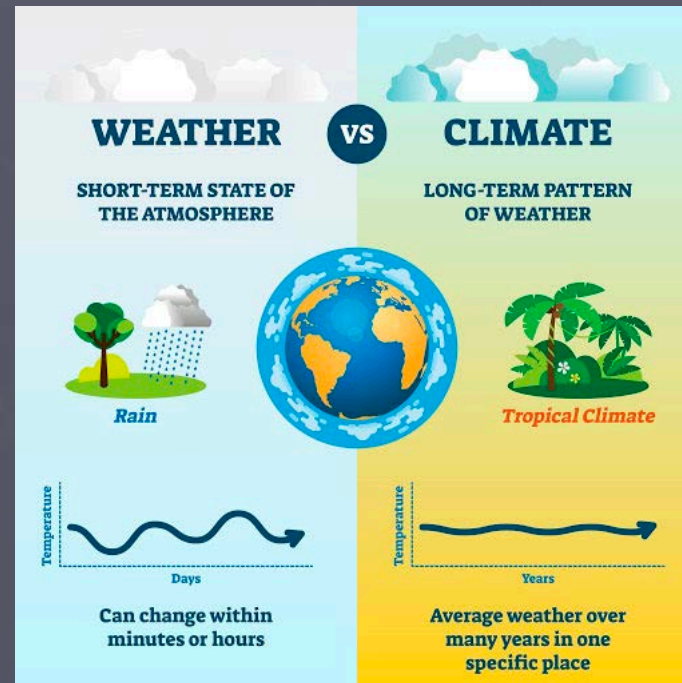# Weather Patterns

Chapter 7: Weather
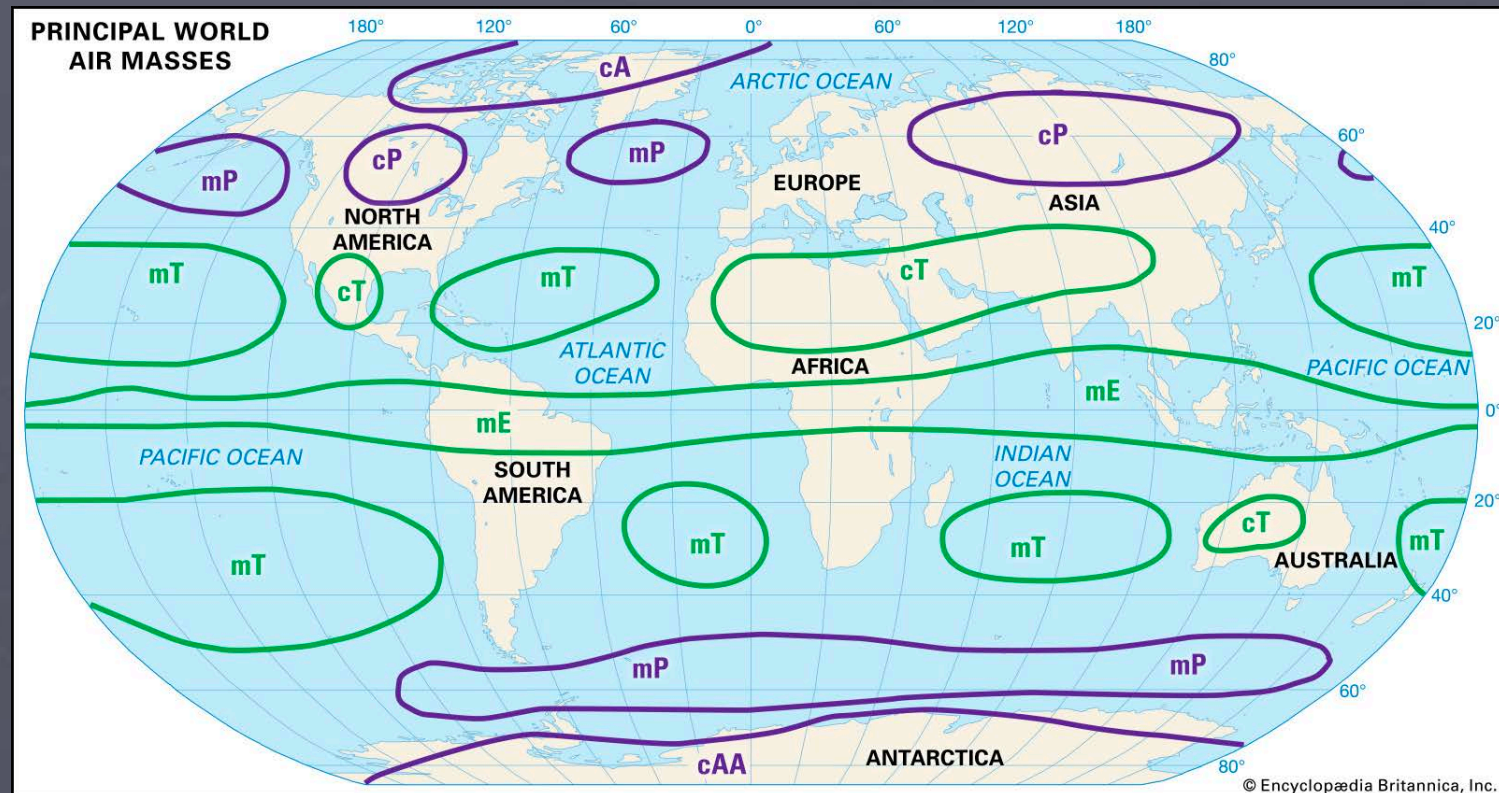
Weather vs. Climate

Weather vs. Climate

- Weather refers to day to day changes in atmospheric conditions
- Climate is long term (decades) trends and patterns of averages of weather patterns
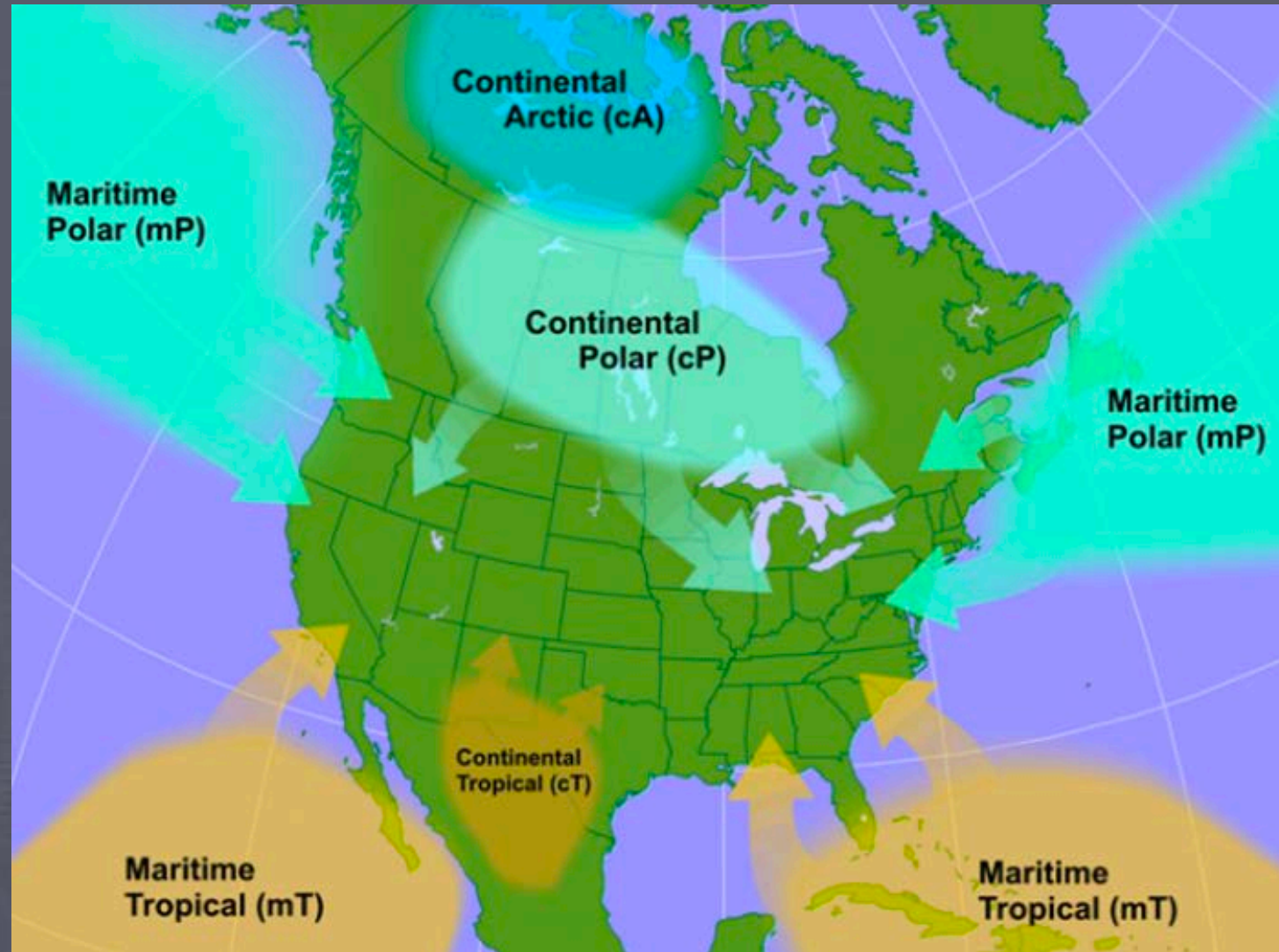
Air Masses

