

10.7 Display/Geographic Coordinate Conversions

10.7.1 Geographic to Display Conversion

The following equations will convert a latitude, longitude position within the site coverage area to a position offset from the radar site in the NEXRAD display plane.

$$A = \cos L_D \sin (\lambda_D - \lambda_S)$$

$$B = \cos L_S \sin L_D - \sin L_S \cos L_D \cos (\lambda_D - \lambda_S)$$

$$\sin S = (A^2 + B^2)^{1/2}$$

$$\cos S = (1 - \sin^2 S)^{1/2}$$

$$D = 135 \text{ km} * \sin S + 6,380 \text{ km}$$

$$X = D * \cos L_D \sin(\lambda_D - \lambda_S)$$

$$Y = \frac{D * (\sin L_D - \sin L_S \cos)}{\cos L_S}$$

where:

L_D, λ_D = latitude, longitude position

L_S, λ_S = latitude, longitude of radar site

X, Y = position offset in kilometers relative to radar site (x positive to east, Y positive to north)

S = angular great circle distance from radar site to latitude, longitude position.

10.7.2 Display to Geographic Conversion

The following equations will convert a position in NEXRAD X,Y coordinates within the site coverage area to a corresponding latitude and longitude:

$$R = (X^2 + Y^2)^{1/2}$$

$$\sin \theta = X/R$$

$$\cos \theta = Y/R$$

$$\sin S = \frac{R}{6,380} \left(1 - \frac{135R}{6,380^2} \right)$$

$$\cos S = (1 - \sin^2 S)^{1/2}$$

$$\sin L_D = \sin L_S \cos S + \cos L_S \sin S \cos \theta$$

$$\cos L_D = (1 - \sin^2 L_D)^{1/2}$$
$$\Delta\lambda = \sin^{-1}(\sin S \sin \theta / \cos L_D)$$
$$LD = \tan^{-1} \left(\frac{\sin L_D}{\cos L_D} \right)$$
$$\lambda_D = \lambda_S + \Delta\lambda$$

where:

L_D, λ_D = latitude, longitude of position
 L_S, λ_S = latitude, longitude of radar site

X, Y = position offset relative to radar site in kilometers (x positive to east, Y positive to north)

R = Range of position from radar site in X, Y display plane in kilometers

θ = Azimuth of position relative to radar site (defined positive CW from north)

S = angular great circle distance from radar site to latitude, longitude of position.