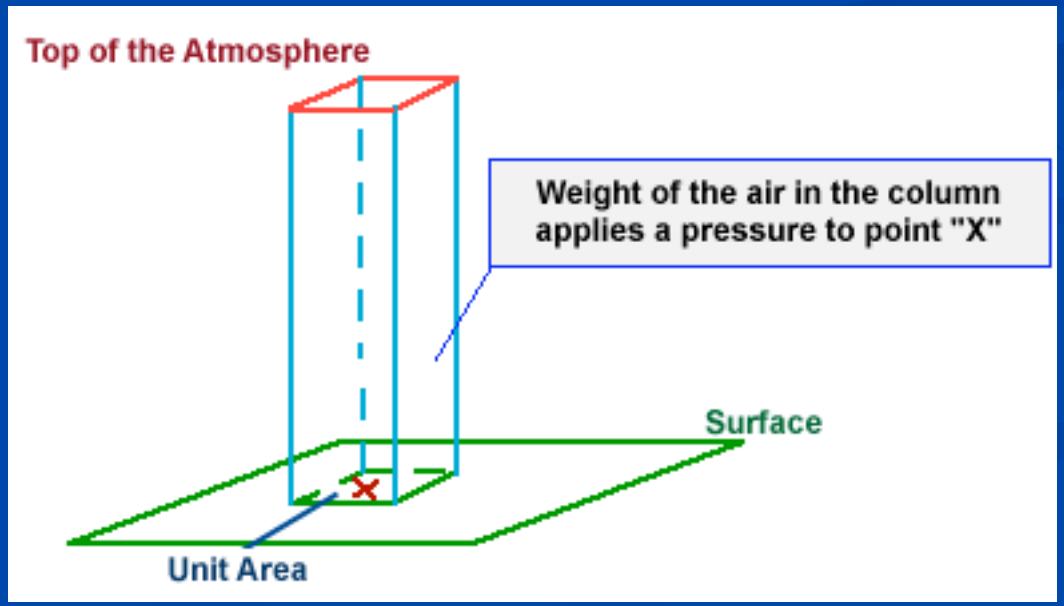
Air Pressure & Wind Flow

How does it relate to surface weather and storm development?

Pressure = Force/Area

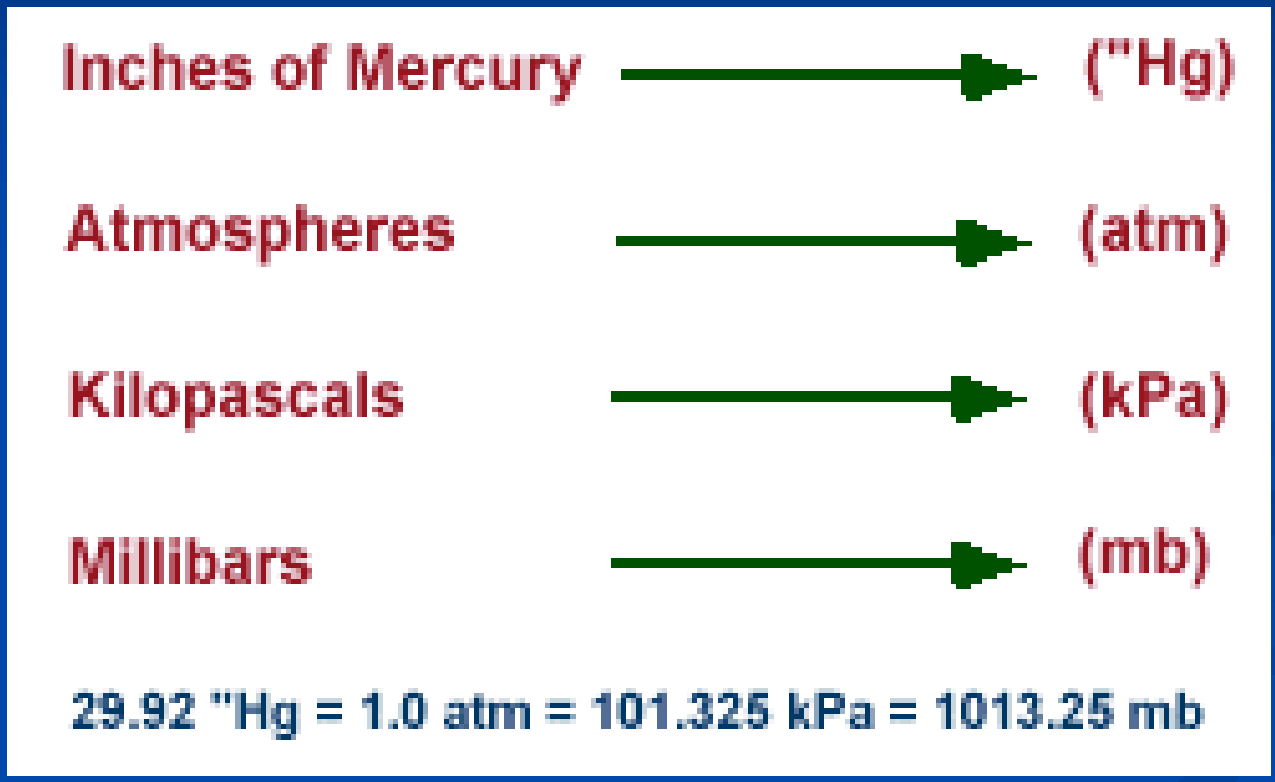
- Atmospheric pressure is defined as the force per unit area exerted against a surface by the weight of the air above that surface. In the diagram below, the pressure at point "X" increases as the weight of the air above it increases. The same can be said about decreasing pressure, where the pressure at point "X" decreases if the weight of the air above it also decreases.



