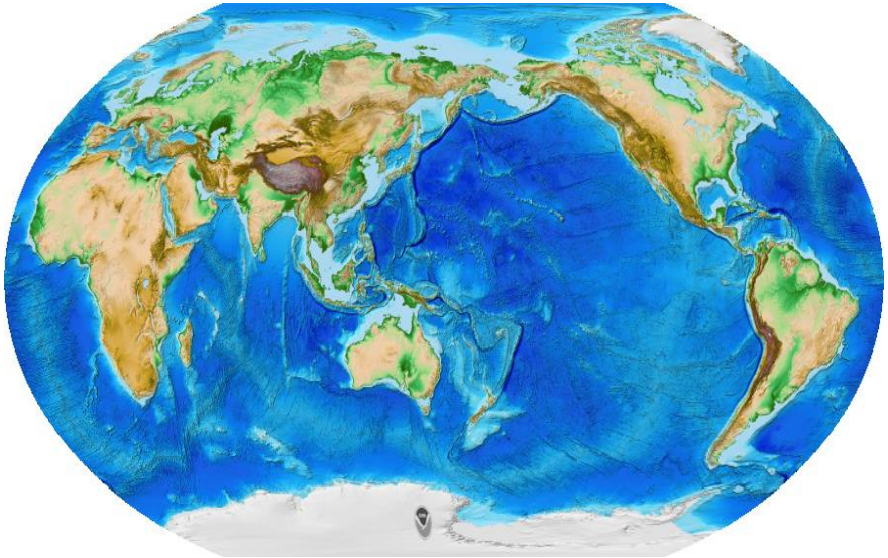
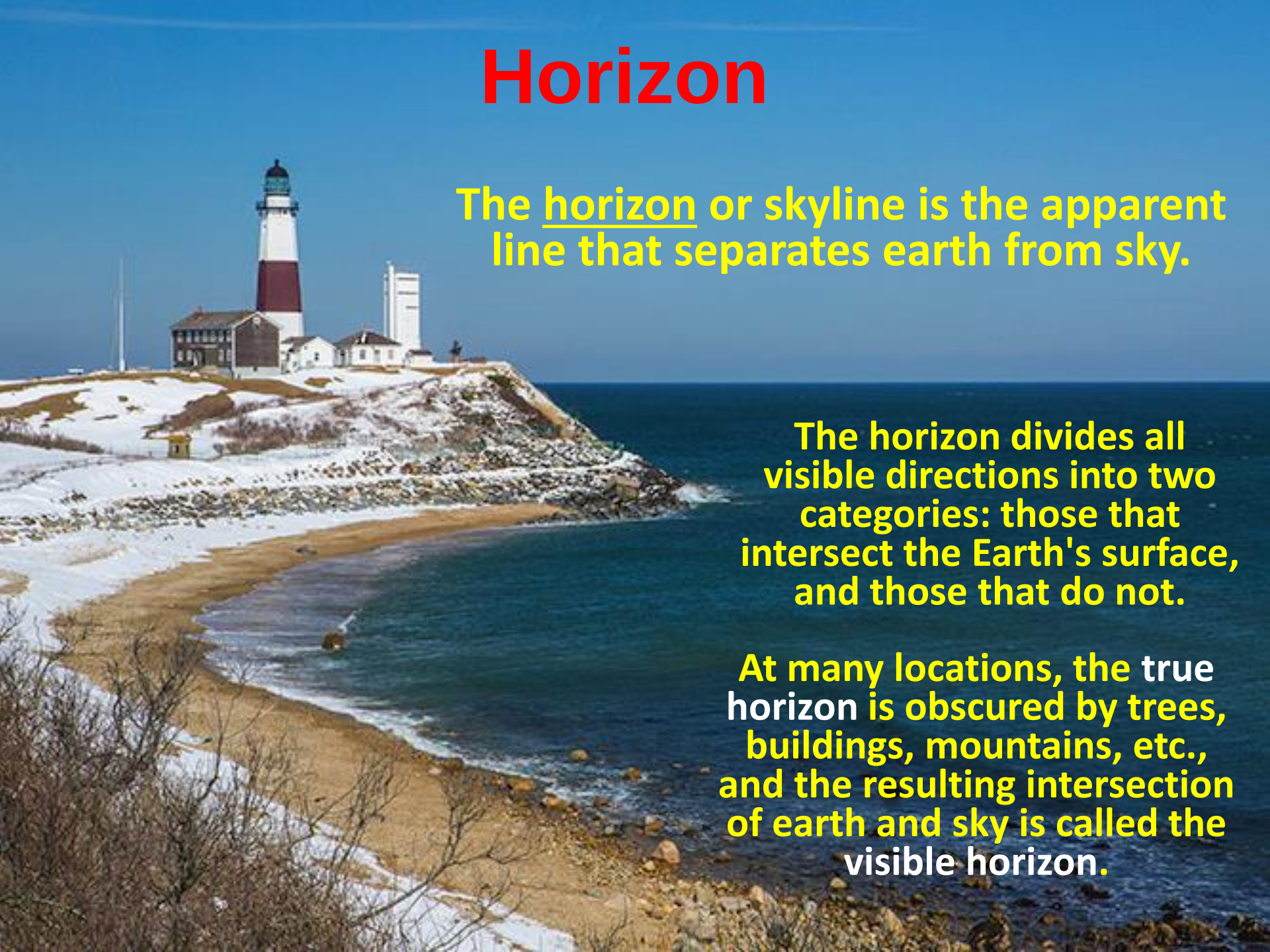
L I V I N G



