

What is a coordinate system?

Coordinate systems enable geographic datasets to use common locations for integration. A coordinate system is a reference system used to represent the locations of geographic features, imagery, and observations such as GPS locations within a common geographic framework.

Each coordinate system is defined by:

- Its **measurement framework** which is either **geographic** (in which spherical coordinates are measured from the earth's center) or **planimetric** (in which the earth's coordinates are projected onto a two-dimensional planar surface).
- **Unit of measurement** (typically feet or meters for projected coordinate systems or decimal degrees for latitude–longitude).
- The definition of the map projection for projected coordinate systems.
- Other measurement system properties such as a **spheroid of reference**, a **datum**, and **projection parameters** like one or more standard parallels, a central meridian, and possible shifts in the x- and y-directions.

Types of coordinate systems

There are two common types of co-ordinate systems used in GIS:

A **global or spherical coordinate system** such as **latitude–longitude**. These are often referred to as geographic coordinate systems.

A **projected coordinate system** based on a map projection such as transverse Mercator, Albers equal area, or Robinson, all of which (along with numerous other map projection models) provide various mechanisms to project maps of the earth's spherical surface onto a two-dimensional Cartesian coordinate plane. Projected coordinate systems are sometimes referred to as map projections.

Datum:

While a spheroid approximates the shape of the earth, a datum defines the position of the spheroid relative to the centre of the earth. A datum provides a frame of reference for measuring locations on the surface of the earth. It defines the origin and orientation of latitude and longitude lines.

Geocentric datums In the last 15 years, satellite data has provided geodesists with new measurements to define the best earth-fitting spheroid, which relates coordinates to the earth's centre of mass. An earth-centred, or geocentric, datum uses the earth's centre of mass as the origin. The most recently developed and widely used datum is WGS 1984. It serves as the framework for locational measurement worldwide.

A local datum aligns its spheroid to closely fit the earth's surface in a particular area. A point on the surface of the spheroid is matched to a particular position on the surface of the earth. This point is known as the origin point of the datum. The coordinates of the origin point are fixed, and all other points are calculated from it.



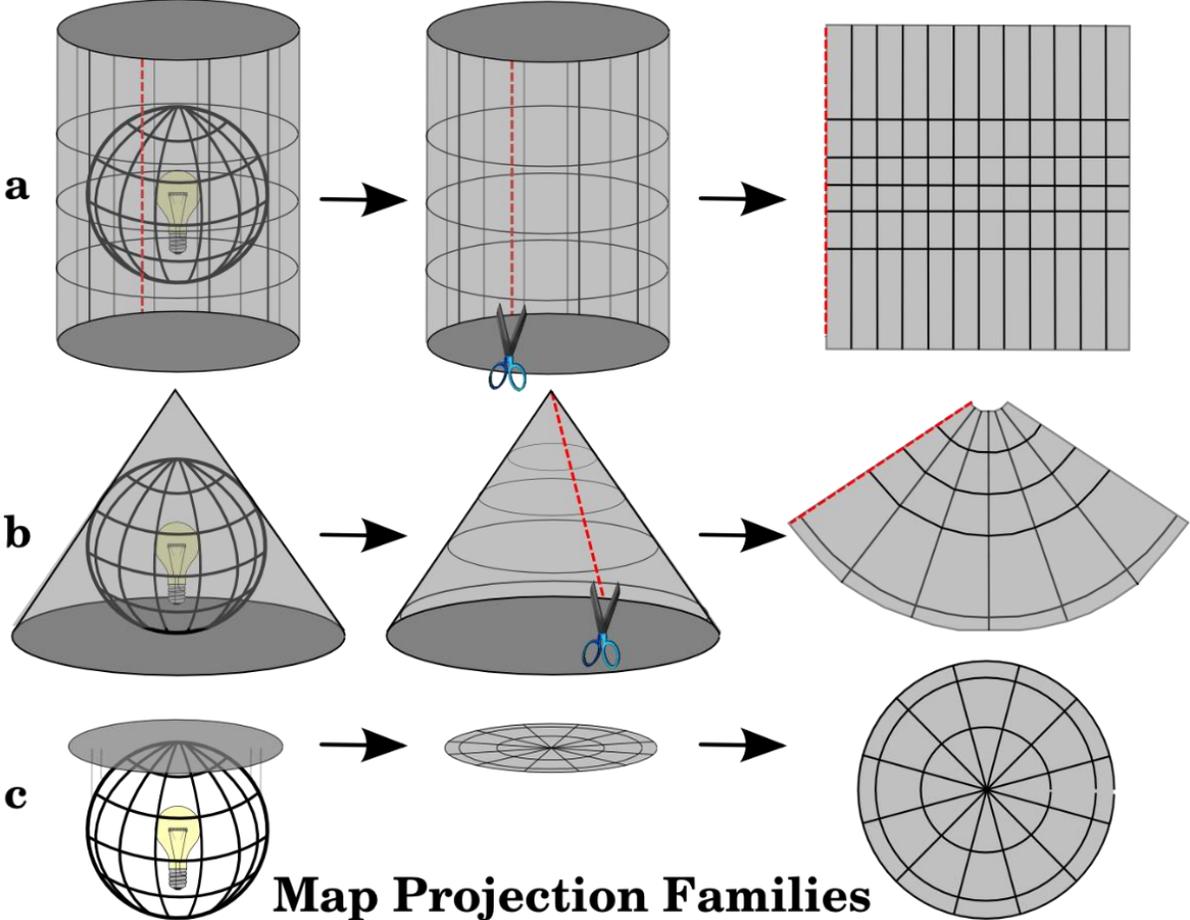
Projection Types

- Because maps are flat, some of the simplest projections are made onto geometric shapes that can be flattened without stretching their surfaces.
- A map projection systematically projects locations from the surface of a spheroid to representative positions on a flat surface using mathematical algorithms.
- The first step in projecting from one surface to another is creating one or more points of contact. Each contact is called a point (or line) of tangency.
- Whether the contact is tangent or secant, the contact points or lines are significant because they define locations of zero distortion.

