Ch 19.2 Pressure Centers and Winds

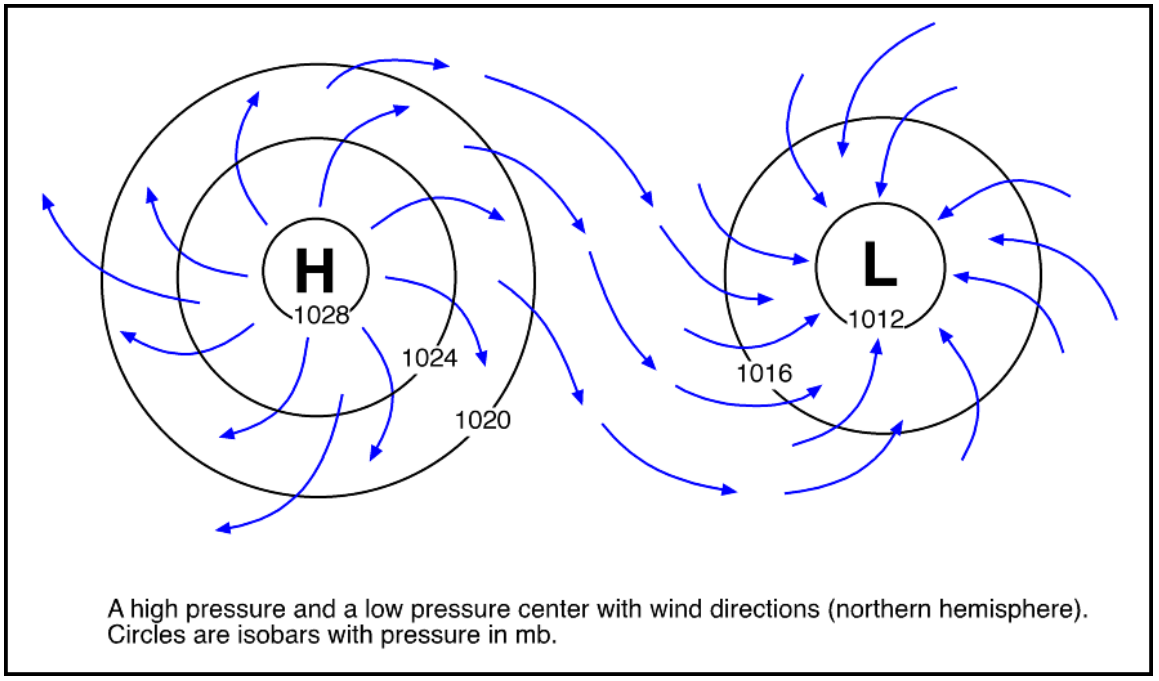
• Pressure centers are the most common features on a weather map. Knowing the basic facts about centers of high and low pressure can increase your understanding of present and forthcoming weather.

Highs and Lows

• Lows, or **cyclones** are centers of **Low** pressure.