on a SPHERE

Horizon



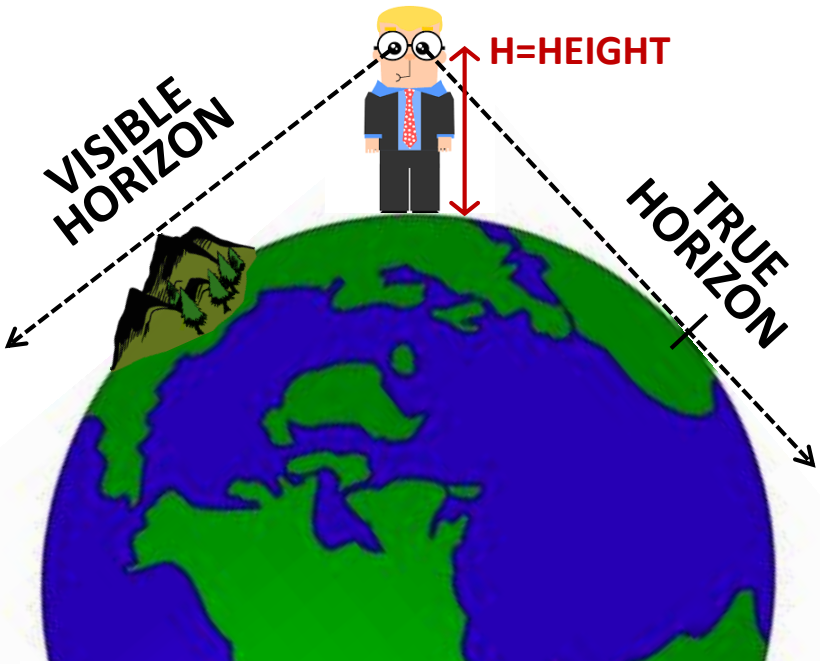
The horizon or skyline is the apparent line that separates earth from sky.

The horizon divides all visible directions into two categories: those that intersect the Earth's surface, and those that do not.

At many locations, the true horizon is obscured by trees, buildings, mountains, etc., and the resulting intersection of earth and sky is called the visible horizon.

How Far is the Horizon?

Historically, the distance to the horizon has long been vital to survival and successful navigation, especially at sea.