Barometer Measures Air Pressure

- Thinking in terms of air molecules, if the number of air molecules above a surface increases, there are more molecules to exert a force on that surface and consequently, the pressure increases. The opposite is also true, where a reduction in the number of air molecules above a surface will result in a decrease in pressure. Atmospheric pressure is measured with an instrument called a "barometer", which is why atmospheric pressure is also referred to as barometric pressure.

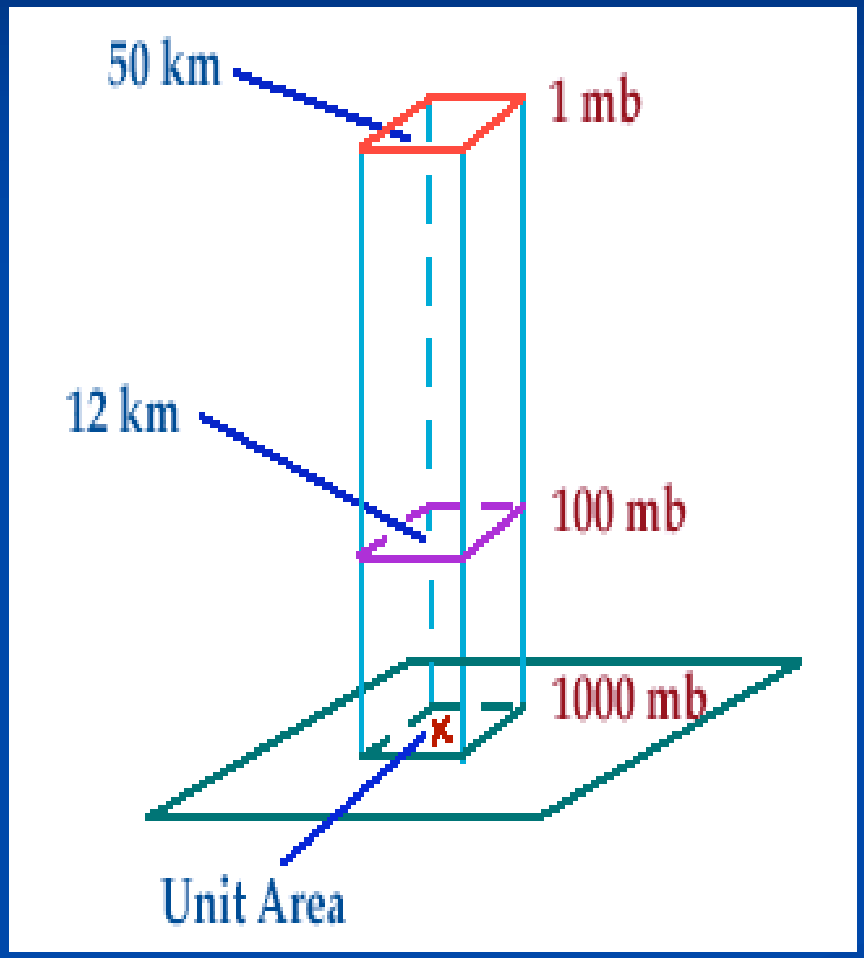
Air pressure in different units



More on air pressure

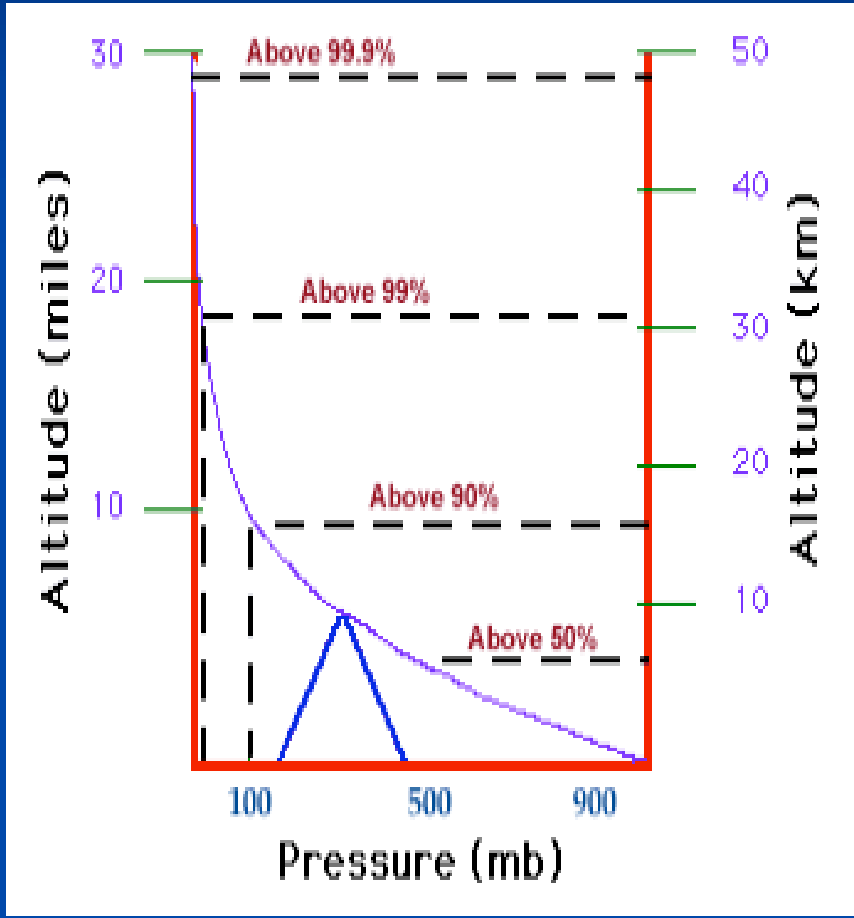
- In aviation and television weather reports, pressure is given in inches of mercury ("Hg), while meteorologists use millibars (mb), the unit of pressure found on weather maps.
- As an example, consider a "unit area" of 1 square inch. At sea level, the weight of the air above this unit area would (on average) weigh 14.7 pounds! That means pressure applied by this air on the unit area would be 14.7 pounds per square inch. Meteorologists use a metric unit for pressure called a millibar and the average pressure at sea level is 1013.25 millibars.

