

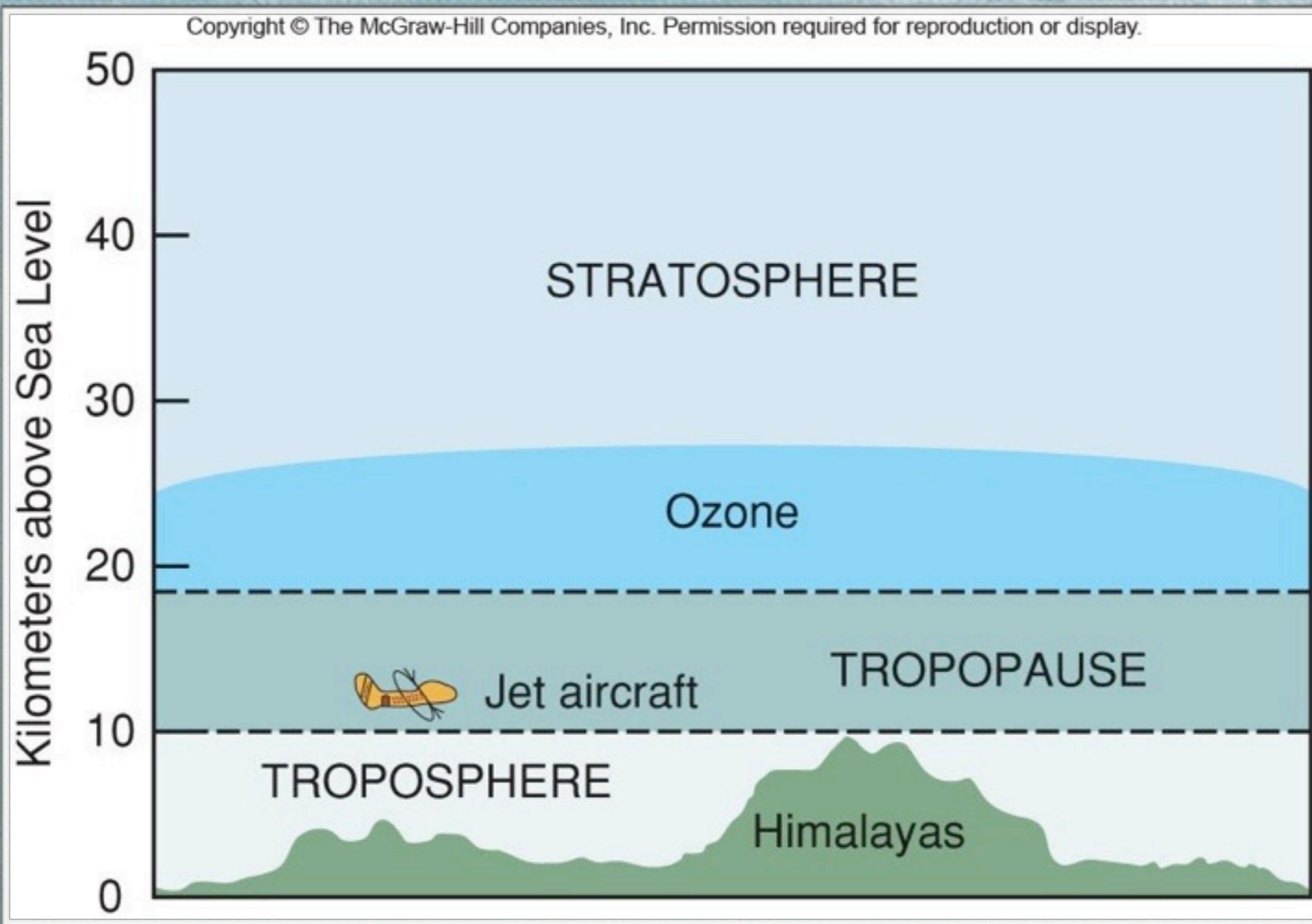
Weather and Climate

GEH 101/GEH 501: Introduction to Geography, Fall 2010

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Weather vs. Climate

- ◆ **Weather:** Atmospheric conditions at a **given time and place**
- ◆ **Climate:** Typical (long-term) weather conditions in a place
- ◆ Virtually all **weather** occurs in the **troposphere**
 - ◆ It is the atmospheric layer closest to the Earth's surface
 - ◆ Contains virtually all of the clouds, air, and precipitation



