



Geocoding and Georeferencing



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Learning Outcomes

- Define coordinate system and map projection
 - Relate coordinate systems and map projections
- Distinguish between *defining* and *changing* coordinate systems
- Create new GIS data from addresses and paper maps
- Explain how to integrate GPS point data





Processing Geographic Information

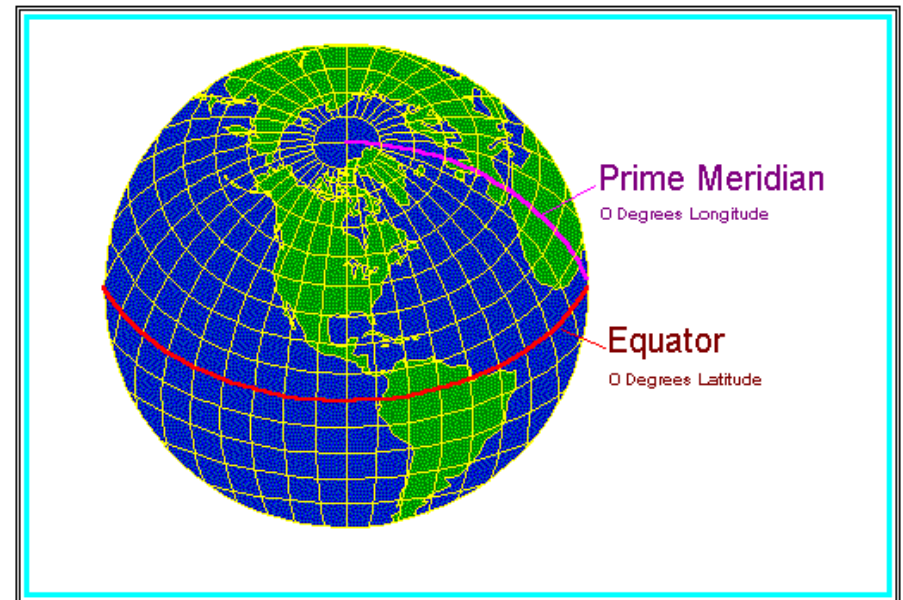
- Georeferencing and Geocoding
 - Linking data we have to geographic frames of reference
 - Supporting the display of our data in a GIS and its integration with other geographic data
 - Geocoding: matching addresses to geographic coordinates (latitude and longitude)
 - Georeferencing: matching geographic images to coordinates





Frames of Reference

- Global: systems that provide discrete coordinates for locations anywhere on the Earth's surface
- The **geodetic latitude** of a point is the angle between the equatorial plane and a line normal to the reference ellipsoid.
- The **geodetic longitude** of a point is the angle between a reference plane and a plane passing through the point, both planes being perpendicular to the equatorial plane.
- The geodetic **height** at a point is the distance from the reference ellipsoid to the point in a direction normal to the ellipsoid.





