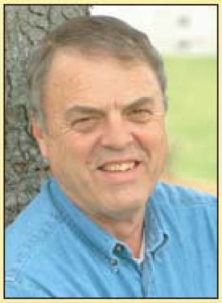
Geography In The News™



Neal G. Lineback

HURRICANES AND THE CORIOLIS EFFECT

The devastation of the U.S. Gulf Coast by hurricanes Katrina and Rita has captured the media's attention for weeks. Even as New Orleans and the impacted Gulf Coasts of Alabama, Louisiana, Mississippi and Texas begin to recover, questions are being asked about the characteristics of hurricanes and similar storms.

A reader of *Geography in the News* recently wrote asking about the rotation of storms. He said he knew that winds around low pressure cells in the Northern Hemisphere rotate counterclockwise, but did not understand how the *Coriolis effect* was involved in all wind circulations.

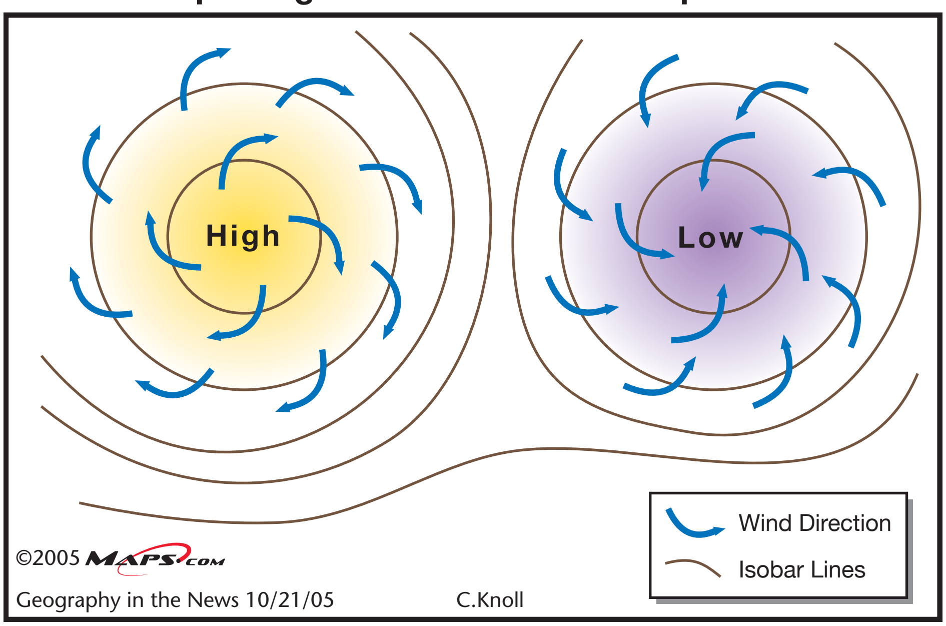
Sailors have long recognized that wind directions are deflected, seemingly by some invisible force. In 1835, however, French mathematician Gaspard G. Coriolis first described the phenomenon. Originally, it was called the Coriolis force, but the more recent and more accurate name is the Coriolis effect.

The result of the Coriolis effect is that wind directions in the Northern Hemisphere are deflected to the right, while those in the Southern Hemisphere are deflected to the left. The cause of the Coriolis effect is the earth's rotation.

As a simple example, a hypothetical airplane leaves the North Pole on a 12-hour trip flying directly south toward Quito, Equador, located on the equator (80 degrees west longitude). During this 12-hour trip, the earth would rotate half way around and the plane would arrive in Sumartra, Indonesia (100 degrees east longitude). Clearly, from the ground, the plane's direction was due south, but the earth's rotation beneath the plane's flight path created the illusion of the plane flying southwestward-a deflection to the right (from the plane's origin at the Pole). No matter which direction air moves in the Northern Hemisphere, the earth's rotation causes it also to be deflected to the right for the same reason.

A simple experiment used by geography teachers is to cut a circle of cardboard, punch a hole in its center and place it on a pencil. While spinning the cardboard disk counterclockwise to simulate the rotation of the Northern Hemisphere, the demonstrator can attempt to quickly mark a straight line on the disk with a marker. Regardless of the direction attempted, the mark will always turn to the right. Turn the disk over, rotate it clockwise to simulate the Southern Hemisphere and the mark will always turn to the left.

Spinning in the Northern Hemisphere



Winds blow from high to low pressure. These winds attempt to move in a straight line, but are always deflected by the Coriolis effect. For example, as wind moves toward a low pressure center, as with a hurricane, its direction is altered so that as wind crosses each isobar surrounding the low, it must cross to the right of a right angle. The cumulative effect causes the hurricane to circulate counterclockwise.

Although this counterclockwise motion may seem counter intuitive, it makes perfect sense by standing at the wind's origin and realizing that the deflection is causing the wind to cross each isobar to the right, rather than at a 90 degree angle. If it were not for the Coriolis effect, the wind would blow straight into the eye of a hurricane and there would be no circulation.

Conversely, as wind blows out of a high pressure cell, it also must cross isobars at right angles. Putting one's self at the origin, or the center of the high pressure, it is easy to realize that high pressure cells circulate clockwise in the Northern Hemisphere.

Wind direction, then, can indicate many things to those who closely monitor the weather, even novice weather forecasters. A conclusion called *Ballot's Law* says that if you face directly downwind in the Northern Hemisphere, the center of a low pressure cell should be located somewhere to your left. This accounts for the counterclockwise rotation of storms, such as hurricanes and other low pressure cells.

And that is Geography in the News ™. October 21, 2005. #803

(The author was former Dean of the College of Arts and Sciences and is a Professor Emeritus of Geography at Appalachian State University, Boone, NC.)