



**GEOG 315 / ENSP 428**  
**FIELD METHODS**



Professor: Dr. Matthew Clark

# Course Objectives

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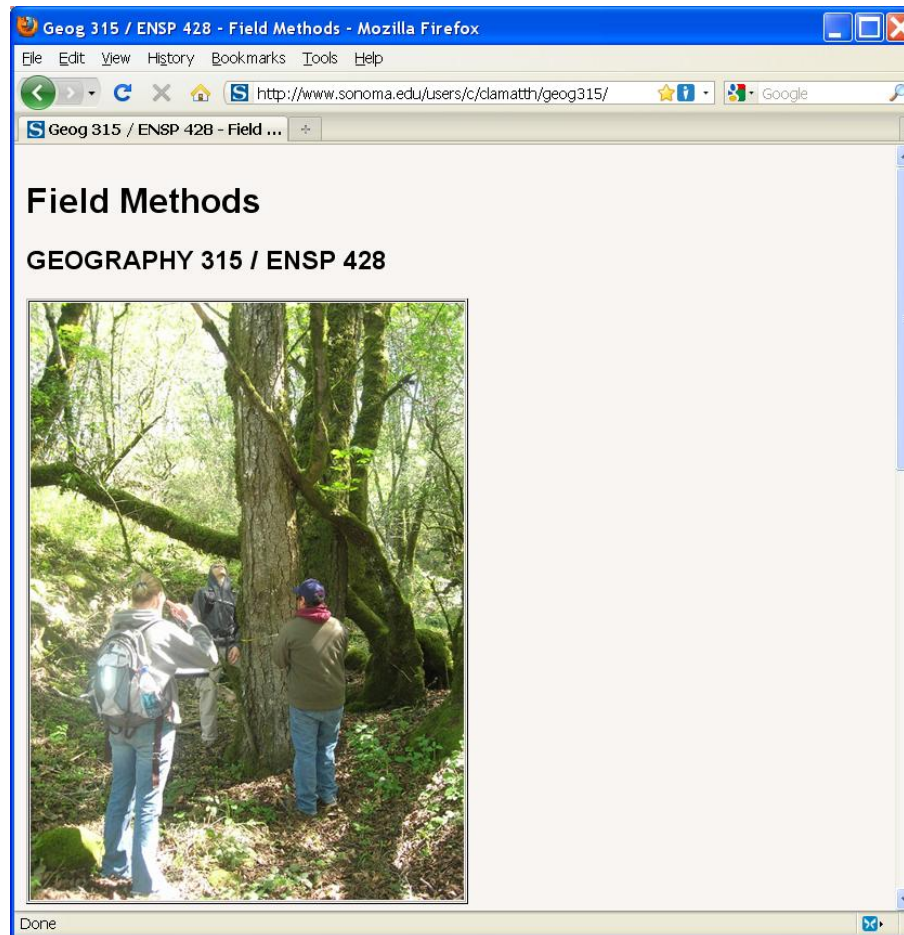
- Introduce common field techniques for collecting biological and physical data for scientific inquiry and analysis.
- Learn how to accurately locate field samples in geographic space using field equipment.
- Acquire data in the field and use these data for geographic visualization, scientific analysis and presentation.

# Books and readings

- Required Text: Elzinga, C.L. et al. 2001. *Monitoring plant and animal populations*. You can order this book online at Amazon or elsewhere. A reserve copy of the book is available in the SSU library.
- Online readings and assignments: Additional readings and assignments will be posted on the course webpage as PDFs

# Course webpage

<http://www.sonoma.edu/users/c/clamatth/geog315>



# SPRING SEMESTER 2010

## Meeting times

This course will meet on select Fridays during the semester. See the course schedule for meeting days and hours.

Lecture & Lab: Stevenson 3059

## Instructor

Dr. Matthew Clark  
Assistant Professor  
Geography and Global Studies

Email: [matthew.clark@sonoma.edu](mailto:matthew.clark@sonoma.edu)  
Office: Stevenson 3060  
Office Hours:  
MW 2:00-3:00 pm or by appointment  
Phone: 707-664-2558

## Course Overview:

This course provides hands-on experience with field sampling techniques commonly used in biophysical data collection and spatial inquiry. Course topics include sampling design, field measurements, statistical data analysis, report writing and the use of field equipment. Field work will be conducted on campus, Copeland Creek and the Laguna de Santa Rosa vicinity. Throughout the course, students will work with Global Positioning System (GPS) receivers to accurately locate their field samples on the Earth, allowing for subsequent visualization or spatial analysis with tools, such as Geographic Information Systems.

### Prerequisites:

Required: Geog 205, with no exception but can be taken concurrently.

## **Quizzes and Exams**

Quizzes will be given at the beginning of class, as indicated on the lecture schedule. The purpose of the quiz is to test your understanding of material found in the course reader, text and/or hand-outs provided in class. There will be a final, integrative exam during finals week.

Make-up quizzes or exams are possible only under extenuating circumstances, but you must notify Dr. Clark of the problem immediately -- preferably before the quiz or exam. You will need a note from a doctor, or some other suitable verification of the excuse. If the quiz or exam has already been graded and handed back, it will no longer be possible to make it up.

## **Participation in Field Exercises**

Two labs will be conducted in the field. Lab 2 will be on SSU's campus and Lab 5 will be in the Laguna de Santa Rosa vicinity. Note that Lab 5 is scheduled for April 30 from 8am to 4pm and transportation will be provided. More information about each field experience will be given in the lab meeting before the field day.

Given that this is a field methods class, it is vital that you participate in the activities on these field days. In particular, Labs 2 and 5 involve heavy data collection exercises and you will receive points for your participation and data products. The scheduled field days may be moved if there is rain or other inclement weather. There are 2 days on the course schedule that are planned as alternate lab days for situations where the field day must be rescheduled. Do not schedule work or other activities on these alternate days. Refer to the class webpage for the latest updates to the course schedule.

## **Lab Assignments**

Labs 3 and 6 involve processing and analysis of field data using lab computers. These labs will be conducted in Stevenson 3059, the Geographic Information Systems (GIS) teaching lab. Lab materials and instruction will be given in class. The lab assignment will likely take more than the scheduled class time to complete and you will have access to the lab computers to finish your work on your own. Be sure to visit Dr. Clark in office hours if you have questions while finishing your lab assignment. All lab assignments are due 1 week after they are assigned. Late assignments will be reduced by 10% of their total points for each day they are late.

**Tentative Course Schedule:**

<b>Date</b>	<b>Time</b>	<b>Location</b>	<b>Lecture/Lab Topic</b>	<b>Readings and Assignments</b>
2/5			No class (Furlough)	
2/12	8 am - 11 am	Stev 3059	Introduction to class; Projections revisited	
2/19			No class (Furlough)	
2/26	8 am - 11:40 am	Stev 3059	<b>Lab 1:</b> Global Positioning Systems; Surveying	QUIZ 1 Bolstad, CH 5; Hurn, pp12-47 on course webpage
3/5	8 am - 11:40 am	Campus, meet in Stev 3059	<b>Lab 2:</b> Field data collection using GPS and rangefinder	
3/12			No class (Furlough)	
3/19	8 am - 11:40 am	Stev 3059 (lab)	<b>Lab 3:</b> Import and mapping of field data with Geographic Information Systems and Google Earth	
3/26			No class (Furlough)	
4/2			No class BACK UP DATE IN CASE OF RAIN ON 3/5	
4/9			No class (Spring Break)	
4/16			No class (Dr. Clark in Washington DC)	
4/23	8 am - 11:40 am	Stev 3059	<b>Lab 4</b> Sampling design	QUIZ 3 Elzinga CH 1; CH 7 pp75-86; CH 8; CH 11
4/30	8am - 4pm	Field trip – Meet at Lot C	<b>Lab 5</b> Experimental design and the measurement of plant populations and vegetation	QUIZ 4 Elzinga CH 5; CH 11; CH 12
5/7			No class (Furlough) BACK UP DATE IN CASE OF RAIN ON 4/30	
5/14	8 am - 11:40 am	Stev 3059 (lab)	<b>Lab 6</b> Analysis and the presentation of data	QUIZ 5 Elzinga CH 9; CH 10
5/21			No class (Furlough)	
TBA			Final Exam	

## Grading Policy:

	<b>% of Grade</b>
Lab 1 - Quiz	5
Lab 2 - Participation	15
Lab 3 - Assignment	20
Lab 4 – Quiz	5
Lab 5 – Participation & Quiz	20
Lab 6 – Assignment & Quiz	20
Lab Exam	15
<b>Total for course</b>	<b>100%</b>

Grades will be assigned as follows:

A = 100-90%, B = 89-80% C = 79-70%

D = 69-60%, F < 60%

Plagiarism will not be tolerated and could result in a failing grade. Each student is expected to turn in his/her own written responses to the assignments. Do not copy text verbatim from the Internet, labs, help manuals or other materials, as this is a form of plagiarism.

