

Map Projections

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Definition: The map projection is a common tool used by cartographers to represent the rounded surface of the earth in two-dimensional maps. Portraying the earth's surface accurately is impossible without some form of distortion, much like attempting to flatten out an orange peel. Cartographers can, however, use different projections in order to preserve certain characteristics that are important to the purpose of the map. Only a globe can be used to represent all of the following correctly: True direction, distance, shape, and area. However, globes tend to be expensive, bulky, and lacking in significant detail. Unfortunately, no flat projection exists that can accurately preserve all of the above characteristics, but there are numerous options that allow the mapmaker to correctly represent some of these.

Commonly Used Projections:

Although there are several variations of these popular projections, those included below are among the most widely used in the cartographic community. For any projection, distortion can be reduced by increasing the scale and mapping a smaller area. To see examples, please access the hyperlink at the end of this document.

Mercator: Possibly the most widely used projection to date; the Mercator is also one of the earliest. Developed in the sixteenth century by Gerardus Mercator, this projection is cylindrical in nature and depicts true direction along any straight line. *Rhumb lines* (lines of constant direction) are usually not the shortest routes however, and shape and area become severely misrepresented as distance from the equator increases.

Sinusoidal Equal Area: As a projection that correctly preserves proportional area, the Sinusoidal Equal Area is often used to thematically map the global distribution of various phenomena. Distances remain accurate along all parallels, as well as the central meridian, but the shapes of features are increasingly distorted as the distance from the central meridian and poles increases.

Orthographic: This projection represents the way the earth would look in a photograph taken from space. The shapes and areas of map features become increasingly distorted with distance from the center point. Any straight line passing through this center point, however, is a great circle, thus representing a true portrayal of distance. Such lines also depict an accurate measure of direction.

Albers Equal Area Conic: This projection, often used to map the 48 coterminous United States is an effective tool for mapping any large area with an east/west extent. As a conic projection, the Albers has two standard parallels, along which distance and direction are true (most often, these are 29 1/2°N and 45 1/2°N for U. S. maps). Furthermore, areas of map features are proportional to the corresponding areas on the earth's surface.

Robinson: Introduced in 1963 by a cartographer at the University of Wisconsin, the Robinson projection is now one of the most widely used projections for mapping the earth. This projection offers more balance of size and shape than a cylindrical projection, such as the Mercator, however all points have some degree of distortion. Direction is true along all parallels and the central meridian; distance is constant along parallels only.

Mapping Smaller Areas: When projecting a more localized area, such as a state or county, it is advisable to use the State Plane Coordinate System. The state plane system employs one of three different projections for a given state based on the state's geometric direction and is effective in representing smaller areas accurately. For more information see <http://gislounge.com/features/aa032700.shtml>.

References/Sources:

U.S. Geological Survey publication on map projections. <http://erg.usgs.gov/isb/pubs/MapProjections/projections.html>.
Accessed: 12 January 2006.