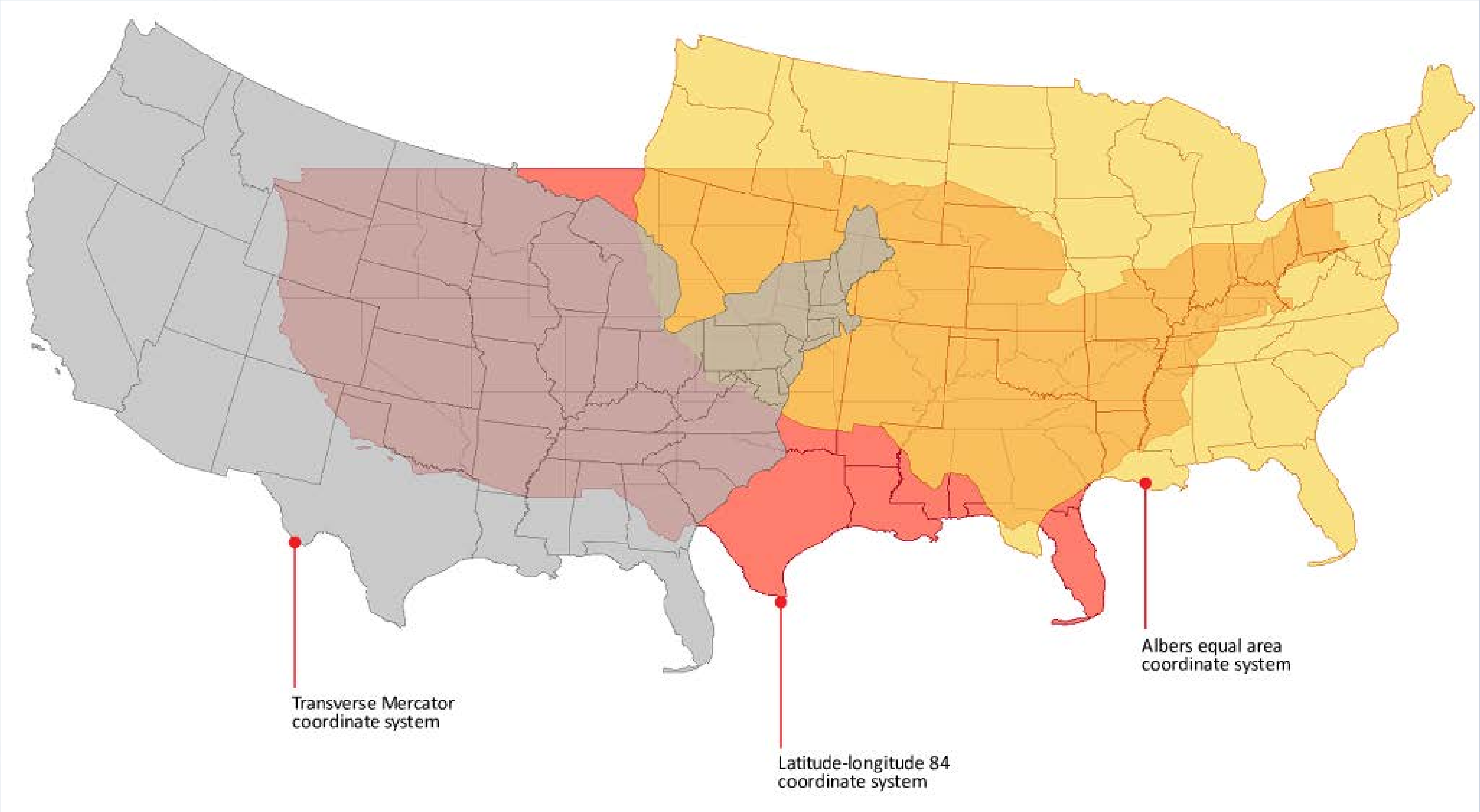


The Importance of Projections - cont





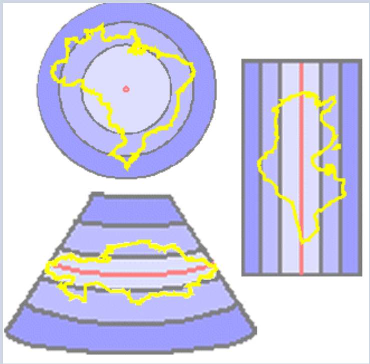
Which Projection?



Always work in **Projected** Coordinate Systems!

