Conic Projections

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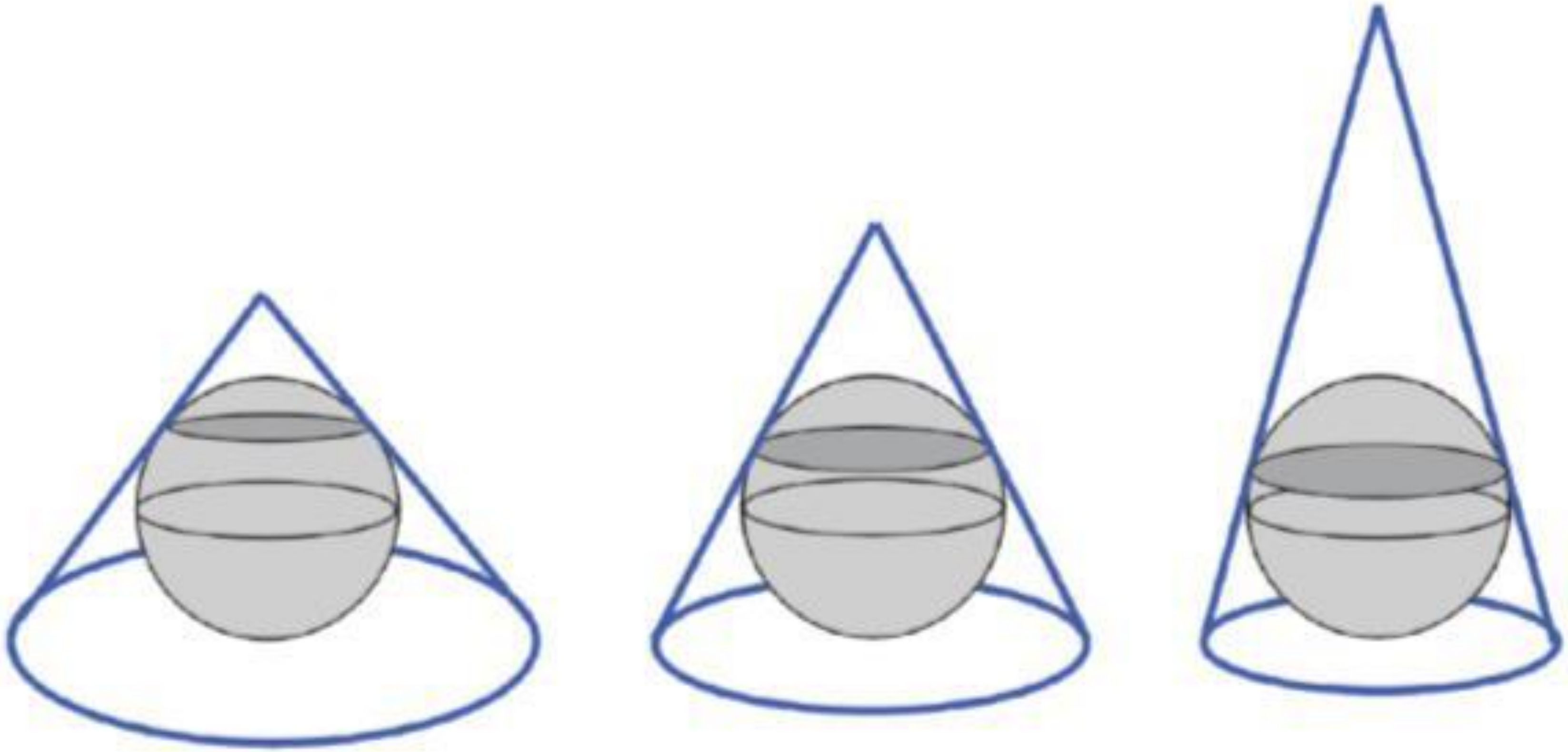
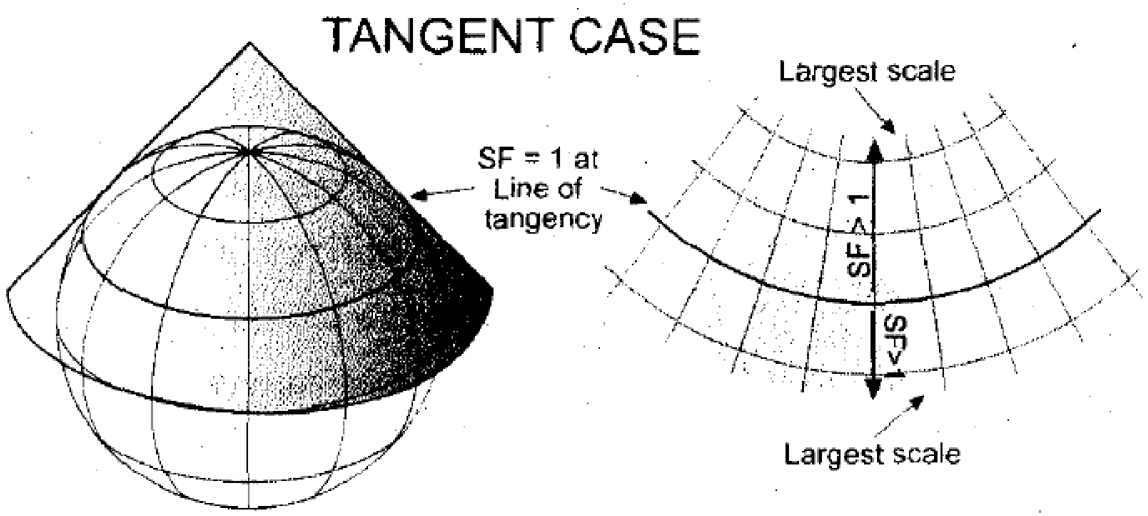