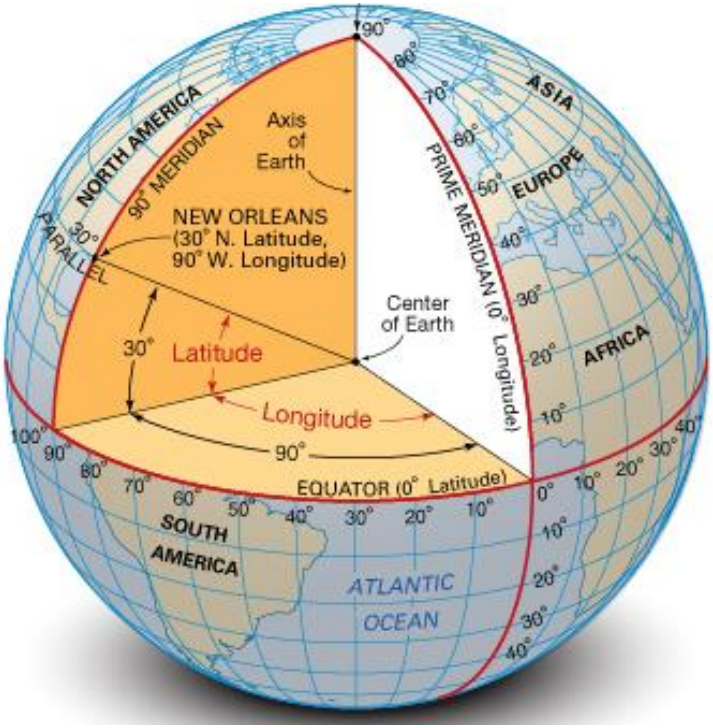


OBSERVER	HEIGHT	DISTANCE to TRUE HORIZON
On the ground	1.7 m (5 ft 7 in)	4.7 km (2.9 mi)
At the Eiffel Tower observation deck	276 m (906 ft)	58.7 km (37 mi)
Atop Mount Everest	8,848 m (29,029 ft)	336 km (209 mi)

In reality, one typically sees further along the Earth's curved surface than a simple geometric calculation allows for because of downward light refraction in the atmosphere. With standard atmospheric conditions, the difference is about 8%.

Coordinates on the Globe

- **Every location on Earth's surface can be specified by a set of numbers and letters using a geographic coordinate system.**
- **A common choice of coordinates is latitude and longitude, forming the *grid system*, and elevation.**



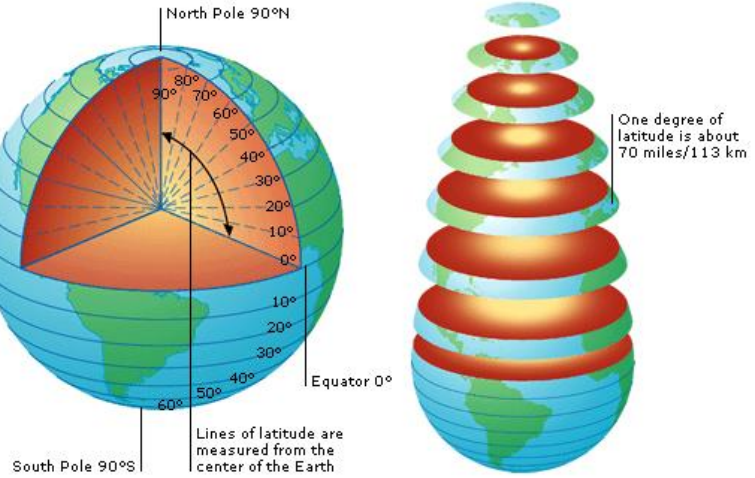
New Orleans, N30° W90°

Washington DC, N39° W77°

Latitude and Longitude

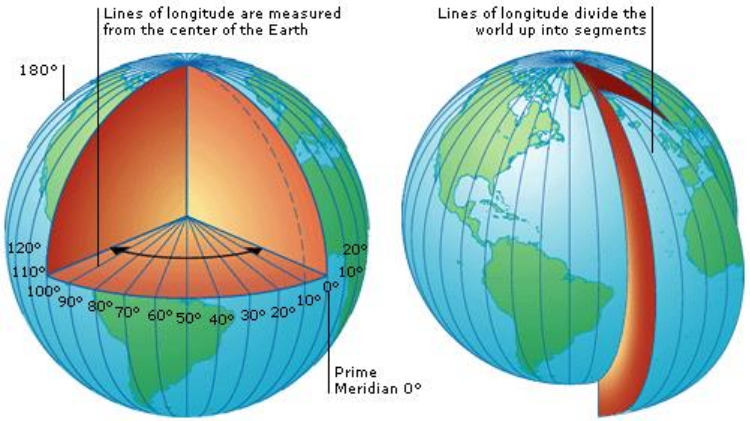
Latitude and longitude are measured in degrees (°) with submultiples of minutes (′) and seconds (″).

Latitude lines (parallels) run horizontally. They are parallel to and an equal distance from each other.



