

Map projection

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1. Prior to reading, check whether you understand these words.

cylinder distortion surface celestial perspective oblate spheroids curvature sphere

2. What are map projections, why are they useful?

3. What are the problems related to map projections?

4. What is the difference between the map and the globe? What are the advantages and disadvantages of each representation?

I. Read the passage, check your answers, and find additional information.

1. What did Gauss prove?

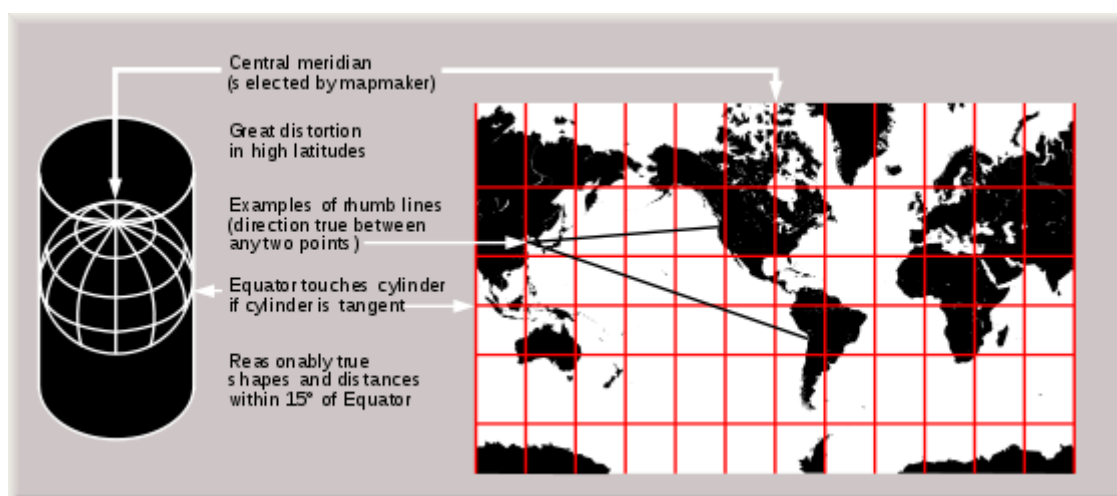
2. What is the method of “flattening”?


3. What is the difference between the earth and asteroids? (in terms of shape)

4. Is there any ideal map projection void of distortions?

A **map projection** is any method of representing the surface of a sphere or other shape on a plane. Map projections are necessary for creating maps. All map projections distort the surface in some fashion. Depending on the purpose of the map, some distortions are acceptable and others are not; therefore different map projections exist in order to preserve some properties of the sphere-like body at the expense of other properties. There is no limit to the number of possible map projections.

Background



 The Mercator projection shows courses of constant bearing as straight lines.

For simplicity, this article usually assumes that the surface to be mapped is the surface of a sphere. However, the Earth and other sufficiently large celestial bodies are generally better modeled as oblate spheroids, and small objects such as asteroids may have irregular shapes. These other surfaces can be mapped as well. Therefore, more generally, a map projection is any method of "flattening" into a plane a continuous surface having curvature in all three spatial dimensions.

Projection as used here is not limited to perspective projections, such as those resulting from casting a shadow on a screen. Rather, any mathematical function transforming coordinates from the curved surface to the plane is a projection.

Carl Friedrich Gauss's Theorema Egregium proved that a sphere cannot be represented on a plane without distortion. Since any method of representing a sphere's surface on a plane is a map projection, all map projections distort. Every distinct map projection distorts in a distinct way. The study of map projections is the characterization of these distortions.

A map of the earth is a representation of a curved surface on a plane. Therefore a map projection must have been used to create the map, and, conversely, maps could not exist without map projections. Maps can be more useful than globes in many situations: they are more compact and easier to store; they readily accommodate an enormous range of scales; they are viewed easily on computer displays; they can facilitate measuring properties of the terrain being mapped; they can show larger portions of the Earth's surface at once; and they are cheaper to produce and transport. These useful traits of maps motivate the development of map projections.

II. Metric properties of maps

Many properties can be measured on the Earth's surface independently of its geography. Some of these properties are: Match the properties and their definitions, they are mixed up.