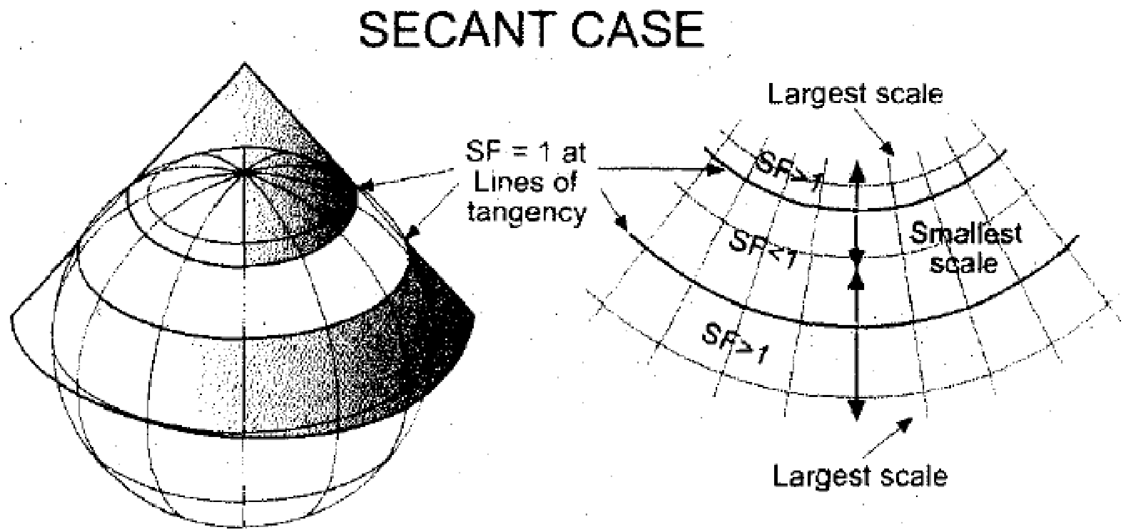
- A conic projection is formed by bringing a cone into contact with the sphere or the ellipsoid, such as **Lambert Conformal conical projection**