Zero degrees latitude is at the Equator. The latitude directions are North (+) and South (-). North Pole is 90°N, South Pole is 90°S. Each degree of latitude corresponds to approximately 70 miles (113 km).

Longitude lines (meridians) run vertically, perpendicular to the Equator. They meet at the Poles and are spaced widest at the Equator.



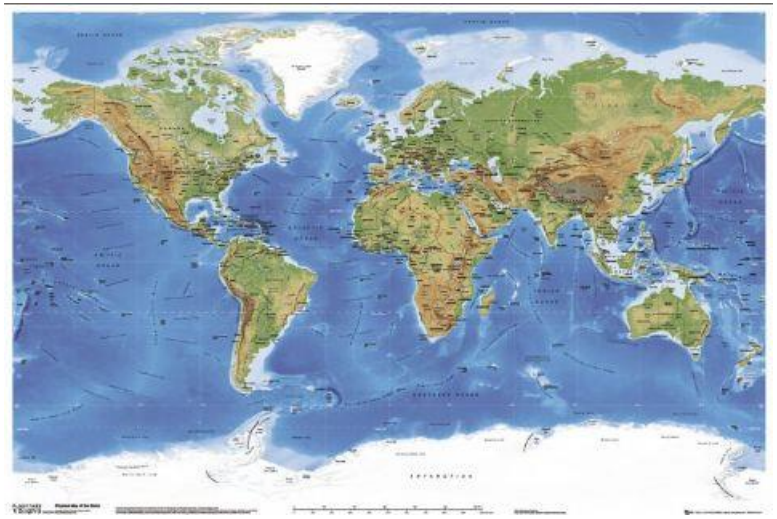
Zero degrees longitude is called the Prime Meridian (goes through Royal Observatory, Greenwich, UK). The longitude directions are East (+) and West (-).

Exercise: on the first day of October, a **tiger** was detected by surveillance cameras at the following locations: **N40°55′12″ and W73°03′**; **N40°51′40″ and W73°12′**; **N40°52′13″ and W72°85′**.

Identify the towns that might have been at risk…

From Globe to Map

- A map is a graphic representation of geographic information on a flat surface.
- Transferring information from the spherical, or ball-shaped, surface of Earth onto a flat piece of paper is called projection.



A globe, a spherical model of Earth, accurately represents the shapes and locations of the continents.

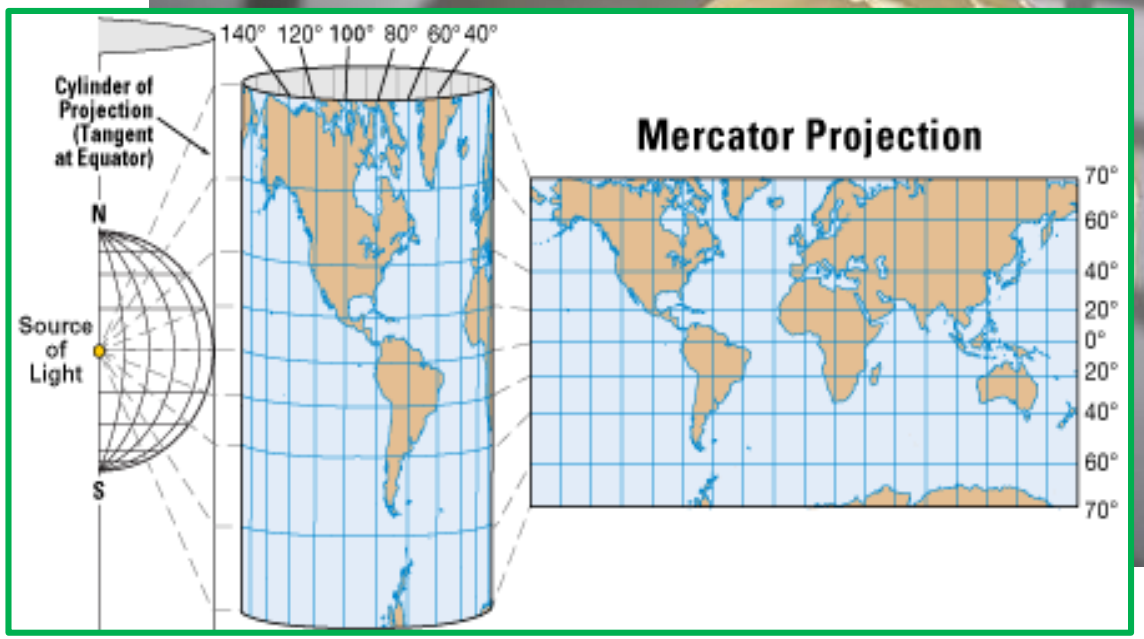
What about a map?