- Large collections of homogeneous atmospheric conditions
  - Source location has large impact on what type of weather patterns it will produce

Classifying Air Masses

- Air Masses organized by characteristics of source locations
  - c refers to Continental (as in over a body of land)
    - Likely to be dryer
  - m refers to Maritime (as in over a body of water)
    - Likely to have more moisture
- Air masses also organized by latitude
  - A is Arctic (AA is Antarctic) – Very high latitudes, more dry, very cold
  - P is Polar – High latitudes, Cold, some moisture
  - T is Tropical – Mid-latitudes, warm
  - E is Equator – Low latitudes, very warm, more moisture

Predominant Air Masses in North America
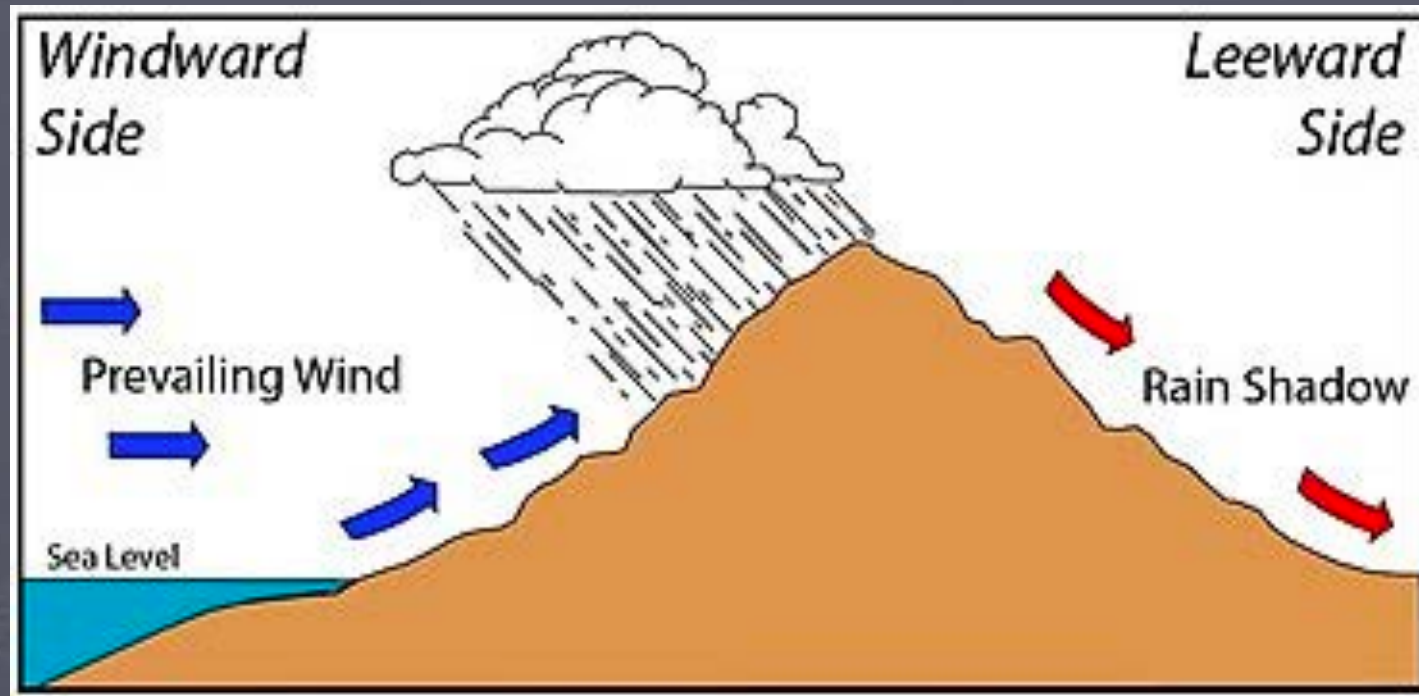
Air Mass Modification