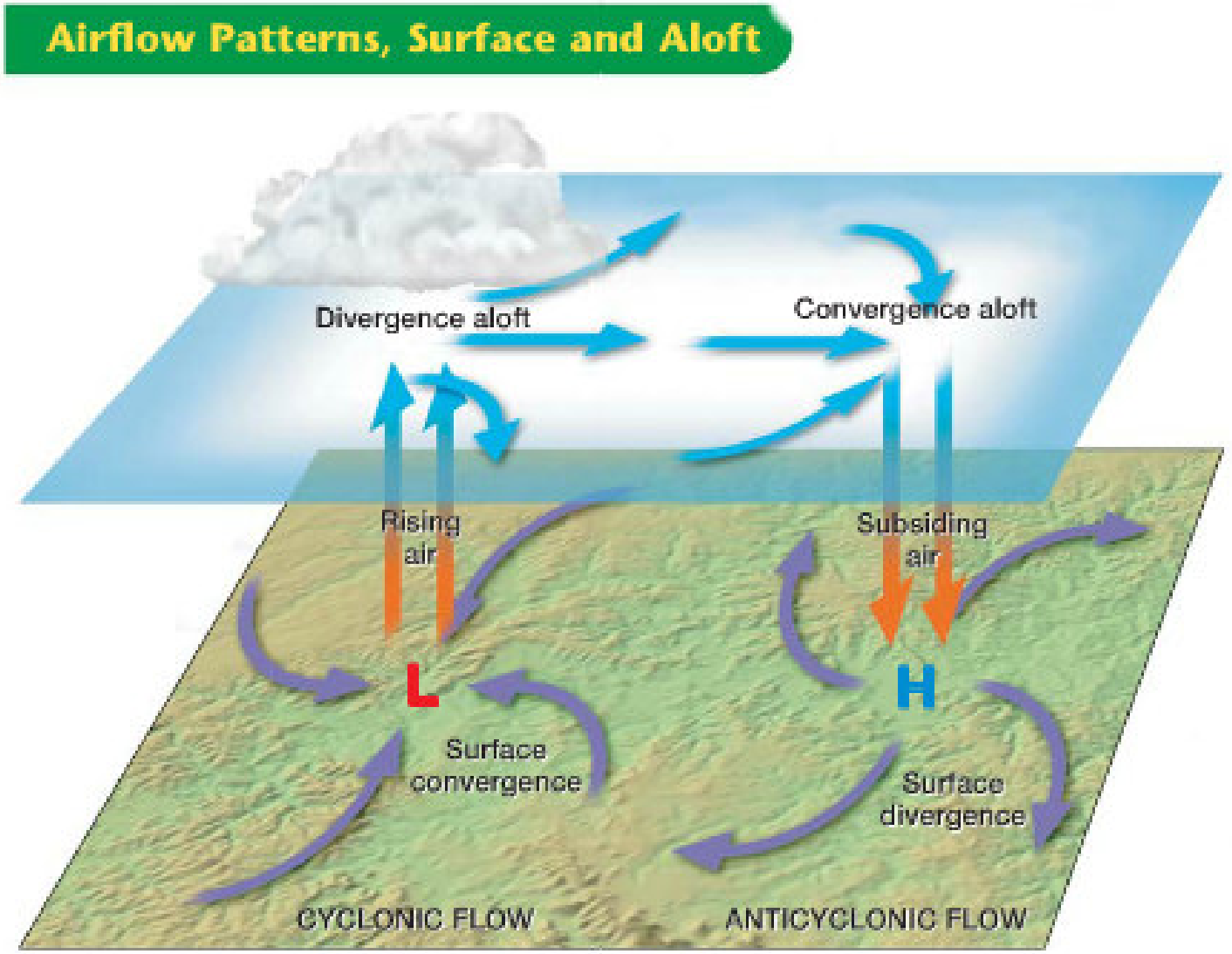
• Highs, or **anticyclones** are centers of **High** pressure.

• In cyclones, the pressure decreases from the outer isobars toward the center.