More force at surface, more air pressure!



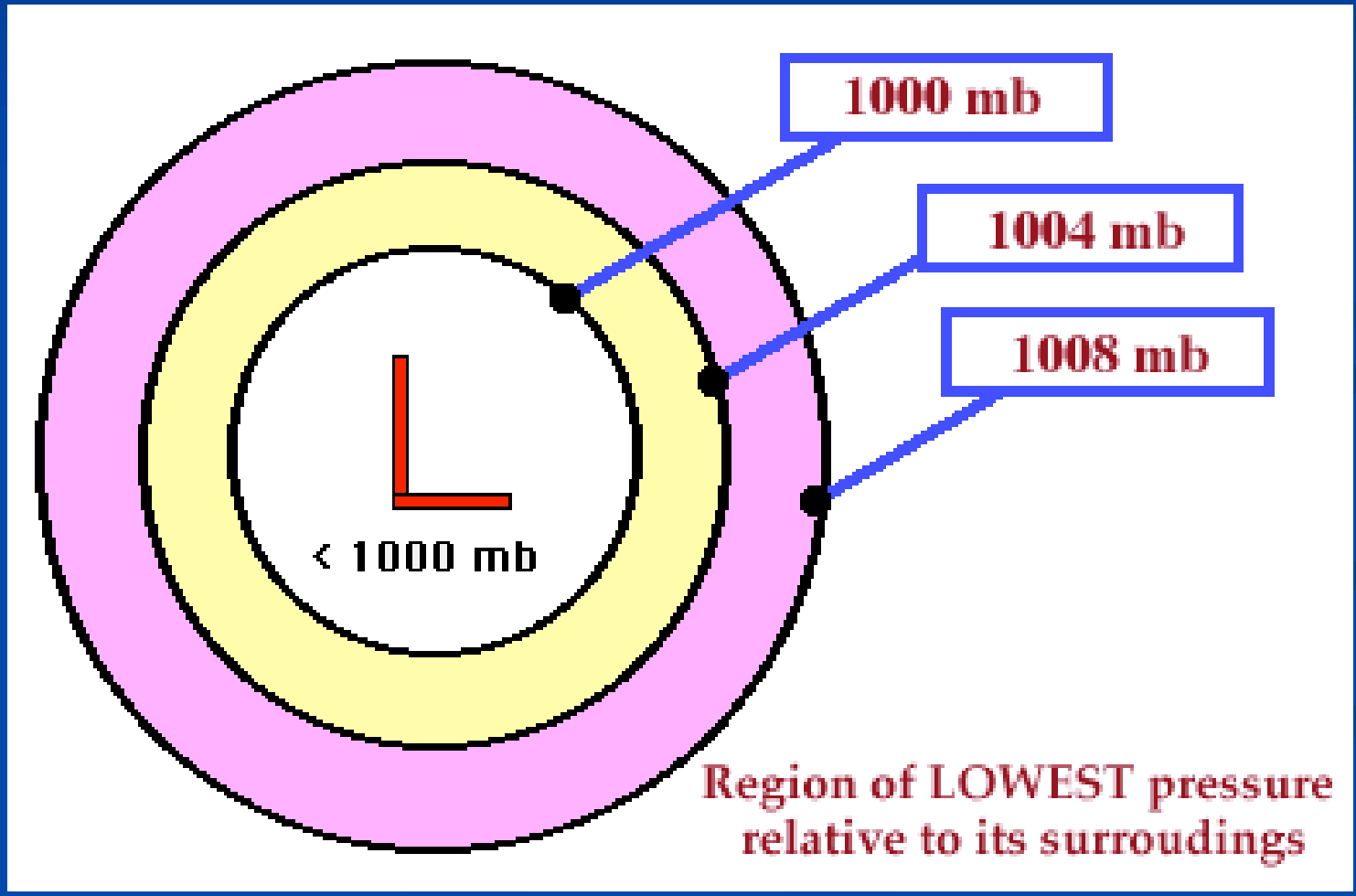
- Most of the atmosphere's molecules are held close to the earth's surface by gravity. Because of this, air pressure decreases rapidly at first, then more slowly at higher levels.