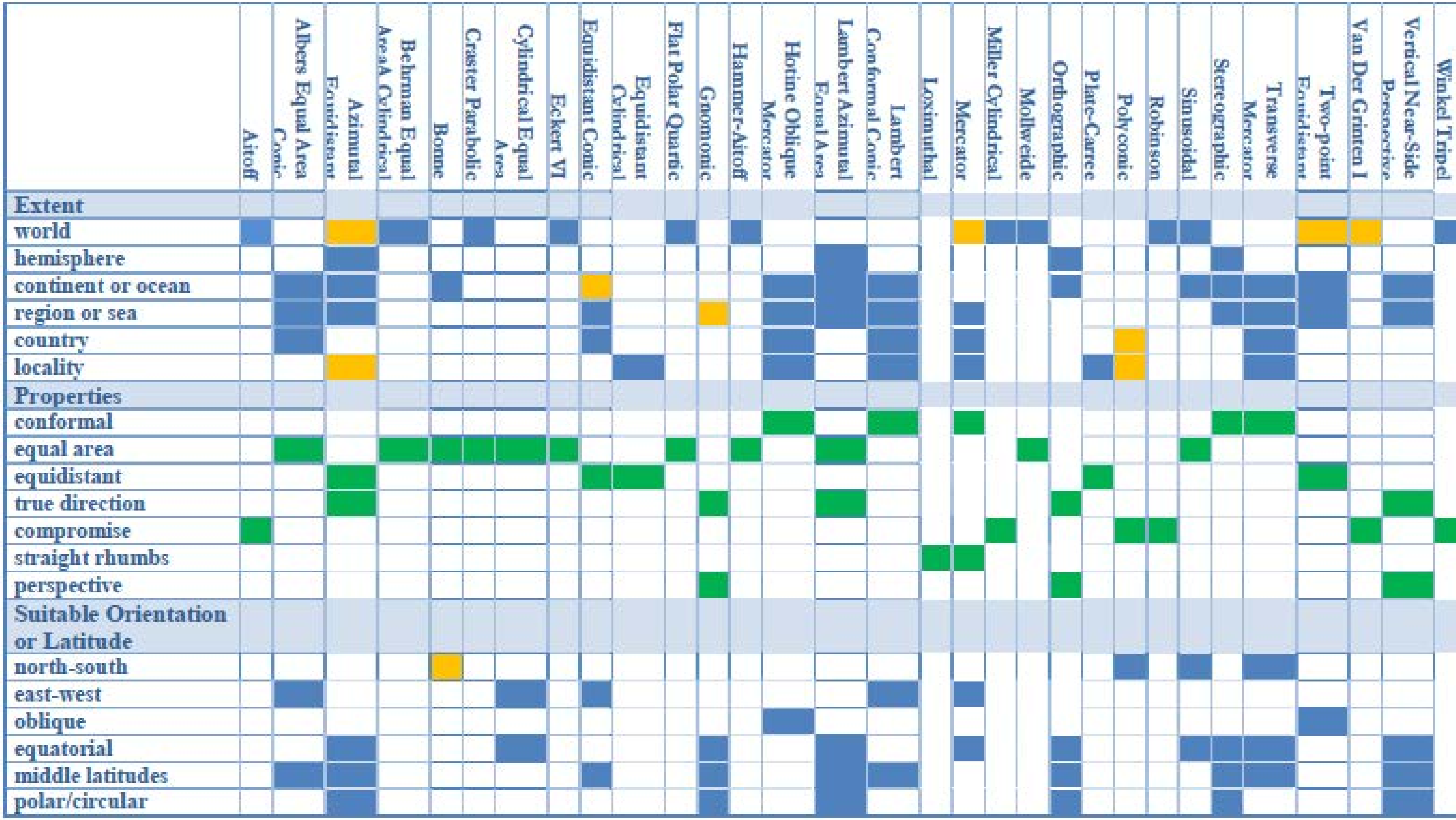
Which projection to use??

- **What is the map's purpose?**
  - For general reference and atlas maps, you usually want to balance shape and area distortion
  - If your map has a specific purpose, you may need to preserve a certain spatial property— shape, area—to achieve that purpose.
- **What shape is your area of interest?**
  - Areas that extend along a great circle: cylindrical projection
  - Areas that extend along a small circle: conic projection
  - Areas that are approximately circular: azimuthal projection



- **Which part of the world does your map show?**
  - Tropical regions: cylindrical projection
  - Middle latitudes: conic projection
  - Polar region: azimuthal projection

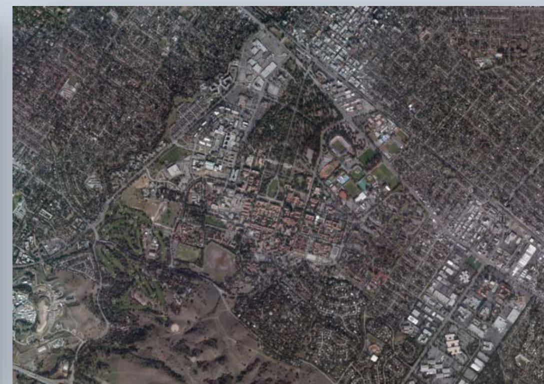
PROJECTIONS CHART



Georeferencing Raster Datasets

Georeferencing describes the process of **locating** an entity in 'real world' coordinates. When you georeference your raster dataset, you define its location using **map coordinates** and assign a **coordinate system**.