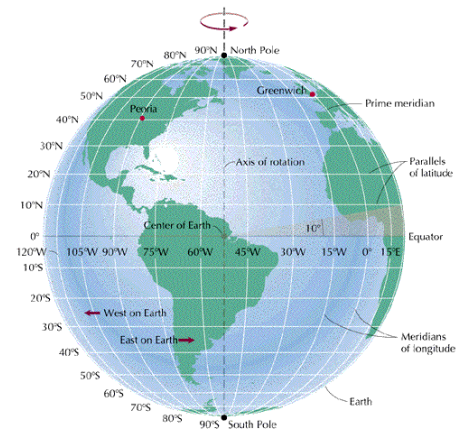
If you are a student with a disability and think you may need accommodations in this course, you should notify the instructor as soon as possible, preferably before the last date to drop the class. You should also contact the Disabled Students Services located in 1049 Salazar Hall, (707) 664-2677.



# Coordinate systems review

# Lecture Overview

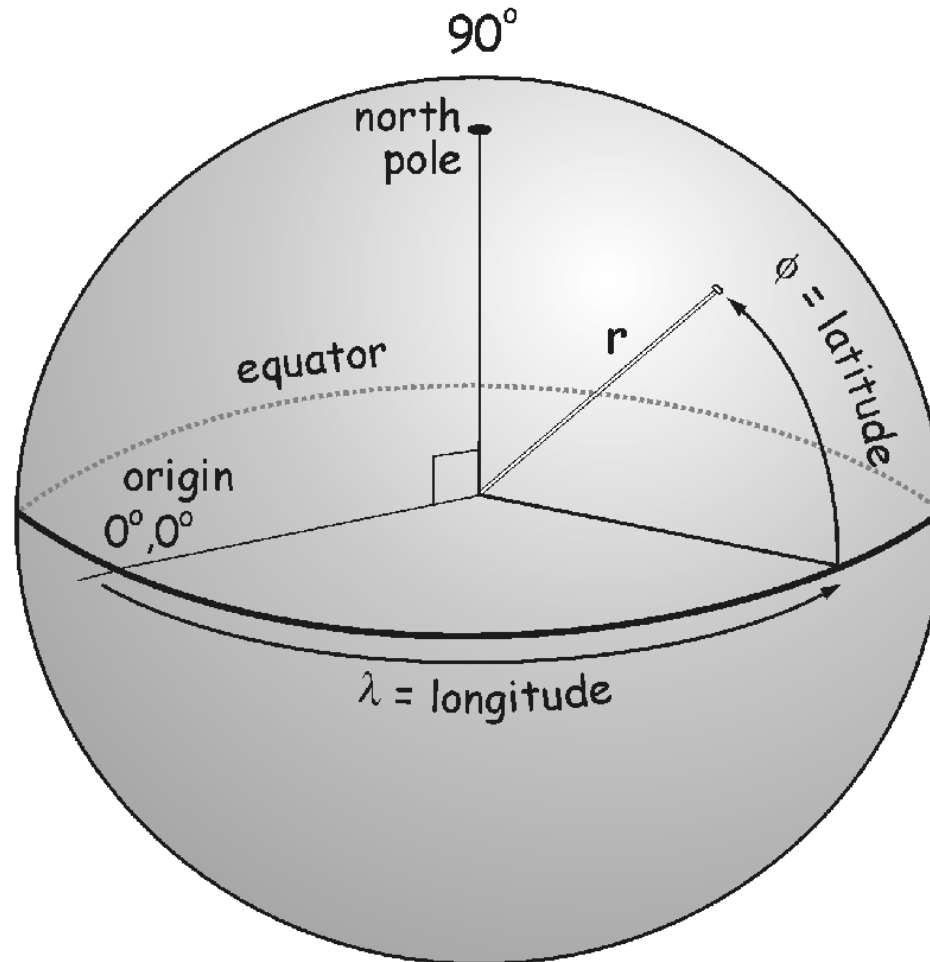
- Geographic coordinate system (GCS)
- Ellipsoid and geoid
- Datums
- Universal Transverse Mercator (UTM) projection