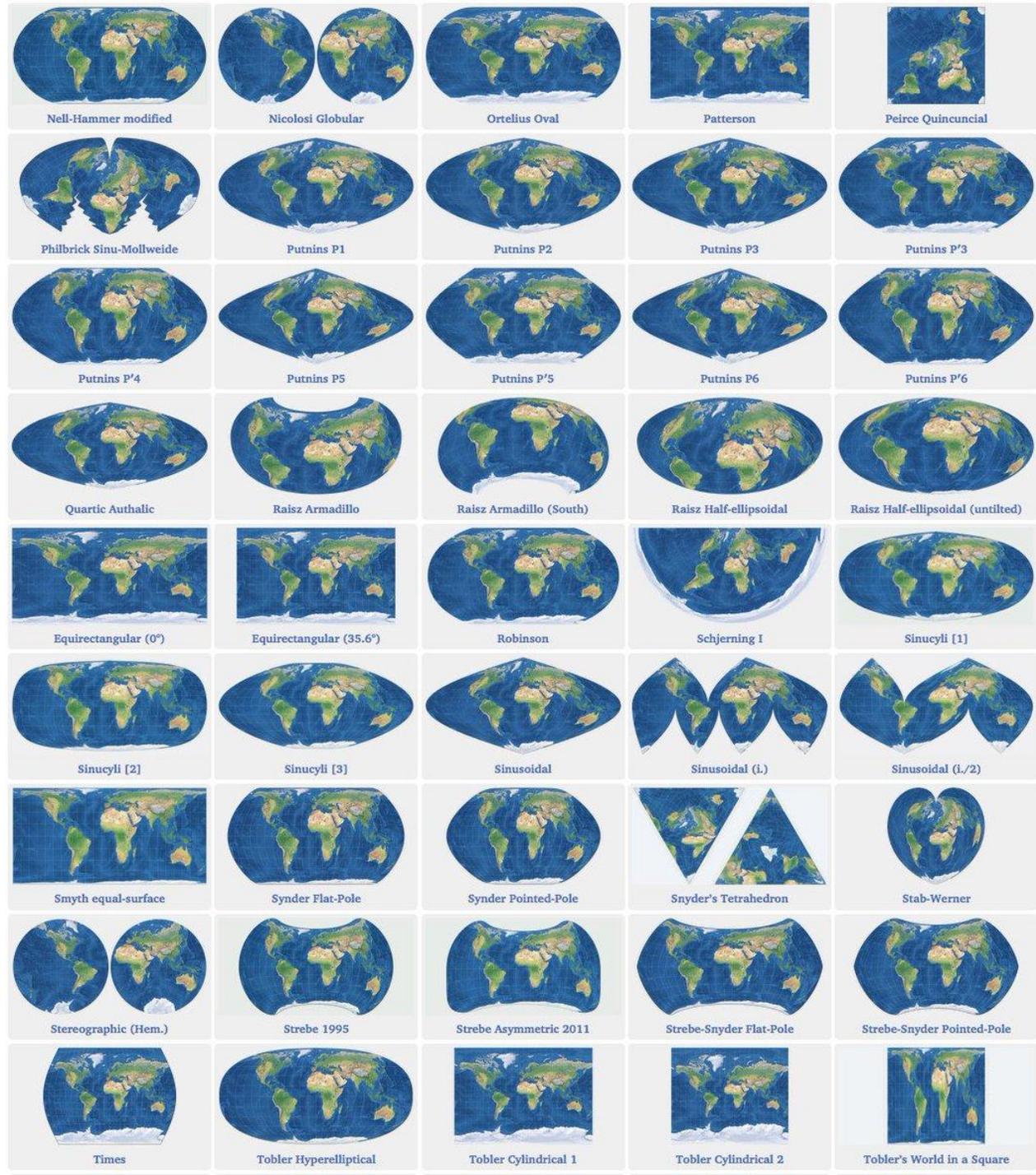
- Lines of true scale include the central meridian and standard parallels and are sometimes called standard lines.
- In general, distortion increases with the distance from the point of contact.

A **map projection** is a way of converting the 3D spherical planet into a planar 2D shape so we can perform analyses more easily.

There are three types of map projections – planar, cylindrical and conical.



There are many to choose from...



To summarise:

An estimate of the earth's surface based on an ellipsoid provides a determination of the elevation of every point on the earth's surface, including sea level, and is often called a **datum**.

The World Geodetic System (**WGS84**), from the U.S. Military in 1984, is internationally accepted as the geodetic reference system.

Geographic Coordinates simply refers to the system of latitude and longitude.

Projected Coordinate systems refer to systematic transformations of locations on earth (latitude/longitude) to planar coordinates