- As air masses move they pick up characteristics of the land or water they pass over
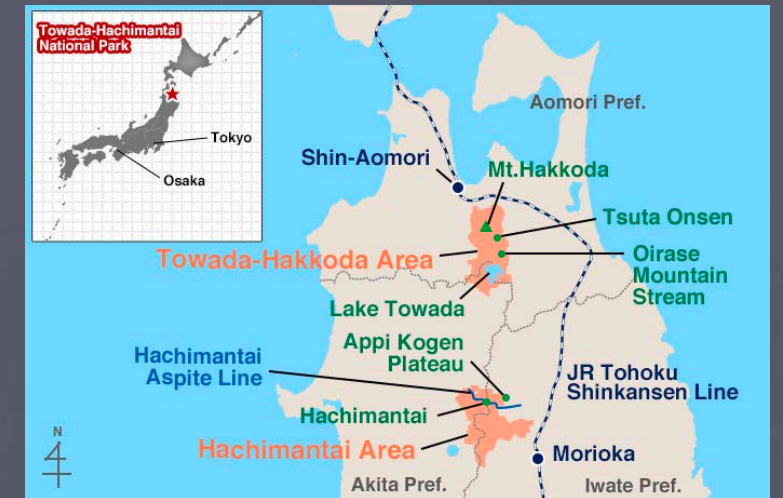 - Ex. Continental Air masses that passes over Great Lakes picks up moisture
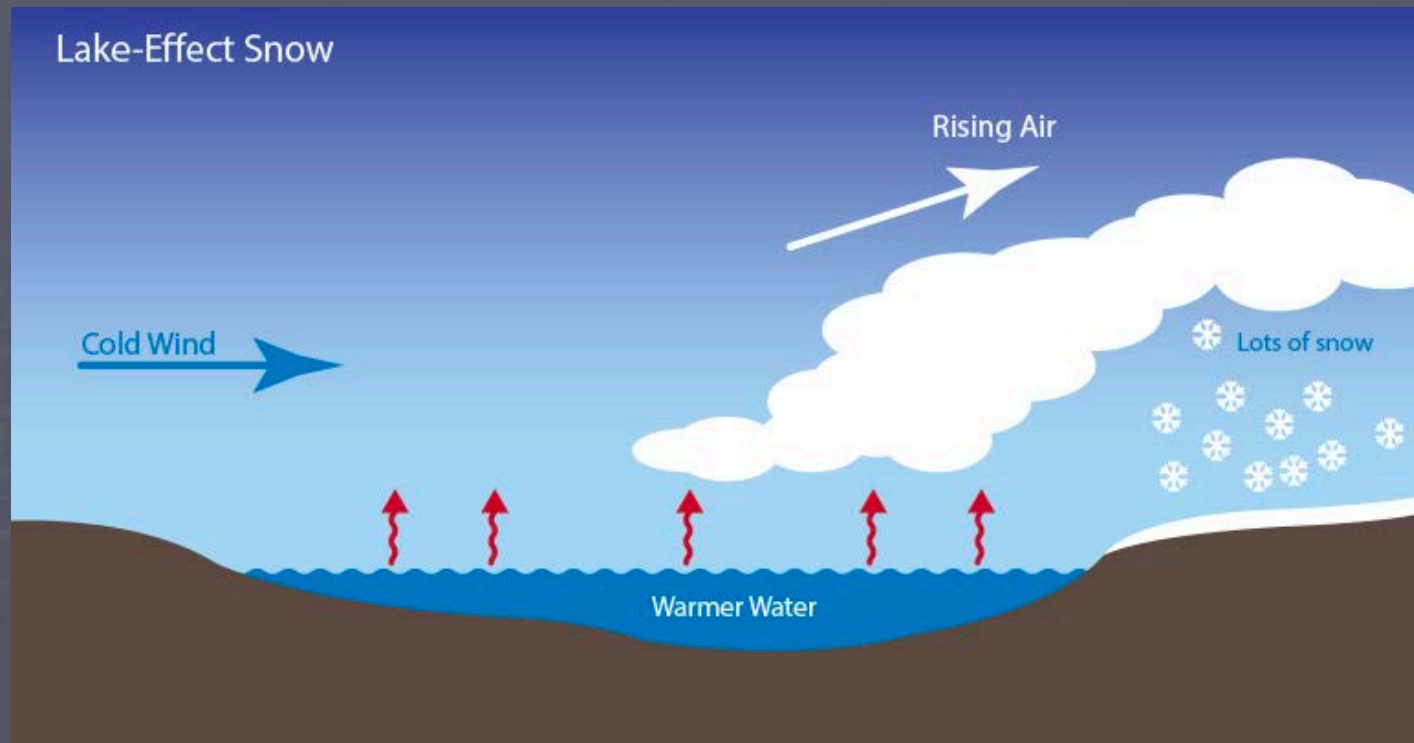
Processes that lift Air

1. Orographic lifting
   - Elevated terrains act as barriers
   - Result can be a rain shadow desert

Hakkoda Snow Monsters (Aomori Prefecture)

Processes that lift Air

2. Convergence

- Air that is roughly the same temperature coming together in an area of low pressure

  - Nowhere to go put up

  - Air rapidly pushed into the atmosphere, usually creating cumulonimbus clouds or heavy precipitation, or both

Low pressure

500 km
Convergence of air
(c)

© 2007 Thomson Higher Education
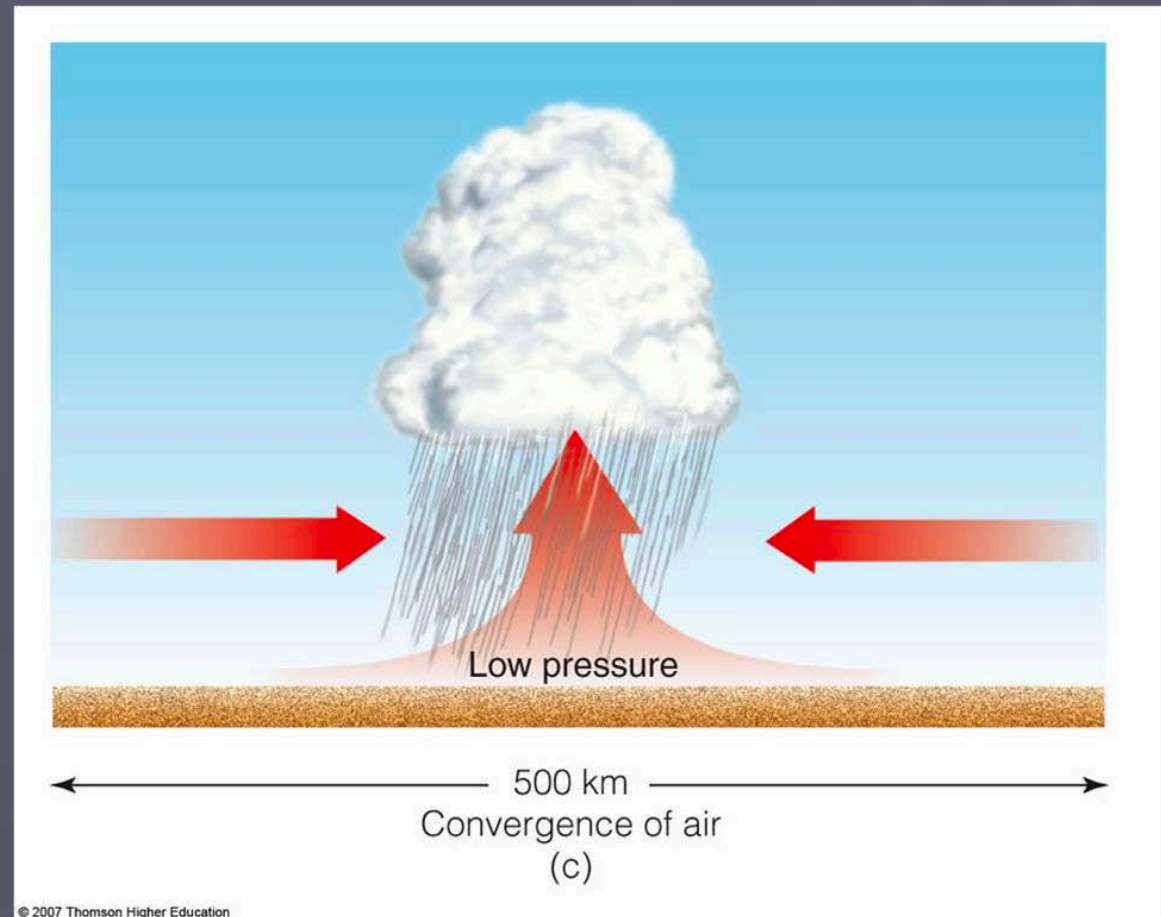
Processes that lift Air

## 3. Localized Convection Lifting

- Air lifting as it is heated by the warmer ground below
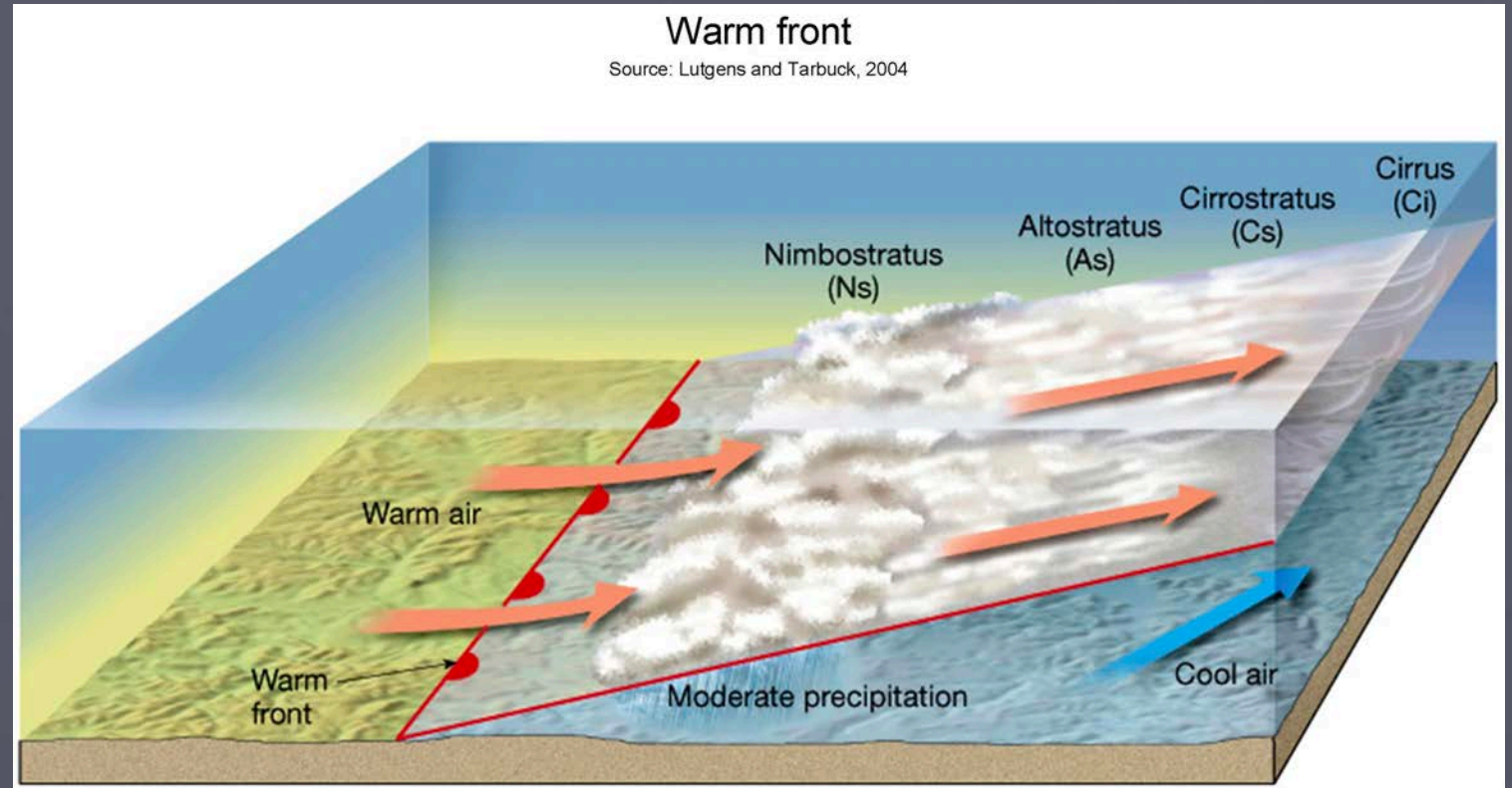 - Causing it to lift into the atmosphere
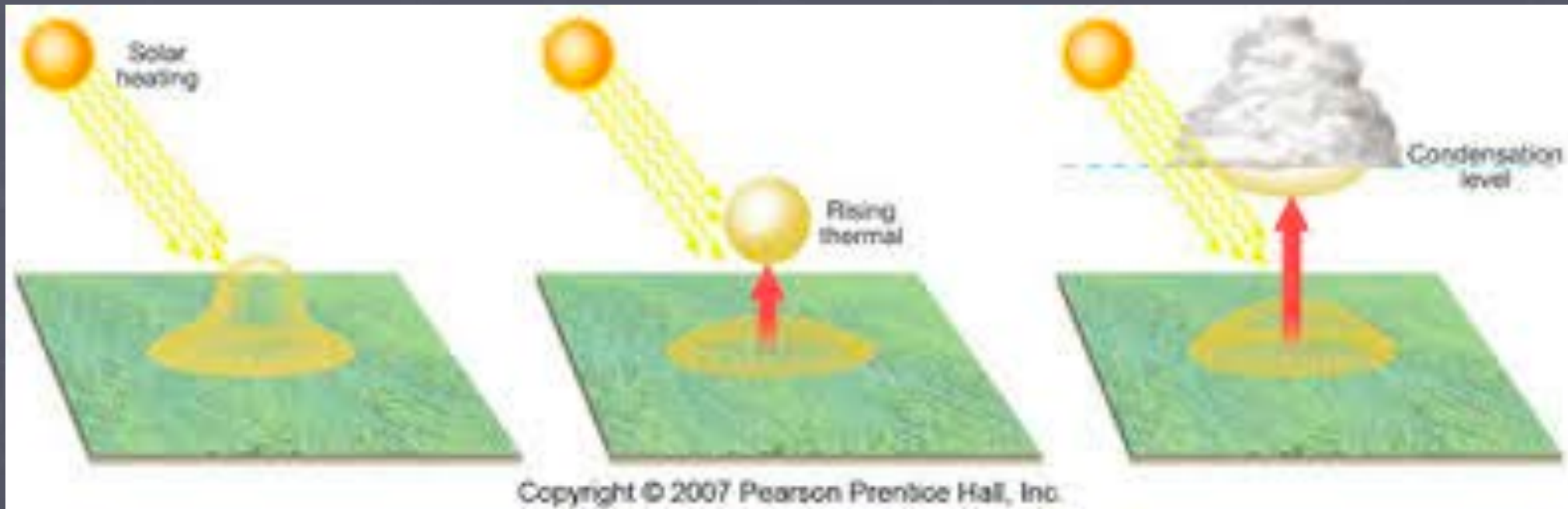
Processes that lift Air

4. Frontal Wedging

- Caused when cool air forces warmer air upward
- Speed of front can lead to more drastic changes in temperature and more severe storms
- Fronts: Separate air masses of different densities

