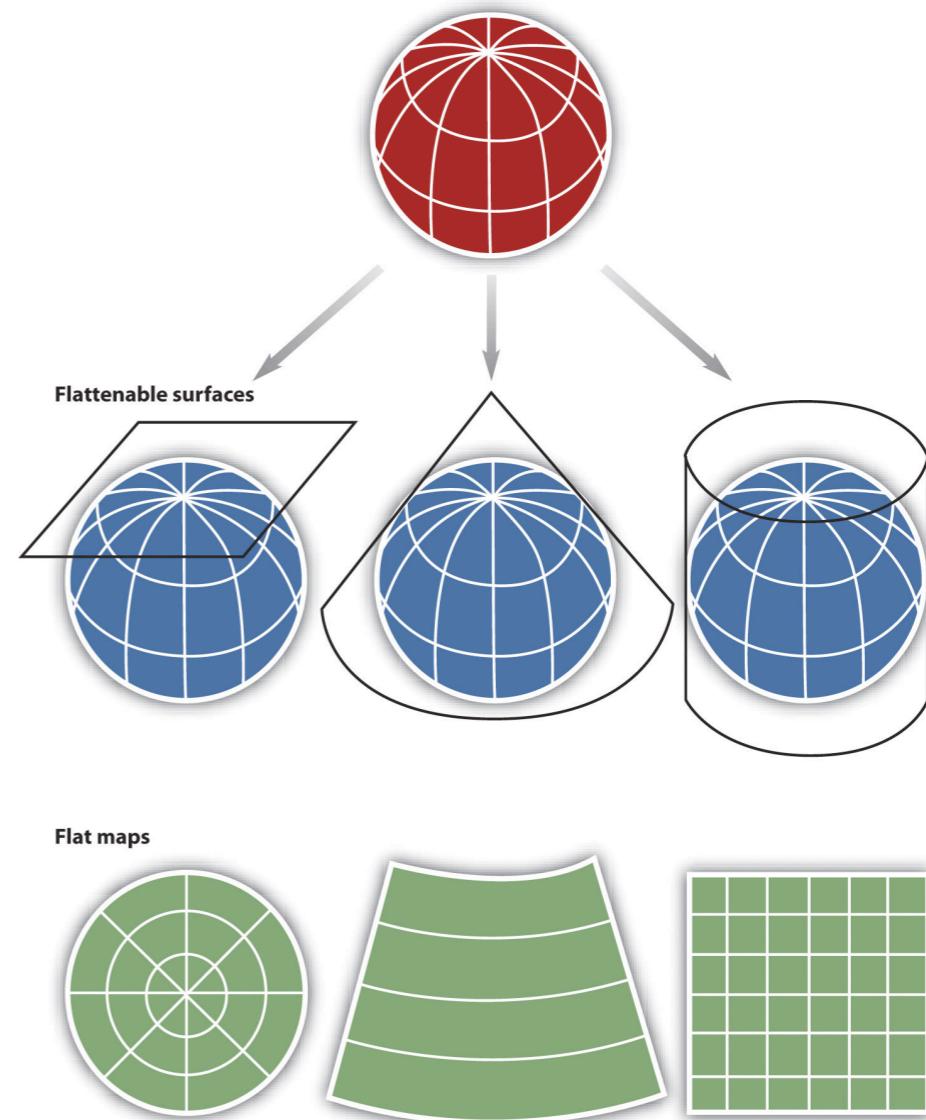