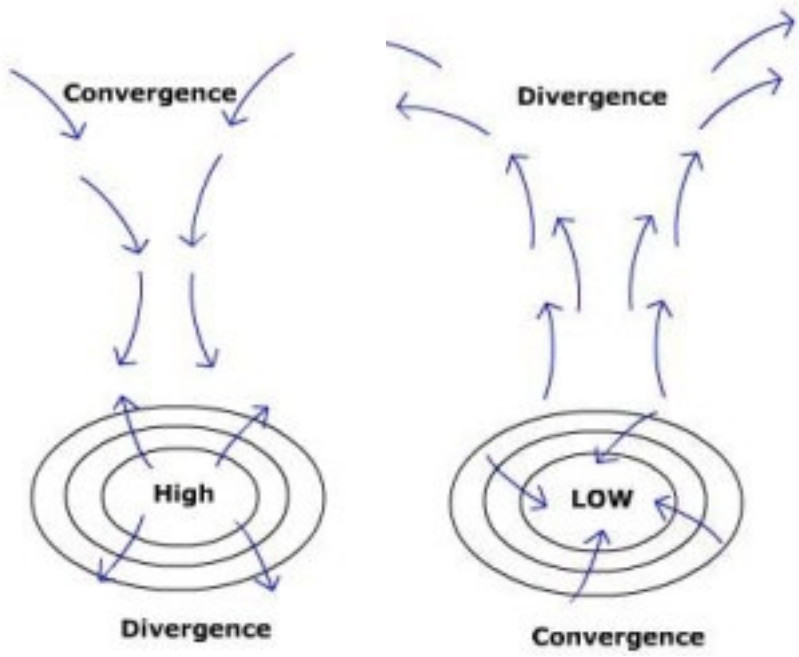


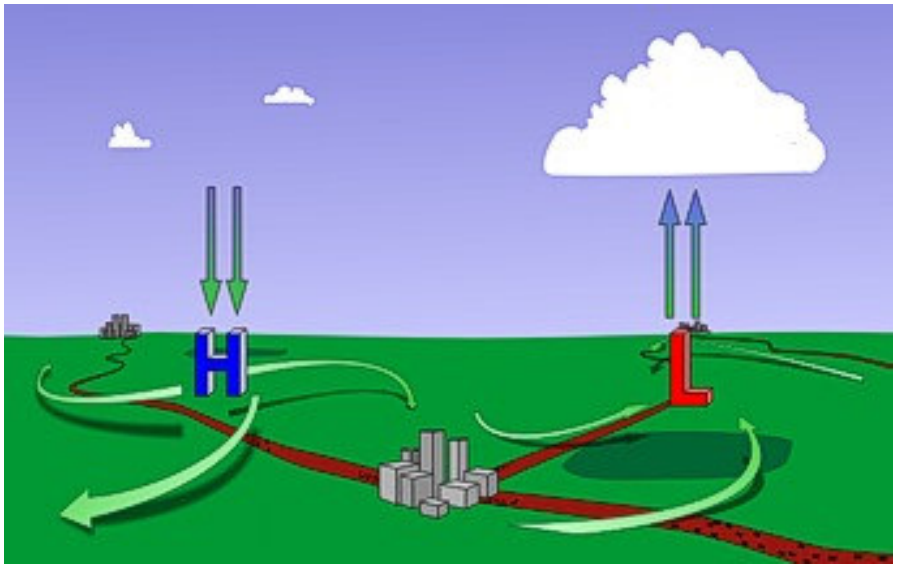
A high pressure and a low pressure center with wind directions (northern hemisphere). Circles are isobars with pressure in mb.

- In anticyclones, just the opposite is the case – the values of the isobars <u>increase</u> from the outside towards the center.



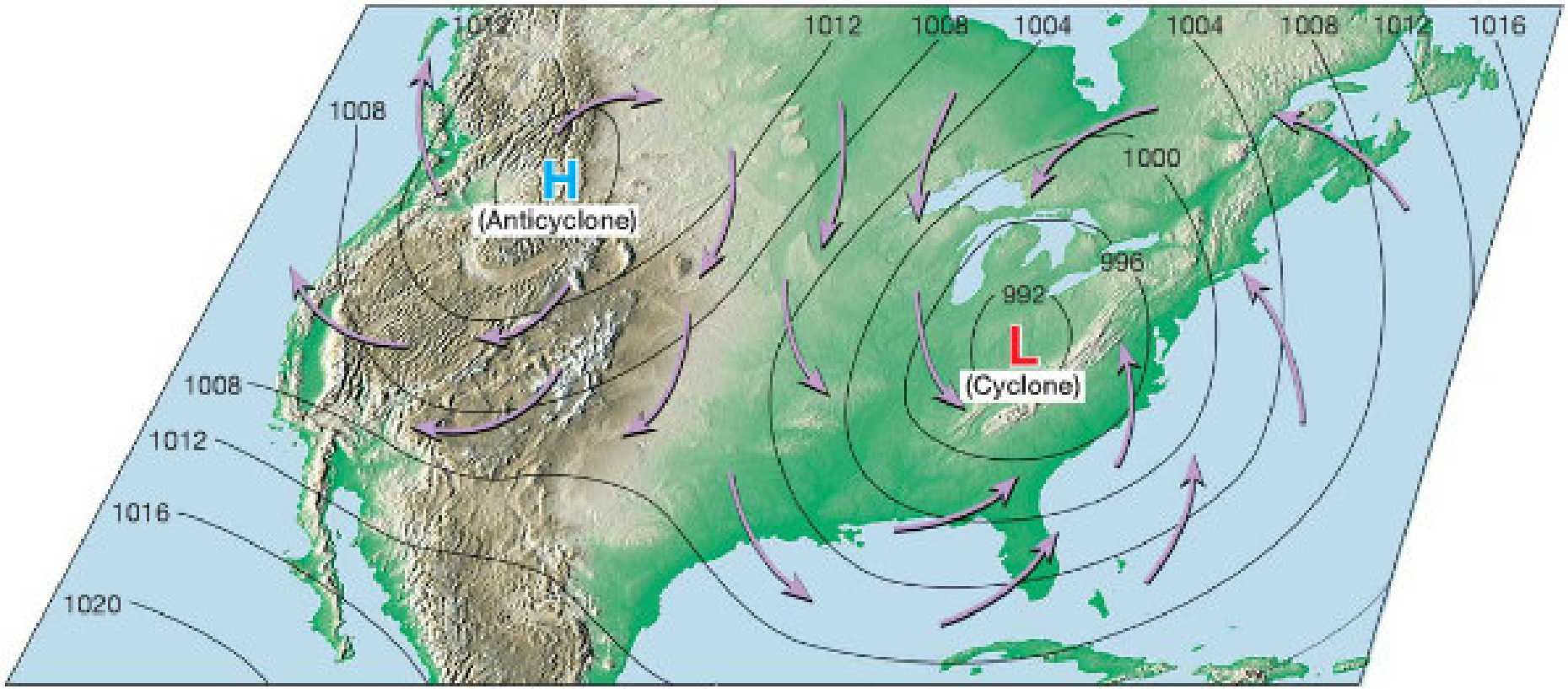
- When air converges (come together) horizontally, it must increase in height to allow for the decreased area it now occupies. This increase in height produces a taller and heavier air column, (a high). The converging air aloft causes air to subside (sink) toward the surface and diverge (spread out).
- A surface low can only exist only as long as the column of air above it exerts less pressure than the surrounding regions. This surface of converging air over a low rises upward to balance subsiding air of a high.