Warm air
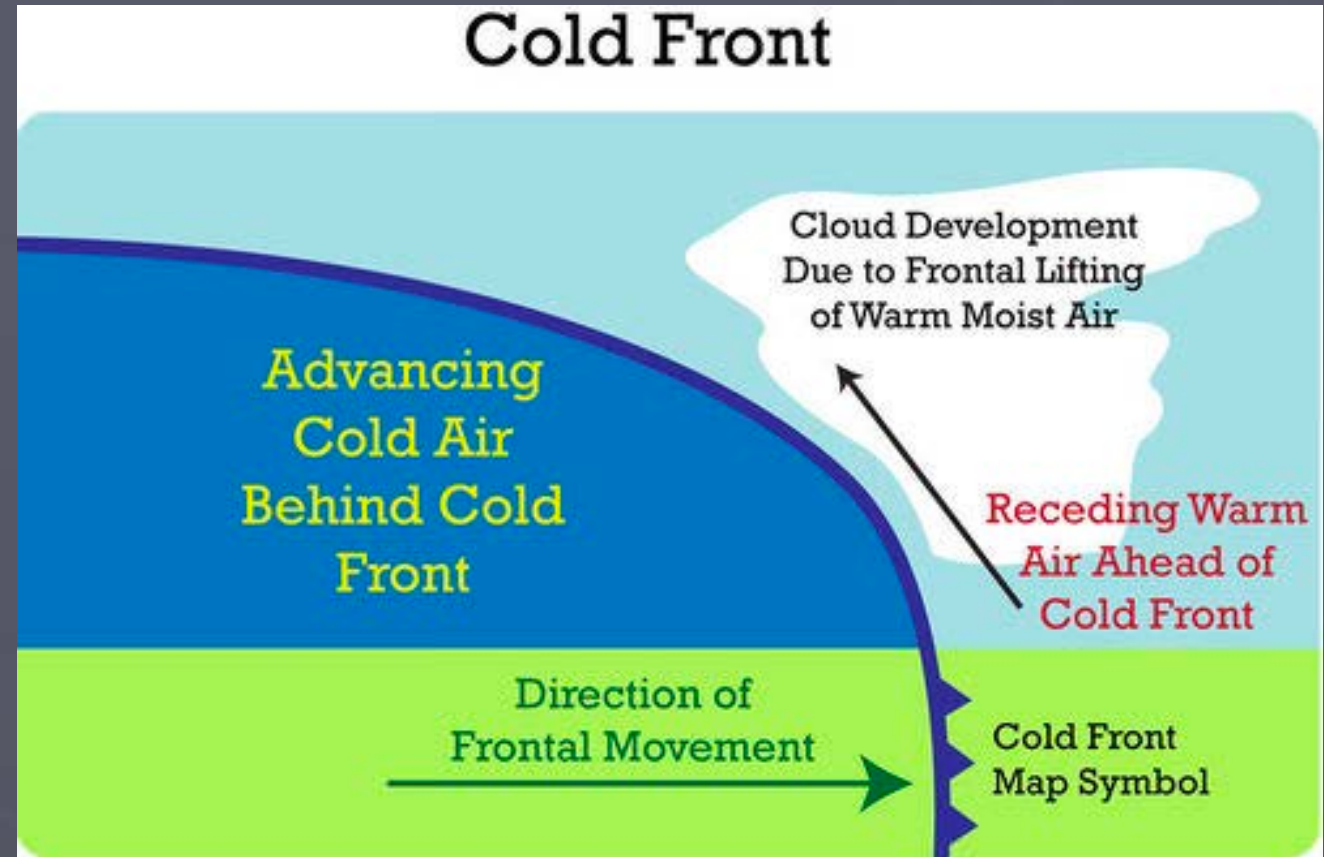
Cold air

B. Frontal wedging
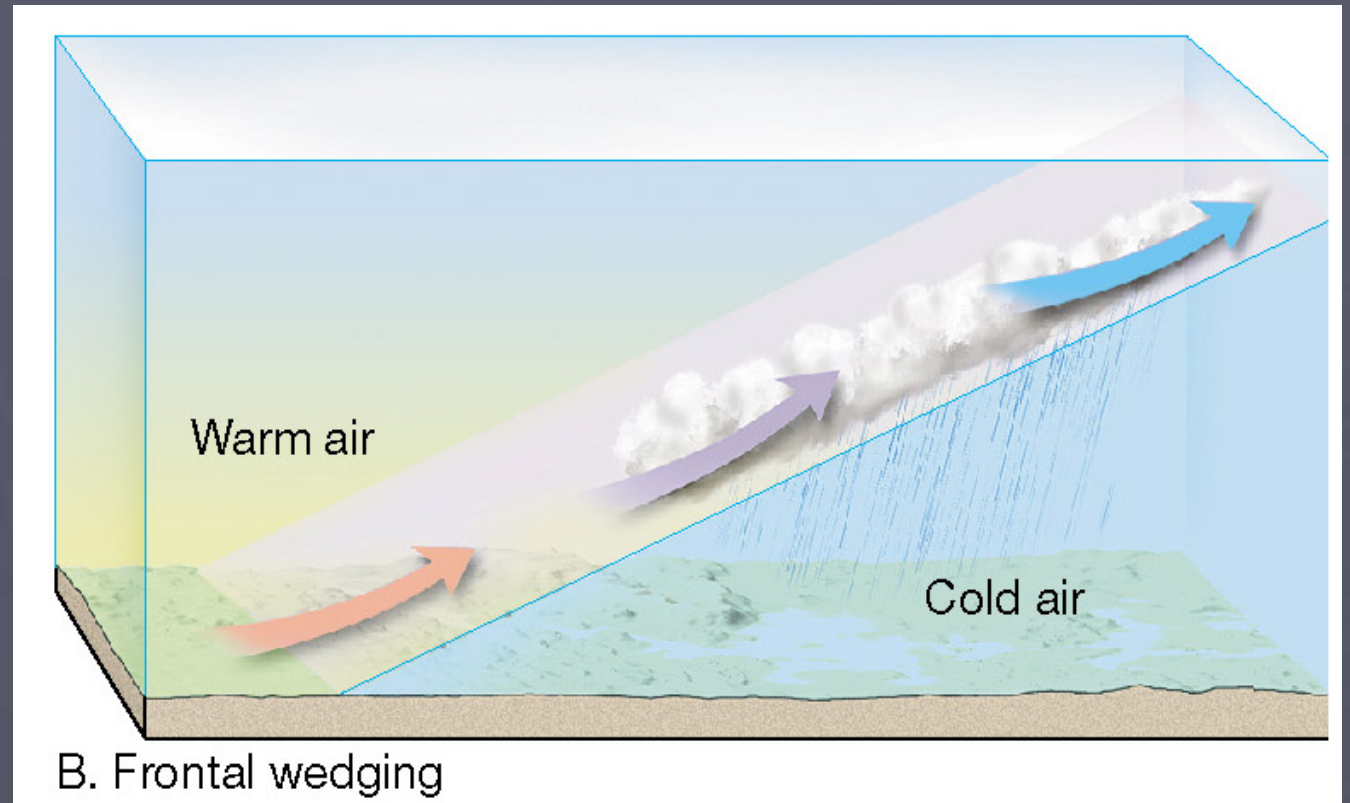
Fronts – Warm Front

- Incoming warm air that replaces cooler air
  - Usually advances much slower
  - Precipitation and clouds heaviest at back end of cold air

Warm front
Source: Lutgens and Tarbuck, 2004

Cirrus (Ci)

Cirrostratus (Cs)

Altostratus (As)

Nimbostratus (Ns)

Warm air

Warm front

Moderate precipitation

Cool air

Fronts – Cold Front

- Incoming cold fronts push warm air up
  - Causing decline in air temperature
  - Most precipitation and cloud cover on the leading edge of the front
  - Can have much more violent weather

Cold Front

Advancing Cold Air Behind Cold Front

Cloud Development Due to Frontal Lifting of Warm Moist Air

Receding Warm Air Ahead of Cold Front

Direction of Frontal Movement

Cold Front Map Symbol

Fronts – Stationary Front

- Stationary fronts form when cold fronts meet warm fronts but neither is strong enough to move the other
  - Winds move parallel to the front
  - If front sits on top of area of low pressure then clouds and precipitation form along front