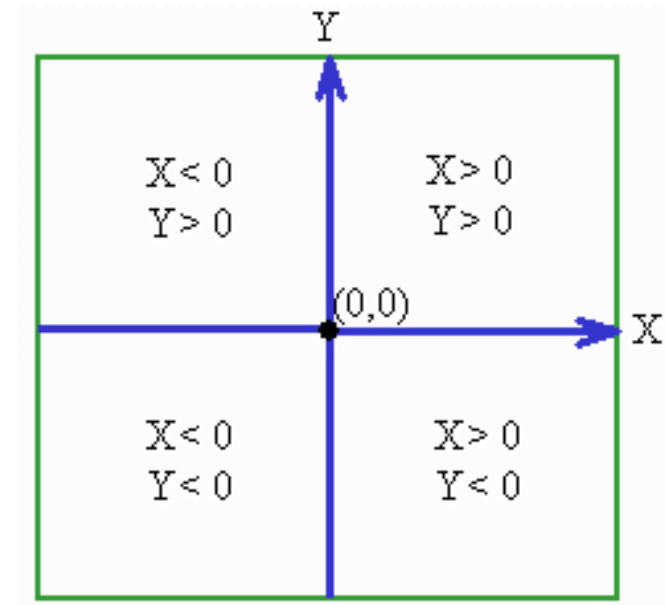
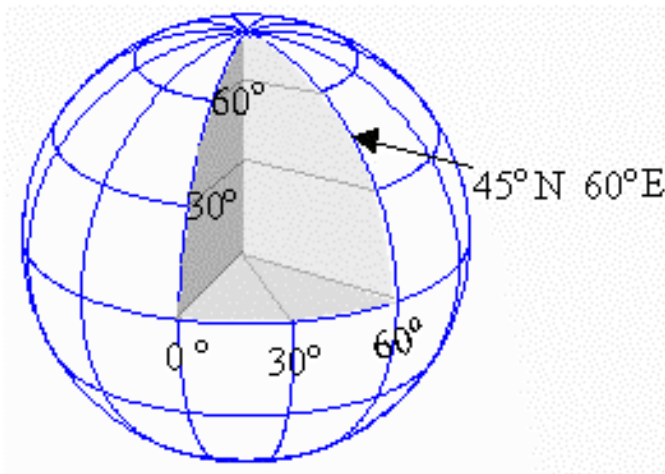
Frames of Reference

- Global Frames of reference are applied to a model of the Earth (size and shape)
 - Earth's actual shape is too complicated
 - Spheroidal and Ellipsoidal models are used
 - Any single model of the Earth's size and shape is called a geodetic datum





Geographic and Projected Coordinates



(ϕ, λ) \longleftrightarrow (x, y)
Map Projection





Coordinate Systems in ArcGIS

- Latitude and Longitude (3-D object surface, locations indicated in degrees)
- Projected (2 D and Planar, X, Y in distances)
- All GIS data is stored according to a coordinate system
 - Sometimes the information about the coordinate system DOESN'T come with the data (but the underlying information is still stored with respect to one)
 - In these situations we need to define or specify the coordinate system (“define” command)
 - Sometimes we want to change the data from one coordinate system to another
 - In these situations need to transform or project the data from one coordinate system to another (“project” command)



