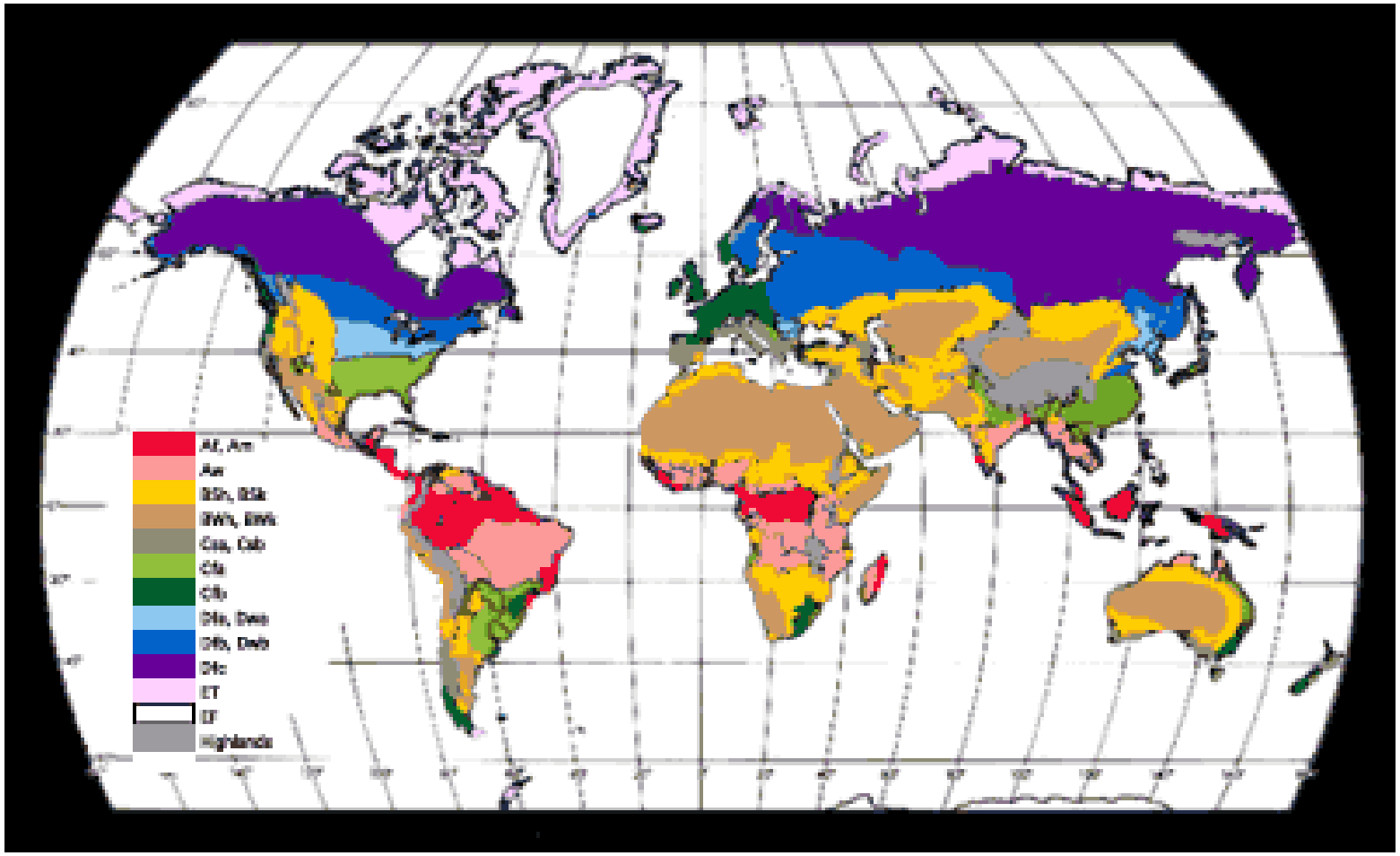
Map projection



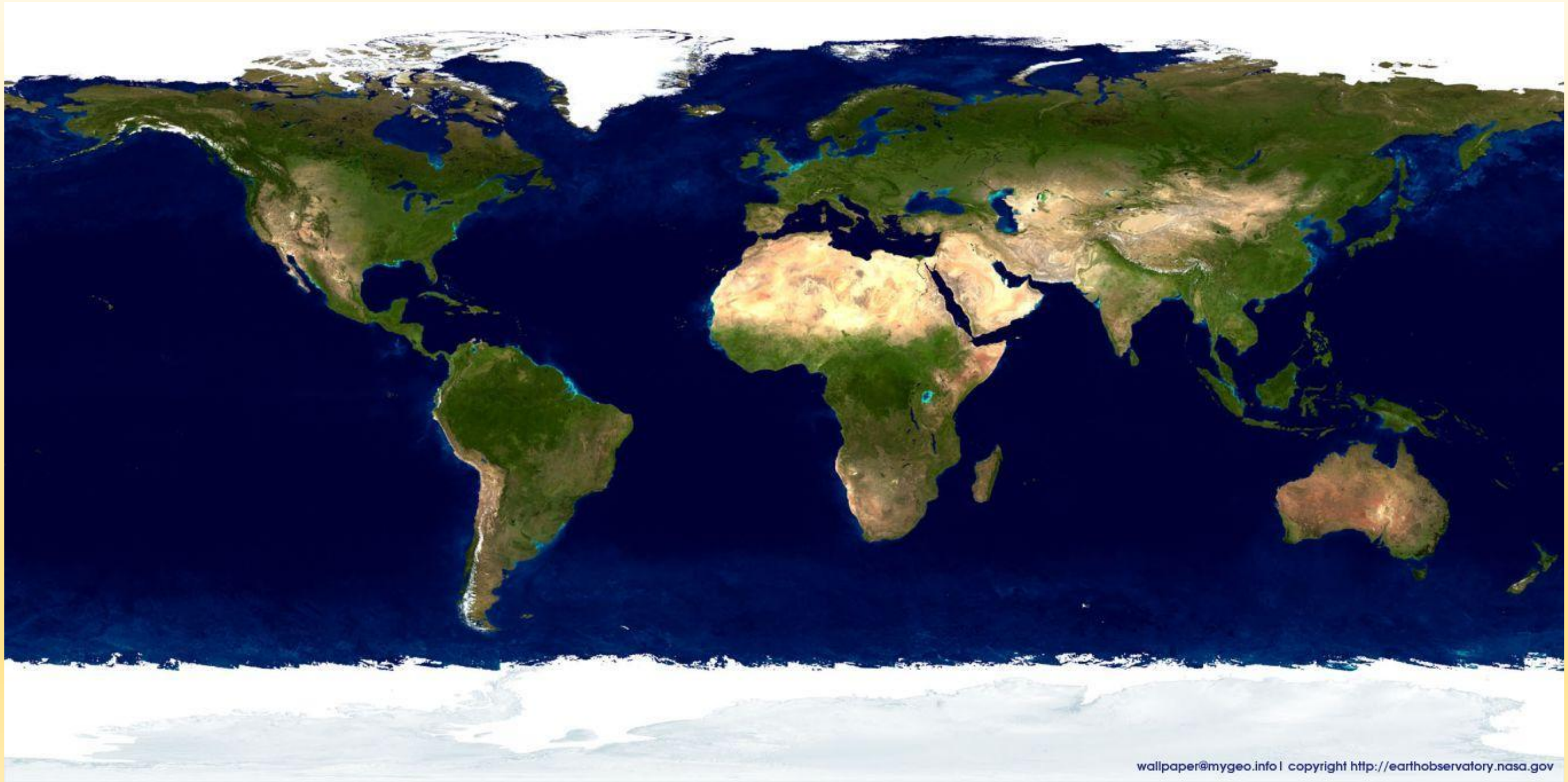
Introduction to maps

- A generalized view of an area, usually some portion of Earth's surface, as seen from above at a greatly reduced size
- Any geographical image of the environment
- A two-dimensional representation of the spatial distribution of selected phenomena

Why make maps?