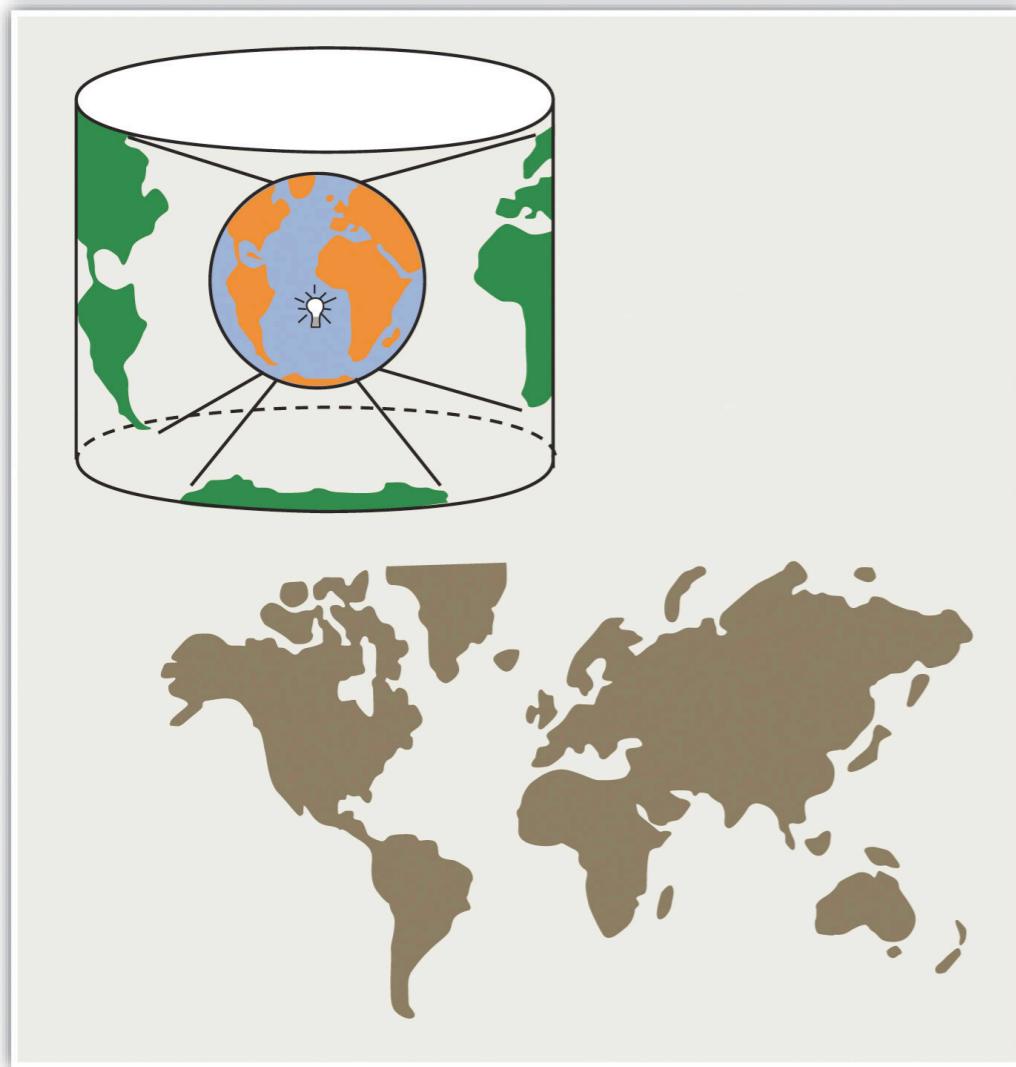