Scanned Map (pdf)



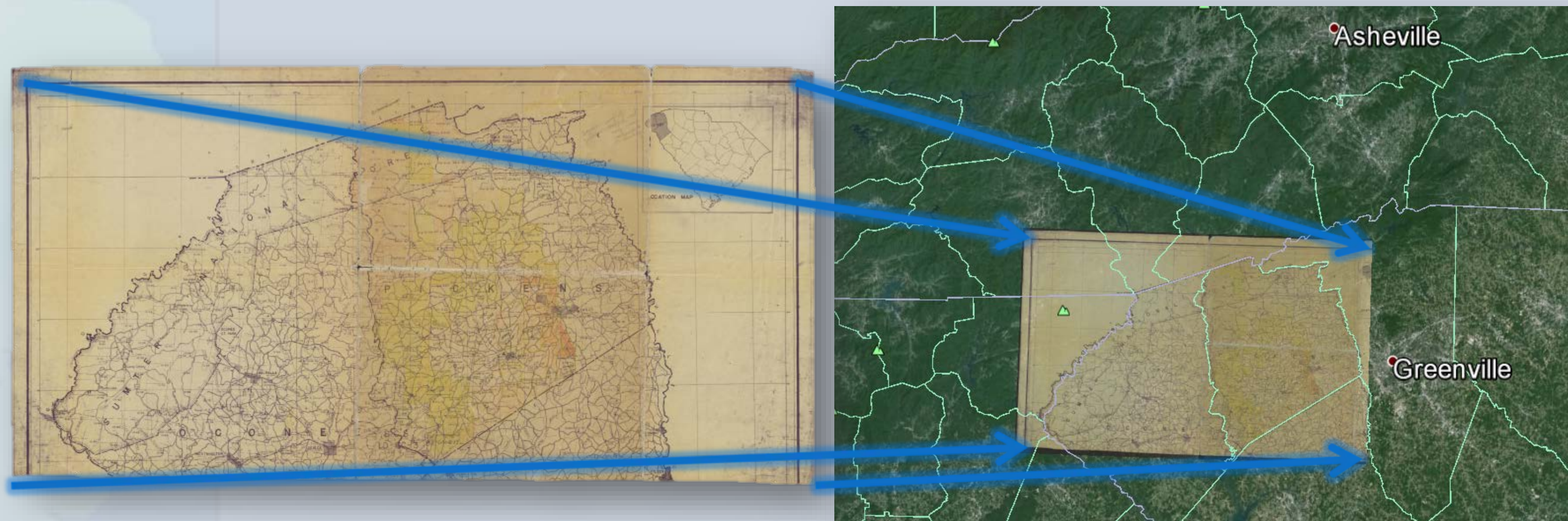
Aerial Photography

Satellite Imagery

Georeferencing Raster Datasets

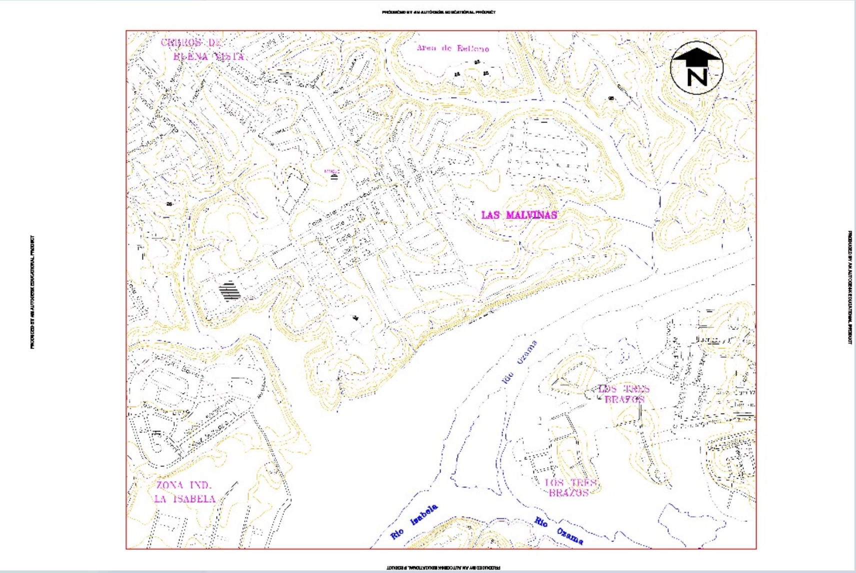
Pdf ----> jpeg or TIFF

GeoTIFF



Aerial Photograph Index Pickens County SC 1938

If given a choice: vector or raster?



Pdf or JPEG - image

CAD – line data

Next Workshop: Working with Tabular Data

Point, line and area features (vector data) are geographic objects on a map and records in a table. Such features can be selected by location or by the values stored in a feature's record. These simple capabilities allow the GIS user to conduct complex analyses.

- Cleaning your data before you do analysis
- Selecting data based on a criteria
- Table queries
- Joins
- Field calculator