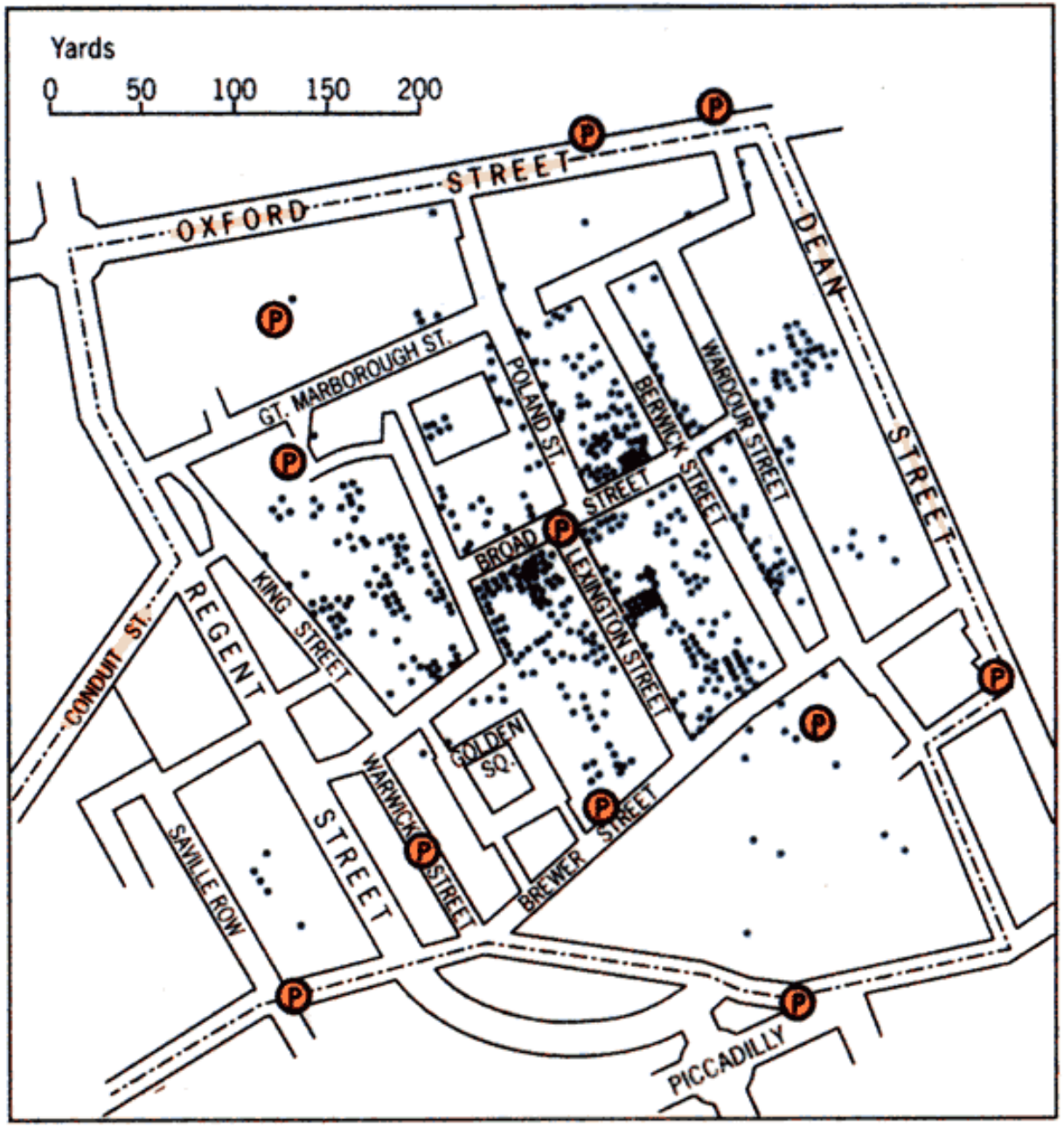
- To represent a larger area than we can see
- To show a phenomenon or process we can’t see with our eyes
- To present information concisely
- To show spatial relationships

Represent a larger area



Show spatial relationships

Cholera and the Map



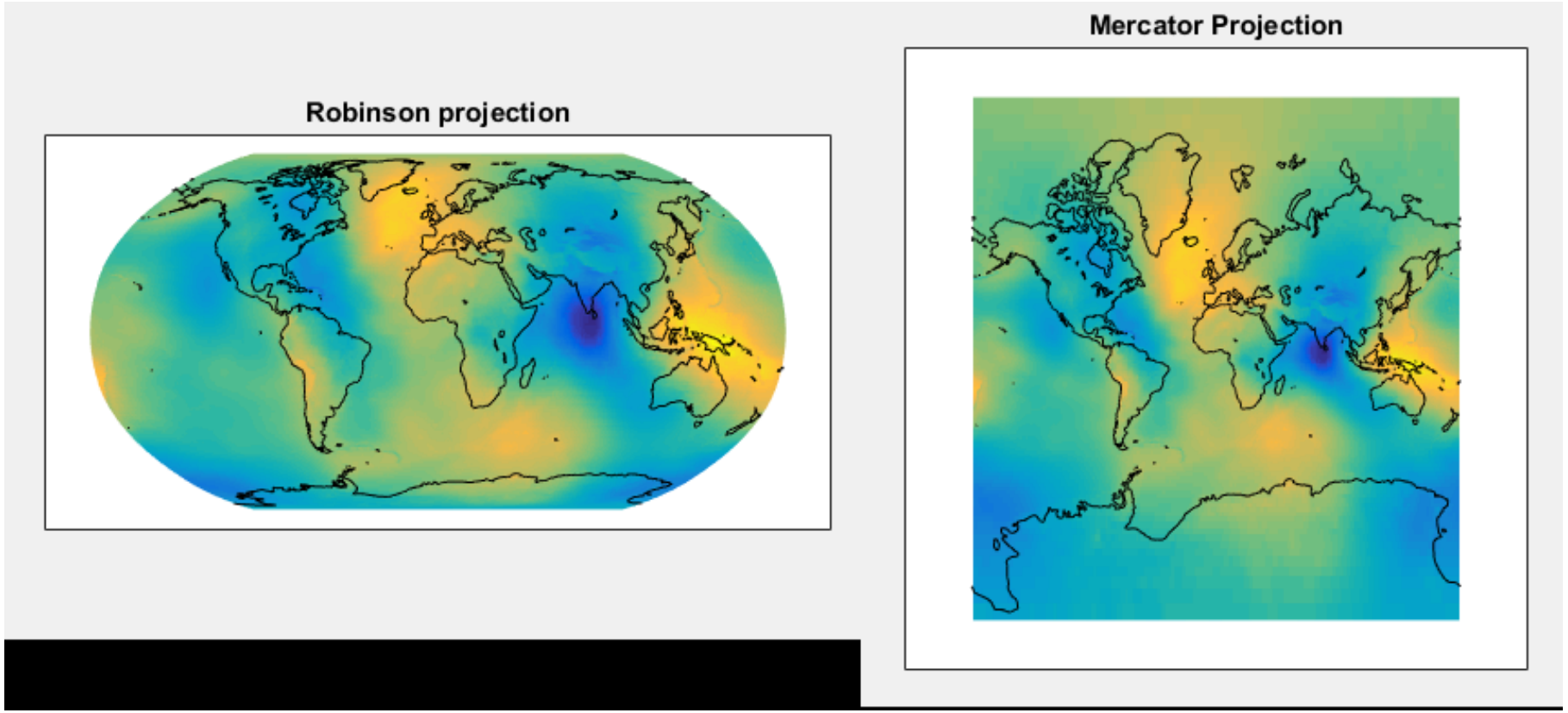
How do we read maps?

