Geography 12: Maps and Mapping

Lecture 5: Some Useful Map Projections

Professor Keith Clarke

The graticule shows increments of latitude and longitude
No flat map can be both equivalent and conformal.

Burn Onto Your Brain Cells

- No flat map can be both equivalent and conformal
- We always distort scale, direction or shape
- We ignore projections at our peril!
We’ve already covered…

- Form (planar, cylindrical, conic)
- Aspect (equatorial, oblique, transverse)
- Property preservation (shape, area, direction)
- Analog vs. mathematical
- Tangent vs. secant

The central meridian

- In the mathematical derivation, x can map onto any meridian
- \( x' = f (\lambda - \lambda_0) \)
- We can change the center of the map
- Can even change the direction of the axis
Changing the central meridian

Mollweide: A pseudocylindrical projection

$x$ and $y$ are not independent

\[ x = \frac{2\sqrt{2}}{\pi} \lambda \cos \left( \frac{\theta}{2} \right) \]
\[ y = \sqrt{2} \sin \left( \frac{\theta}{2} \right) \]

\[ \theta + \sin(\theta) = \pi \sin(\phi) \]
We can also choose the interruptions

Interrupted Mollweide

And mix projections together
(Goode’s Homolosine=Miller plus sinusoidal)
Many possible interruptions

Projection distortion: Tissot’s Indicatrix

Werner projection
Mercator plus Tissot

Sinusoidal plus Tissot
Projections for the USA

Lambert conformal conic

USA on Mercator
GS-50 Snyder

Fun projections

Hammer retroazimuthal

Berghaus star
Customizing error

Projection DOES matter!

Three Map Projects Centered at 39 N and 96 W

Mercator
Lambert Conformal Conic

Un-Projected Latitude and Longitude

Peter H. Dana 6/23/97
Final notes

• Many features of projections can be varied
• Since no flat map can be both conformal and equivalent, all have distortion
• We can customize where and how much error is in a projection
• We can know and display the error
• The smaller the extent the map covers, the less overall distortion
• Always include information about the projection