Fronts – Occluded Front

- Happens when a cold front overtakes a warm front in the same direction
  - Cold air typically moved faster than warm air
  - The occlusion is where the two cold fronts come together
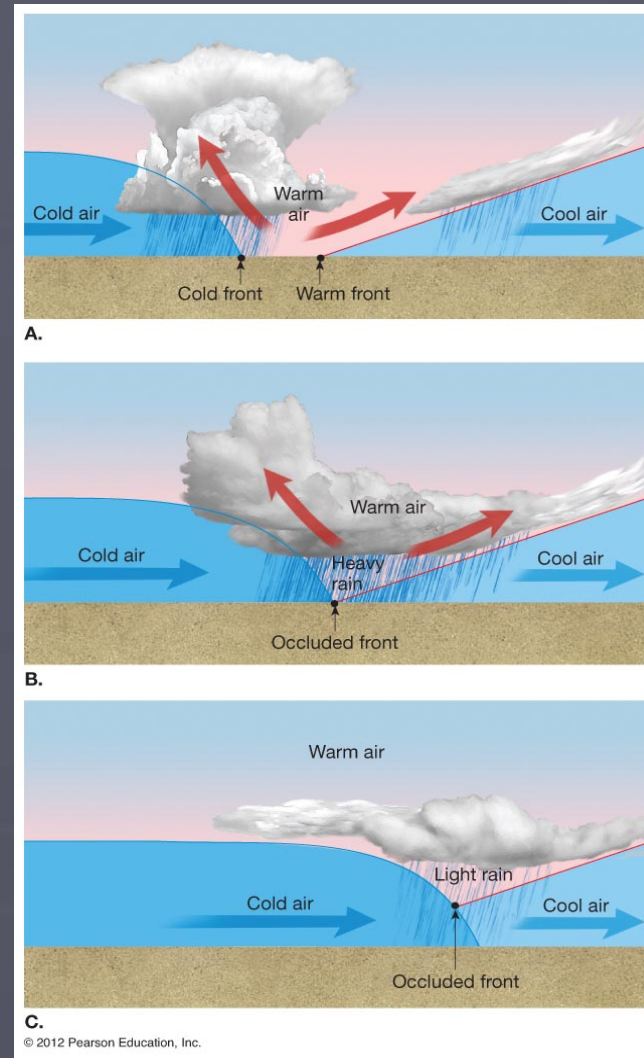 - Precipitation and clouds form over the Occluded front
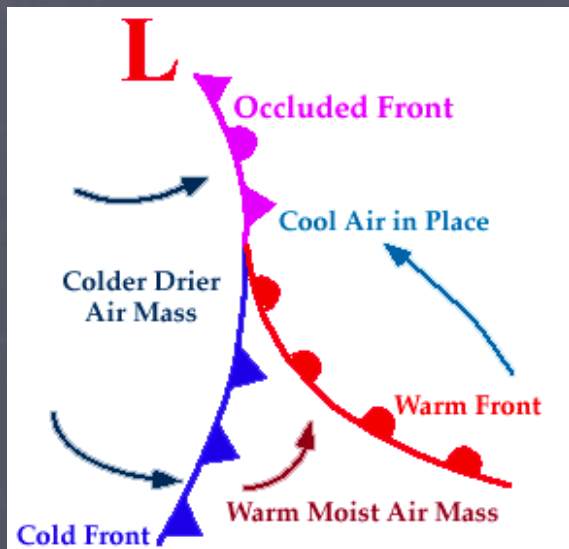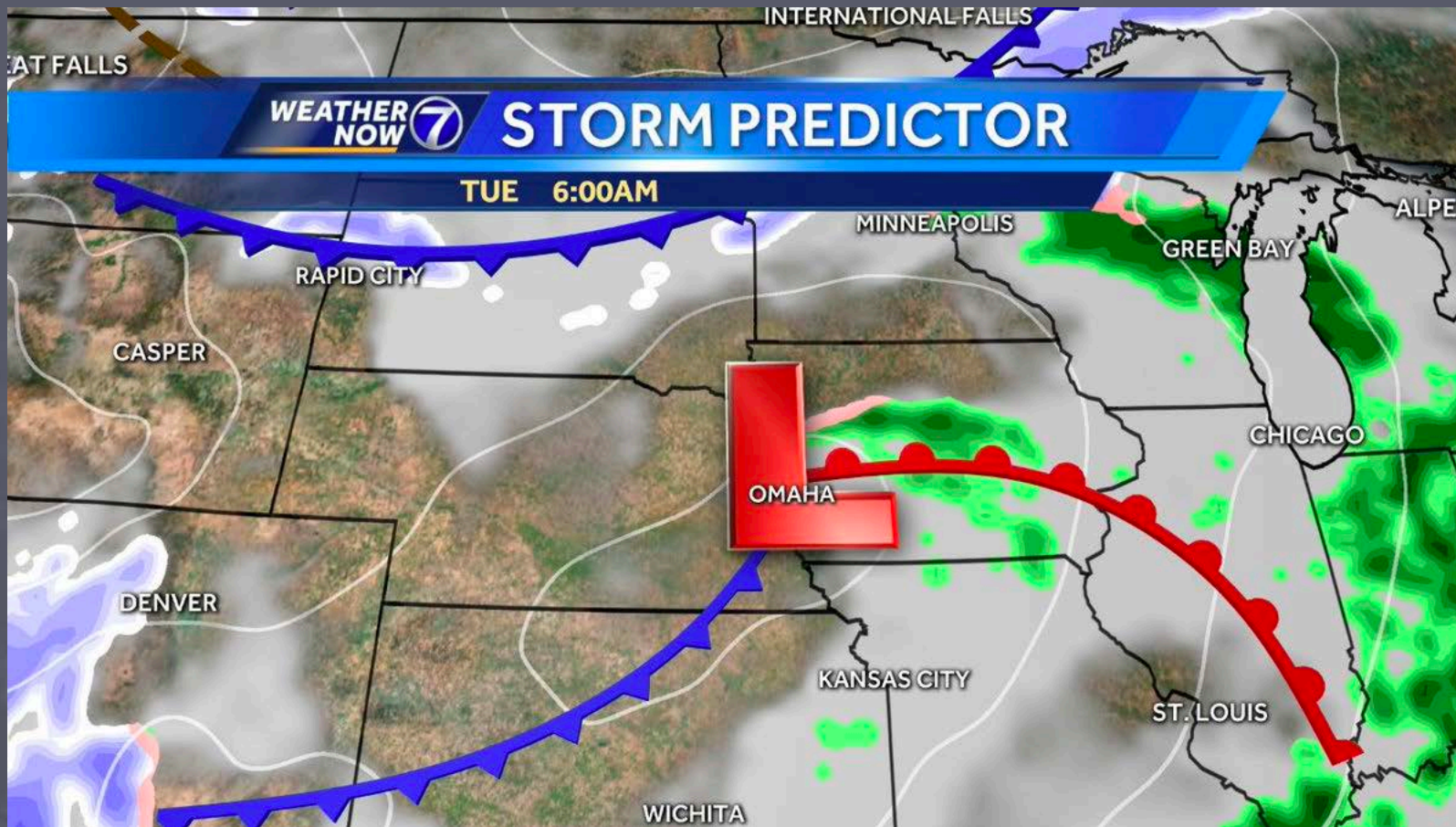
Occluded Front