Geospatial Maps in R

Biology 724D:
Foundations of Data Science for Biologists

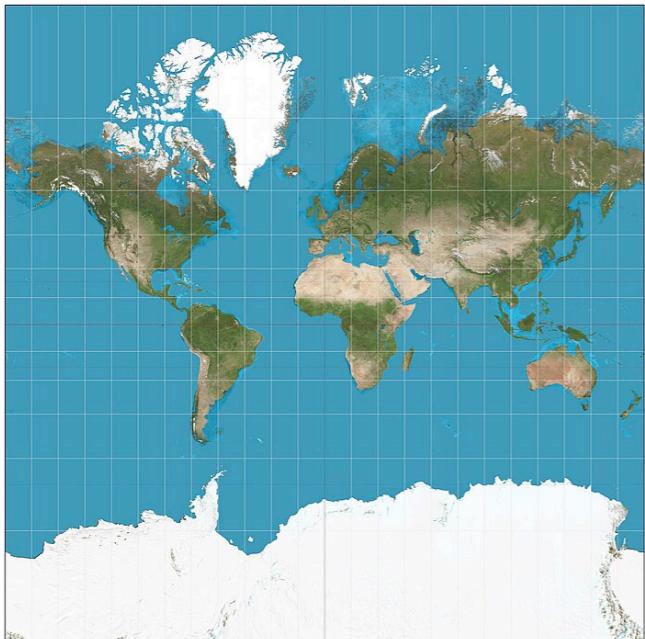
The Problem: Flattening the Earth



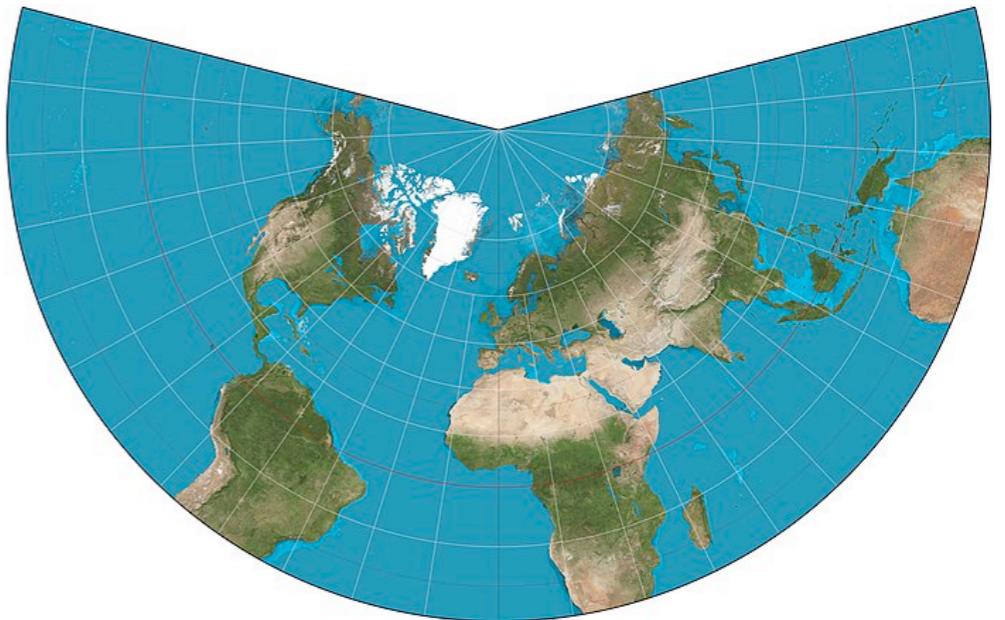
Coordinate Reference Systems

1. Geodetic Datum -- assumptions about the shape of the earth (spheroid), center of the planet, origin points for latitude and longitude, etc.
 - World Geodetic System (WGS84) -- common default
 - North American Datum (NAD83) -- most appropriate for North America
2. Map projection -- mathematical operations required to map points from a 3D object and 2D surface. Area preserving vs Shape preserving.
 - e.g. Mercator projection (shape preserving, cylindrical projection), Lambert conformal projection (shape preserving, conical projection), Albers projection (area preserving, conical projection), etc.
3. Parameters of the projection -- origin and bounds

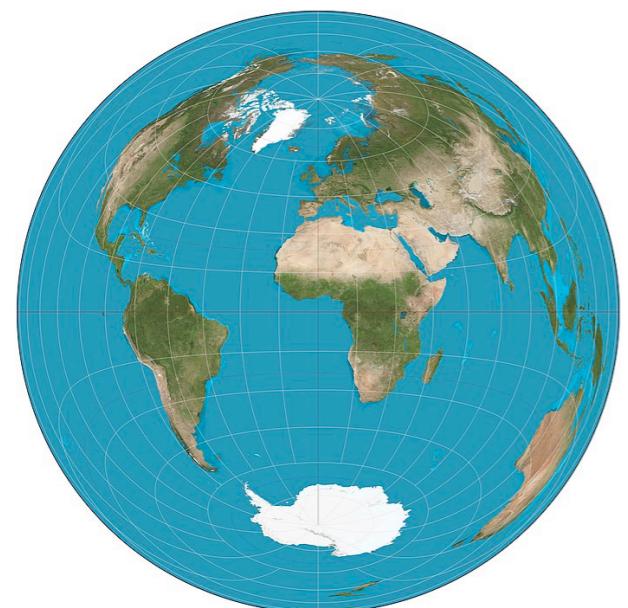
Map Projections: Examples from Wikipedia