- Maps are selective views of reality
- Size of the map relative to reality (scale)
- What's on the map (symbolization)
- Shape of the map (projection)

But, what is the problem

Map projections

A map projection is the process of transforming and representing positions from the earth's three-dimensional curved surface to a two-dimensional (flat) surface.

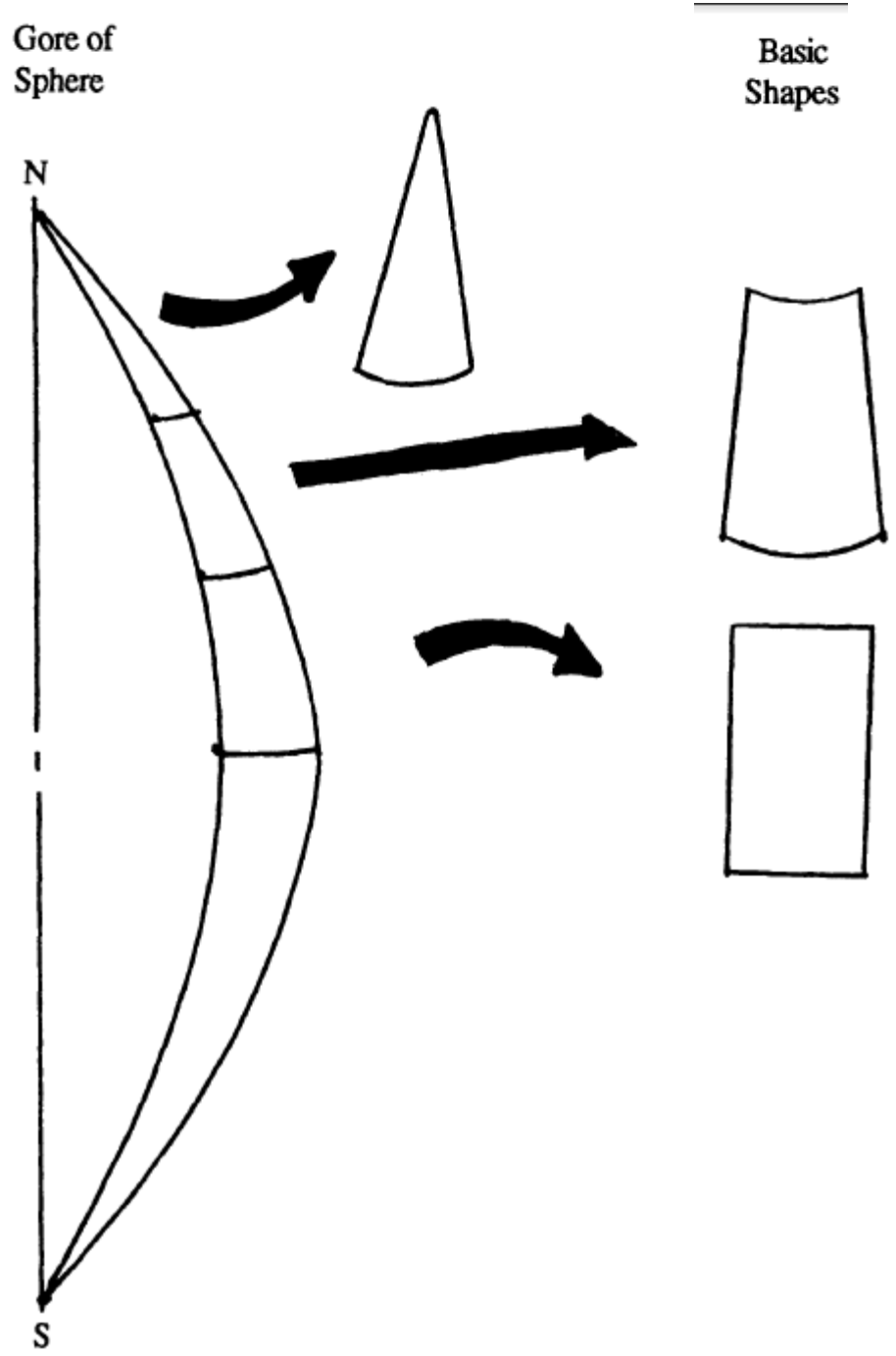


INTRODUCTION TO THE PROBLEM

- Since the surface of a sphere cannot be laid flat on a plane without distortion.
- The types of distortion are considered in terms of length, angle, shape, and area

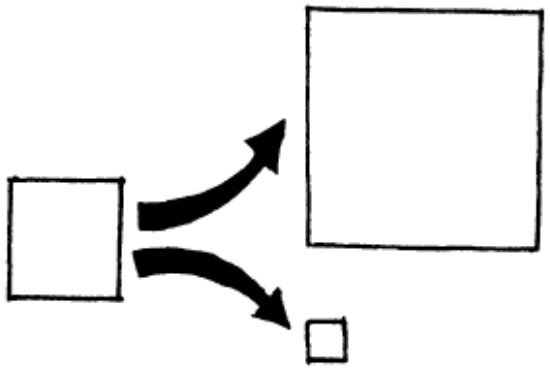
BASIC GEOMETRIC SHAPES

- One of the easiest ways to minimize distortions is to choose a projection
- **DISTORTION**
  - Distortion is the limiting factor in the process of map projection

