Atmospheric Sciences 528: Atmospheric Data Analysis
Dr. Jared Marquis (Fall 2024)
Assignment #0: The Polar Stereographic Projection
Due: 6 September 2024 by 11:59PM
50 pts

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

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

2. Show that

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

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 φ_0 = 60 degrees.