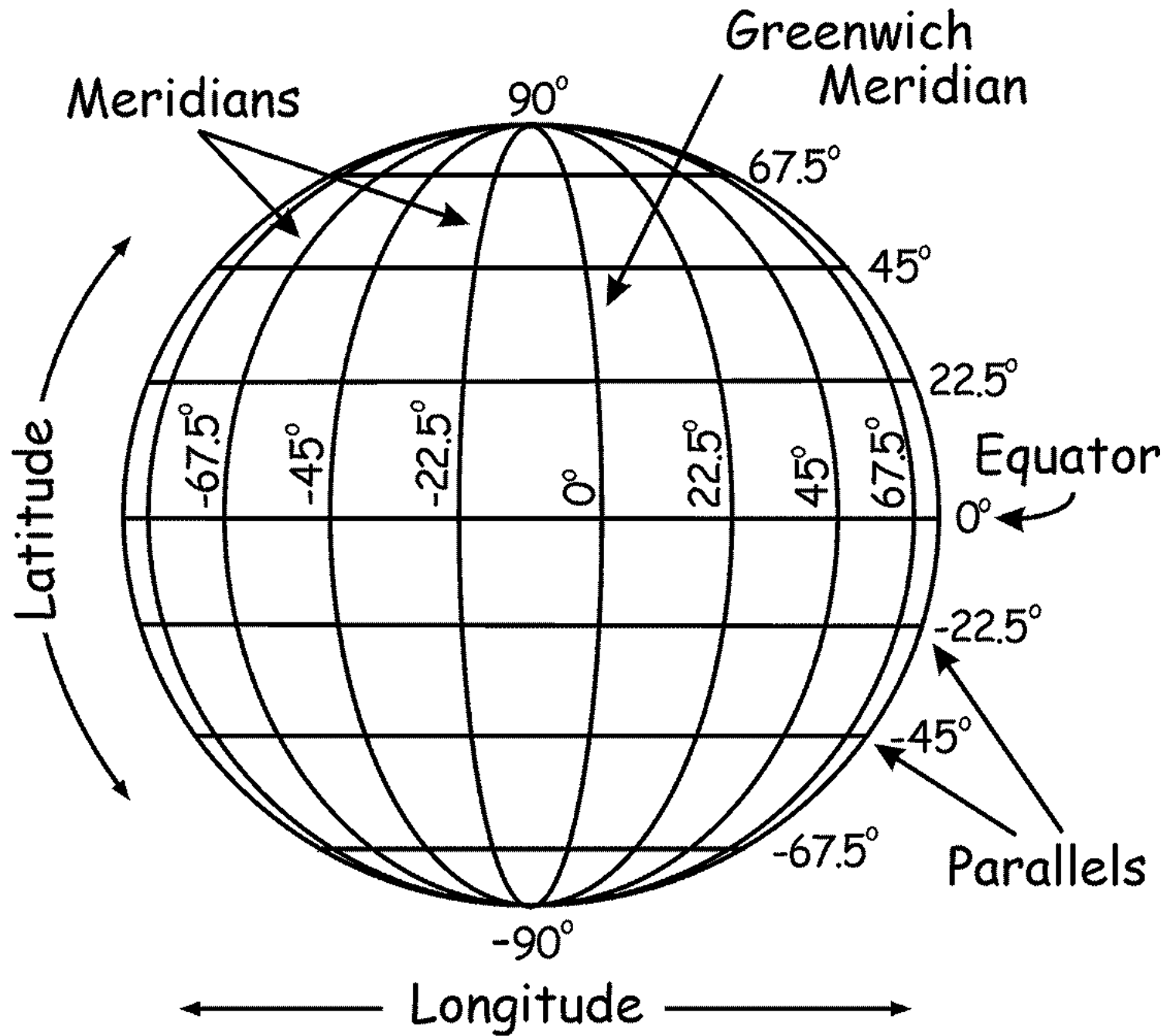


# Geographic Coordinate System (GCS)

- Earth's *spherical coordinate system*, ranging from 90 degrees south to 90 degrees north in *latitude* and 180 degrees west to 180 degrees east in *longitude*
- A line with a constant latitude running east to west is called a *parallel*
- A line with constant longitude running from the north pole to the south pole is called a *meridian*
- The zero-longitude meridian is called the *prime meridian* and passes through Greenwich, England
- A grid of parallels and meridians shown as lines on a map is called a *graticule*

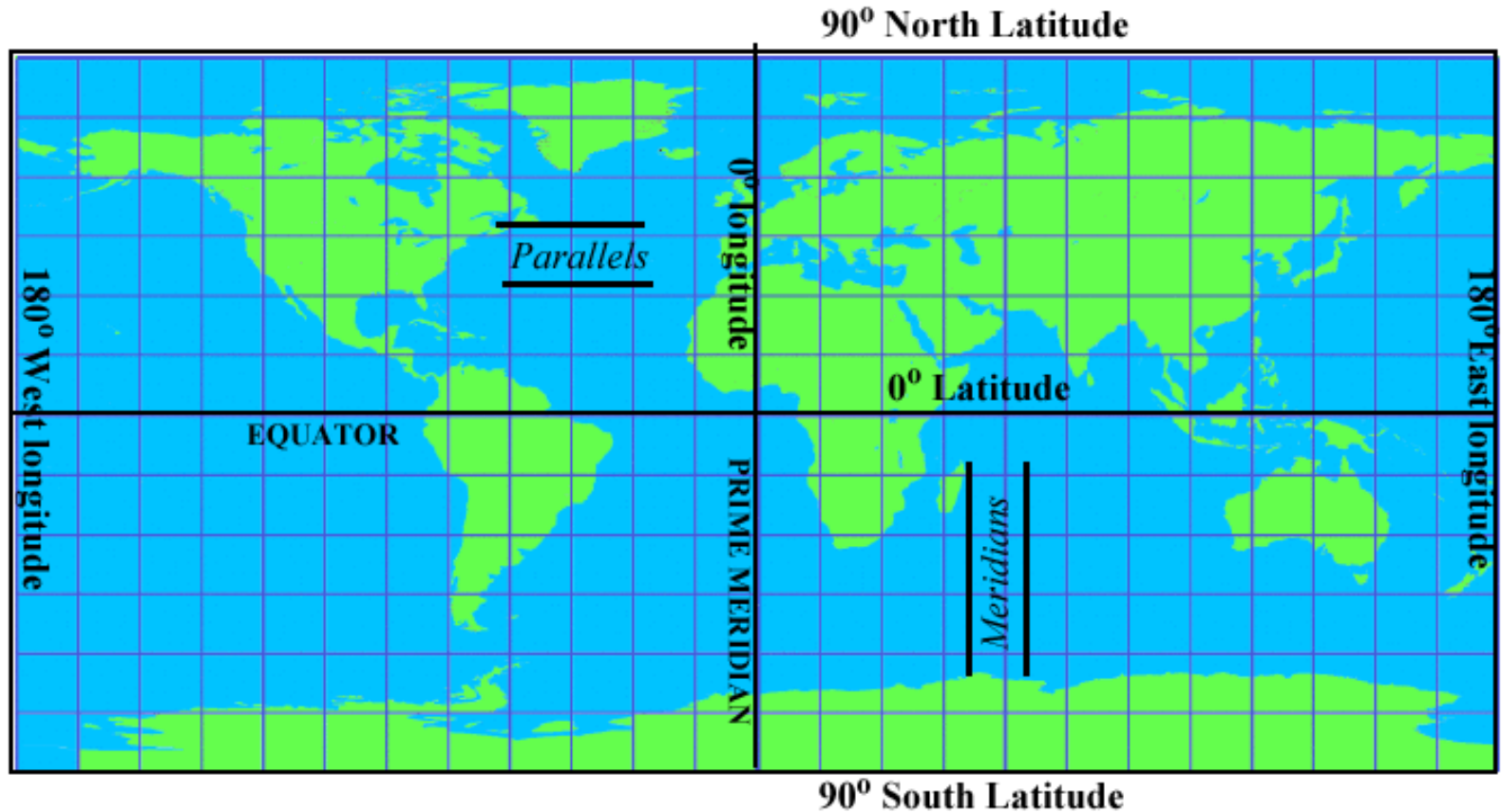
# Spherical coordinate system





# Geographic Coordinate System (GCS)

Shown in the Equirectangular or “Unprojected” Projection

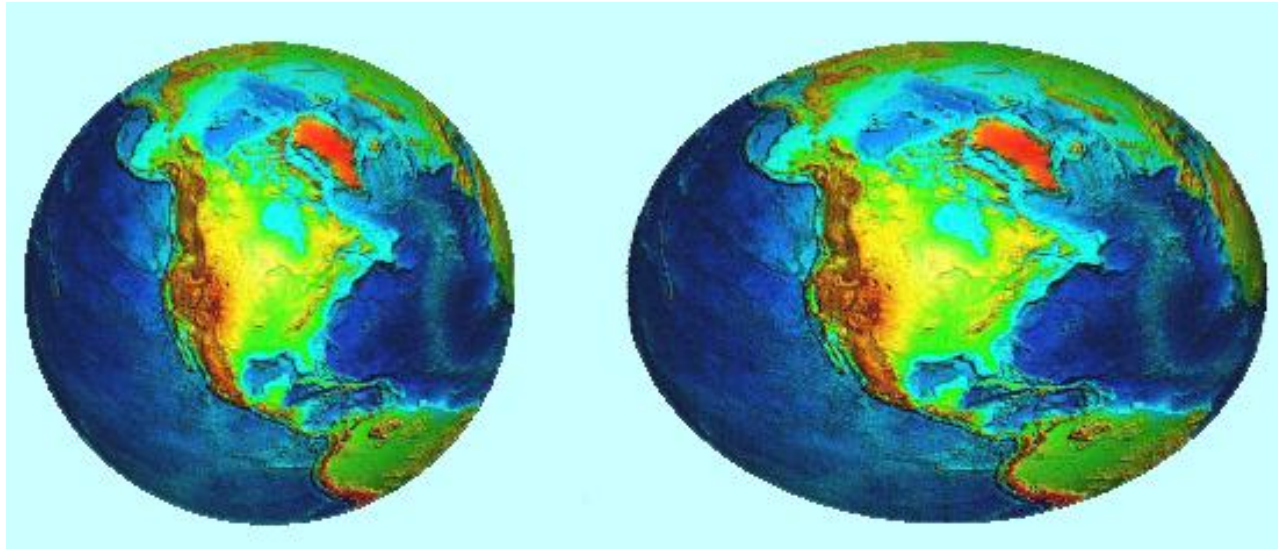


**Figure 2.6** Geographic coordinates. The familiar latitude and longitude system, simply converting the angles at the earth's center to coordinates, gives the basic equirectangular projection. The map is twice as wide as high (360° east-west, 180° north-south).