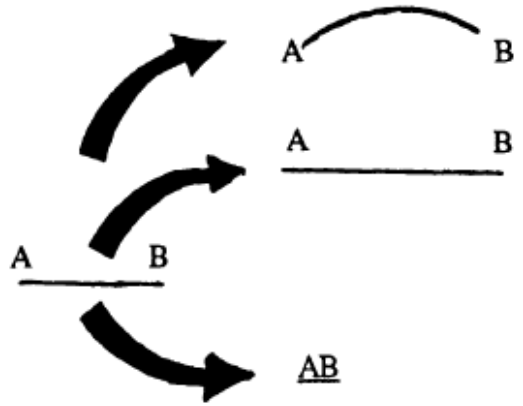


DISTORTION

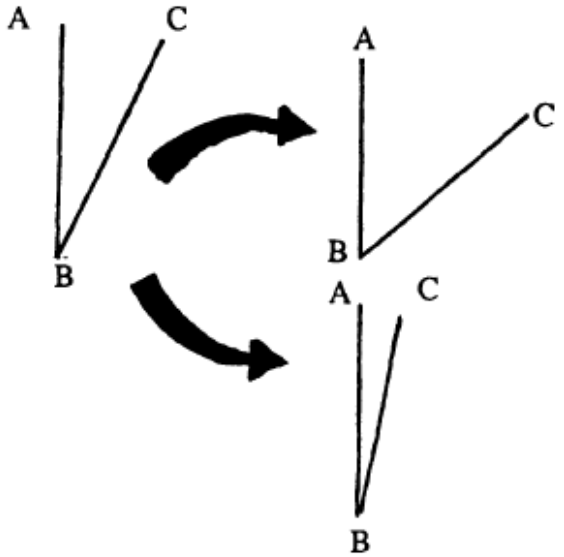
It is an untrue representation of area, linear dimensions, angle, or shape.



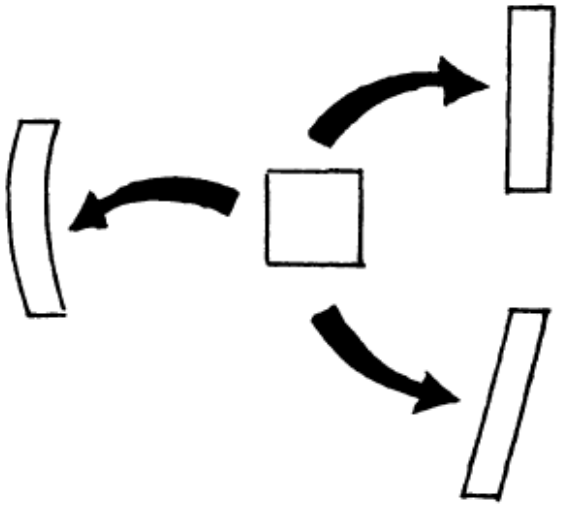
a) Distortion in Area



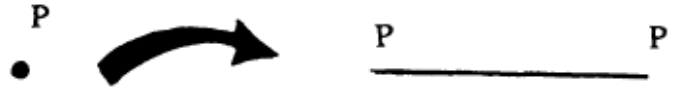
b) Linear Distortion



c) Angular Distortion



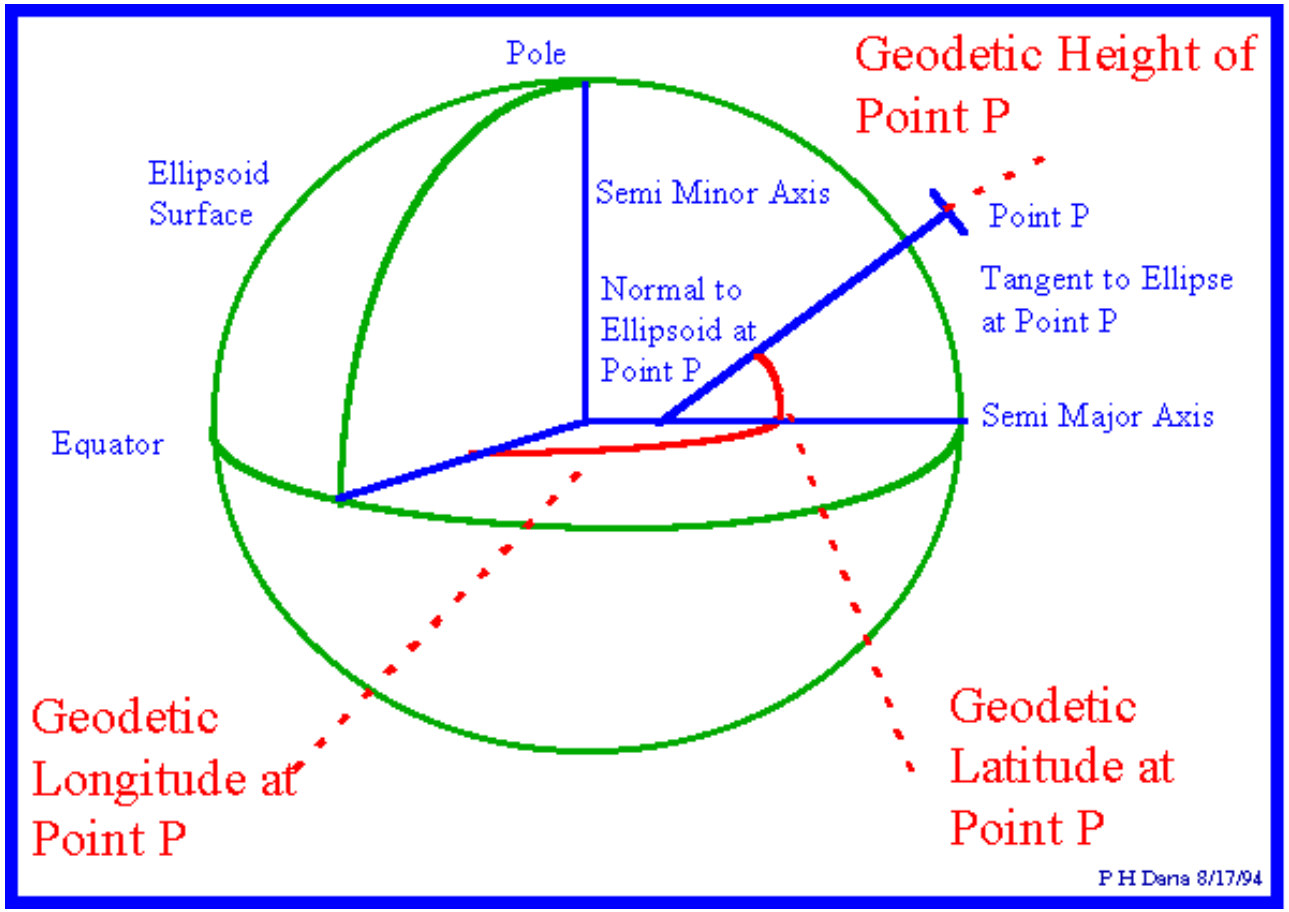
d) Distortion in Shape



e) Transformation of a Point into a Line

Ellipsoid (Global) Coordinate Systems

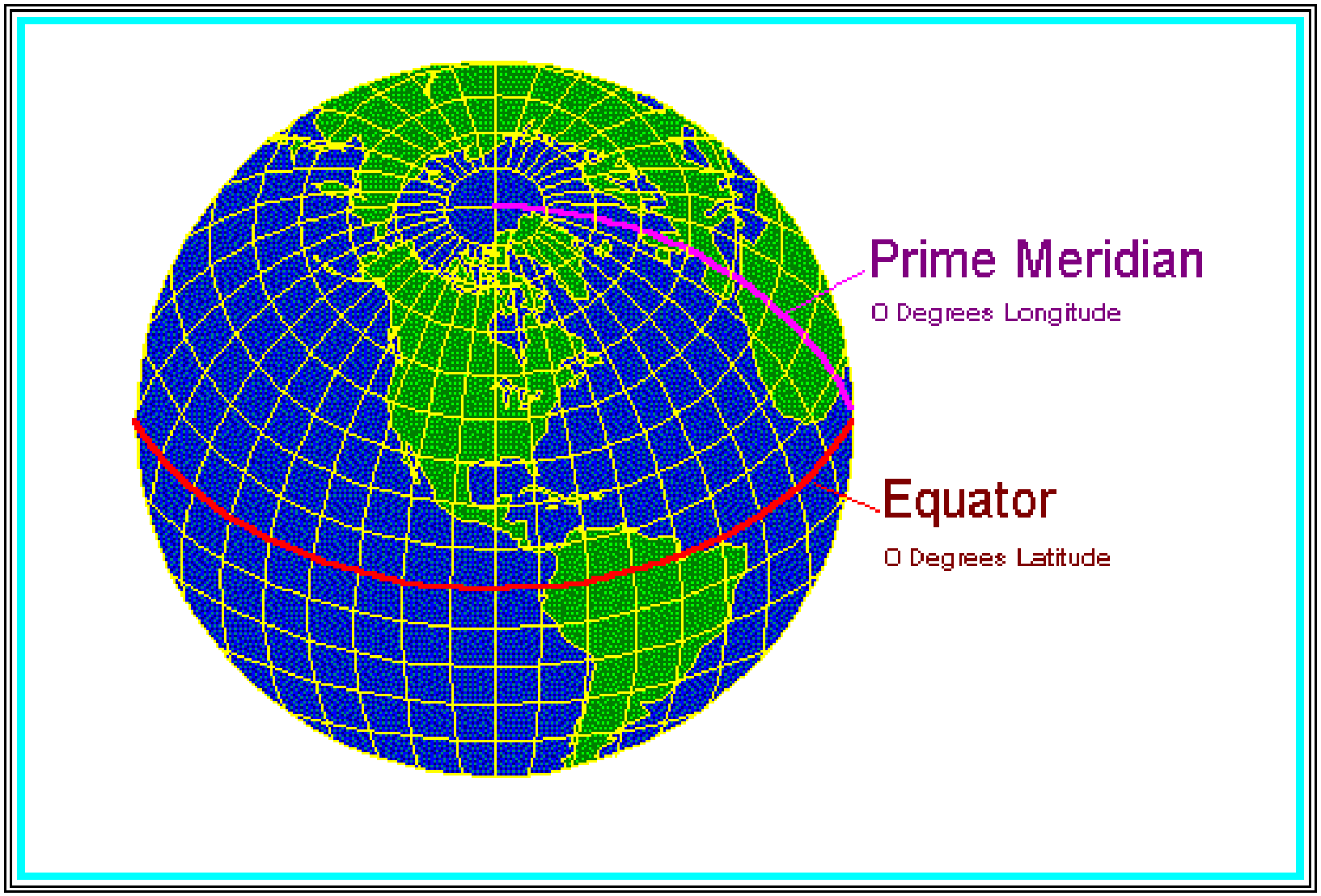
- Global coordinates based upon “spherical” coordinates modified to account for imperfect shape of earth.



Latitude-Longitude System

- The most commonly used coordinate system today is the latitude, longitude, and height system.
- The Prime Meridian and the Equator are the reference planes used to define latitude and longitude.

Equator and Prime Meridian



Meridian = (N-S Longitude); Parallel = (E-W Latitude)

Latitude-Longitude Systems

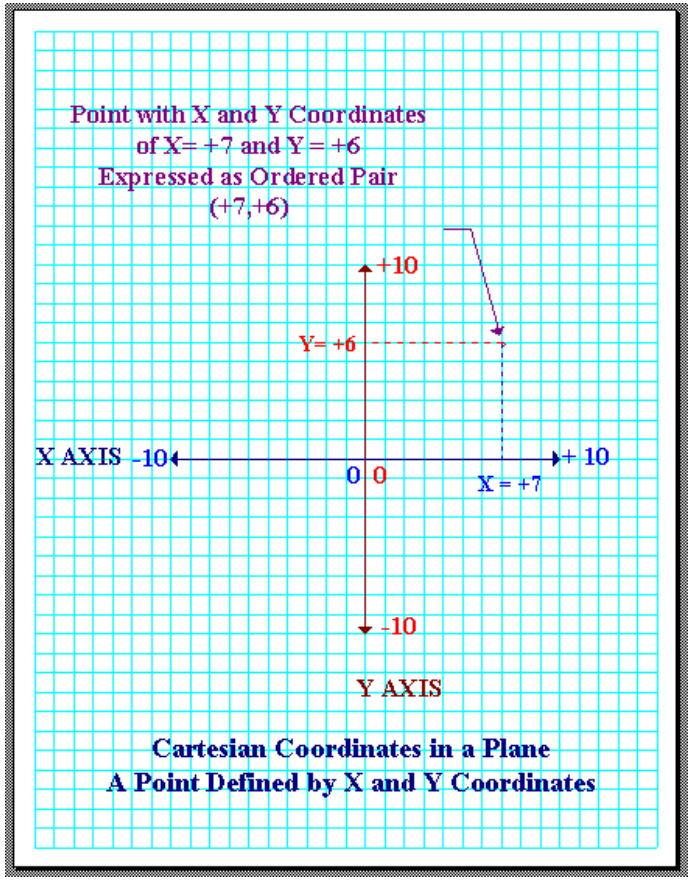
- Degree-Minute-Second (DMS)
  - 1 deg = 60 min
  - 1 min = 60 sec
- Decimal Degrees (DD)
  - 45°52′30″= 45.875 °

Plane Coordinate Systems

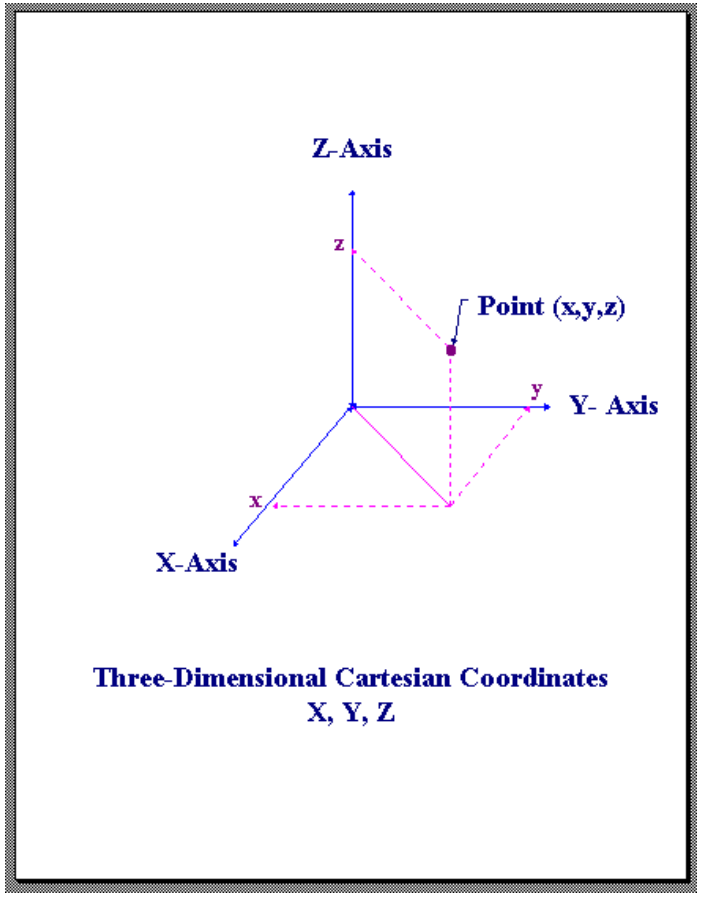
- René Descartes (1596-1650) introduced systems of coordinates based on orthogonal (right angle) coordinates.
- These two and three-dimensional systems used in analytic geometry are often referred to as Cartesian systems.
- Similar systems based on angles from baselines are often referred to as polar systems.

Plane Coordinate Systems

- 2-D Systems
  (1 plane)



- 3-D Systems
  (2 orthogonal planes)



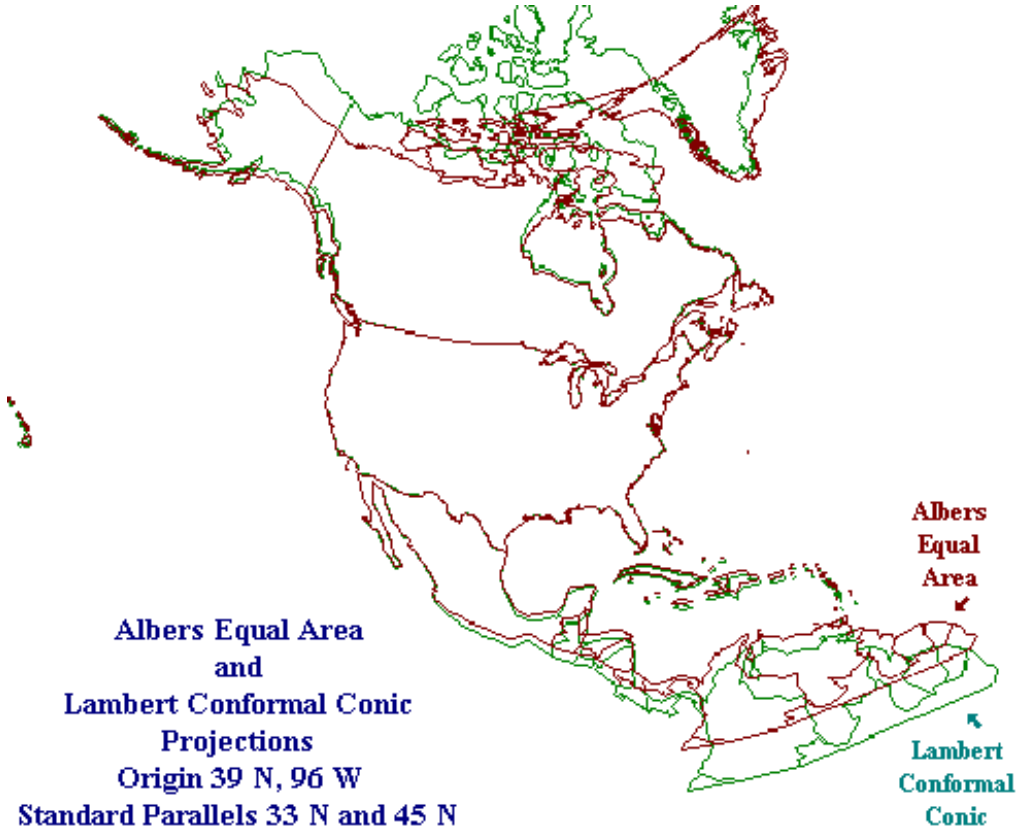
Projection Classes

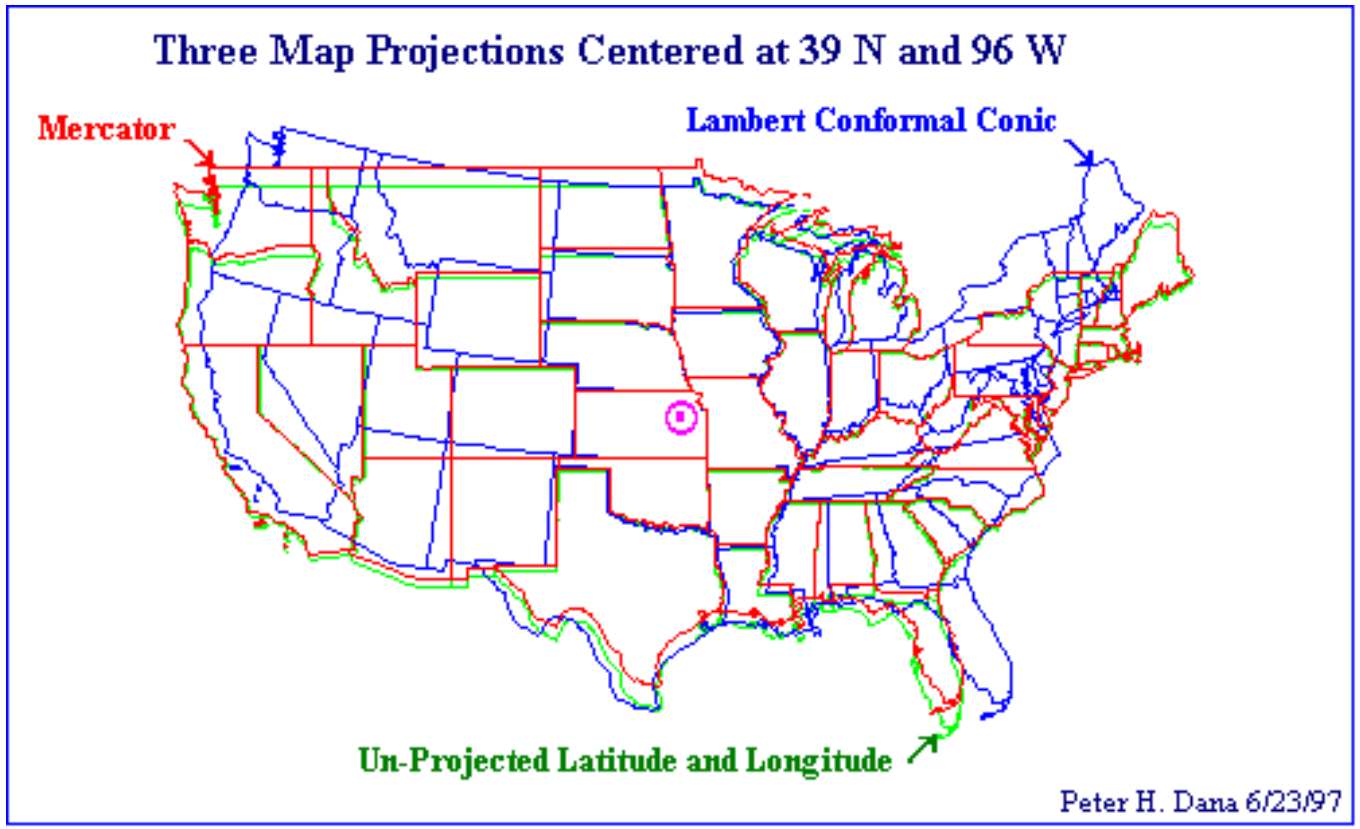
- Conformal: preserves local shape
- Equivalent: preserves area
- Equidistant: preserves length
- Azimuthal: preserves directions

Map can have more that one property, but conformal and equivalent are mutually exclusive

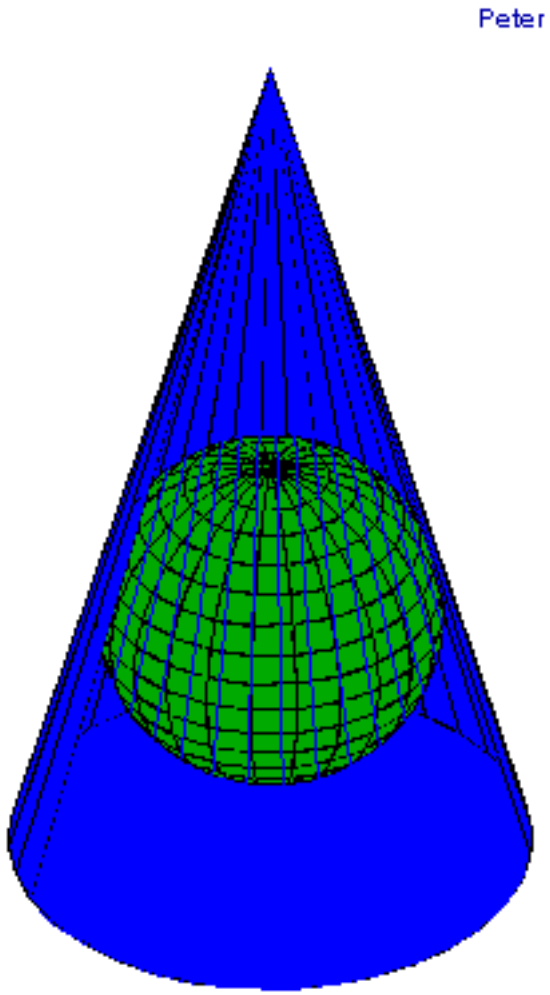
Projections Affect Maps

The greater the map area, the greater the impact of projection

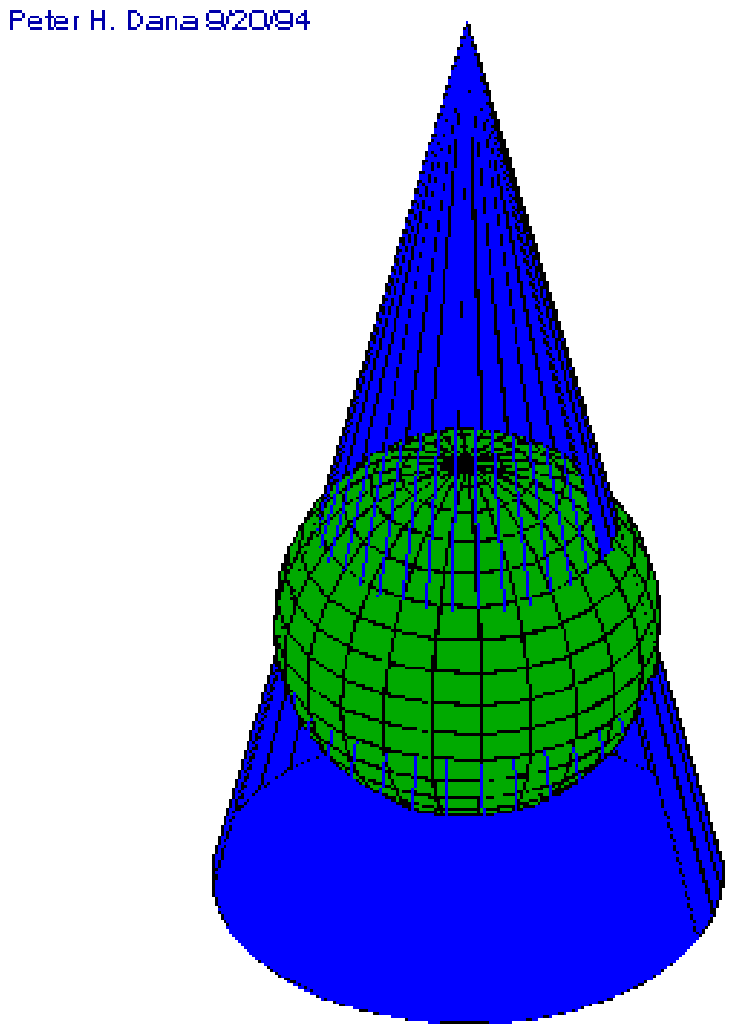




Conic Projection

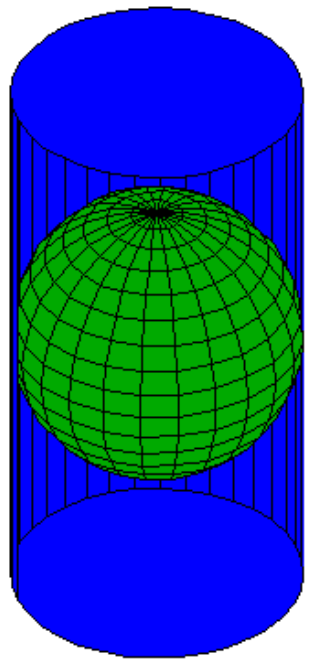


Conical Projection Surface

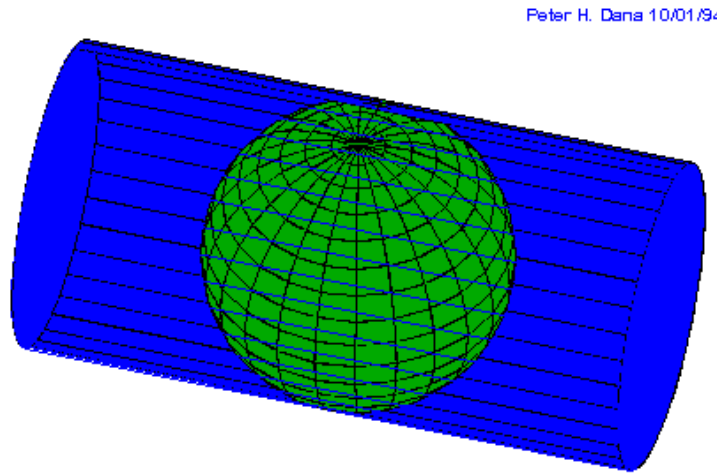


Secant Conic Projection

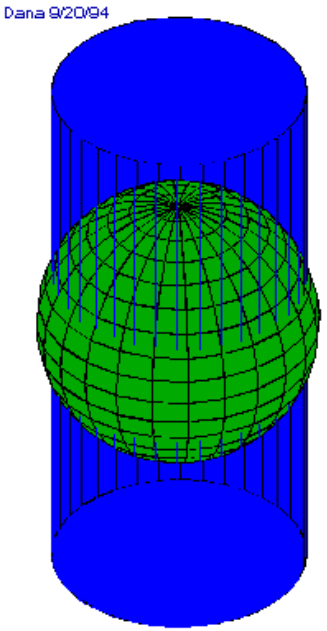
Cylindrical Projection



