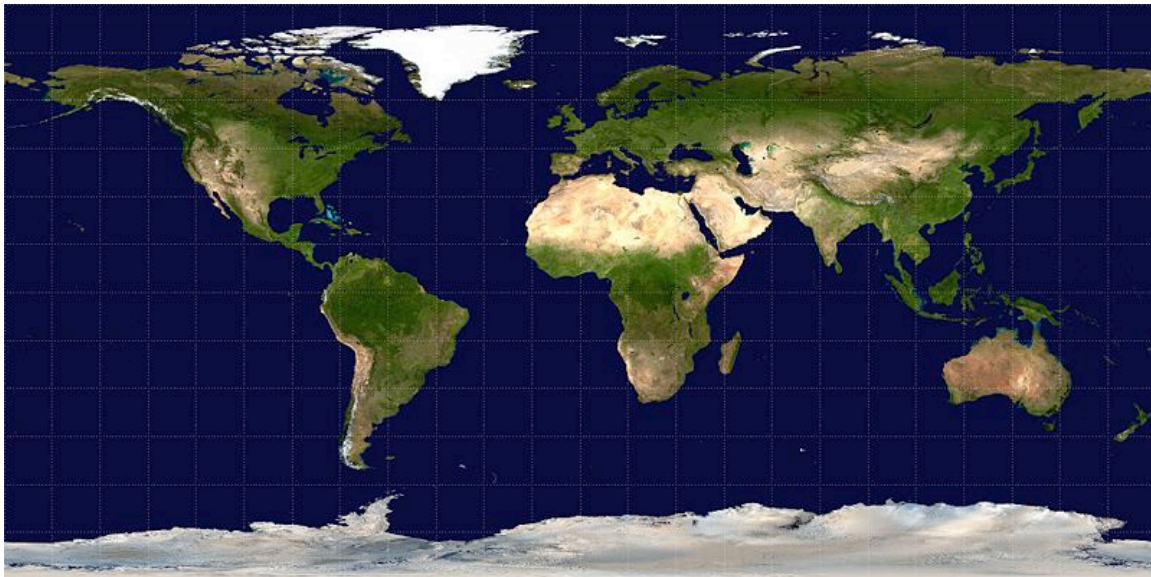# Map Projection
(excerpted from Wikipedia)

A **map projection** is any method used in cartography to represent the two-dimensional curved surface of the earth or other body on a plane.

The term "projection" here refers to any function defined on the earth's surface and with values on the plane, and not necessarily a geometric projection.
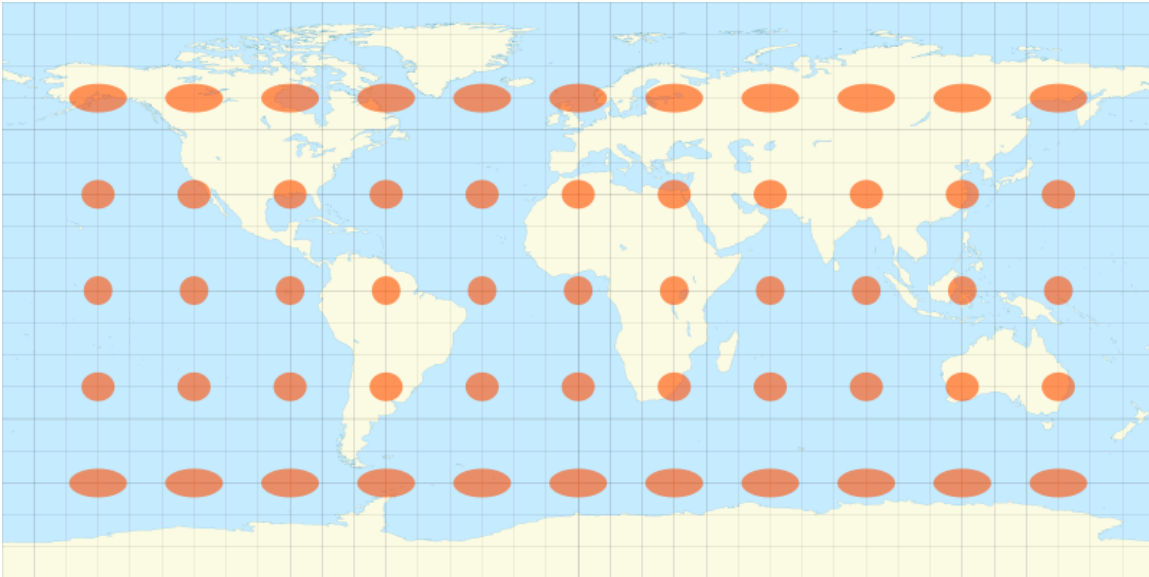
Equirectangular projection

The **equirectangular projection** (also called the **equidistant cylindrical projection**, **geographic projection**, **plate carré** or **carte parallelogrammatique projection** or **CPP**) is a very simple map projection attributed to Marinus of Tyre, who Ptolemy claims invented the projection about 100 AD.[1] The projection maps meridians to equally spaced vertical straight lines, and parallels to equally spaced horizontal straight lines.

