

Atmospheric Sciences 528: Atmospheric Data Analysis
 Dr. Jared Marquis (Fall 2022)
 Assignment #0: The Polar Stereographic Projection
 Due: 2 September 2022
 50 pts

1. Show that the radius of a latitude circle on the image plane r is equal to

$$r = \rho(1 + \cos\psi_0) \tan \frac{\psi}{2}$$

2. Show that

$$\sigma = \frac{\rho(1 + \cos\psi_0) \tan \frac{\psi}{2}}{\rho \cos\varphi}$$

can be written as

$$\sigma = \frac{1 + \sin\varphi_0}{1 + \sin\varphi}$$

3. Show that the latitude and longitude of a point (x,y) on the image plane can be calculated according to

$$\varphi = \frac{\pi}{2} - 2 \tan^{-1} \left[\frac{(x^2 + y^2)^{\frac{1}{2}}}{\rho(1 + \cos\psi_0)} \right]$$

$$\lambda - \lambda_0 = \tan^{-1} \left(\frac{y}{x} \right)$$

4. Suppose that you wish to construct a polar stereographic map of the entire northern hemisphere utilizing a piece of paper with dimensions 20 x 20 inches. What would be the largest map scale that you could use? Let $\varphi_0 = 60$ degrees.