Pressure decreases slowly then quickly as you go up

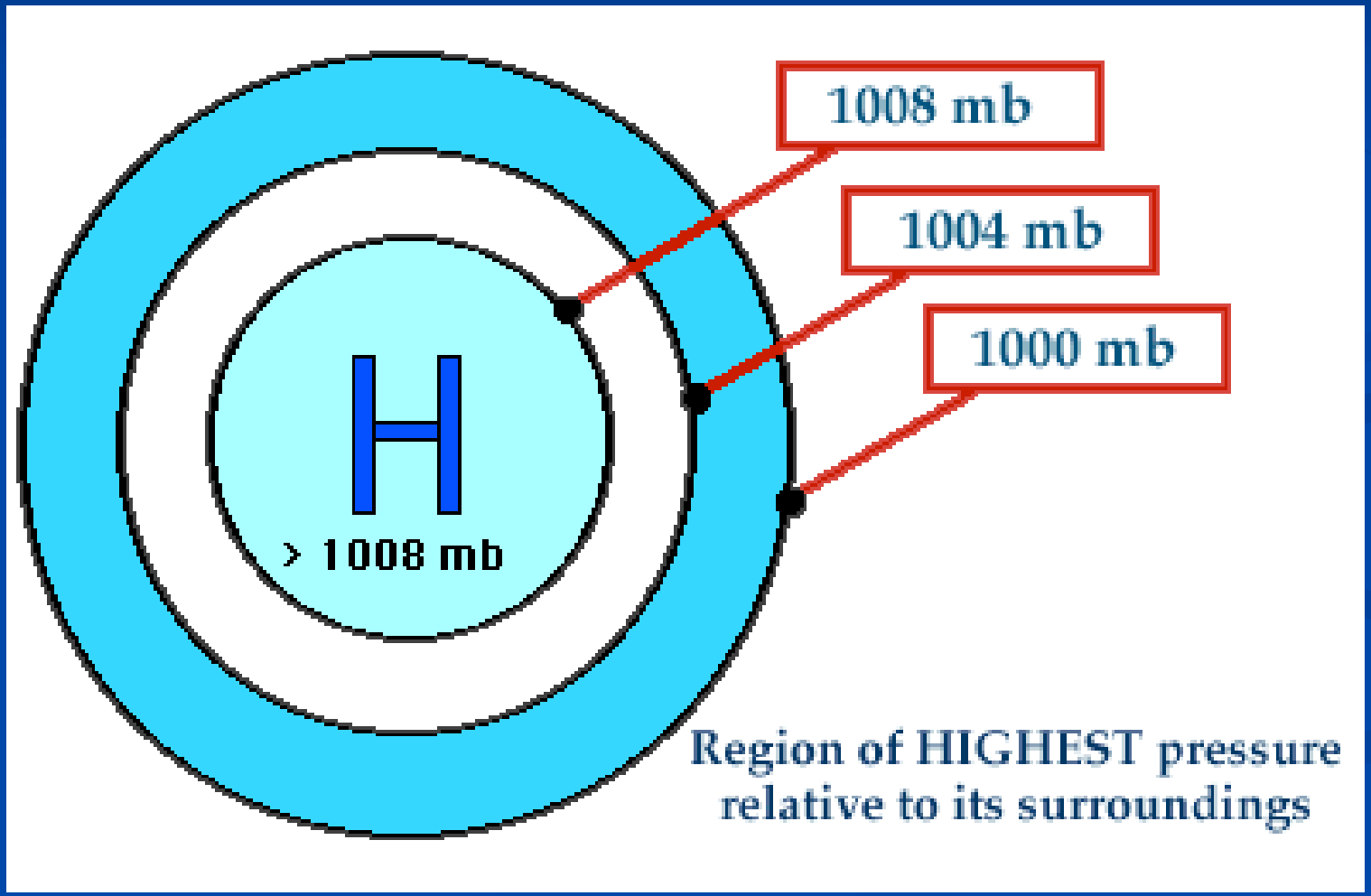


- Since more than half of the atmosphere's molecules are located below an altitude of 5.5 km, atmospheric pressure decreases roughly 50% (to around 500 mb) within the lowest 5.5 km. Above 5.5 km, the pressure continues to decrease, but at an increasingly slower rate (to about 1 mb at 50 km).

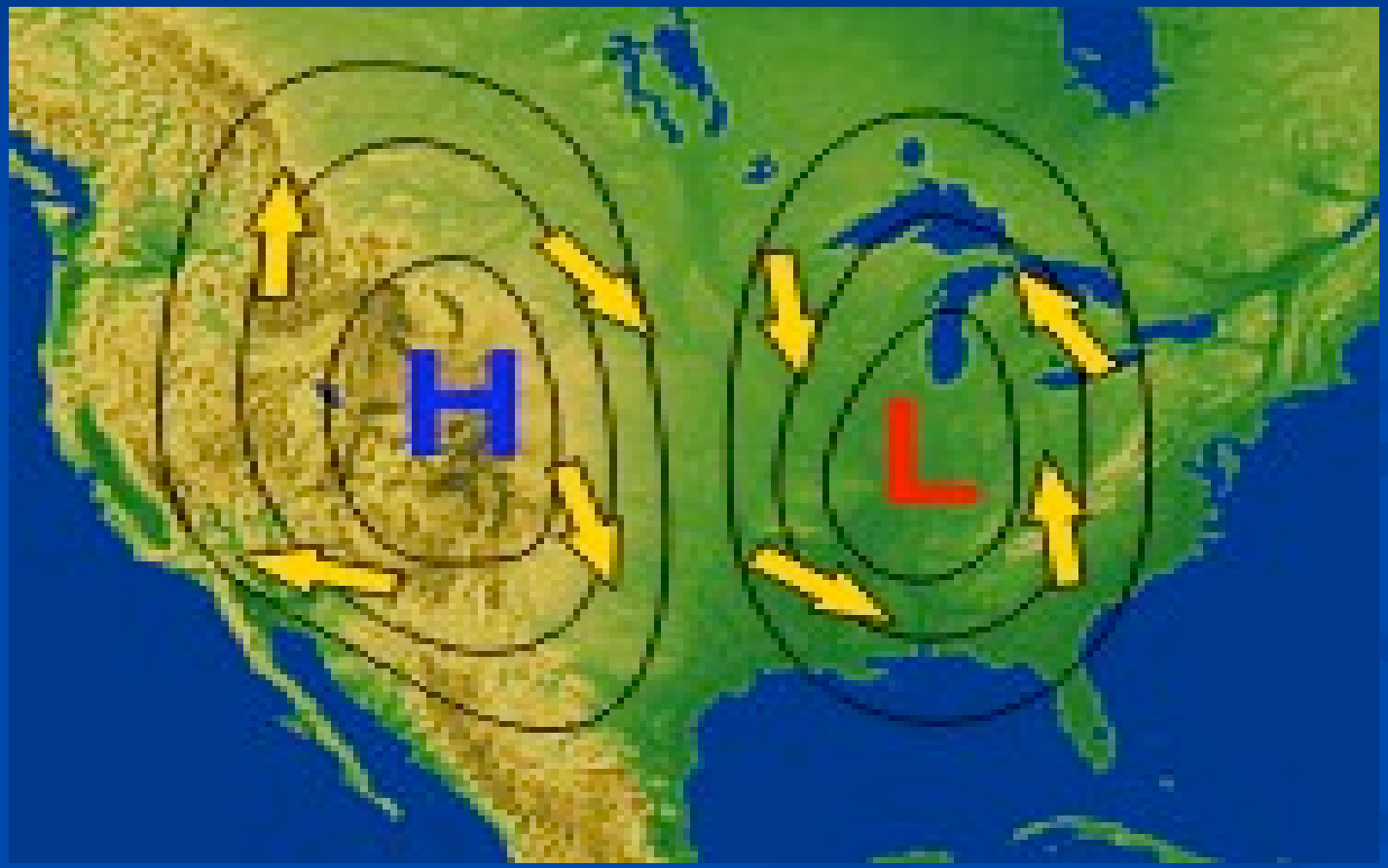
Pressure decreases towards the center of a LOW