Active cold front overtakes
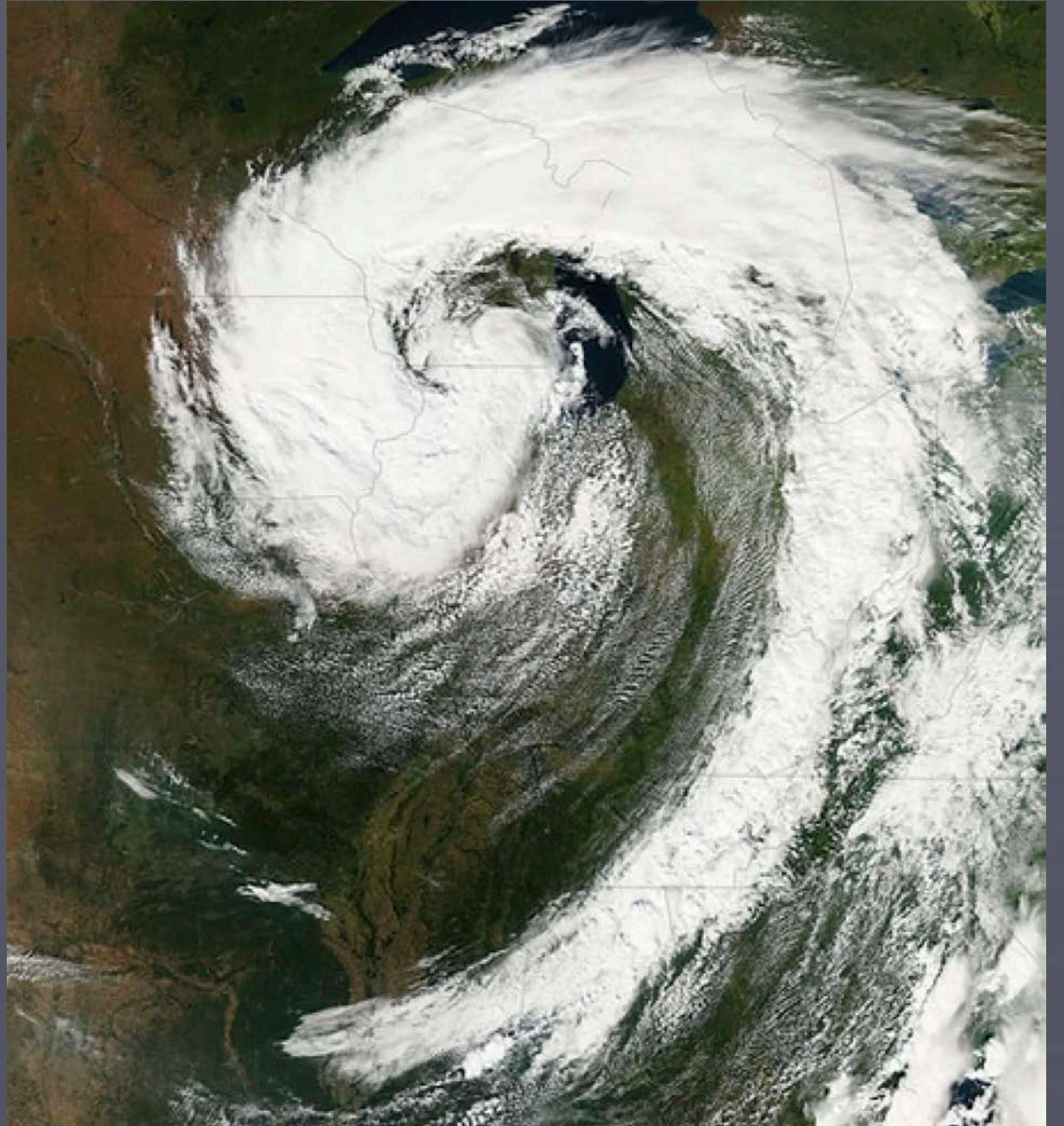a warm front

Cold air wedges the warm
air upward

Precipitation is associated
with warm air being forced aloft

Fronts in Action (Feb 28, 2017)

Mid-Latitude Cyclones

- Predominant weather producing force in the United States
- Caused by cooler air from the West and North
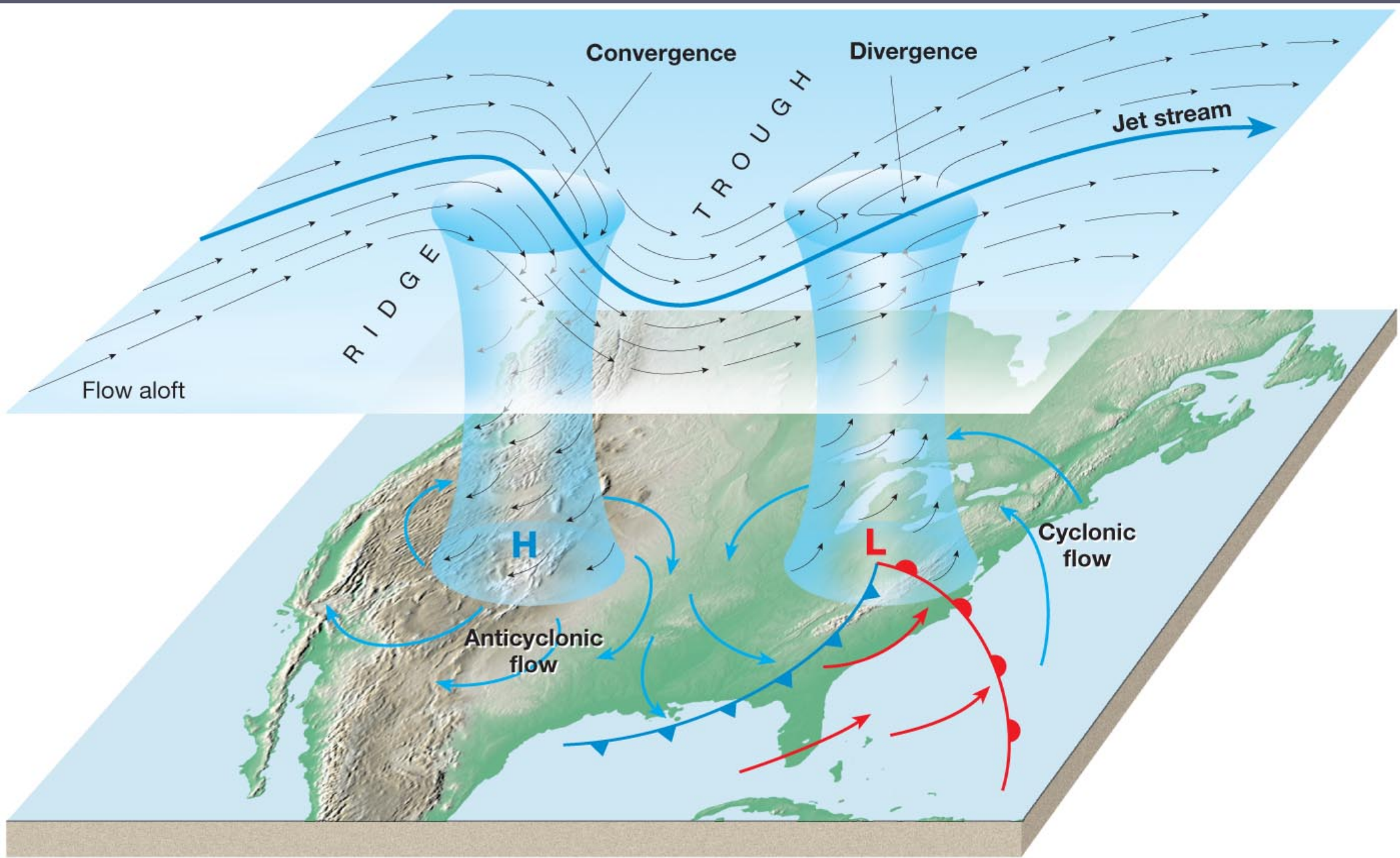 - Can lead to major weather systems that impact entire country

Mid-Latitude Cyclone as seen from space

Mid-Latitude Anticyclone

- High Pressure System with slight temperature variation over large distance

- Wind diverged in cyclonic direction (clockwise)