# Geographic Coordinates in GIS

- Degrees, minutes, seconds (DMS)
  - ▣  $48^{\circ} 18' 40.2''$  W,  $99^{\circ} 57' 56.9''$  N
- Decimal degrees: often used in GIS, with significant figures for precision
  - ▣ -48.311167, +99.965806
- Longitude
  - ▣  $0^{\circ}$  to  $180^{\circ}$  W, negative numbers (-)
  - ▣  $0^{\circ}$  to  $180^{\circ}$  E, positive numbers (+)
- Latitude
  - ▣  $0^{\circ}$  to  $90^{\circ}$  S, negative numbers (-)
  - ▣  $0^{\circ}$  to  $90^{\circ}$  N, positive numbers (+)

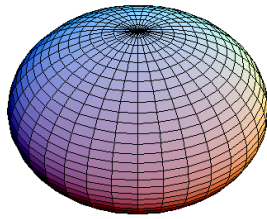
# Earth model: Sphere and Ellipsoid



Sphere

Oblate Spheroid  
(Ellipsoid)

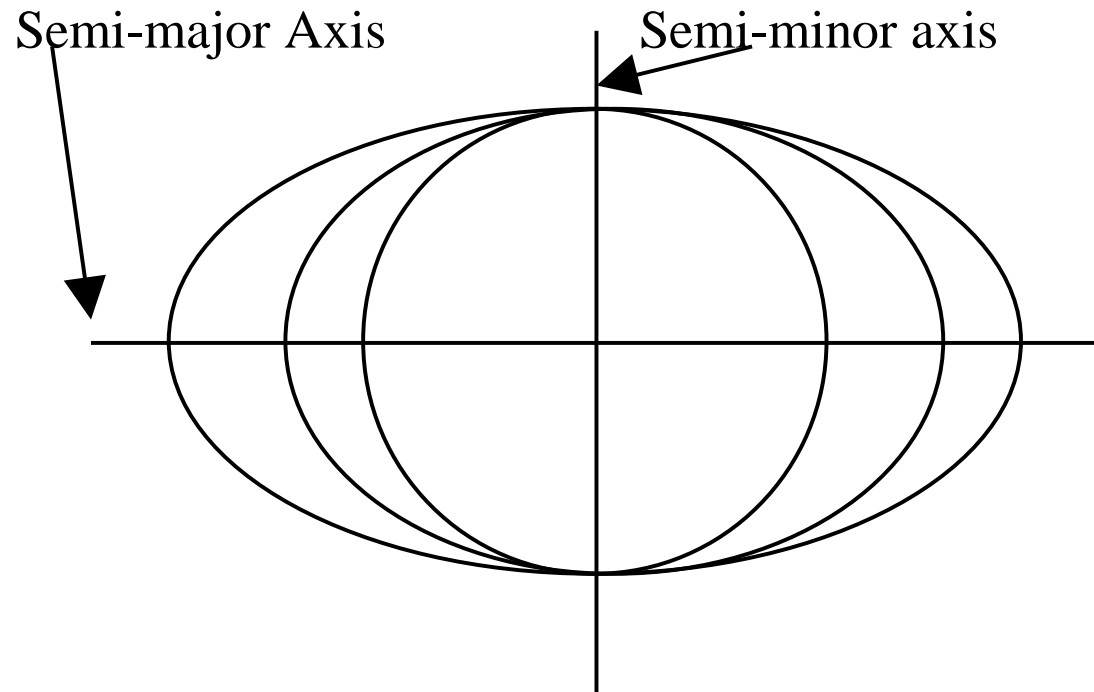
# Ellipsoid



- An ellipsoid is an ellipse rotated in three dimensions about its shorter axis
- Many ellipsoids have been measured, and maps based on each. Examples are Clarke 1886, GRS80 and WGS84

There are two axes:

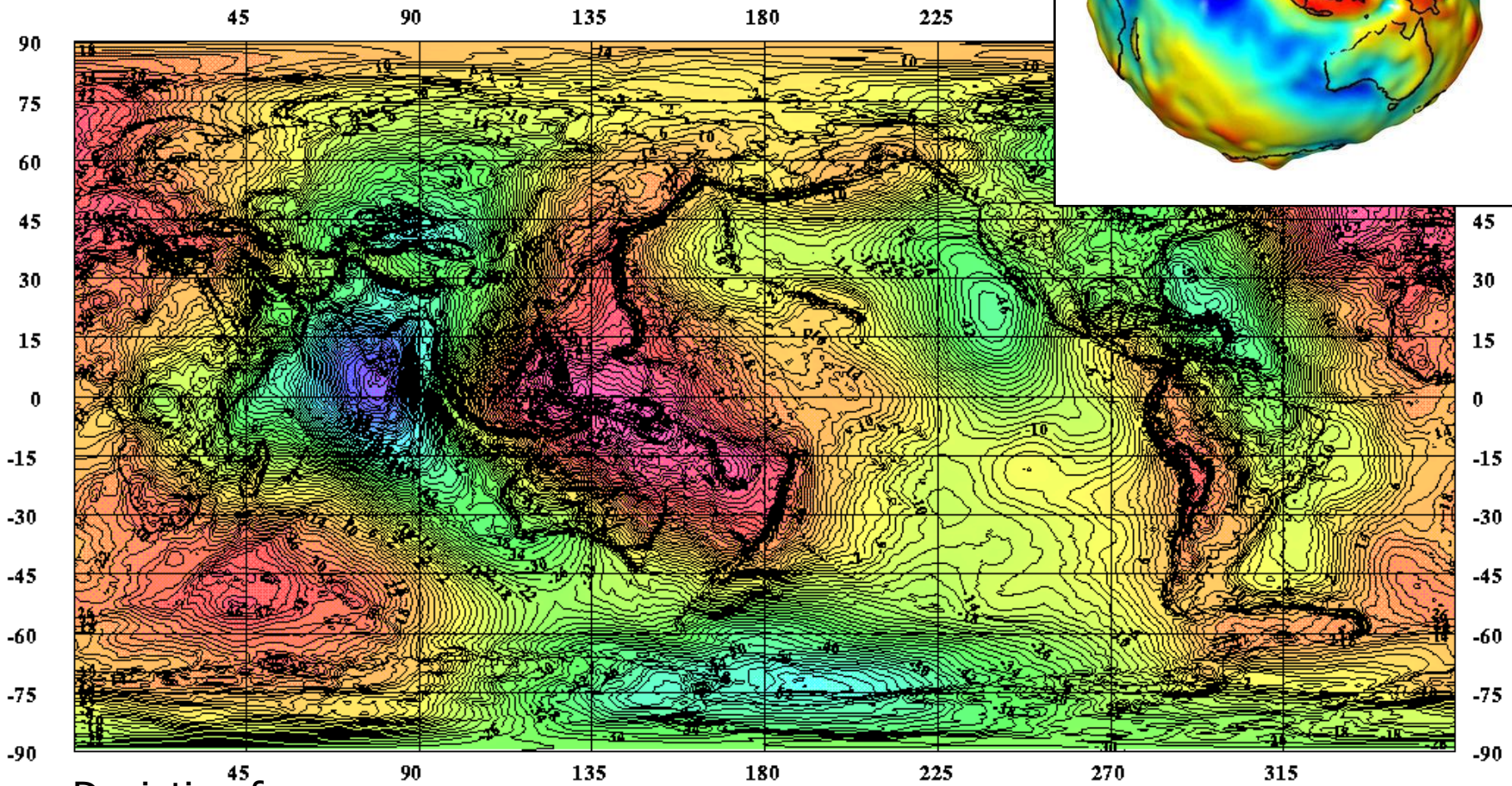
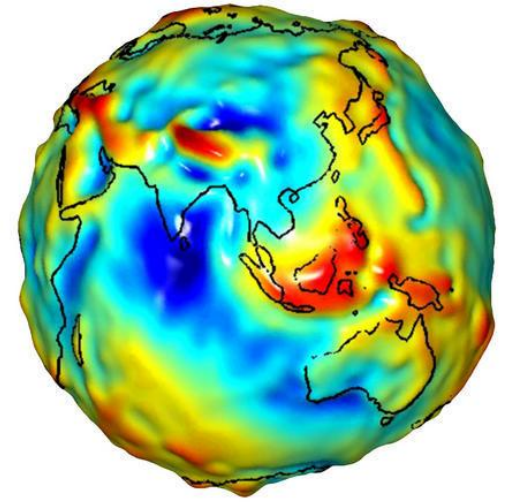
- **semi-major** axis  
(through the equator)
- **semi-minor** axis  
(through the poles)