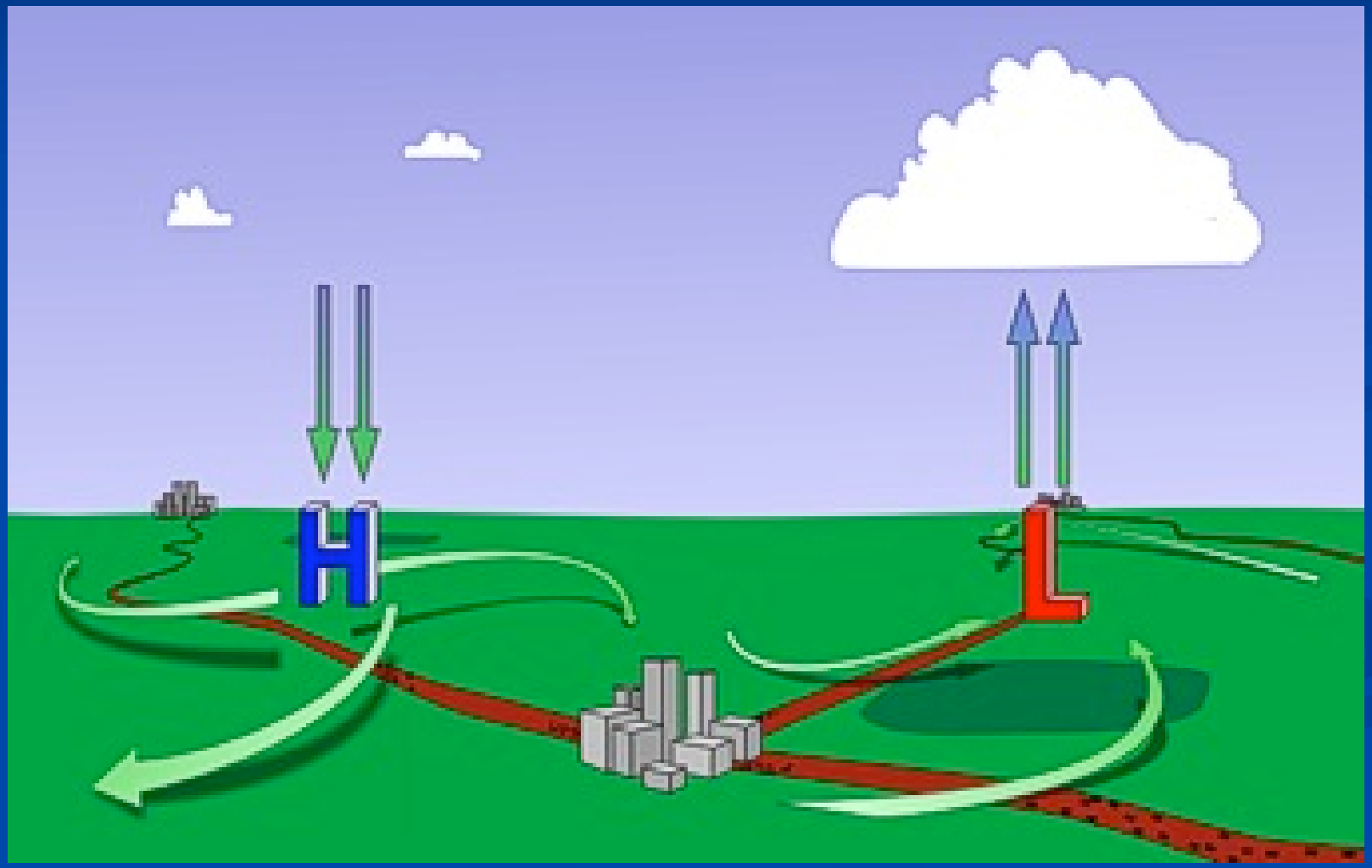
Pressure increases towards the center of a HIGH