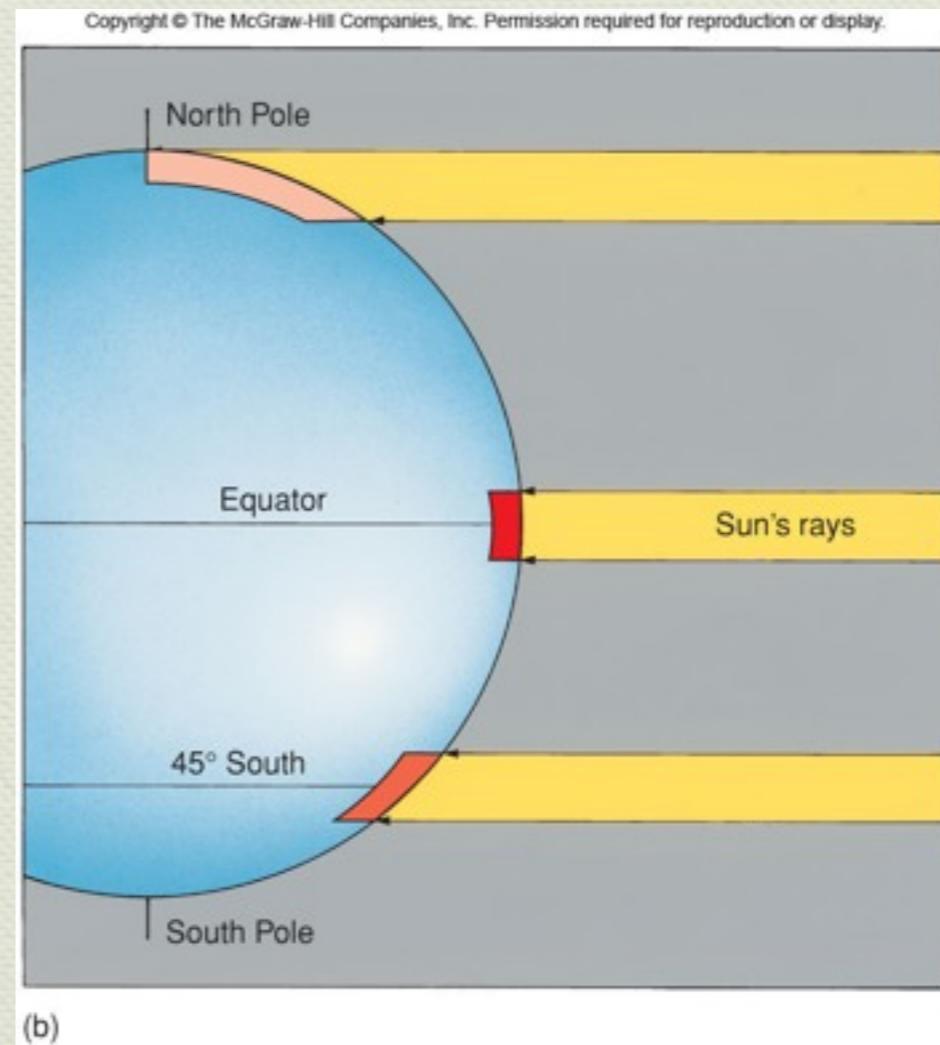
Atmospheric Layers

Air Temperature

- ◆ Varies by latitude:
 - ◆ **equator=hot**
 - ◆ **poles=cold**
 - ◆ **everywhere else (temperate regions)=in between**
- ◆ But why?

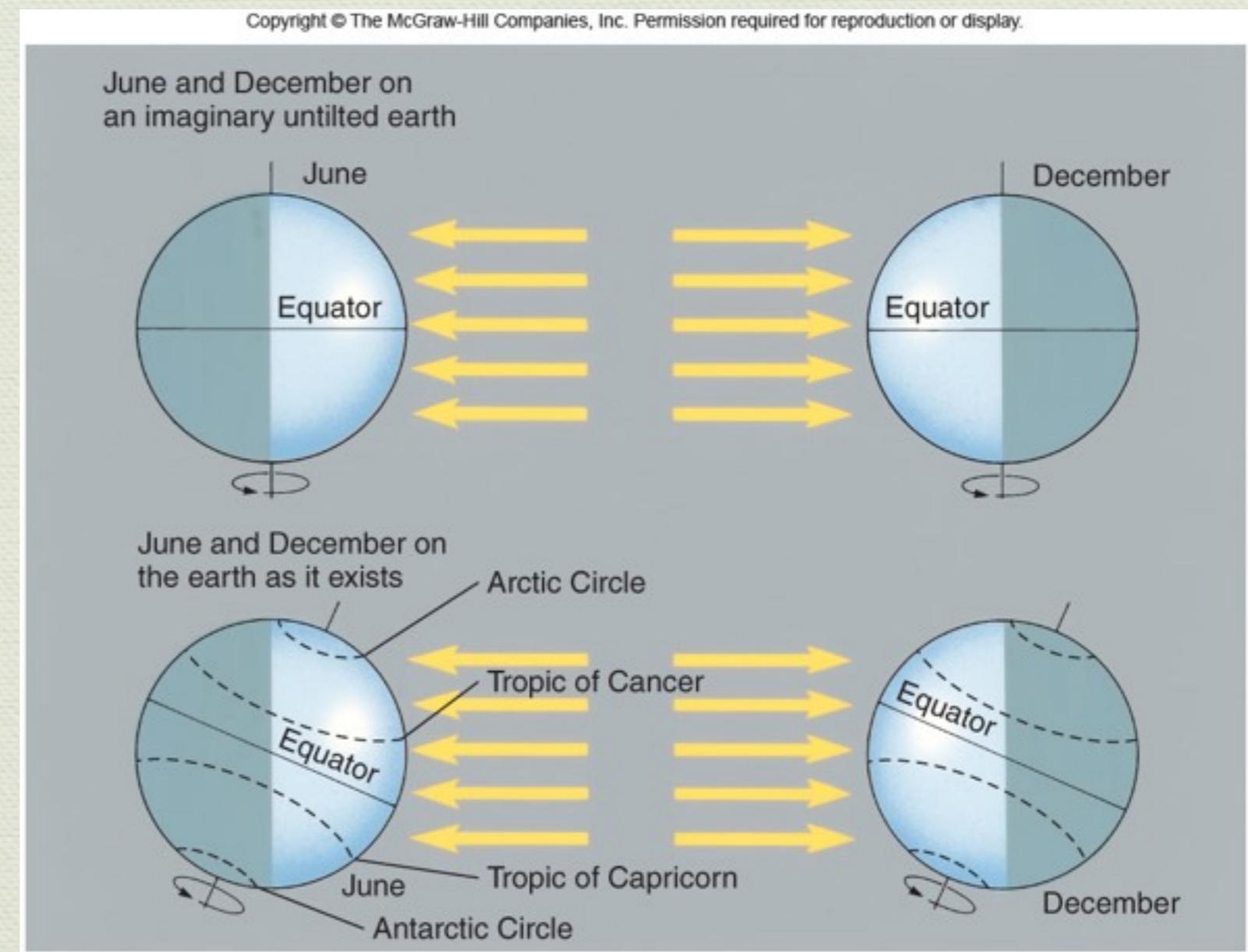
Insolation

- ◆ Incoming **solar radiation**: the amount of sunlight in a place
- ◆ Based on the Earth's elliptical orbit, inclination, rotation, and spherical shape
- ◆ Spherical shape: angle of incidence decreases as you approach the poles
 - ◆ same energy spread over larger area (cosine)