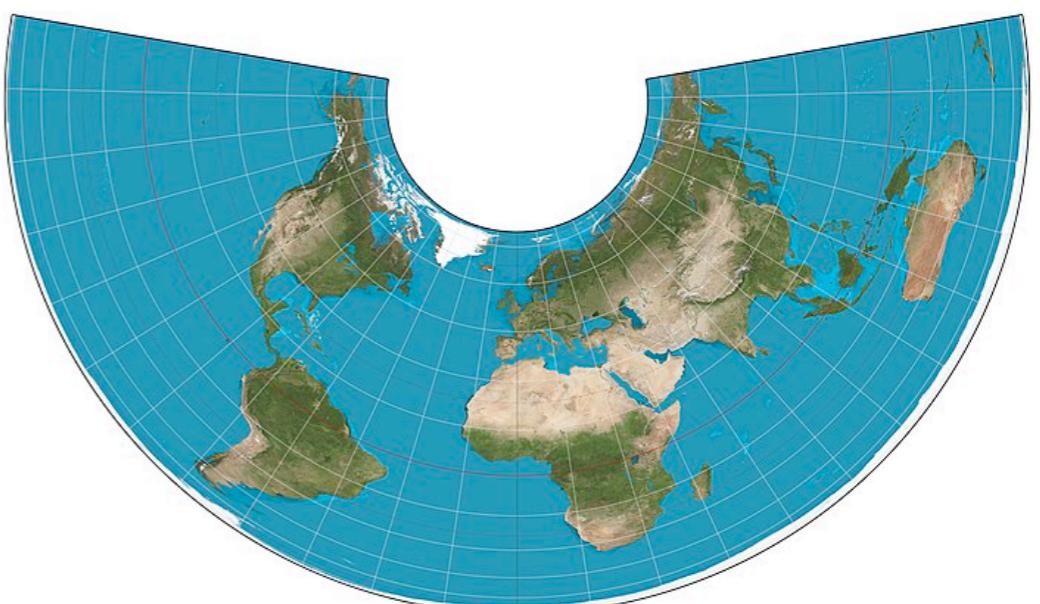
Mercator conformal



Lambert conformal



Lambert azimuthal equal area



Albers equal area

Representing spatial features

- Problem: What spatial features do we want to map and how do we represent them?
- "Simple Features" files:
 - "Simple Features (officially Simple Feature Access) is a set of standards that specify a common storage and access model of geographic features made of mostly two-dimensional geometries (point, line, polygon, multi-point, multi-line, etc.) used by geographic databases and geographic information systems. It is formalized by both the Open Geospatial Consortium (OGC) and the International Organization for Standardization (ISO)." (source: Wikipedia)

sf: Simple Features for R



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R: Mapping and Geospatial

Geospatial applications using the R programming language

Overview

- Getting Data
- Preparing Data and Joining More Data
- Geocoding
- Visualizing
- Raster Data
- Projections / CRS
- Output
- Related GIS Guides

Created using R

The figure consists of a 3x2 grid of maps of the United States. The top row shows 'Median Income' and 'Legislators'. The middle row shows 'Poverty' and 'Substance Abuse Soc. Wks'. The bottom row shows 'Teachers' and 'Wages'. Each map uses a color gradient to represent different values across US states.

Overview

Introduction Tutorials Contacts for more help

A choropleth map of North Carolina's counties, where each county is colored according to its estimated population. A color scale legend on the right ranges from dark purple (200,000) to yellow (1,000,000). A callout box points to the city of Roanoke Rapids. The map also labels major cities like Knoxville, Winston-Salem, Charlotte, and Virginia Beach.

- [Spatial Data Science](#)
Book by Edzer Pebesma and Roger Bivand. Focuses on the tidyverse packages to perform geospatial analysis in R.
- [Geocomputation with R](#)
Online book by Robin Lovelace, et al. covering both vector and raster mapping. Generally uses the tidyverse packages.
- [Get Spatial! Using R as GIS](#)
"Intended to introduce you to the different spatial data types and how to create, read, manipulate and analyze spatial data in R."
- [CRAN Task View: Analysis of Spatial Data](#)
An overview of R packages used for spatial data analysis and visualization.
- [An Exploration of Simple Features for R](#)
Extensive blog post by Jesse Sadler about R's `sf` package, implementing the Simple Features standard into R and fitting nicely into the tidyverse set of packages.
- [Introduction to visualising spatial data in R](#)
20-page PDF by Robin Lovelace, et al. Overview on R's spatial functions, projections, and creating thematic maps.