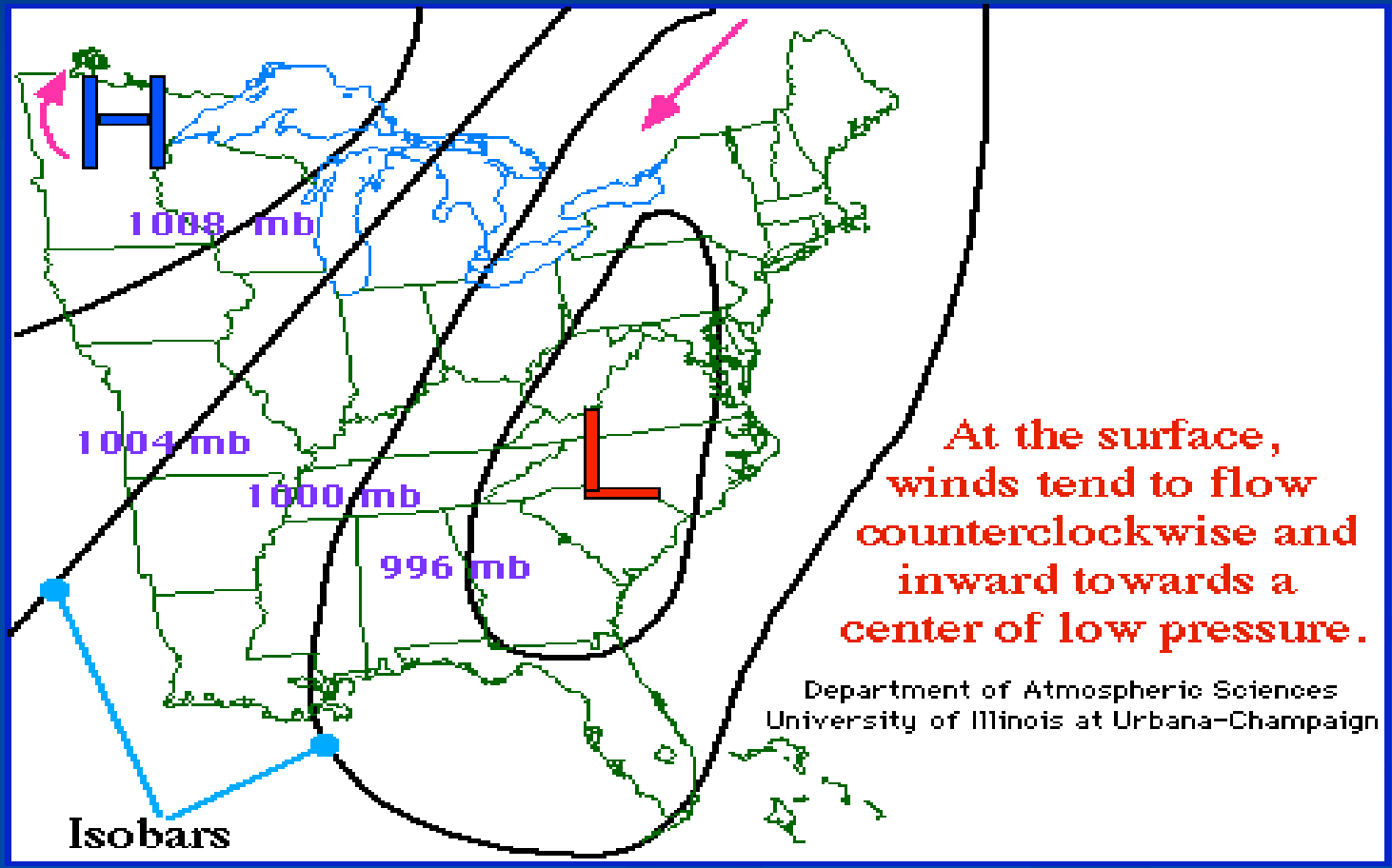
Air flows into low
Air flows out of high