# Geoidal earth model

- A *geoid* is a representation of the surface of the earth as if it were covered completely by ocean
- Also known as surface of equal gravitational attraction (equipotential) that approximates *mean sea level*, for sea and continents
- Excludes effects of tides and waves

# EGM96 Geoid

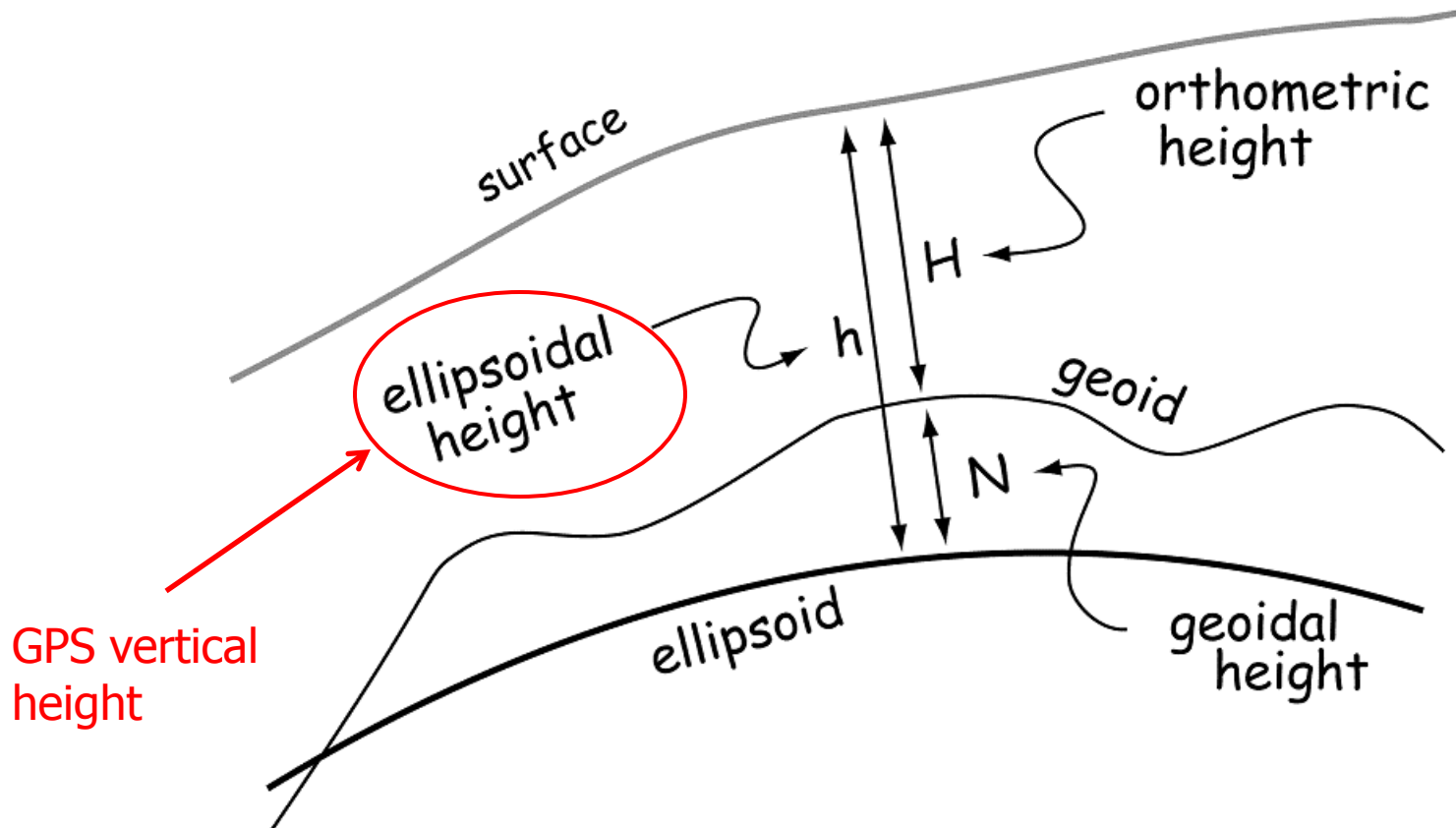


Deviation from  
WGS84 spheroid

EGM96 15 MINUTE GEOID CI = 2 Meters

-105.0  85.0 Meter

# Surface, ellipsoidal and geoidal height



$$h = H + N$$

ellipsoidal height = orthometric height + geoidal height

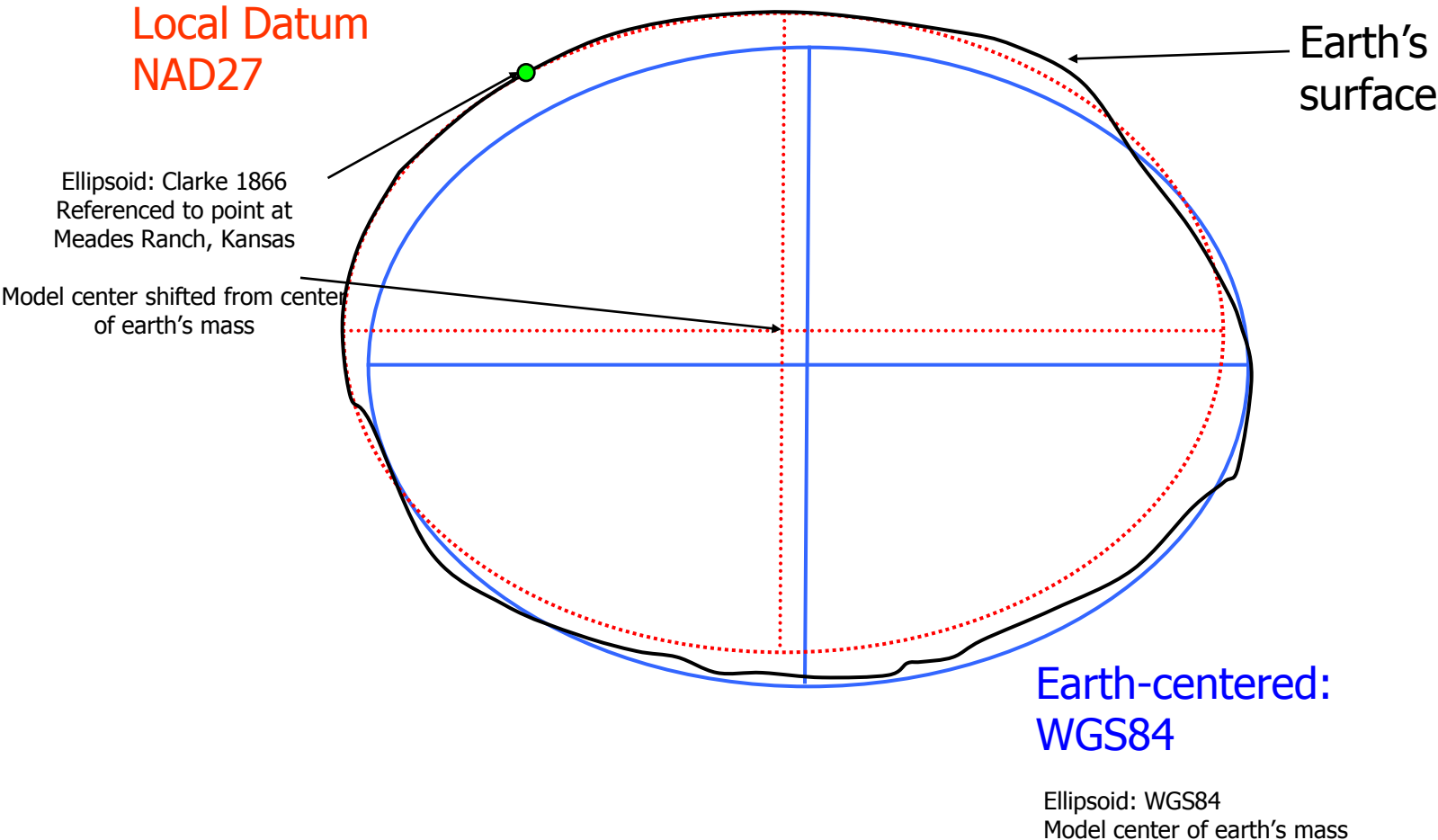
# The Datum (1)

