

Natural Disasters

Lecture 5

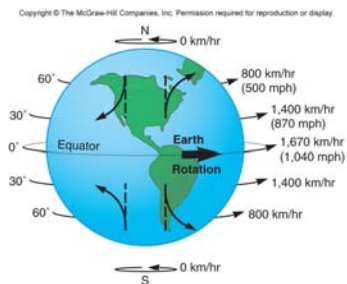
Ch 9 – External Energy Fuels Weather and Climate

Text Source Today:
Chapter 9 (p. 236-249)

9.2: Ch. 9 – External Energy Fuels Weather and Climate

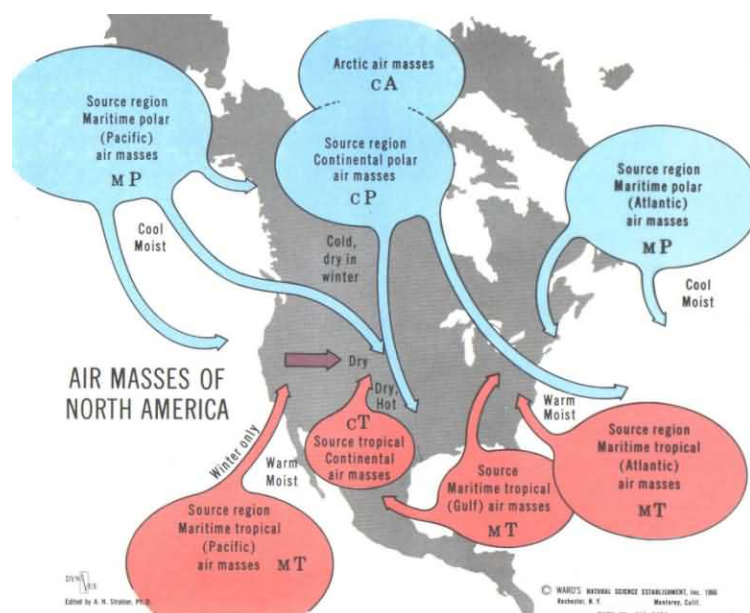
♦ **Coriolis effect:** the **rotation** of Earth creates an apparent deflection of winds to the **right** in the Northern Hemisphere (and to the **left** in the Southern Hemisphere).

Fig. 9.16

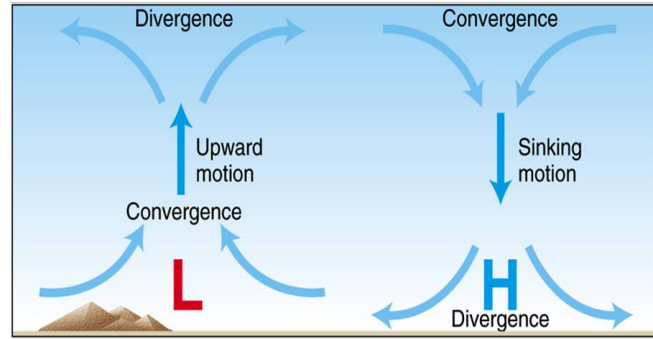


♦ The **sun** is the primary source of **heat for atmospheric motions**. The maximum **heating** from the sun occurs when the sun is directly overhead, and decreases as the **angle of incidence** increases. Thus, the tropics are generally **warmer** than the mid-latitudes, which in turn are **warmer** than the poles. (This relationship combines with the Earth's tilt to cause **the seasons!**)

♦ Land and water heat at **different rates**; land tends to heat and cool more quickly, since land has a **lower specific heat** than water. As air **resides** over land or water, it takes on the ambient characteristics (temperature & RH), creating large **air masses**:



♦ **Cyclones (lows)**: are defined by low pressure at the surface. This low pressure causes nearby air to **flow in toward** the center of the rotation, where it **ascends** (creating a cold-core system).



However, as the air moves **inward**, the **Coriolis effect** turns the air to the **right** in the Northern Hemisphere (and to the **left** in the Southern Hemisphere). This effect causes **cyclones to spin counter-clockwise** in the Northern Hemisphere (and **clockwise** in the Southern Hemisphere). (Similar to Fig. 11.17)

♦ **Anticyclones (highs)**: are defined by high pressure at the surface. **Descending** air from aloft **diverges** from the center of the high. This air is turned by the **Coriolis effect** as well; thus, **anticyclones rotate clockwise** in the Northern Hemisphere (and **counter-clockwise** in the Southern Hemisphere).

♦ A **jet stream** is a relatively narrow swath of **very strong winds** in the atmosphere. They tend to form near strong **horizontal temperature gradients**.