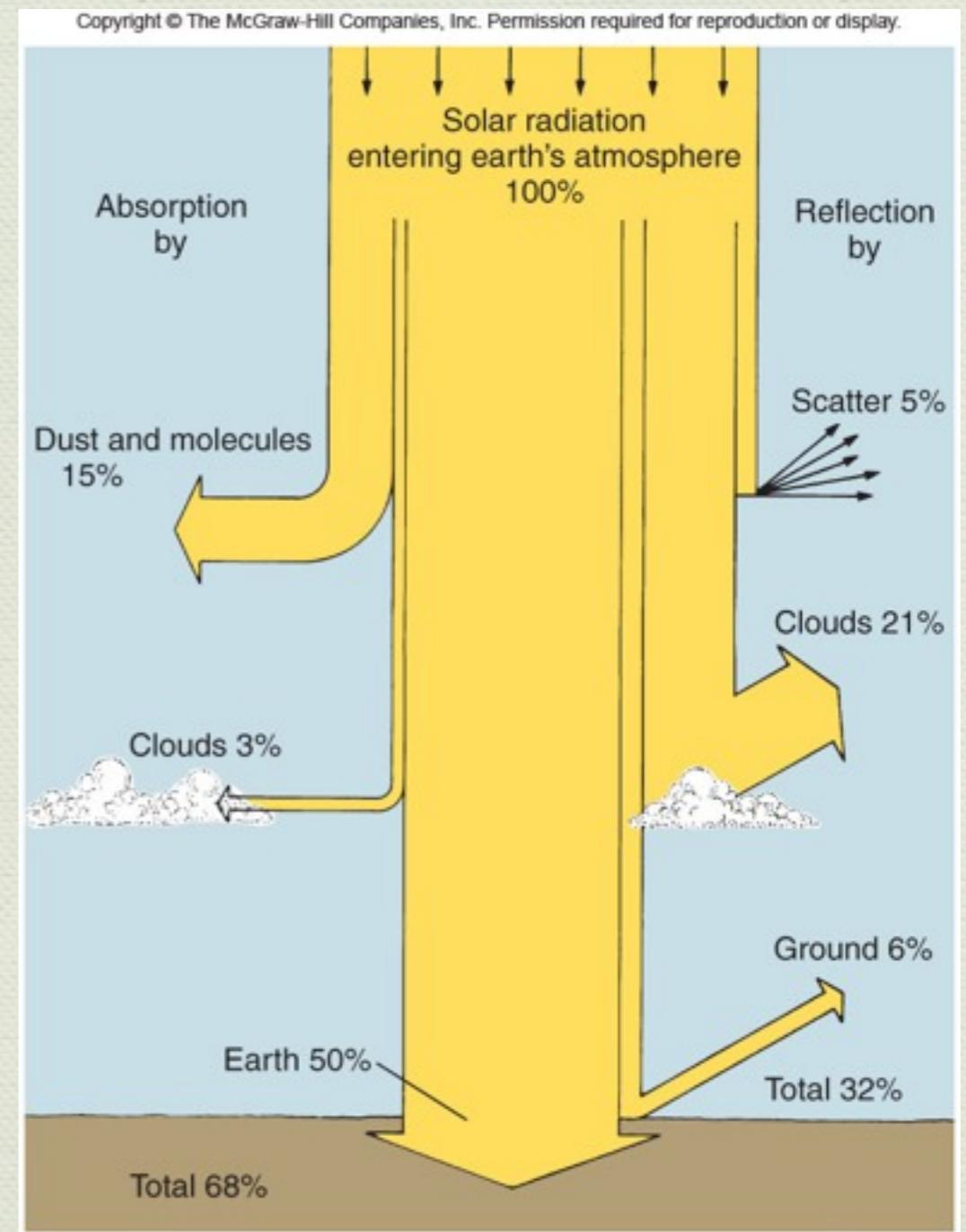
Insolation & Inclination

- ◆ Axis Tilt: causes seasons due to angle of incidence and length of daytime
- ◆ Summer vs. Winter...
- ◆ Arctic / Antarctic Circles
- ◆ Psychological Effects...S.A.D.



Reflection and Reradiation

- ◆ Reradiation: light (short wave) radiation absorbed and converted to heat (long wave) radiation
- ◆ Solar radiation is easily stored and dispersed by water due to its transparency and large heat capacity
- ◆ Solar radiation that hits the ground is concentrated on the surface so temperatures fluctuate to greater extremes; heat not stored
- ◆ Large bodies of water near land help regulate temperatures: marine environments (vs. continental environments)

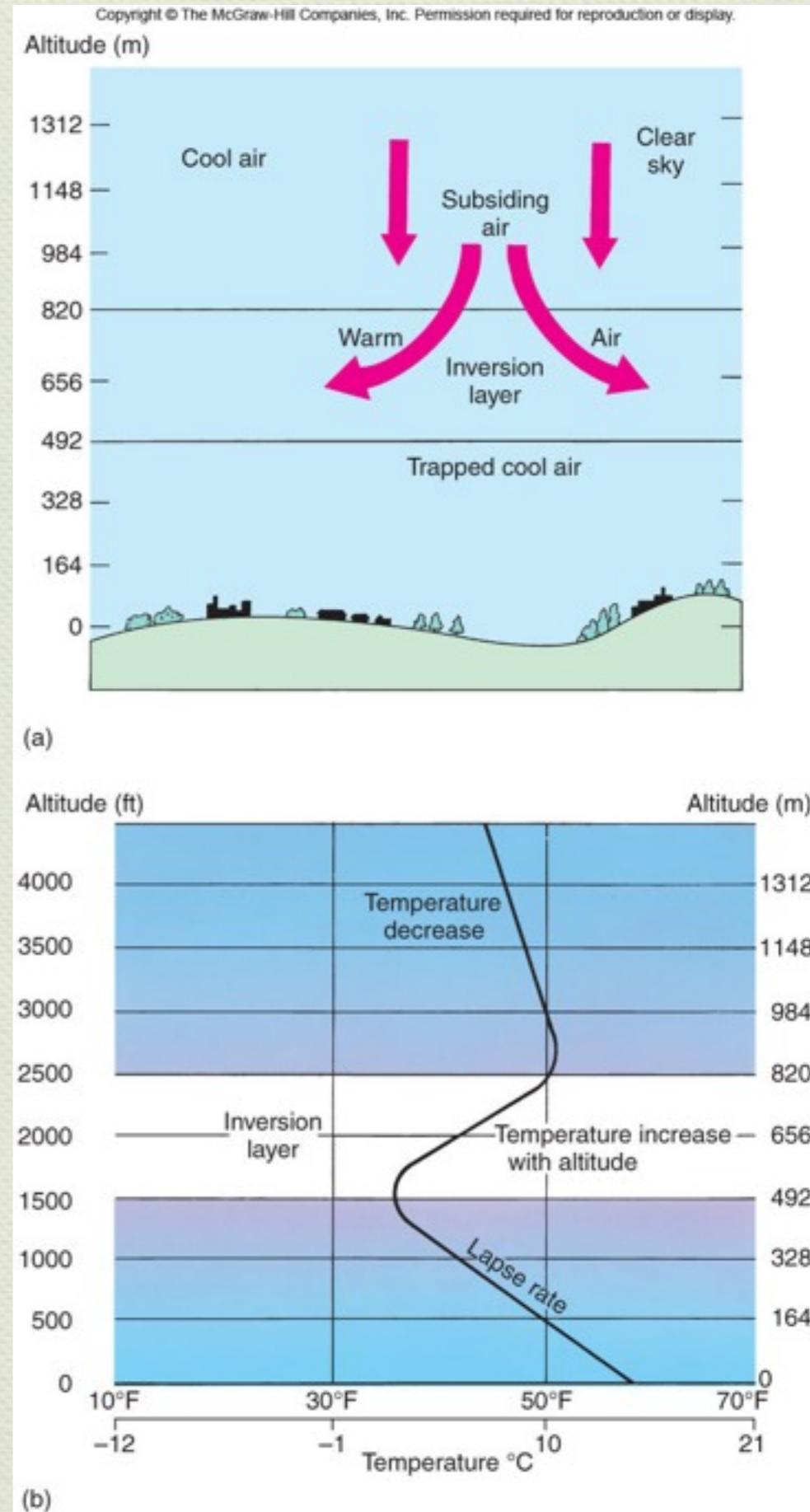


Air Temperature Modifiers

- ◆ Solar insolation
- ◆ Amount of water vapor in the air
- ◆ Cloud cover
- ◆ Physical surface features of the Earth
- ◆ Elevation
- ◆ Direction and velocity of air movement

Lapse Rate

- Temperature decreases as altitude increases due to reradiation of heat from the Earth's surface
- Inversion: warm air traps cooler air like a cap
 - Often caused by warm front moving over cold front or when radiation exceeds heating from sun
 - Smog and thunderstorms