- Area – the information contained in the relative position of one point with respect to another without distance information
- Shape – the angle between a line connecting two points and a north-south line
- Direction – a numerical description of how far apart objects are
- Bearing - the ratio of a distance on the map to the corresponding distance on the ground
- Distance – the part of some space occupied by the object
- Scale- a quantity expressing the two-dimensional size of a defined part of a surface

III. Scale Read about scale and fill in the missing expressions.

equivalent cylindrical equidistant globe radiating conformal constant longitude

A 1..... is the only way to represent the earth with constant scale throughout the entire map in all directions. A map cannot achieve that property for any area, no matter how small. It can, however, achieve 2..... scale along specific lines.

Some possible properties are:

- The scale depends on location, but not on direction. This is 3..... to preservation of angles, the defining characteristic of a 4..... map.
- Scale is constant along any parallel in the direction of the parallel. This applies for any 5..... or pseudocylindrical projection in normal aspect.
- Combination of the above: the scale depends on latitude only, not on 6..... or direction. This applies for the Mercator projection in normal aspect.
- Scale is constant along all straight lines 7..... from a particular geographic location. This is the defining characteristic of an 8..... projection such as the Azimuthal equidistant

projection. There are also projections (Maurer, Close) where true distances from *two* points are preserved.

IV. Choosing a model for the shape of the Earth

1. Explain the term geographic datums.

What is a geoid?

What does the abbreviation WGS84 mean?

What are mantle convection patterns?

Read the text, try to find information concerning these topics.

2. There are some missing parts of sentences in the text, try to fill them in.

1. This model is not used for mapping due to its complexity but is instead used for control purposes in the construction of geographic datums.

2. at the expense of some accuracy in smaller regions.

3. Historically, datums have been based on ellipsoids that best represent the geoid within the region the datum is intended to map.

4. However, the Earth is not exactly spherical but is closer in shape to an oblate ellipsoid,

Projection construction is also affected by how the shape of the Earth is approximated. In the following discussion on projection categories, a sphere is assumed. A)..... a shape which bulges around the equator. Selecting a model for a shape of the Earth involves choosing between the advantages and disadvantages of a sphere versus an ellipsoid. Spherical models are useful for small-scale maps such as world atlases and globes, since the error at that scale is not usually noticeable or important enough to justify using the more complicated ellipsoid. The ellipsoidal model is commonly used to construct topographic maps and for other large and medium scale maps that need to accurately depict the land surface.

A third model of the shape of the Earth is called a geoid, which is a complex and more or less accurate representation of the global mean sea level surface that is obtained through a combination of terrestrial and satellite gravity measurements. B) (In geodesy, plural of "datum" is "datums" rather than "data".) A geoid is used to construct a datum by adding irregularities to the ellipsoid in order to better match the Earth's actual shape (it takes into account the large scale features in the Earth's gravity field associated with mantle convection patterns, as well as the gravity signatures of very large geomorphic features such as mountain ranges, plateaus and plains). C)..... Each ellipsoid has a distinct major and minor axis. Different controls (modifications) are added to the ellipsoid in order to construct the datum, which is specialized for a specific geographic regions (such as the North American Datum). A few modern datums, such as WGS84 (the one used in the Global Positioning System GPS), are optimized to represent the entire earth as well as possible with a single ellipsoid, D).....

WORD STUDY

Supply the missing information. (if there exists)

noun	adjective	adverb
sphere		
	global	
		geographically
equator		
	cylindrical	
mathematics		
geomorphology		
		topographically
	gravitational	
complexity		
	terrestrial	

Video – Map projections

<http://www.youtube.com/watch?v=AI36MWAH54s>

List the kinds of Map projections and state what are the advantages and disadvantages of each type.

1.
2.
3.
4.
5.

Listen again and fill in the missing information.

Mercator was a cartographer who devised the projection in

Lines of latitude are of the same length as

This projection was used as a marine

Greenland looks larger than South America even if it is closer in size to.....

The Polar map has either.....or

Polar routes can cut

The Mollweide map is used to show the distribution.....

The Mollweide map is for navigation.

In the Mollweide mapare shown correctly.

Areas on this map defined by meridians orare equal.

In the Interrupted map continental areas areor

The Interrupted map is used to show the distribution of.....

The Robinsons map is a picture of the world.

It was devised in

There are some distortions in

It is now used in

In 1988 it was adopted by