Address Matching and Geocoding

- Frames of Reference

- Continuous

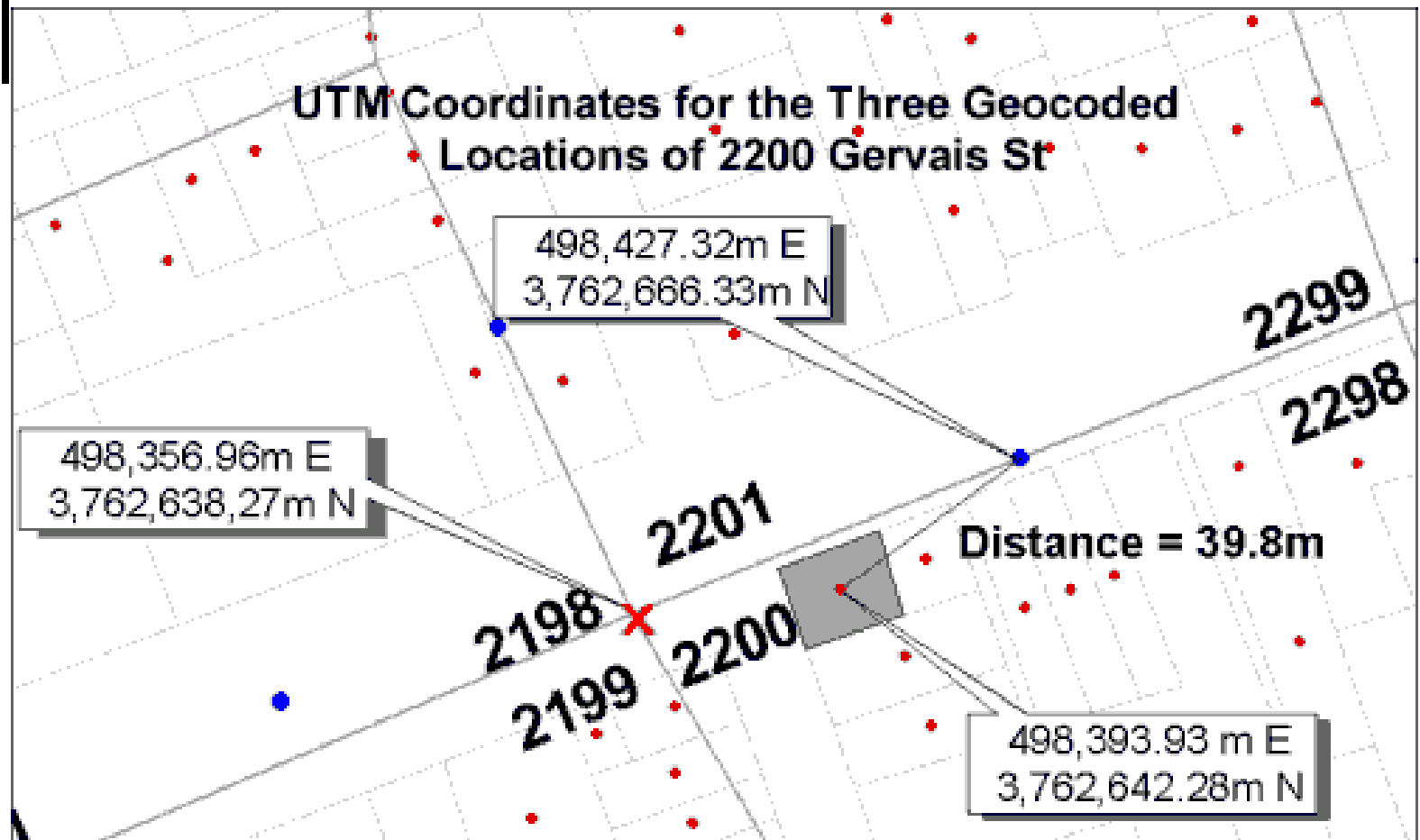
- Discrete, Objects, and Areas

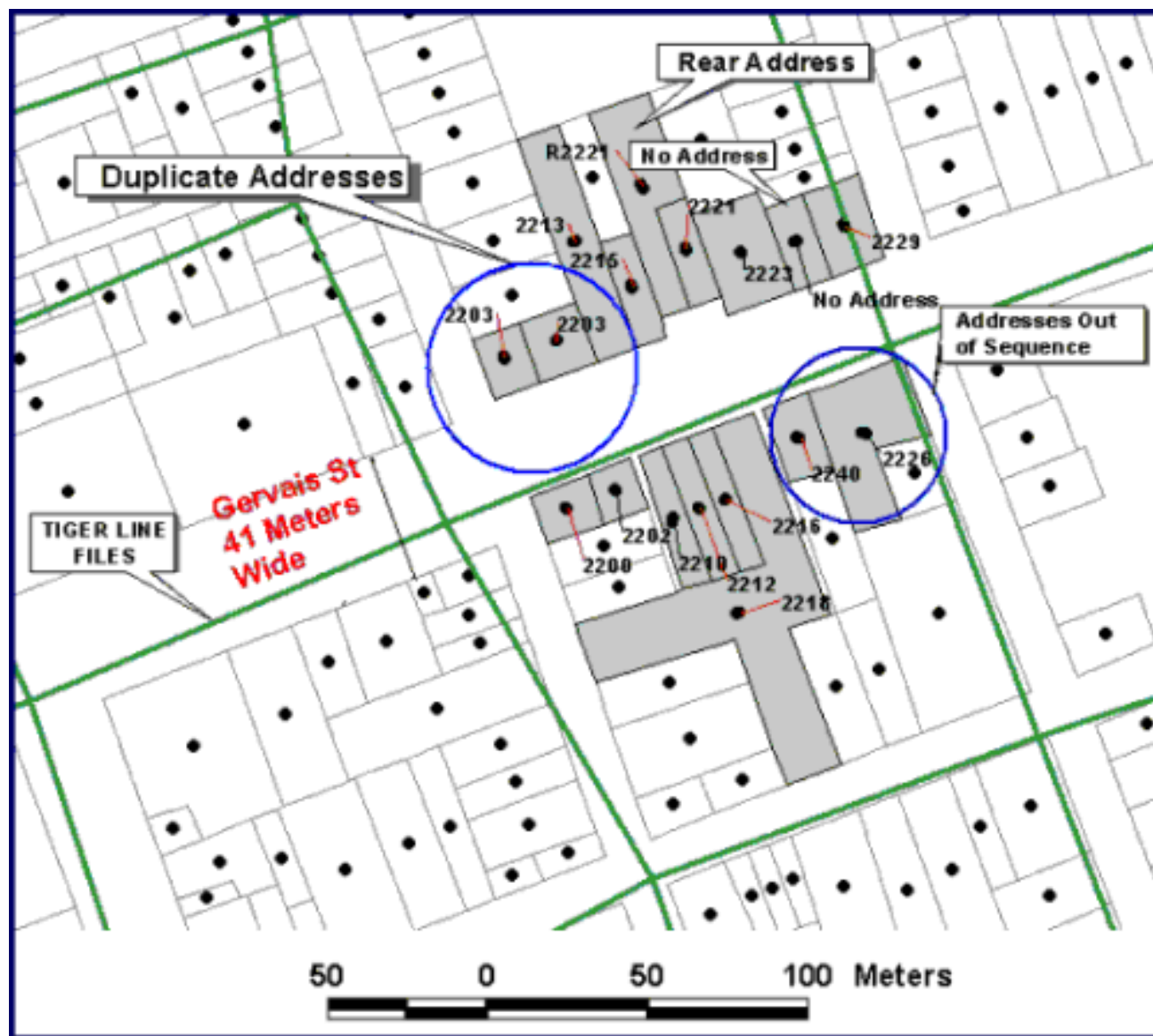
- Street Address: Palmetto Seafood Co.
2200 Gervais St.
Columbia, SC 29204-1808 USA
 - Section, ¼ section, township
 - Larger? City, province, etc

- Uh-oh, problems

- For the most part databases produce successful geocoding results











Georeferencing a Paper Map

- Sometimes the data we want is only available in a hard copy
 - Or is an image
- If we know some important things about the contents of the image or map we can coordinate it with global reference systems
- Establish links between the image and a geographically known database



Layers

- ny_Clip
- manhattan.sid**
 - RGB
 - Red: Band_1
 - Green: Band_2
 - Blue: Band_3





Control Points

- Link points are called “control points”
- Control points should be:
 - Easy to confirm (same location in the world)
 - Be spread across the space being georeferenced
 - Have good overlap between the two datasets
 - Established by clicking as close as possible to your intended target is important (zooming in helps)





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Universal Transverse Mercator

- Locations indicated in meters (from a pair of origins)
 - Lat/Long locations in degrees make it difficult to derive distances between places or make measurements in non-spherical coordinates
 - Most of us intuitively understand meters, kilometers, etc. for distance and area better than degrees, minutes, and seconds