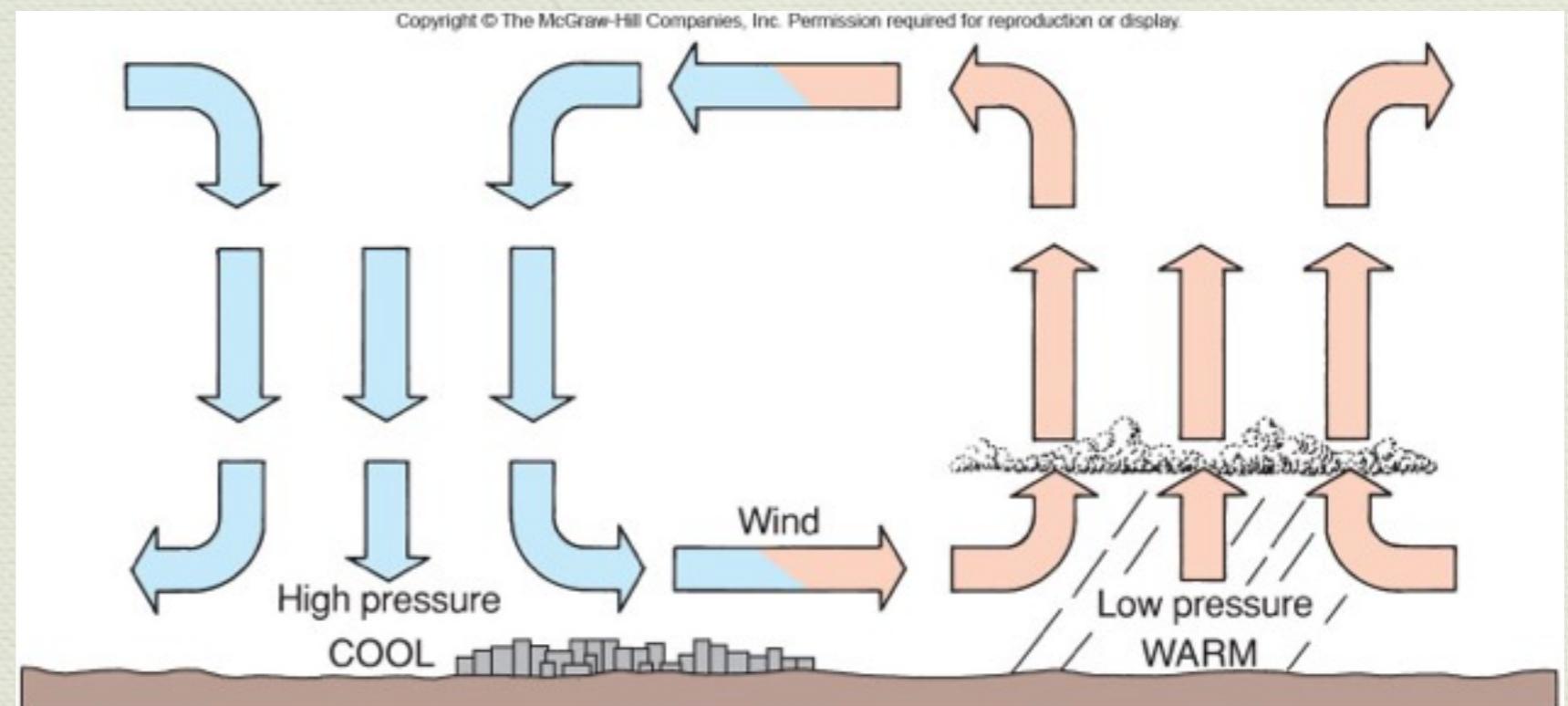


Air Pressure

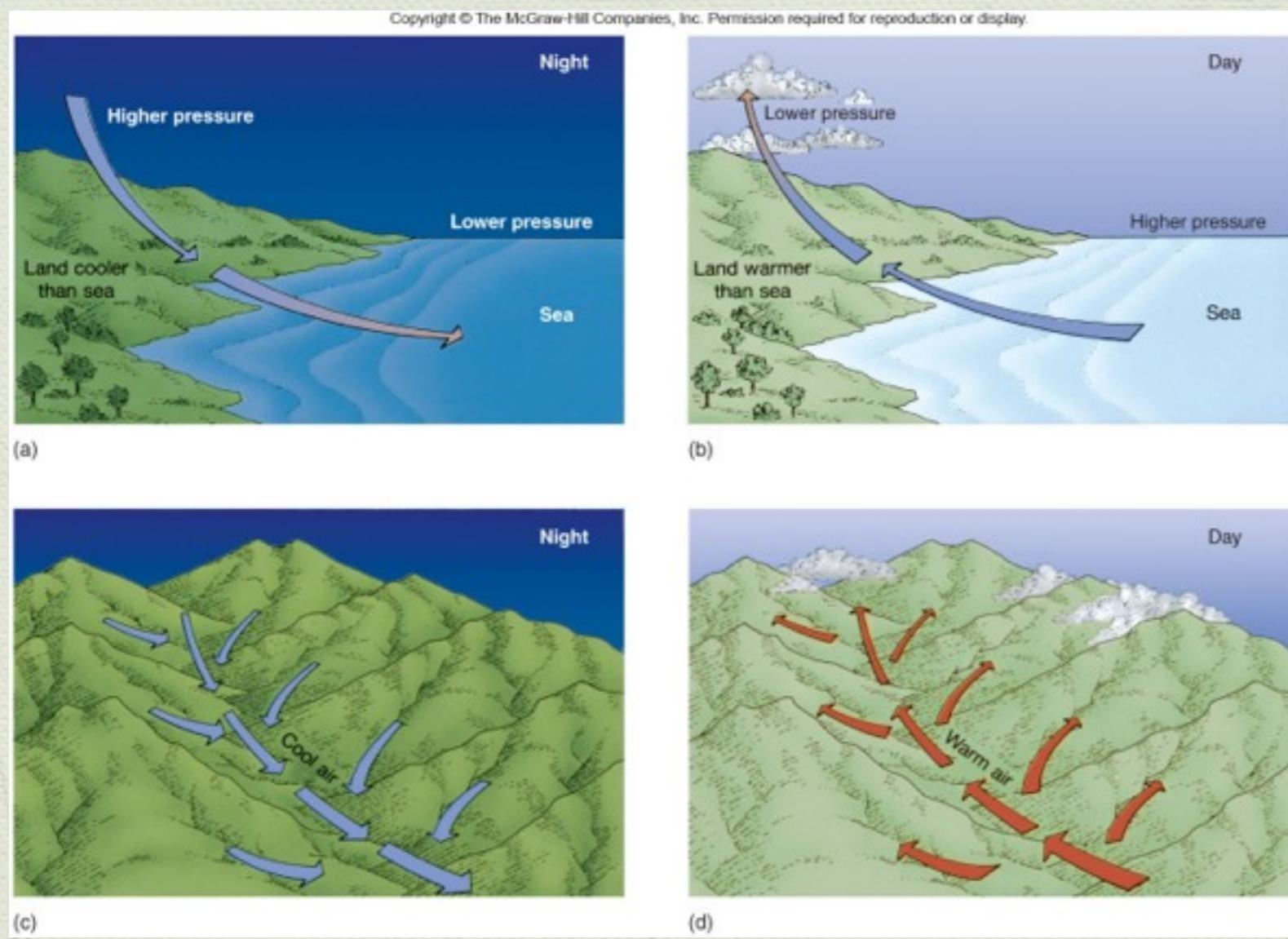
- ◆ Air pressure: force caused by weight of the air due to gravity and temperature
- ◆ Increase elevation = less air above = lower pressure
- ◆ Colder air = **more dense** (more air per vol.) = **higher pressure**
- ◆ Warmer air = **less dense** = **lower pressure**
- ◆ Winds caused by differences in air pressure...

Wind: Temperature effects

- ◆ Wind blows from **higher** pressure to **lower** pressure
- ◆ Wind speed proportional to difference in pressure
- ◆ Convection currents: **warm air rises**, **cool air sinks**