Conic Projections

- Standard parallel of the projection, is the parallel of latitude that tangent the sphere
- It is either one tangent or two tangents in the case of the secant





There are three important classes of conic projections

- The equidistant

- the conformal

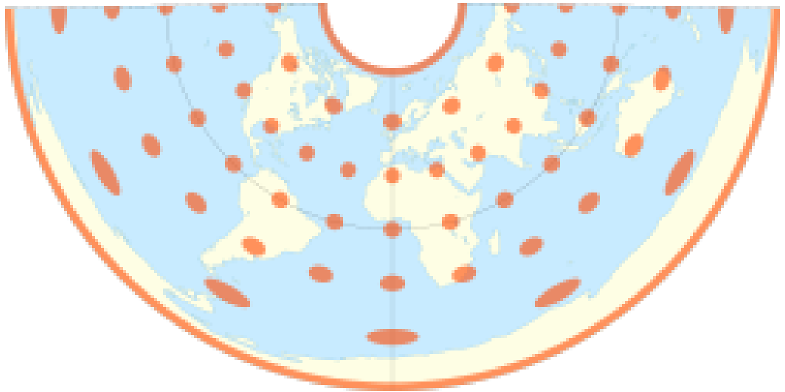
- the equal-area.

The conic Equidistant

- A conic equidistant projection preserves the scale factor along a meridian (SF = 1)
- The parallels are then equally spaced arcs of concentric circles
- This conic projection can be based on one or **two standard parallels**.
- all circular parallels are spaced evenly along the meridians
- This is true whether one or two parallels are used as the standards

The conic Equidistant

- **Shape**; Local shapes are true along the standard parallels.
- **Distortion** is constant along any given parallel but increases with distance from the standard parallels.
- **Area**; Distortion is constant along any given parallel but increases with distance from the standard parallels.
- **Direction;** Locally true along the **standard parallels**
- **Distance**; True along the meridians and the standard parallels
- **LIMITATIONS;** Range in latitude should be limited to 30 degrees.



The conic Equidistant (Lambert conformal, **one standard parallel**)

- the Cartesian plotting coordinates.

$$x = \rho S \sin\theta$$

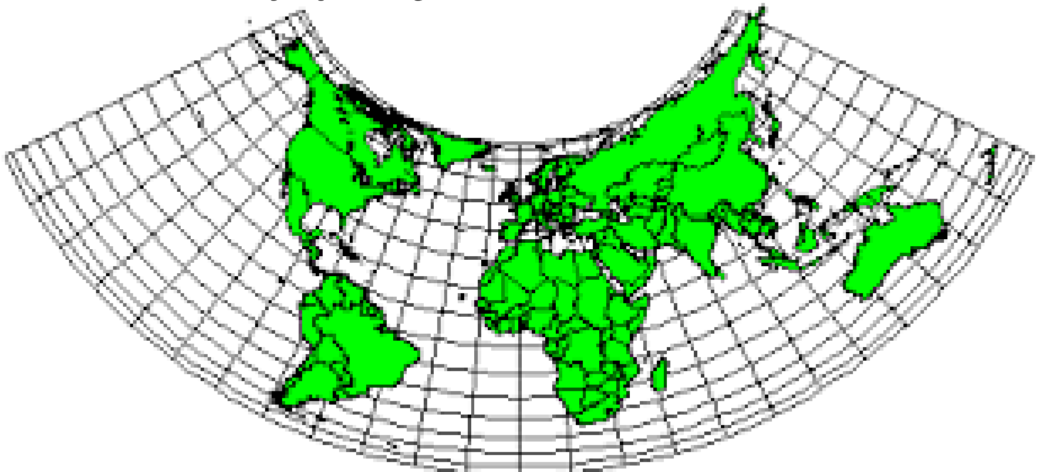
$$y = S(\rho_o - \rho\cos\theta)$$

$$\rho_o = R_{po}\cot\phi_o$$

$$\rho = \rho_o \left\{ \frac{\tan\left(\frac{\pi}{4} - \frac{\phi}{2}\right)\left(\frac{1 + e\sin\phi}{1 - e\sin\phi}\right)^{e/2}}{\tan\left(\frac{\pi}{4} - \frac{\phi_o}{2}\right)\left(\frac{1 + e\sin\phi_o}{1 - e\sin\phi_o}\right)^{e/2}} \right\}^{\sin\phi_o}$$

The conic Equal Area

- Such as Albers Equal-Area conic projection, with standard parallels at **20 and 60 north**
- Parallels are unequally spaced arcs of concentric circles, more closely spaced at the north and south edge of the map.
- Meridians are equally spaced radii of the same circles, cutting parallels at right angles.
- There is no distortion in scale along two standard parallels,
- One of the most commonly projection used in the united state



The conic Equal Area (ALBERS **ONE STANDARD**)

$$x = S\rho\sin(\Delta\lambda\sin\phi_o)$$

$$y = S[R\cot\phi_o - \rho\cos(\Delta\lambda\sin\phi_o)]$$

$$\rho = \frac{R}{\sin\phi_o}\sqrt{1 + \sin^2\phi_o - 2\sin\phi\sin\phi_o}$$

ALBERS ONE STANDARD

- How to find ϕ and λ

$$\rho = \frac{1}{S}\sqrt{x^2 + SR\cot\phi_o - y)^2}$$

$$\Delta\lambda = \frac{\sin^{-1}\left(\frac{x}{S\rho}\right)}{\sin\phi_o} = \frac{\sin^{-1}\left(\frac{0.2}{10.8367}\right)}{0.5}$$

$$\lambda = \lambda_o + \Delta\lambda$$

$$\phi = \sin^{-1}\left\{\frac{1}{2\sin\phi_o} + \frac{\sin\phi_o}{2} - \frac{\sin\phi_o}{2S^2R^2}[x^2 + (SR\cot\phi_o - y]^2\right\}$$