Cyclonic and Anticyclonic Winds

- When the pressure gradient and the Coriolis effect are applied to pressure centers in the N. Hemisphere, winds blow counterclockwise around a Low and clockwise around a High.
- Friction causes a net flow of air inward around a cyclone and a net flow of air outward around an anticyclone.



Friction

- The effect of friction on wind is important only within a few kilometers of Earth's surface. Friction acts to slow air movement, which changes wind direction.
- Friction with pressure gradient force and with the Coriolis effect causes a change in wind direction.
- One prominent feature of this are the **jet streams**. Fast-moving rivers of air near the tropopause that travel between 120 and 240 kilometers per hour in a west to east direction.

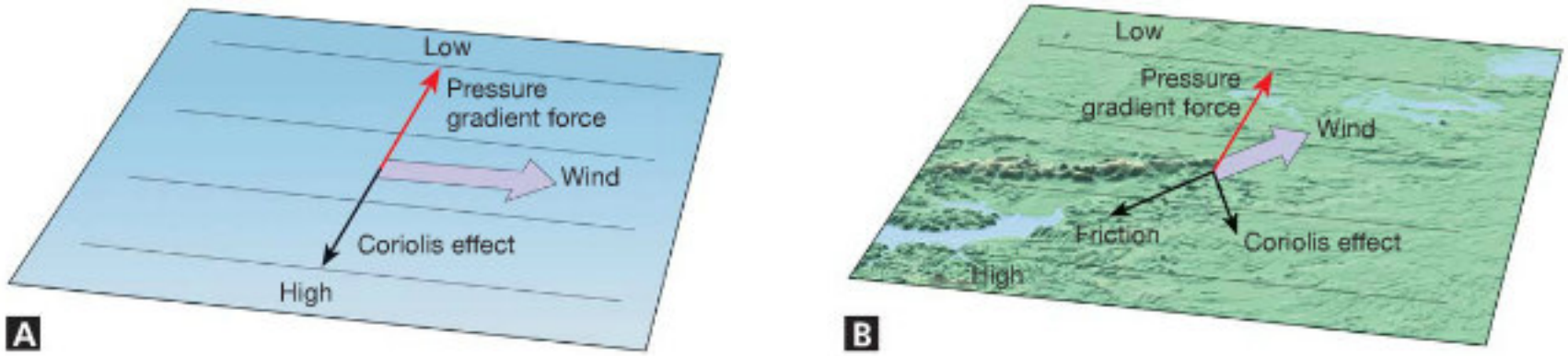


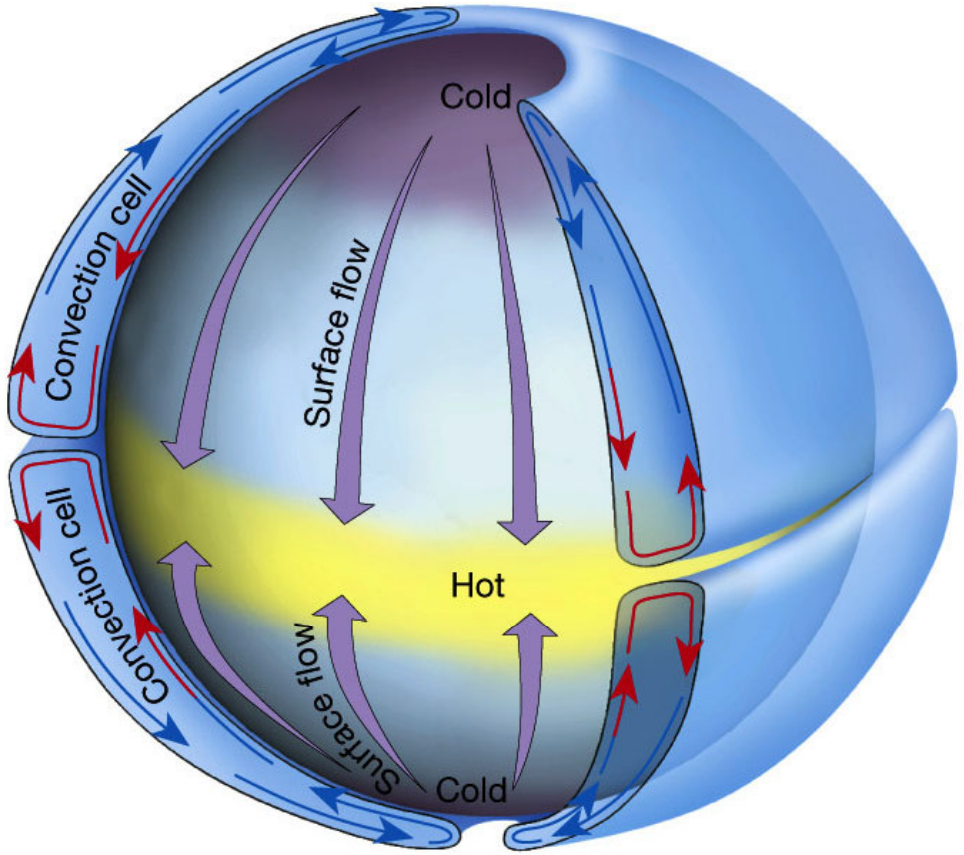
Figure 5 **A** Upper-level wind flow is balanced by the Coriolis effect and pressure gradient forces. **B** Friction causes surface winds to cross isobars and move toward lower pressure areas.

Global Winds

- The underlying cause of wind is the unequal heating of Earth's surface.
- In the tropical regions, more solar radiation is received than is radiated back to space.
- It is the opposite regions near the poles, less solar energy is received than is lost.
- The atmosphere balances these differences by acting as a giant heat-transfer system.
- This system moves warm air toward high latitudes and cool air towards the equator.