- Dry air with few clouds

Convergence Divergence

Jet stream

T R O U G H

R I D G E

Flow aloft

H

L

Cyclonic flow

Anticyclonic flow

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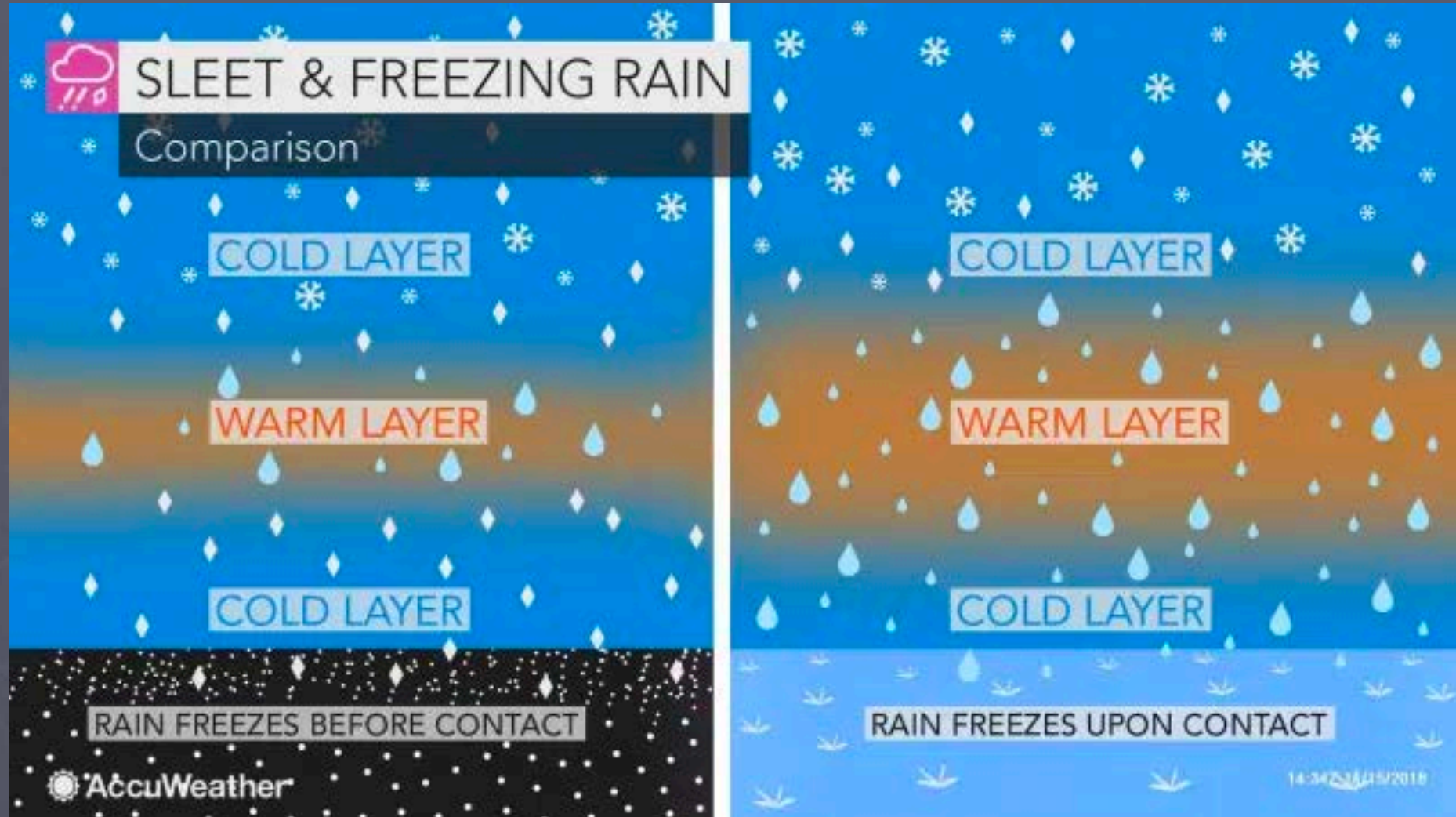
Precipitation – Snow and Rain

Snow

Temperatures consistently below freezing from clouds to ground (or very near ground)

Rain

Temperatures consistently above freezing from clouds to ground (or warm enough to thaw before reaching ground)
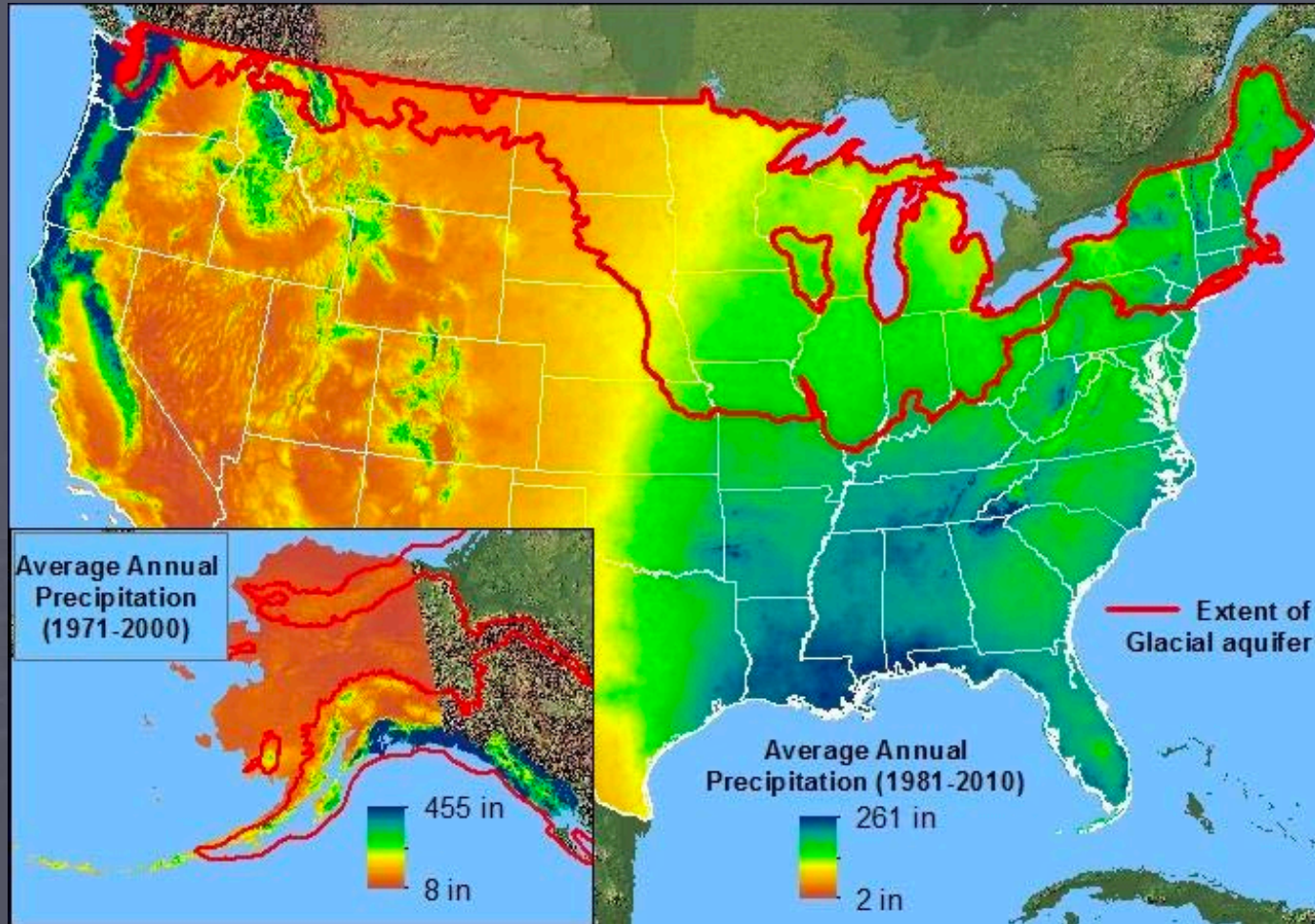
Precipitation - Sleet and Freezing Rain

Precipitation – Sleet and Freezing Rain

Average Annual Precipitation (1981-2010)

Annual Snow Averages