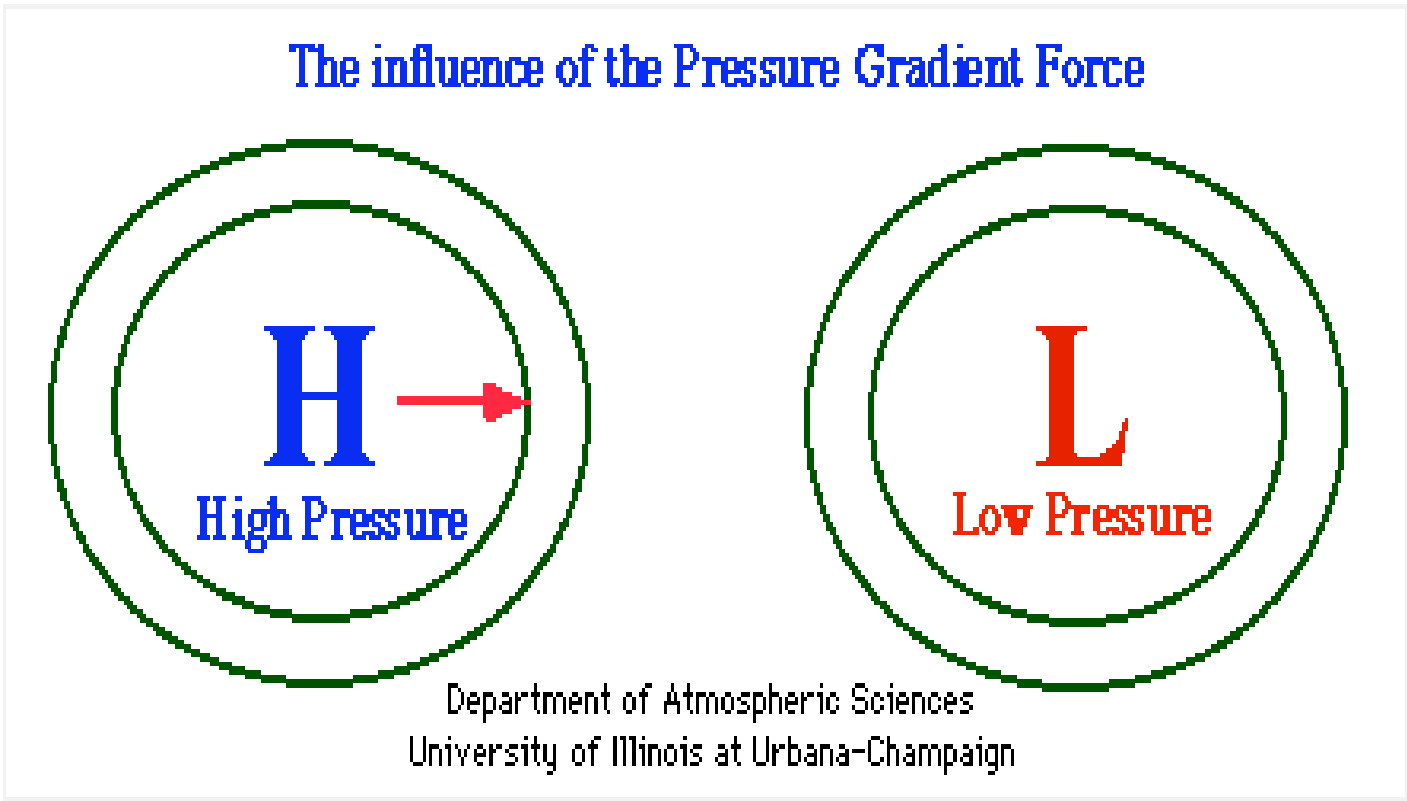
Sideways view of air pressure and surface systems