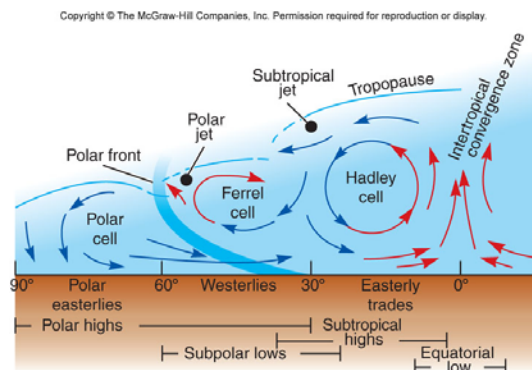
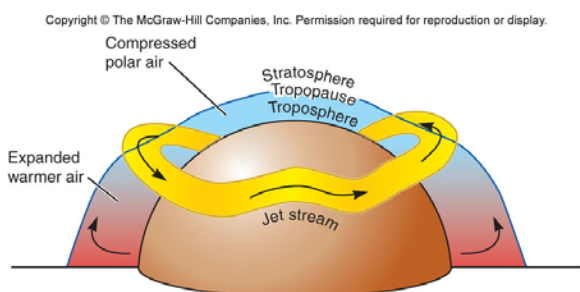


Fig. 9.20



• Both the Northern and Southern Hemispheres have **two** primary **jet streams** encircling Earth – the **polar jet** and the **subtropical jet**.

Fig. 9.25

- **“Kinks” in the jet stream** can help to develop **tropospheric-deep circulations**. These circulations in the atmosphere develop as either **cyclones (lows)** or **anticyclones (highs)**, depending on whether air flows **into or out of** the rotation at the surface.

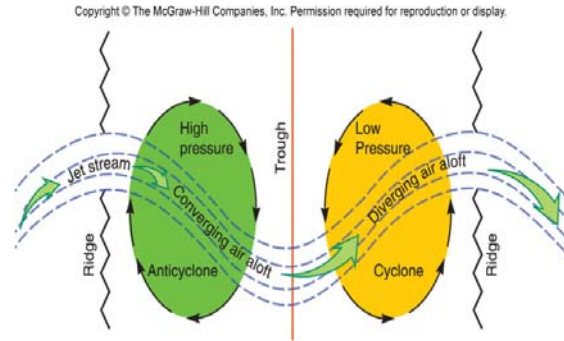


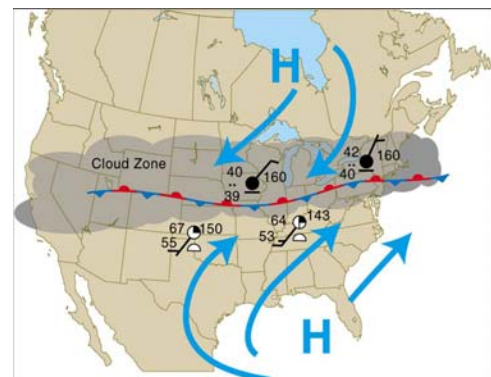
Fig. 9.26

- ◆ **Fronts:** refer to **boundaries** between **air masses** within the atmosphere. Clouds, precipitation, and severe weather are often found near **fronts** because warm, moist air is forced **to rise at the boundary** if one air mass is moving toward another.

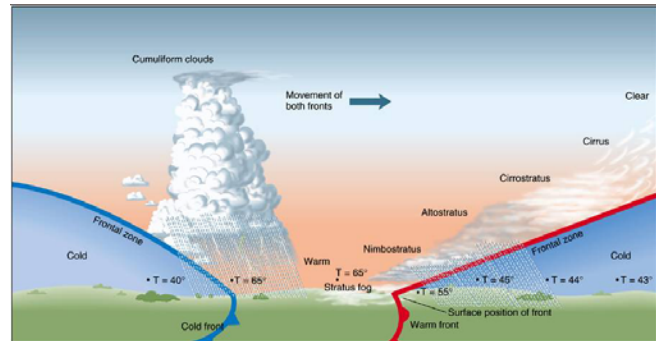
- **Fronts** are much more likely with **lows** than highs. **Converging and rotating** winds in a **cyclone** bring different **air masses** closer together, tightening the **temperature** gradient and causing air **to rise**. This is why precipitation and severe weather most often occurs with **cyclones**. The **descending** (i.e., **warming and drying**) air in the center of a **high** spreads out at the surface and reduces the **temperature** gradients in the area.