- Provides reference surface for obtaining horizontal and vertical position
- Datum includes:
  - ▣ size and shape of the earth model
  - ▣ origin and orientation of the coordinate systems used to map the earth
  - ▣ Set of control points and their coordinates
- There are hundreds of different datums, many specific to countries or continents

# The Datum (2)

- In the last 15 years, satellite measurements have helped refine the ellipsoid model of the earth, with model center at earth's center of mass
- A *geocentric* datum has model origin in earth's center of mass
- Most recently developed geocentric datum is **WGS84** (has own WGS84 ellipsoid)
- Very common datum used with GPS receivers

# Datums: Earth-centered vs. Local



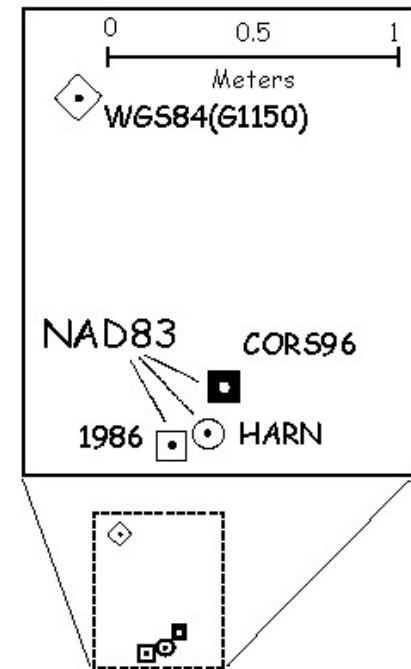
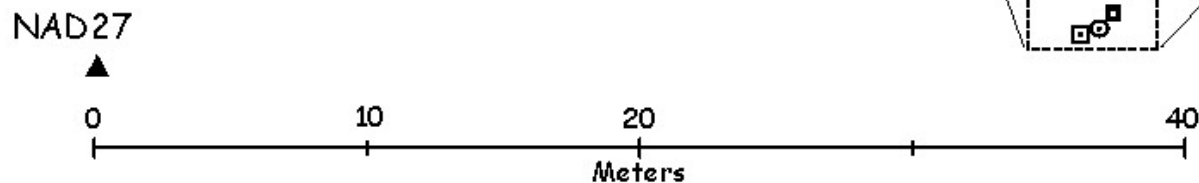
# Datum effect on spatial location

## Examples of Datum Shifts

New Jersey control point, successive datum transformations applied

Datum	Longitude (W)	Latitude(N)	Shift(m)
NAD27	74° 12' 3.86927"	40° 47' 0.76531"	36.3
NAD83(1986)	74° 12' 2.39240"	40° 47' 1.12726"	0.04
NAD83(HARN)	74° 12' 2.39069"	40° 47' 1.12762"	0.05
NAD83(CORS96)	74° 12' 2.39009"	40° 47' 1.12936"	0.05
WGS84(G1150)	74° 12' 2.39720"	40° 47' 1.15946"	0.95

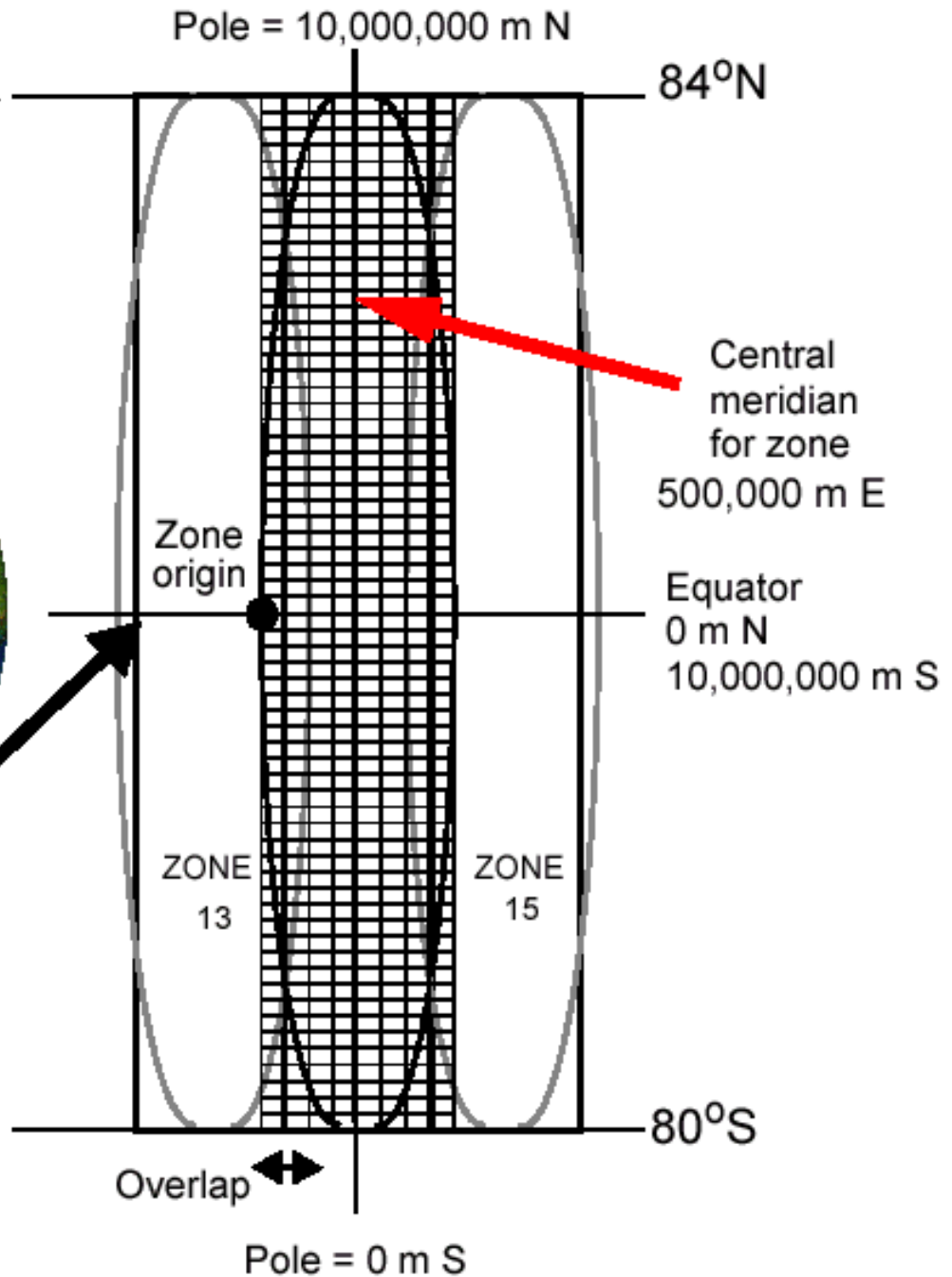
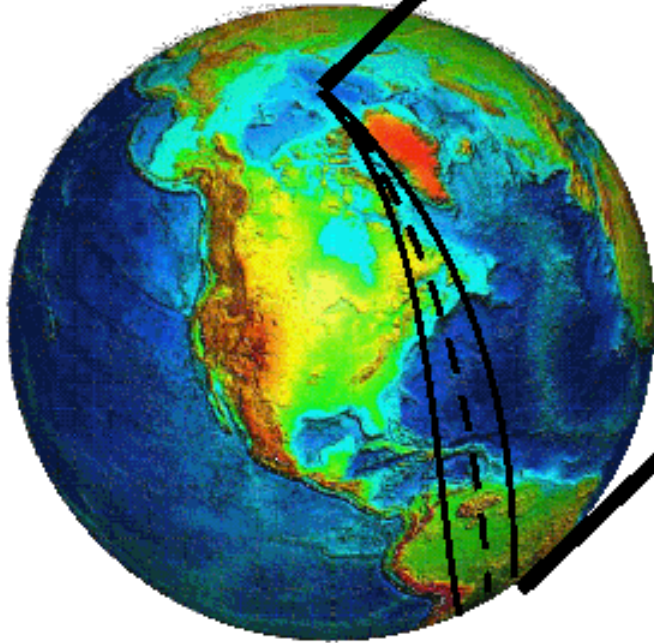
GPS receivers often don't tell you which version of the datum they're using!