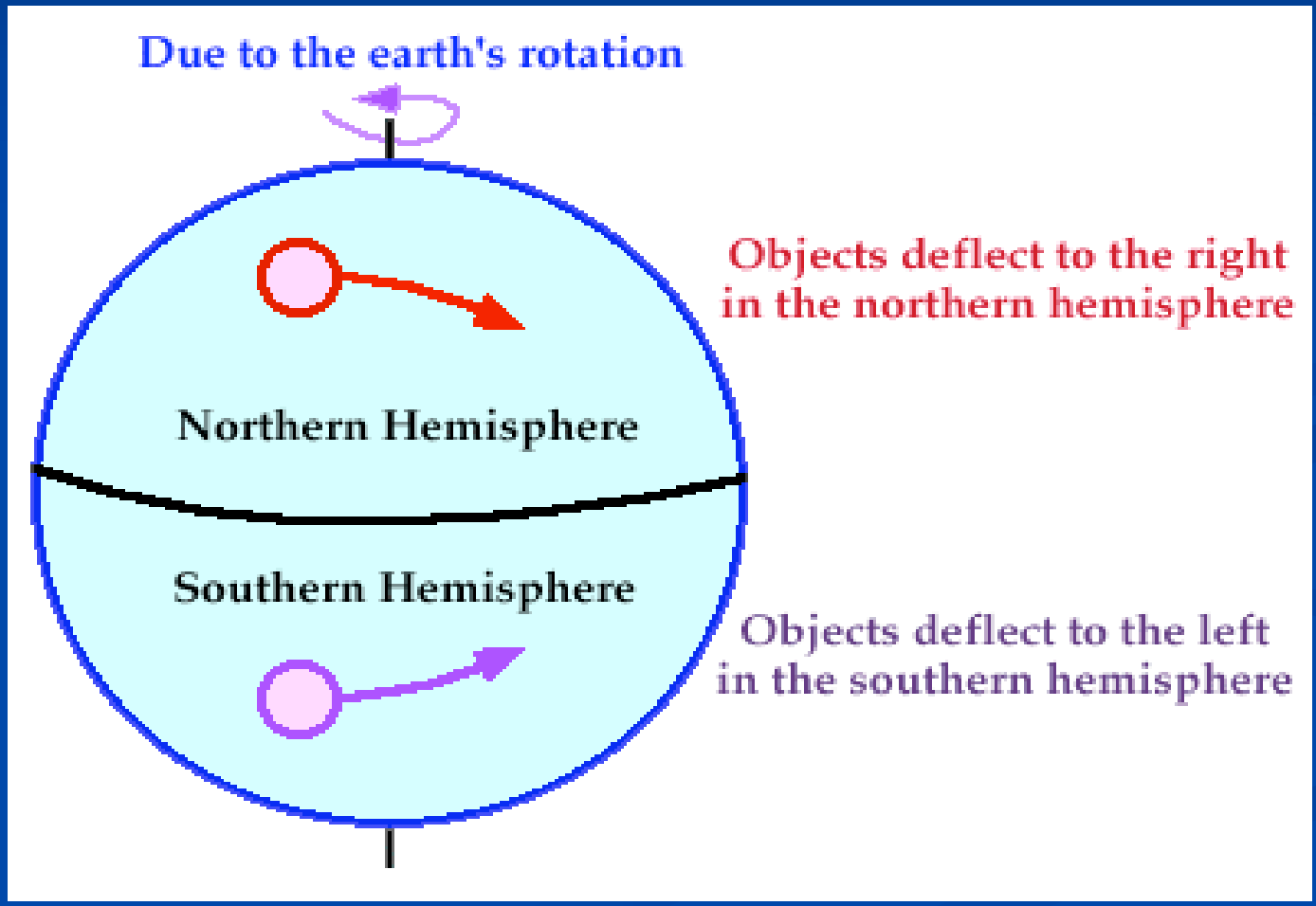
High and Low Together



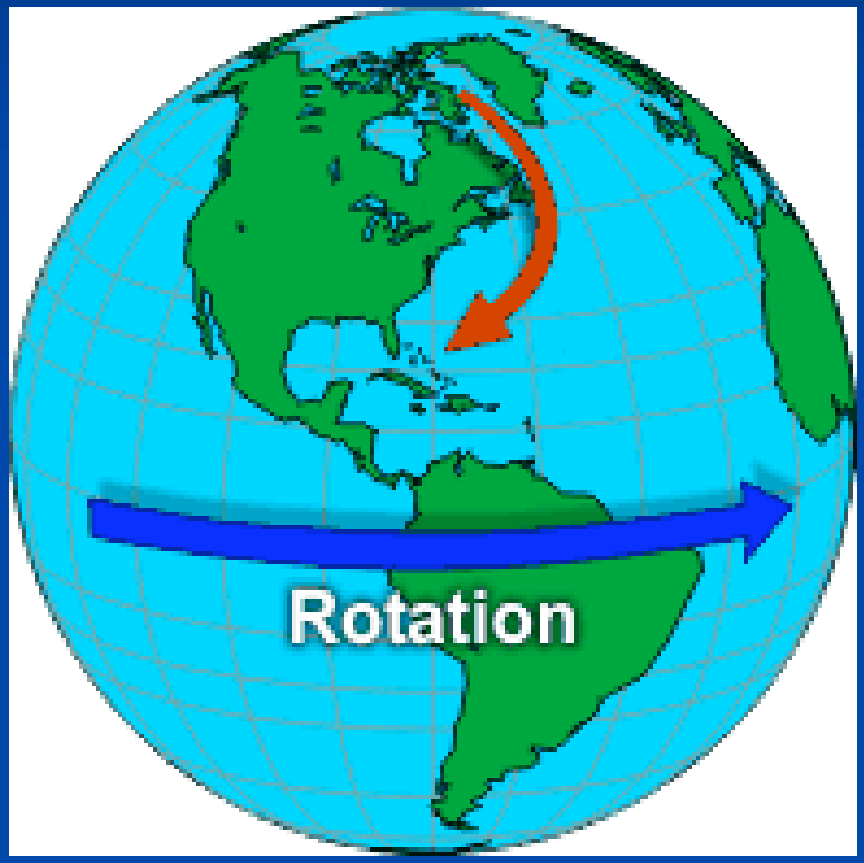
Pressure Gradient Force



Objects are deflected by the earth's rotation

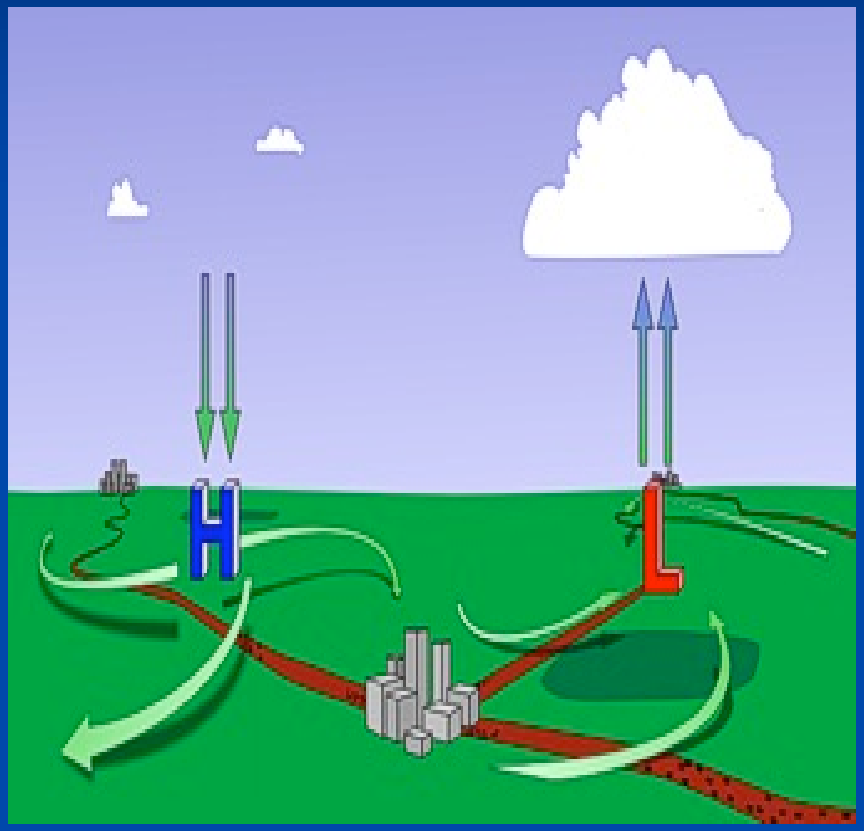


Coriollis Effect



- When viewed from space, wind travels in a straight line. However, when view from the Earth, air (as well as other things in flight such as planes and birds) is deflected to the right in the northern hemisphere (red arrow on image at right). The combination of the two forces would cause the wind to blow parallel to straight isobars with high pressure on the right.

One last force: Friction



- So why does air spiral out from highs and into lows? There is one other force, called Friction, which is the final component to determining the flow of wind. The surface of the earth is rough and it not only slows the wind down but it also causes the diverging winds from highs and converging winds near lows.

last force!