- There are **four** major types of **fronts**:

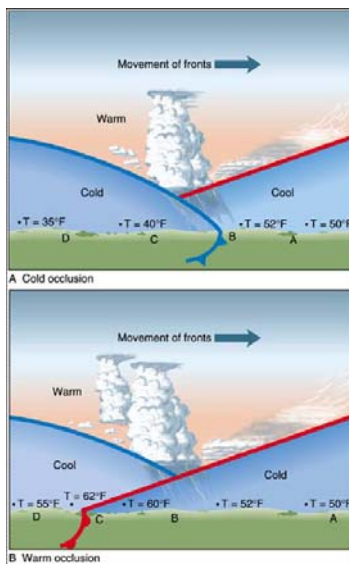
- ◆ **Stationary front:** is a front where cold and warm air masses are **right next to each other**, but neither is **moving into** the other's territory.



♦ **Warm front:** forms when warm air encroaches on cold air. The **less dense warm air** rises up and over the more **dense cold air**, but at a much shallower slope.



♦ **Cold front:** is a boundary where **cold, more dense air** is moving into a region of **warmer, less dense air**; the **cold** air forces the **warm** air to **rise up and over** the front.

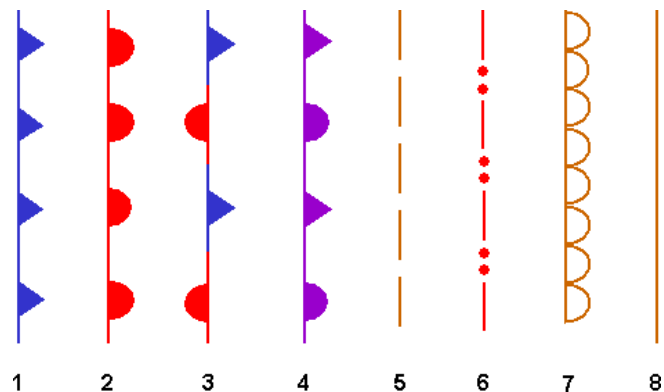


♦ **Occluded front:** is a specialized type of front in which the **faster-moving cold** front catches up to the **slower-moving warm** front, allowing the cold polar air to wrap completely around a **mature cyclone**.

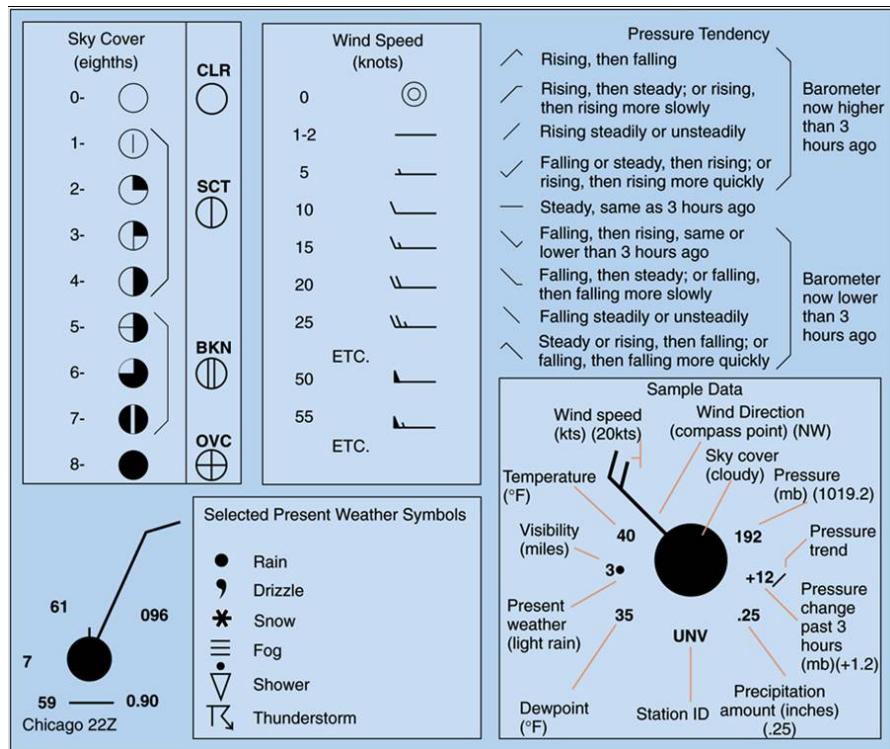
- **Cold occlusion:** when there is colder air to the west (normal for our weather in NY).
- **Warm occlusion:** when there is colder air to the east (normal in the Pacific NW).

♦ **Weather Map Symbols:**

(1) **cold** front; (2) **warm** front; (3) **stationary** front; (4) **occluded** front; (5) trough line; (6) squall line; (7) dry line; (8) **isobar**.



● Weather Station Plotting Model:



◆ Sample Weather Map:

