Therefore, the horizontal momentum equations may be written into the following component equations in natural coordinates

(19) $$\frac{D|\vec{V}|}{Dt} = -\frac{\partial \Phi}{\partial s}$$

(20) $$\frac{|\vec{V}|^2}{R} + f|\vec{V}| = -\frac{\partial \Phi}{\partial n}$$

Note: $R > 0$ if air parcels turn toward the left following motion (cyclonic)

$R < 0$ if air parcels turn toward the right following motion (anticyclonic).

Geostrophic Flow in natural coordinates

For steady state $\left(\frac{D|\vec{V}|}{Dt} = 0\right)$, and

for straight line flow $(R \rightarrow \infty)$, (2.0)

becomes

$$|\vec{V}_g| = -\frac{1}{f}\frac{\partial \Phi}{\partial n} \quad (21)$$

Geostrophic wind scale

Since geopotential height is typically contoured in 60 m intervals, a graph may be constructed for operational use:

Geostrophic Windscale