UTM

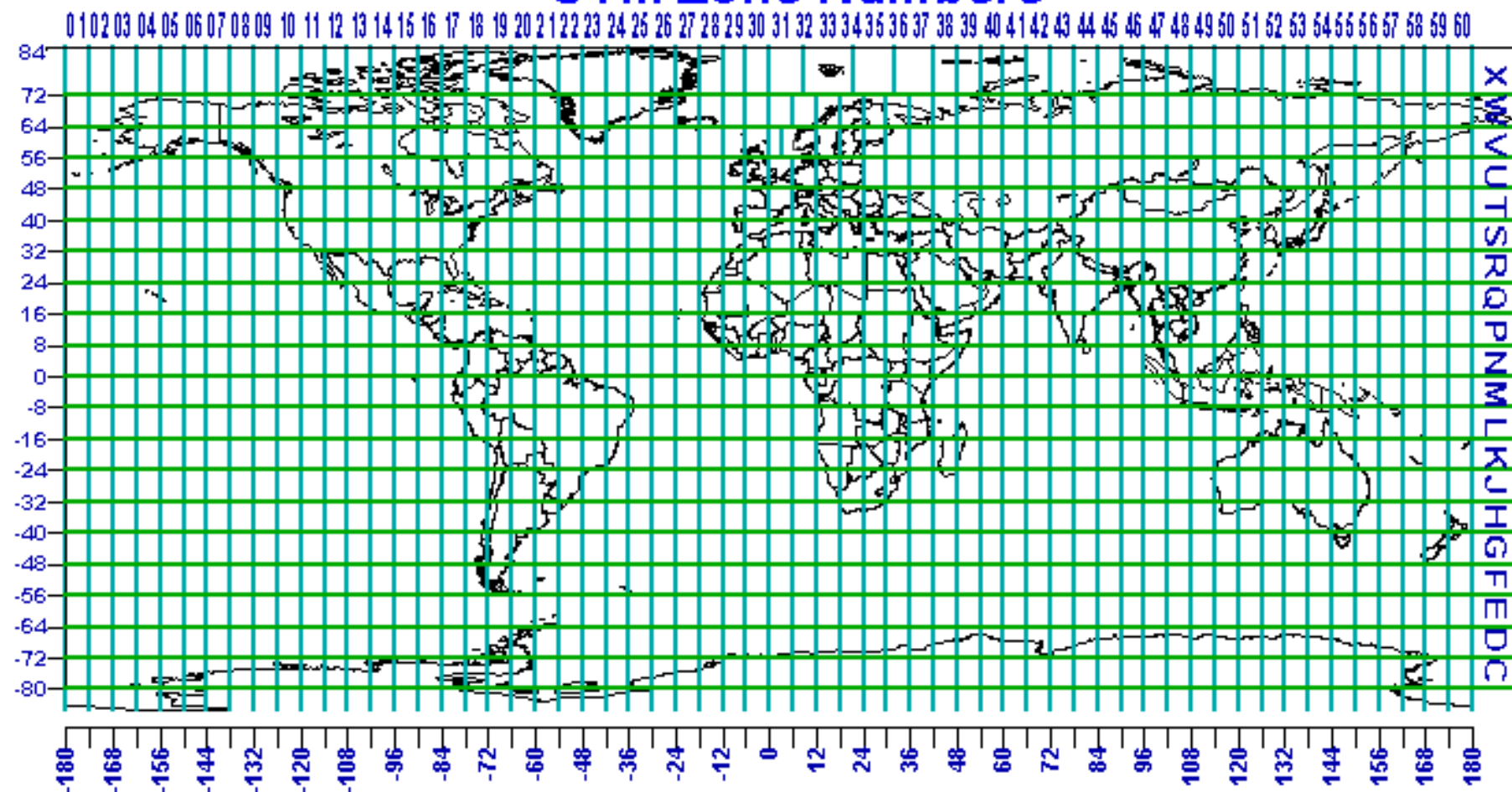
- However...
- This apparent simplicity comes at the cost of a complex frame of reference and multiple origins



