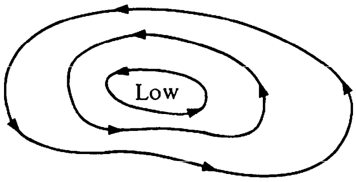
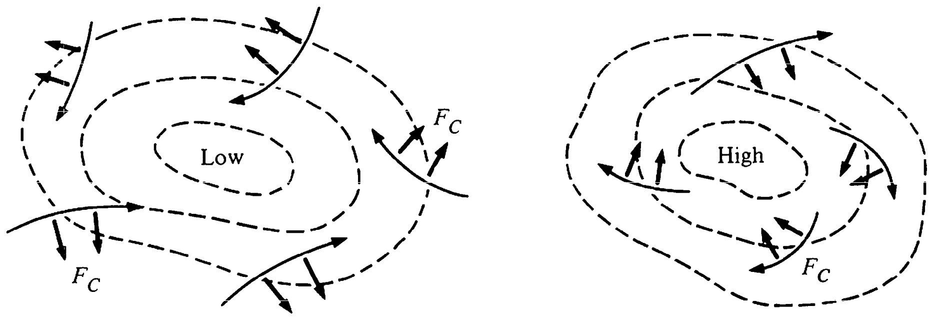
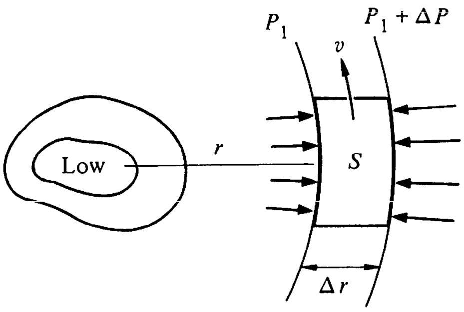


force, as shown in figure *a*. (The drawing is for the northern hemisphere.) The result is that the wind circulates counterclockwise about the low along the isobars, as in the sketch at left. Similarly, wind circulates clockwise about regions of high pressure in the northern hemisphere. Since the Coriolis force is essentially zero near the equator, circular weather systems cannot form there and the weather tends to be uniform.



(*a*) (*b*)



In order to analyze the motion, consider the forces on a parcel of air which is rotating about a low. The pressure force on the face along the isobar P_1 is $P_1 S$, where S is the area of the inner face, as shown in the sketch. The force on the outer face is $(P_1 + \Delta P)S$, and the net pressure force is $(\Delta P)S$ inward. The Coriolis force is $2mv\Omega \sin \lambda$, where m is the mass of the parcel and v its velocity. The air is rotating counterclockwise about the low, so that the Coriolis force is outward. Hence, the radial equation of motion for steady circular flow is

$$\frac{mv^2}{r} = (\Delta P)S - 2mv\Omega \sin \lambda.$$

The volume of the parcel is $\Delta r\, S$, where Δr is the distance between the isobars, and the mass is $w\, \Delta r\, S$, where w is the density of air, assumed constant. Inserting this in the equation of motion and taking the limit $\Delta r \rightarrow 0$ yields

$$\frac{v^2}{r} = \frac{1}{w}\frac{dP}{dr} - 2v\Omega \sin \lambda. \qquad 1$$

Air masses do not rotate as rigid bodies. Near the center of the low, where the pressure gradient dP/dr is large, wind velocities are highest. Far from the center, v^2/r is small and can be neglected. Equation (1) predicts that far from the center the wind speed is

$$v = \frac{1}{2\Omega \sin \lambda}\frac{1}{w}\frac{dP}{dr}. \qquad 2$$

The density of air at sea level is 1.3 kg/m^3 and atmospheric pressure is $P_{\text{at}} = 10^5$ N/m^2. dP/dr can be estimated by looking at a weather map.