An equirectangular projection of the Earth; the standard parallel is the equator.

The projection is neither equal area nor conformal. Because of the distortions introduced by this projection, it has little use in navigation or cadastral mapping and finds its main use in thematic mapping. In particular, the plate carrée has become a de-facto standard for computer applications that process global maps, such as Celestia and NASA World Wind, because of the trivial connection between an image pixel and its geographic position.

The equirectangular projection with Tissot's Indicatrix of deformation

Flat maps could not exist without map projections, because a sphere cannot be laid flat over a plane without distortions. One can see this mathematically as a consequence of Gauss's Theorema Egregium. Flat 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 flat maps motivate the development of map projections.

Projections by surface

Cylindrical

The term "cylindrical projection" is used to refer to any projection in which meridians are mapped to equally spaced vertical lines and circles of latitude (parallels) are mapped to horizontal lines (or, mutatis mutandis, more generally, radial lines from a fixed point are mapped to equally spaced parallel lines and concentric circles around it are mapped to perpendicular lines)

The mapping of meridians to vertical lines can be visualized by imagining a cylinder (of which the axis coincides with the Earth's axis of rotation) wrapped around the Earth and then projecting onto the cylinder, and subsequently unfolding the cylinder.
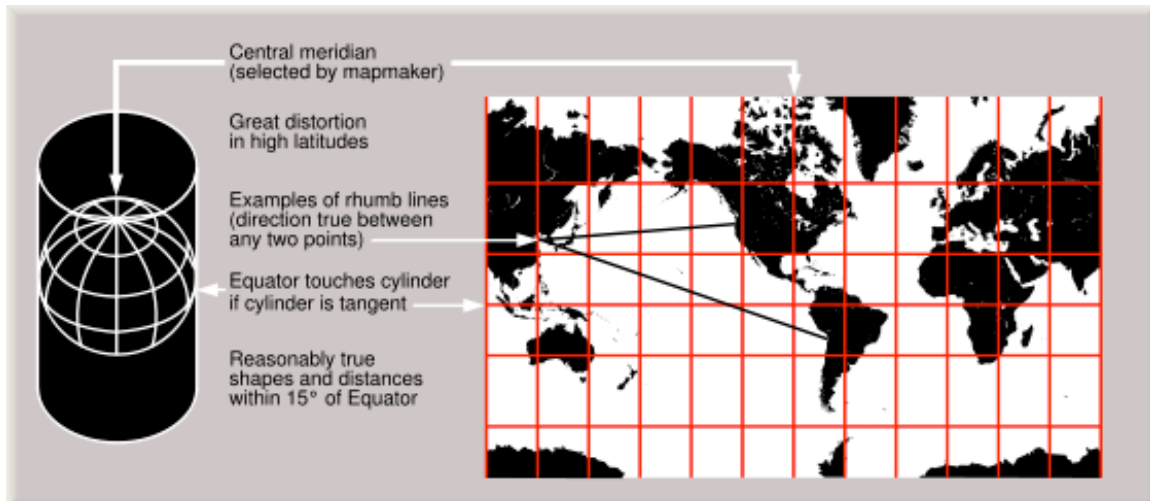
The Mercator projection shows courses of constant bearing as straight lines.

Unavoidably, all cylindrical projections have the same east-west stretching away from the equator by a factor equal to the secant of the latitude, compared with the scale at the equator. The various cylindrical projections can be described in terms of the north-south stretching:

- North-south stretching is equal to the east-west stretching (secant(L)): The east-west scale matches the north-south-scale: conformal cylindrical or Mercator; this distorts areas excessively in high latitudes (see also transverse Mercator).
- North-south stretching growing rapidly with latitude, even faster than east-west stretching (secant(L))²: The cylindric perspective (= central cylindrical) projection; unsuitable because distortion is even worse than in the Mercator projection.
- North-south stretching grows with latitude, but less quickly than the east-west stretching: such as the Miller cylindrical projection (secant(L*4/5)).
- North-south distances neither stretched nor compressed (1): equidistant cylindrical or plate carrée.
- North-south compression precisely the reciprocal of east-west stretching (cos(L)): equal-area cylindrical (with many named specializations such as Gall-Peters or Gall orthographic, Behrmann, and Lambert cylindrical equal-area). This divides north-south distances by a factor equal to the secant of the latitude, preserving area but heavily distorting shapes.

In the first case (Mercator), the east-west scale always equals the north-south scale. In the second case (central cylindrical), the north-south scale exceeds the east-west scale everywhere away from the equator. Each remaining case has a pair of identical latitudes of opposite sign (or else the equator) at which the east-west scale matches the north-south-scale.

Cylindrical projections map the whole Earth as a finite rectangle, except in the first two cases, where the rectangle stretches infinitely tall while retaining constant width.