The Cartesian plotting coordinates for the Albers projection with **two standard parallels**

$$x = S\sqrt{\rho_1^2 + \frac{4R^2(\sin\phi_1 - \sin\phi)}{\sin\phi_1 + \sin\phi_2}}\ \sin(\theta)$$

$$y = S[\frac{\rho_1 + \rho_2}{2} - \sqrt{\rho_1^2 + \frac{4R^2(\sin\phi_1 - \sin\phi)}{\sin\phi_1 + \sin\phi_2}}\ \cos(\theta)$$

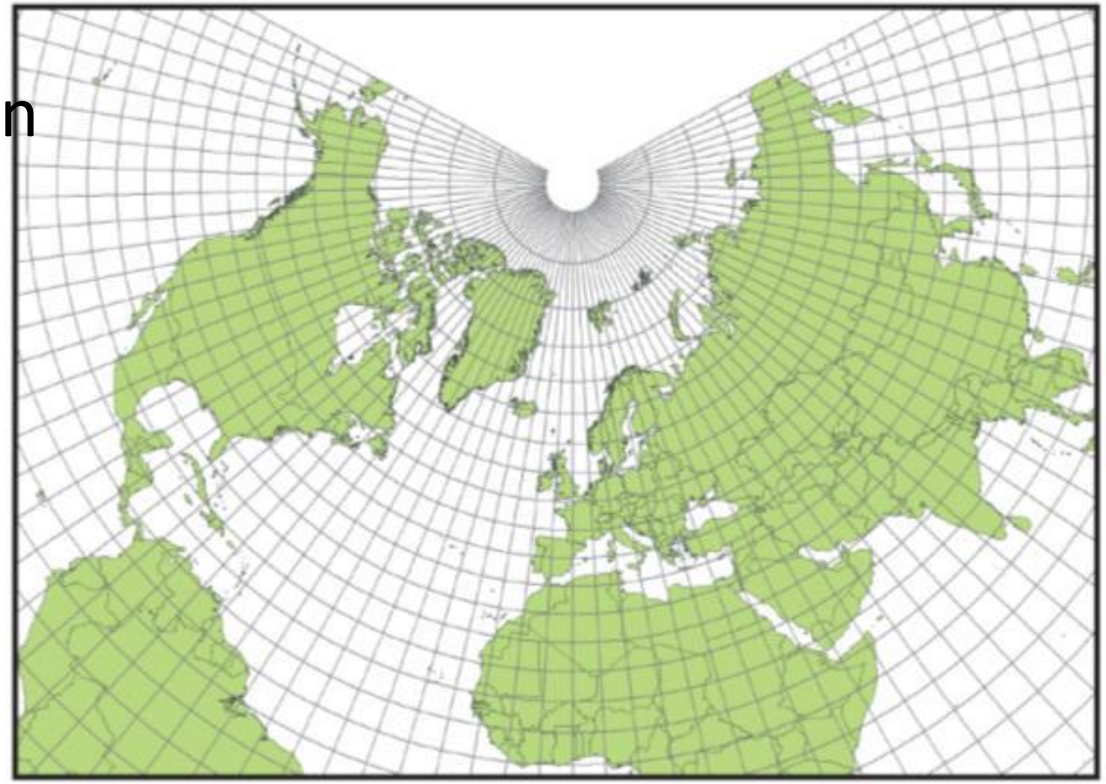
$$\theta = \frac{\Delta\lambda}{2}(\sin\phi_1 + \sin\phi_2)$$

$$\rho_1 = \frac{2R\cos\phi_1}{\sin\phi_1 + \sin\phi_2}$$

$$\rho_2 = \frac{2R\cos\phi_2}{\sin\phi_1 + \sin\phi_2}$$

Lambert Conformal Conic

- The conformal version of the conic projection is usually named after Lambert
- who first developed it in 1772 (Snyder 1987).
- The full name is the Lambert Conformal Conic(LCC),
- This is an extremely widely used projection



Lambert Conformal Conic

- The parallels are unequally spaced arcs of concentric circles, more closely spaced near the centre of the map.
- Meridians are equally spaced radii of the same circles, thereby cutting parallels at right angles.
- Pole in same hemisphere as standard parallel is a point; other pole is at infinity
- Used for maps of countries and regions with predominant east-west expanse.