Non-Rotating Earth Model

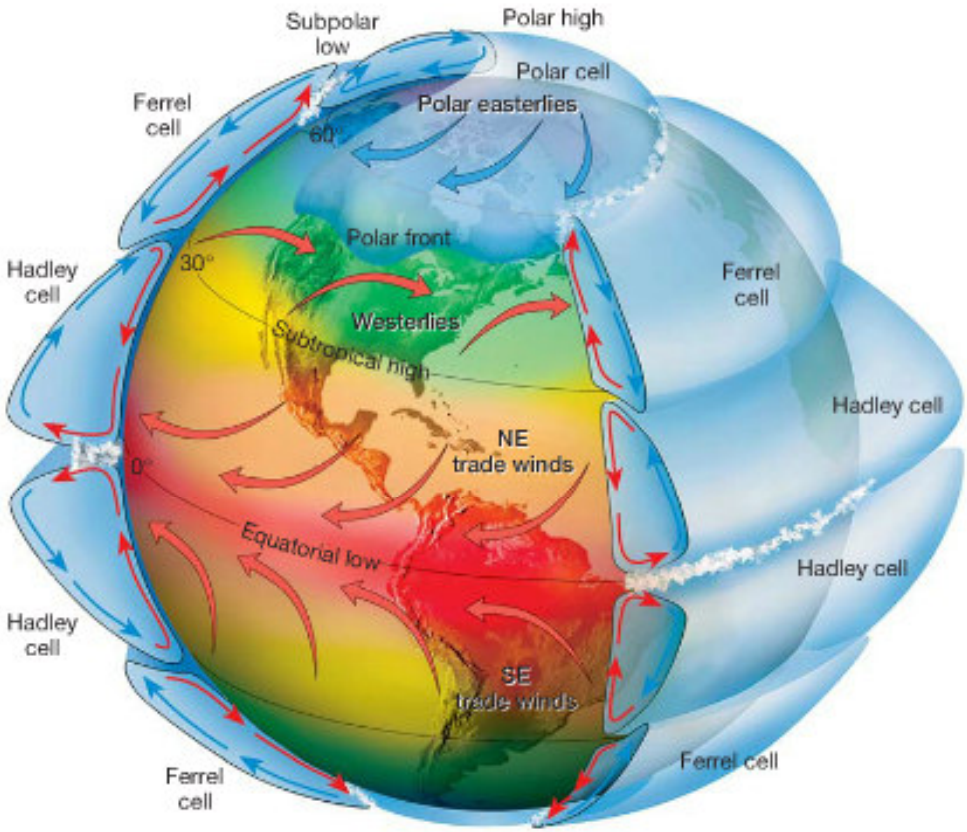
- On a hypothetical non-rotating planet with a smooth surface, tw large thermally produced cells would form, see picture to the right.
- The heated air at the equator would rise until it reached the boundary between the troposphere and the stratospher
- There the air would be deflected toward the poles. Eventually, the upper-level airflow would reach the poles, sink, spread out in all direction, and move back toward the equator.



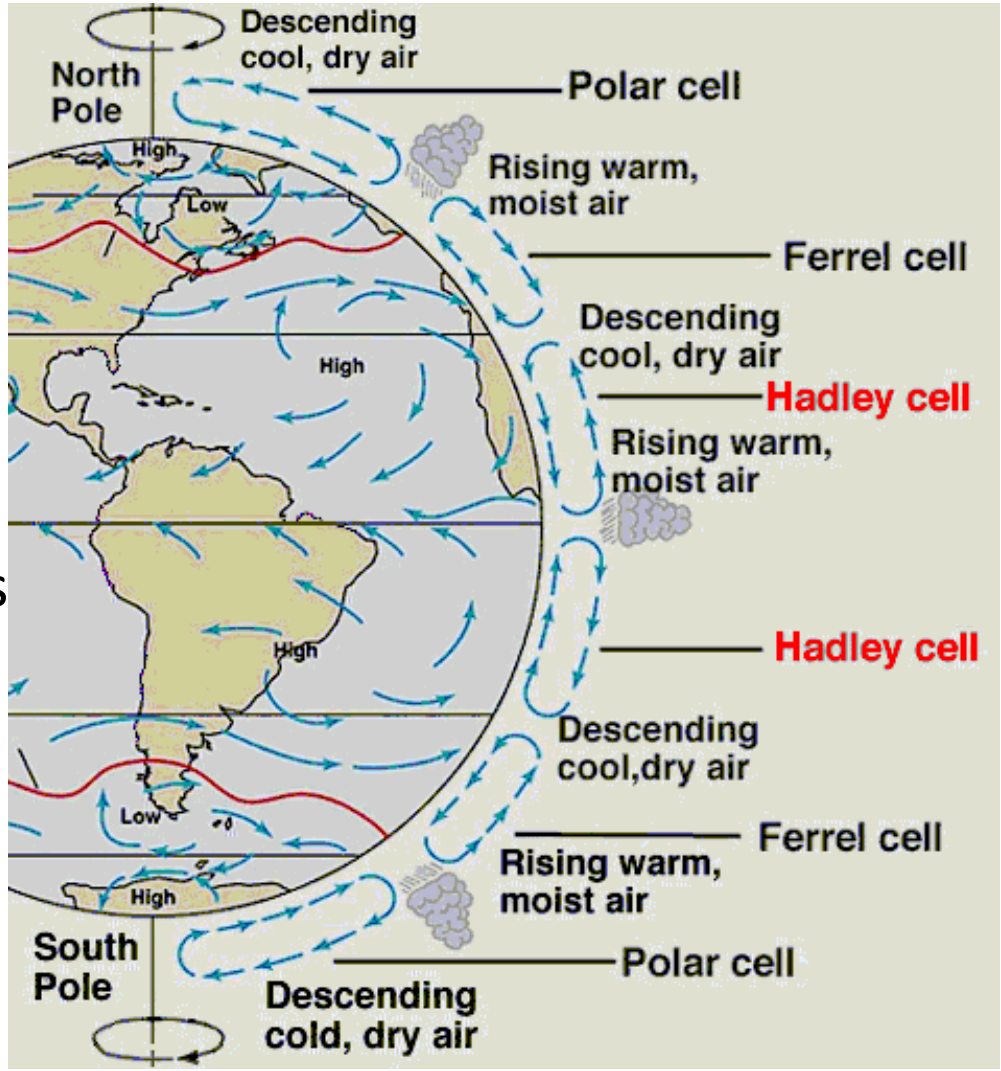
- Once at the equator, it would be reheated and start the process over again.

Rotating Earth Model

- With the effect of rotation, the two-cell **convection** system would break down into smaller cells.
- The three cells would carry on the task of redistributing heat on the Earth.
- At the equator air is heated by sunlight, it rises and moves toward the 30 degrees north/south latitude, and sinks, (Hadley cell).

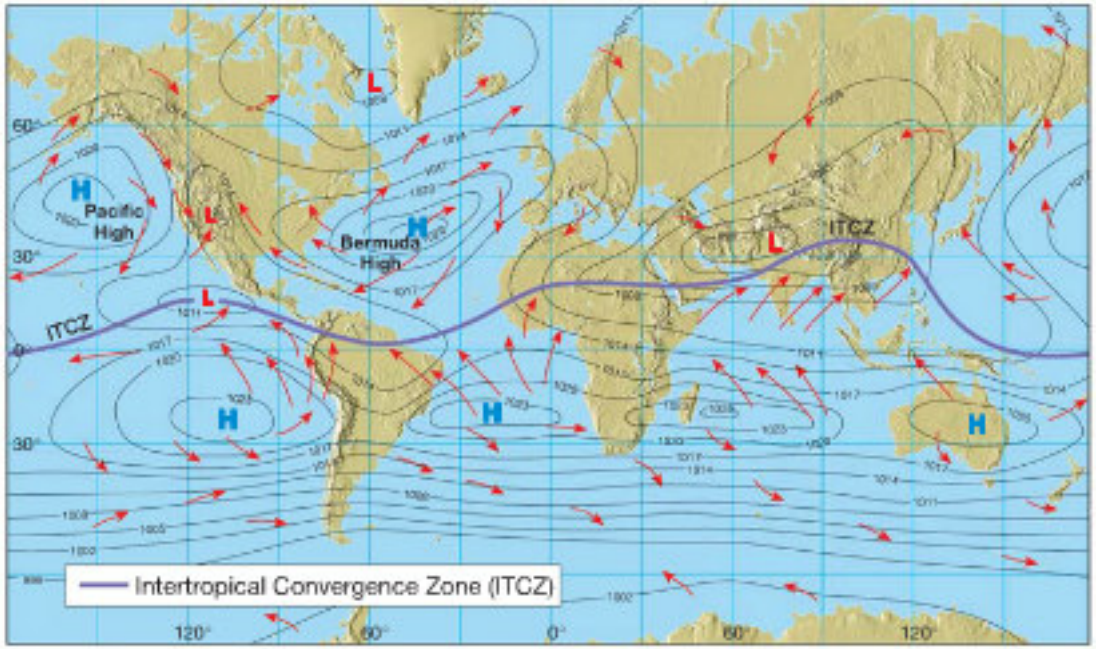


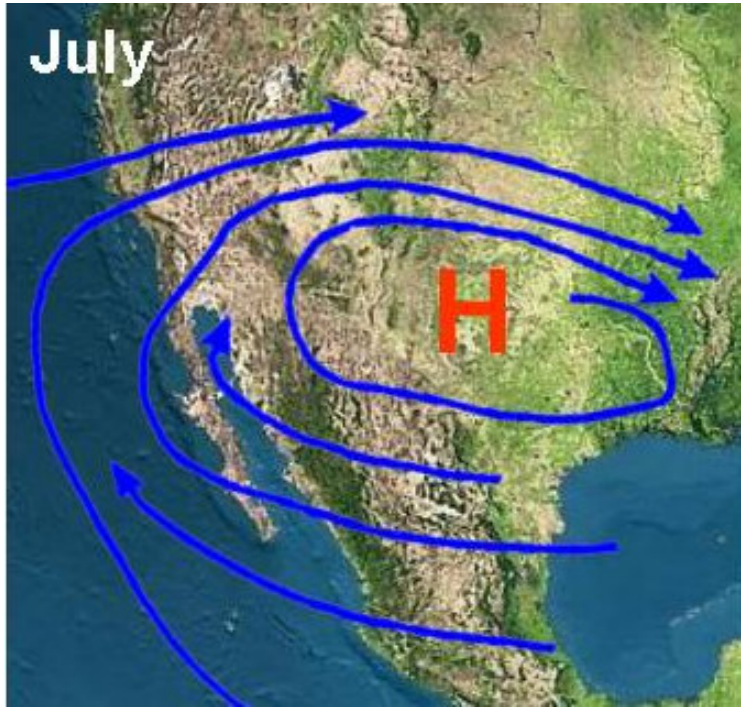
- Winds for each **Hadley cell** called **trade winds** blow toward the equator and is deflected to the right by the **Coriolis effect** depending on the hemisphere the trade wind is located in.
- At the 30 degree north latitude, the cool winds from the **Ferrel cell** descends, warms, generates the prevailing **westerlies**, and blows the dominant west-to-east motion.
- The cold **Polar cell** winds blow south toward the 60 degrees north latitude, and is deflected to the right by the **Coriolis effect**.



Influence of Continents

- Where landmasses break up the ocean surface, large seasonal temperature differences disrupt the global pattern of pressure zones in the atmosphere.
- These seasonal changes in wind direction are known as **monsoons**. Monsoons in Arizona are during the summer when a High pressure center is over New Mexico and Arizona which brings wind and moist air up from Mexico.

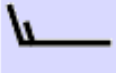
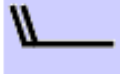
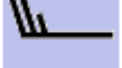




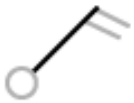
Wind Speed & Direction

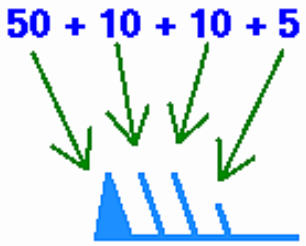
Wind speed. A combination of long/short barbs and pennants indicate the speed of the wind in station weather plots rounded to the nearest 5 knots. Calm wind is indicated by a large circle drawn around the skycover symbol.

One long barb is used to indicate each 10 knots with the short barb representing 5 knots. At 50 knots, the barbs changes to a pennant. For wind speeds higher than 50 knots, long and short barbs are used again in combination with the pennant(s). (See examples below.)

Observed wind speed	0-2 kts (0-2 mph)	3-7 kts (3-8 mph)	8-12 kts (9-14 mph)	13-17 kts (15-20 mph)	18-22 kts (21-25 mph)	23-27 kts (26-31 mph)	28-32 kts (32-37 mph)	33-37 kts (38-43 mph)	48-52 kts (55-60 mph)	53-57 kts (61-66 mph)	58-62 kts (67-71 mph)	63-67 kts (73-77 mph)	98-102 kts (113-117 mph)	102-107 kts (119-123 mph)
Rounded to the nearest 5	0 kts	5 kts	10 kts	15 kts	20 kts	25 kts	30 kts	35 kts	50 kts	55 kts	60 kts	65 kts	100 kts	105 kts
Plotted as														

The **wind direction** is indicated by the long shaft. The shaft will point to the direction **FROM** which the wind is blowing. The direction is based upon a 36-point compass.

Wind FROM 340° (NNW)	Wind FROM 040° (NE)	Wind FROM 190° (S)
		



Wind blowing from the west at 75 knots

Wind blowing from the northeast at 25 knots

Wind blowing from the south at 5 knots

Calm winds