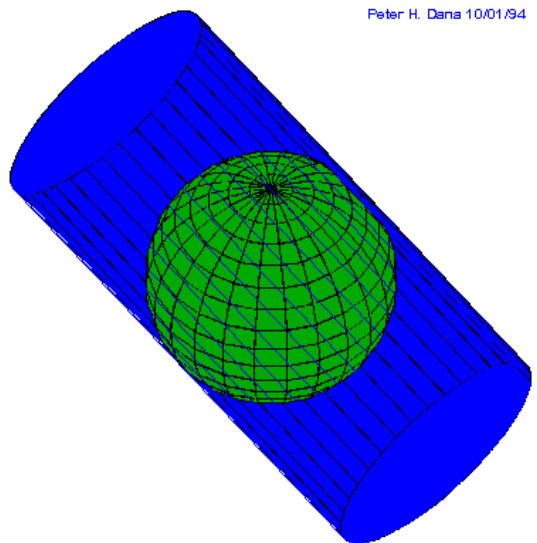
Cylindrical Projection Surface



Transverse Cylindrical Projection Surface

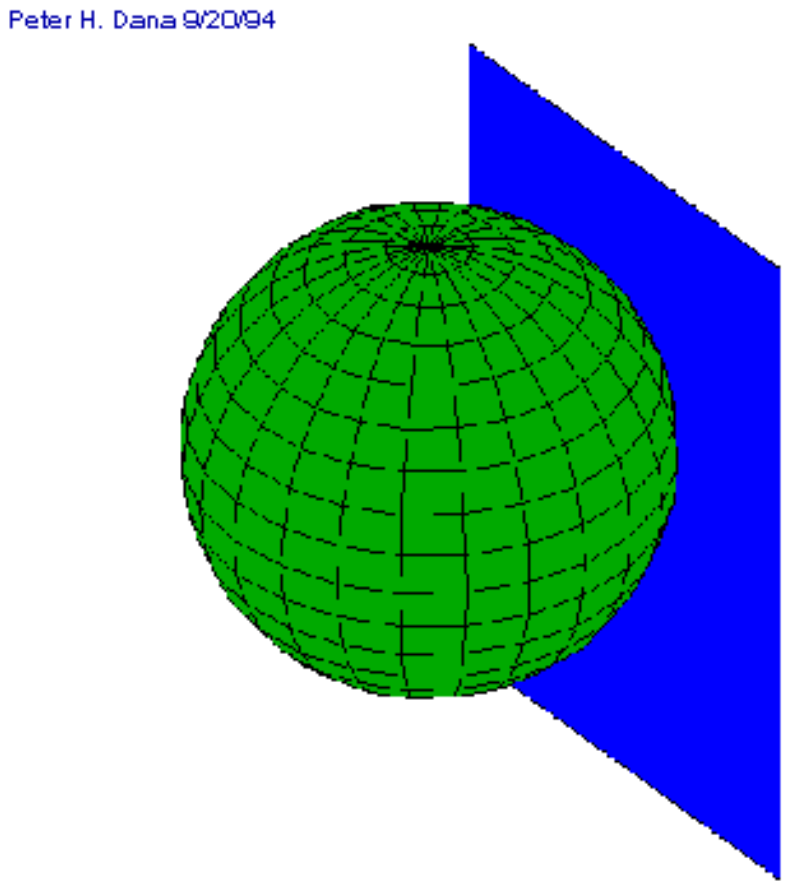


Secant Cylindrical Projection

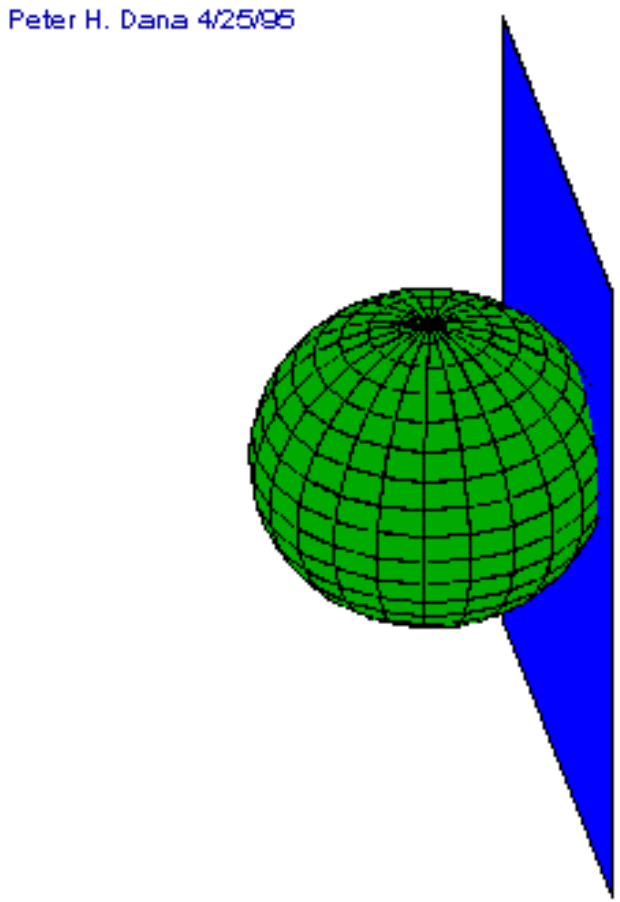


Oblique Cylindrical Projection Surface

Azimuthal Projection



Planar Projection Surface



Secant Planar Projection

Common Map Projections

- Choice of map projection depends upon:
  - Attribute to be preserved
  - Scale to be represented
  - Aspect of the map