# Universal Transverse Mercator (UTM)

- Has a transverse mercator projection and its own coordinate system
- Horizontal positions world-wide by dividing the surface of the Earth into 6 degree zones with a central meridian in the center of the zone
- Good for large-scale applications (i.e., fine detail, precise measurements)
- Commonly used with GPS applications as provides units in meters – easier to understand – yet accurate enough for most applications

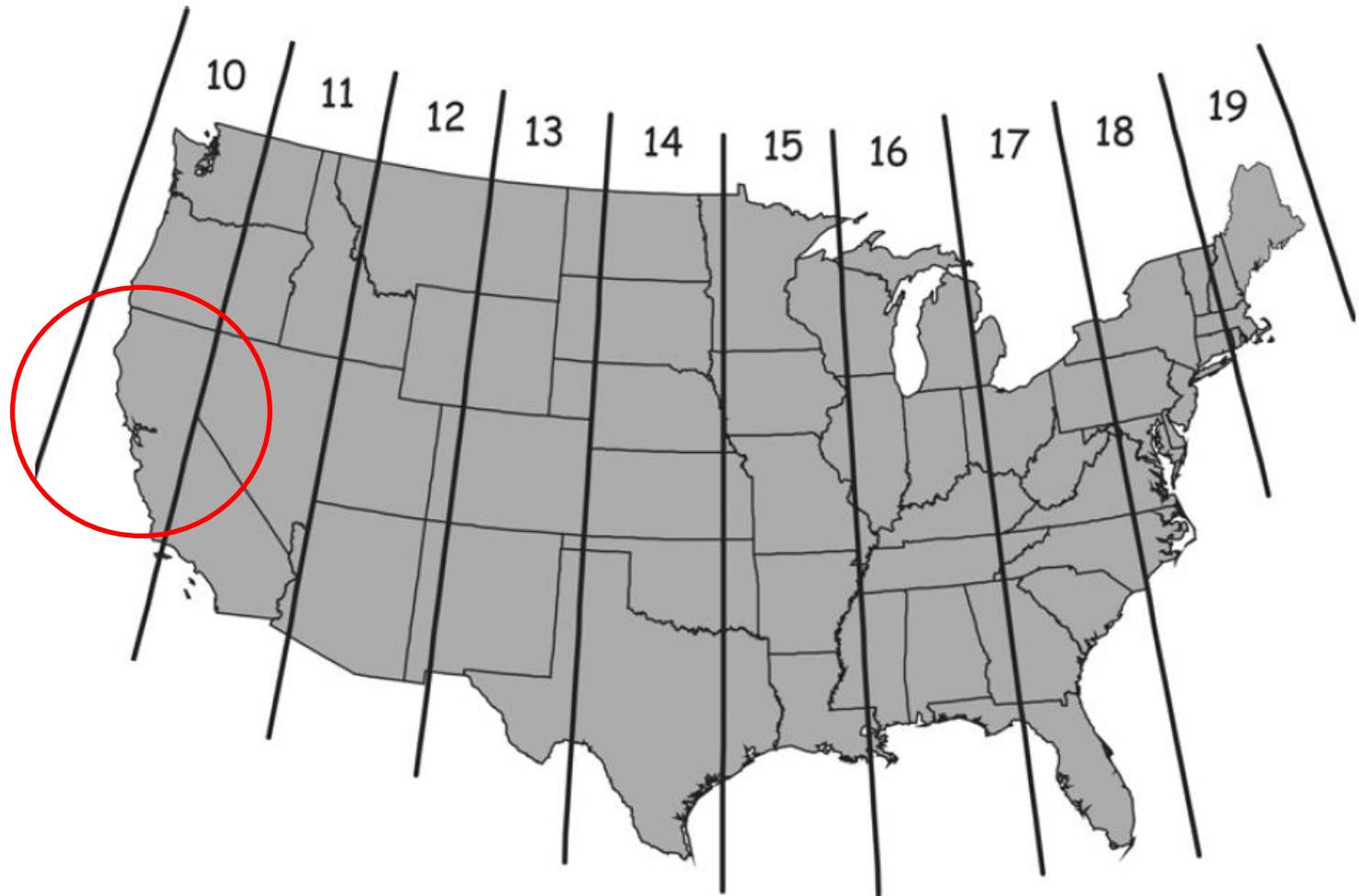
# Universal Transverse Mercator



- Units are meters!
- Conformal, preserves shape

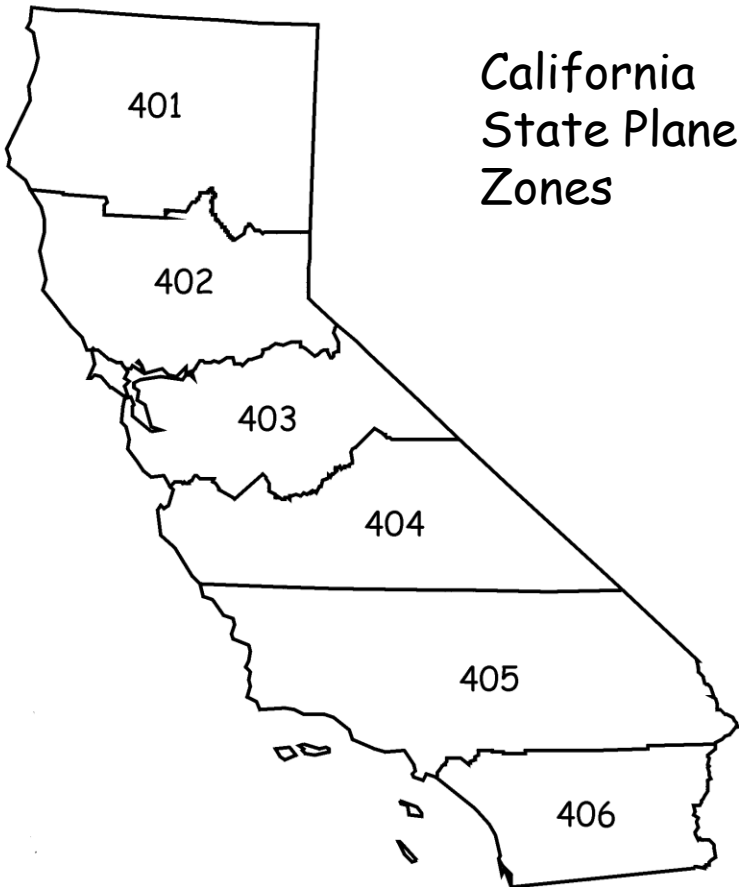
Figure 2.14 The universal transverse Mercator coordinate system.