How do you…

(UN)WRAP IT?

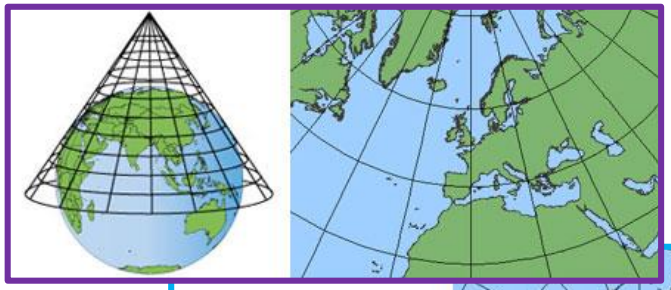
Map Projections

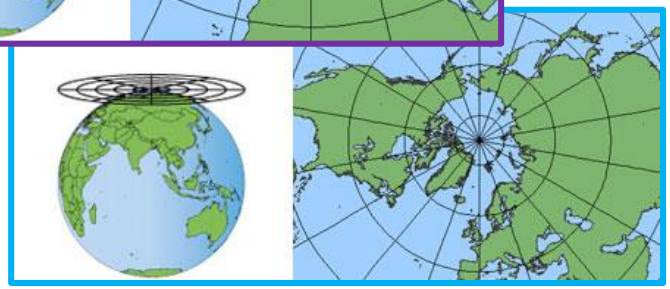
Projection is a **major challenge** for cartographers. Every map has some sort of **distortion**: it can retain ***either*** **the correct sizes** of landmasses ***or*** **the correct shapes** of very small areas, **but not both**.

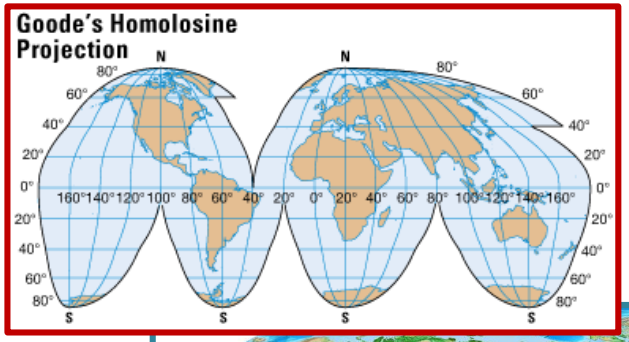


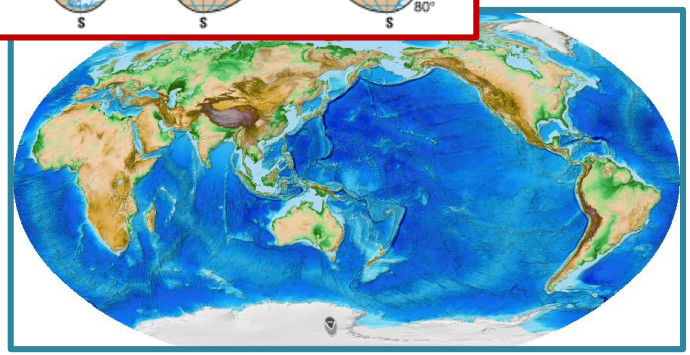
- **Cylindrical** (Mercator): projection onto a *tube* that is wrapped around the globe and touches it along one line, most often the Equator (the regions **near the Equator** are the **most accurate**, regions **near the poles** are the **most distorted**).

More Map Projections









- **Conical**: projection on a flattened cone, with curved lines of latitude and straight meridians (great for mapping mid-latitudes, for example the US Map).
- **Planar**: projection onto a plane with a single point of contact (most accurate at that point; often used for maps of one of the poles).
- **Interrupted**: "orange-peel map" equal-area projection (preserves area measure, generally distorting shapes).
- **Winkel-Tripel**: compromise projection; it minimizes all three kinds of distortion - area, direction and distance.