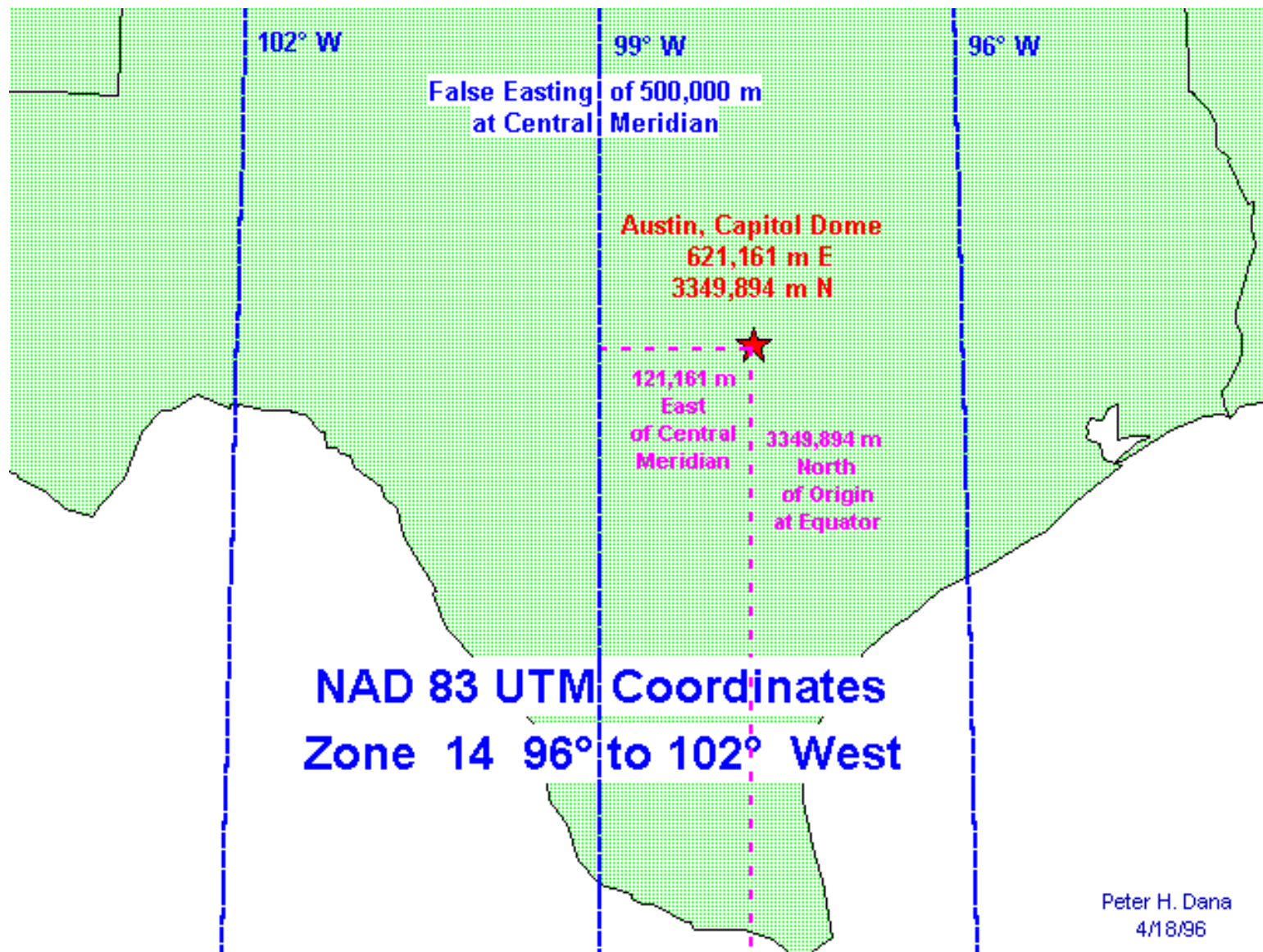


UTM Zone Numbers

UTM Zone Designators



Universal Transverse Mercator (UTM) System



Peter H. Dana
4/18/96





Geodetic Datums