# UTM zones in the lower 48

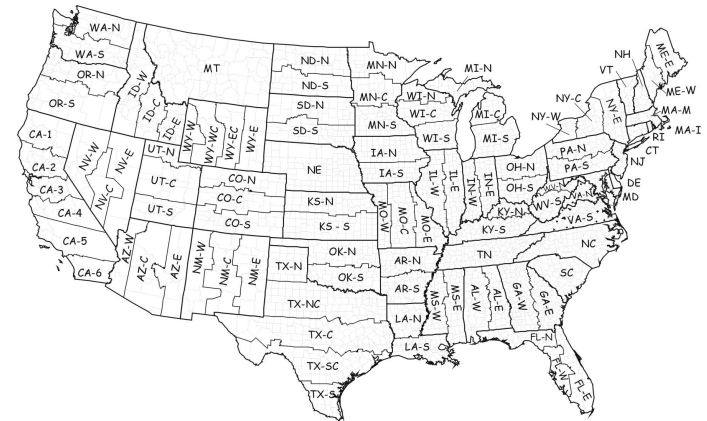


**Figure 3-30:** UTM zones for the lower 48 contiguous states of the United States of America. Each UTM zone is 6 degrees wide. All zones in the Northern Hemisphere are north zones, e.g., Zone 10 North, 11 North,...19 North.

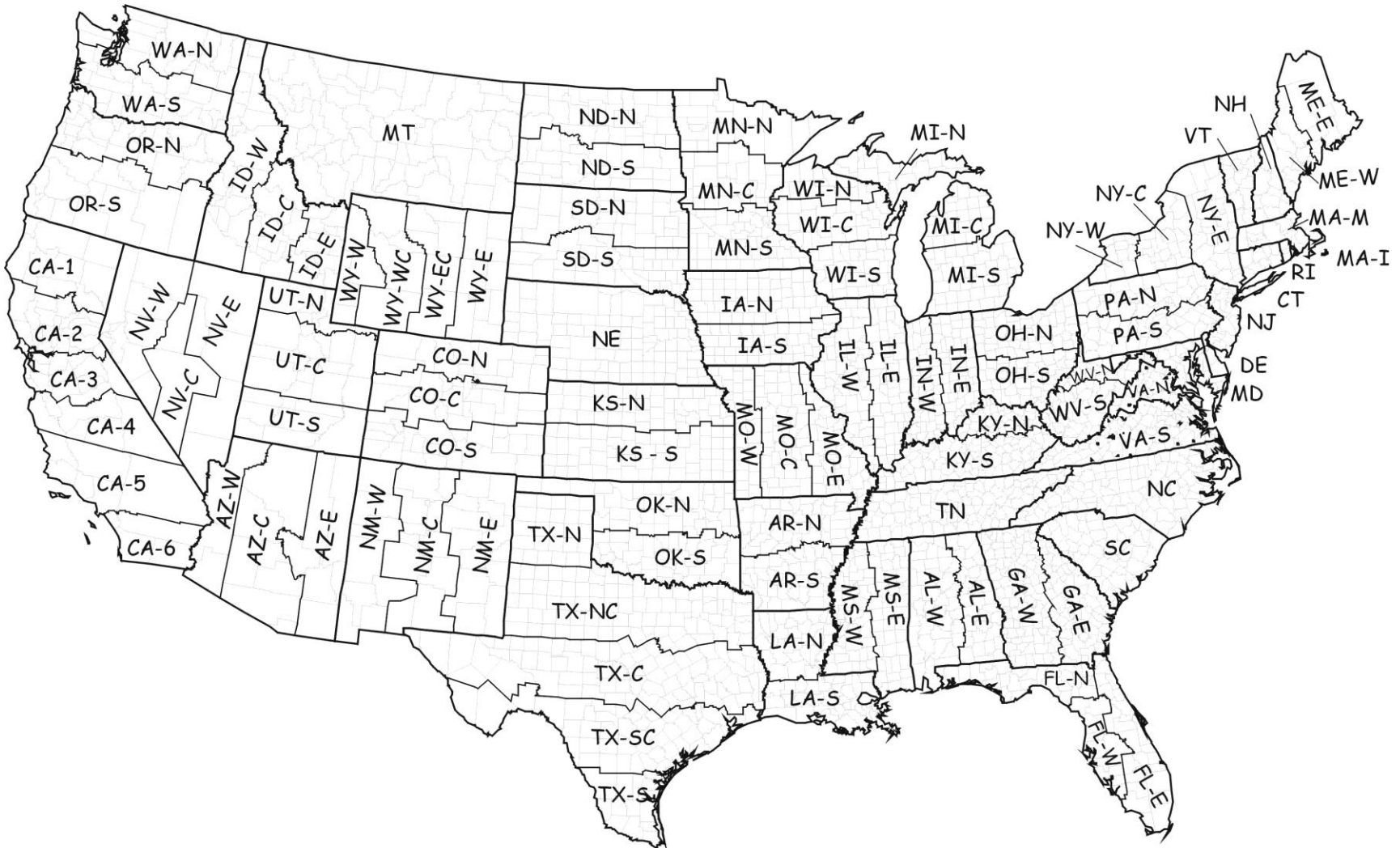
# State Plane Coordinate System (SPCS)



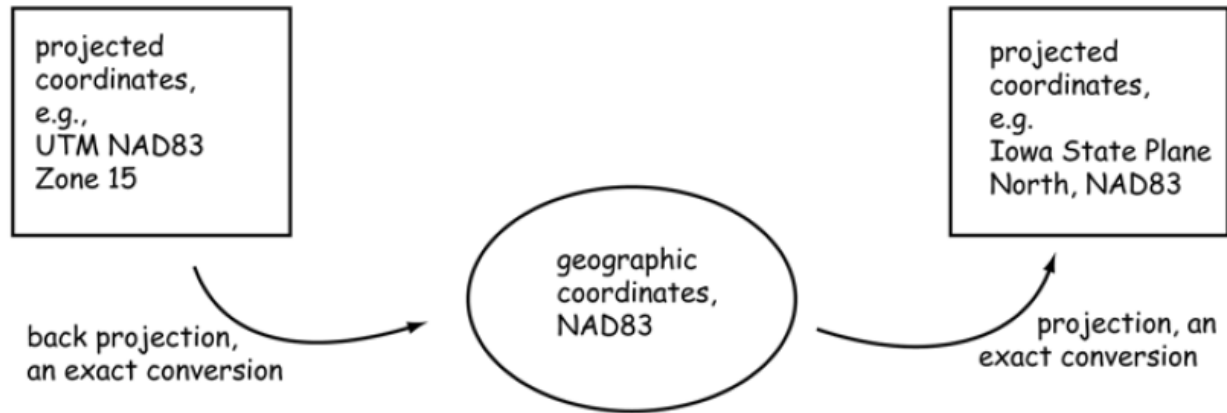
- Each U.S. state partitioned into zones, each with their own projection
- Lambert Conformal Conic projection for E-W oriented zones
- Transverse Mercator projection for N-S oriented zones
- Distortion less than UTM
- Typically used for detailed surveying work -- United States only



# State Plane Coordinate System



a) From one projection to another - same datum



b) From one projection to another - different datums