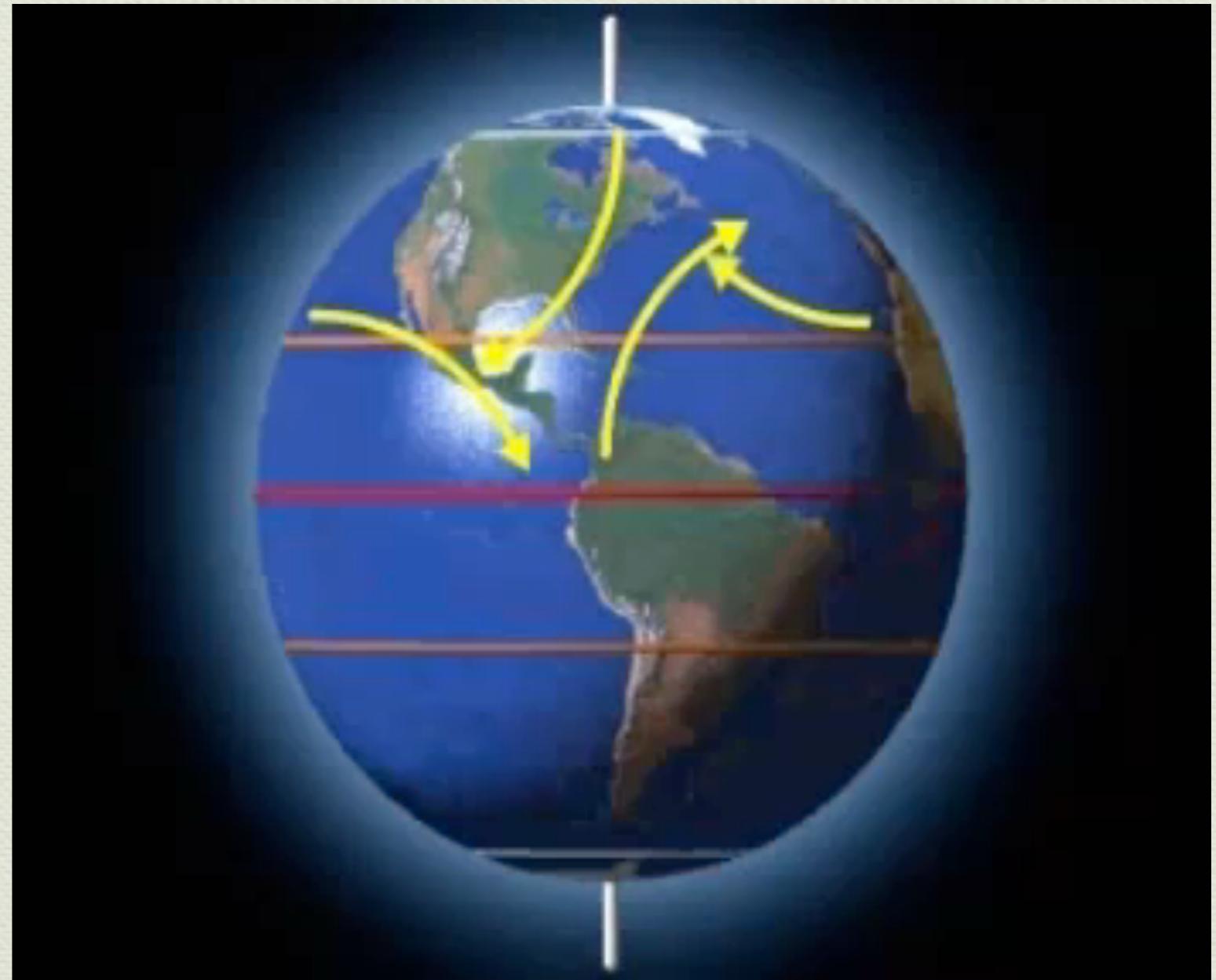
Wind: Daily localized patterns



- ◆ Land/Sea breeze:
sea maintains temp
while land warms/
cools
- ◆ Mountain/Valley
breeze: valley heats
up quickly,
mountains cool
quickly

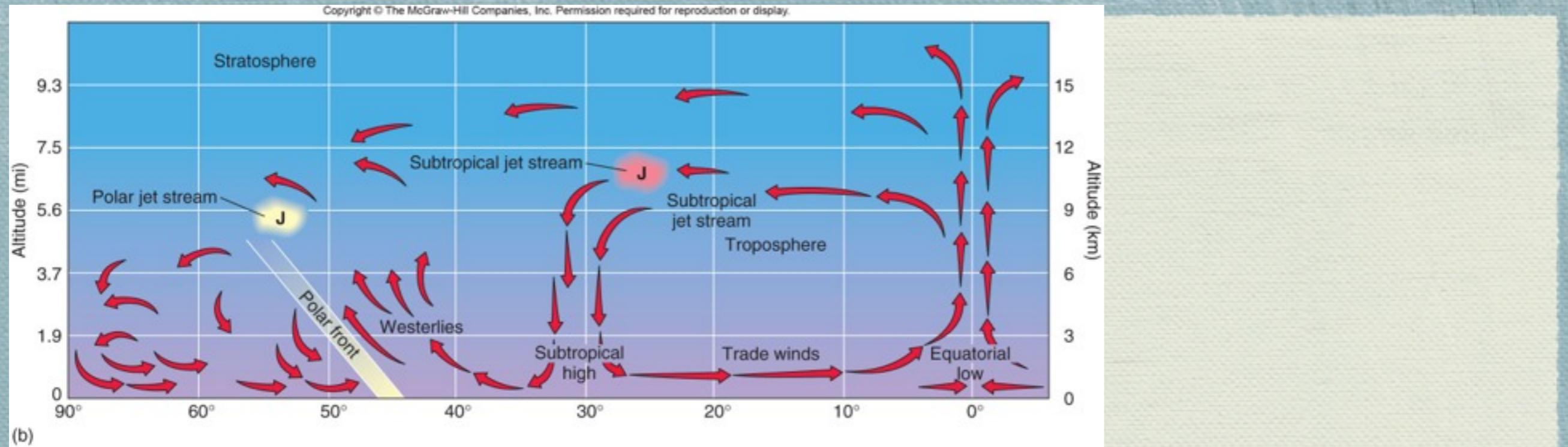
Coriolis Effect & Friction

- ◆ Earth rotation causes winds to deflect relative to surface
- ◆ Frictional effects of Earth's surface “drag” wind
- ◆ similar to baseball pitches

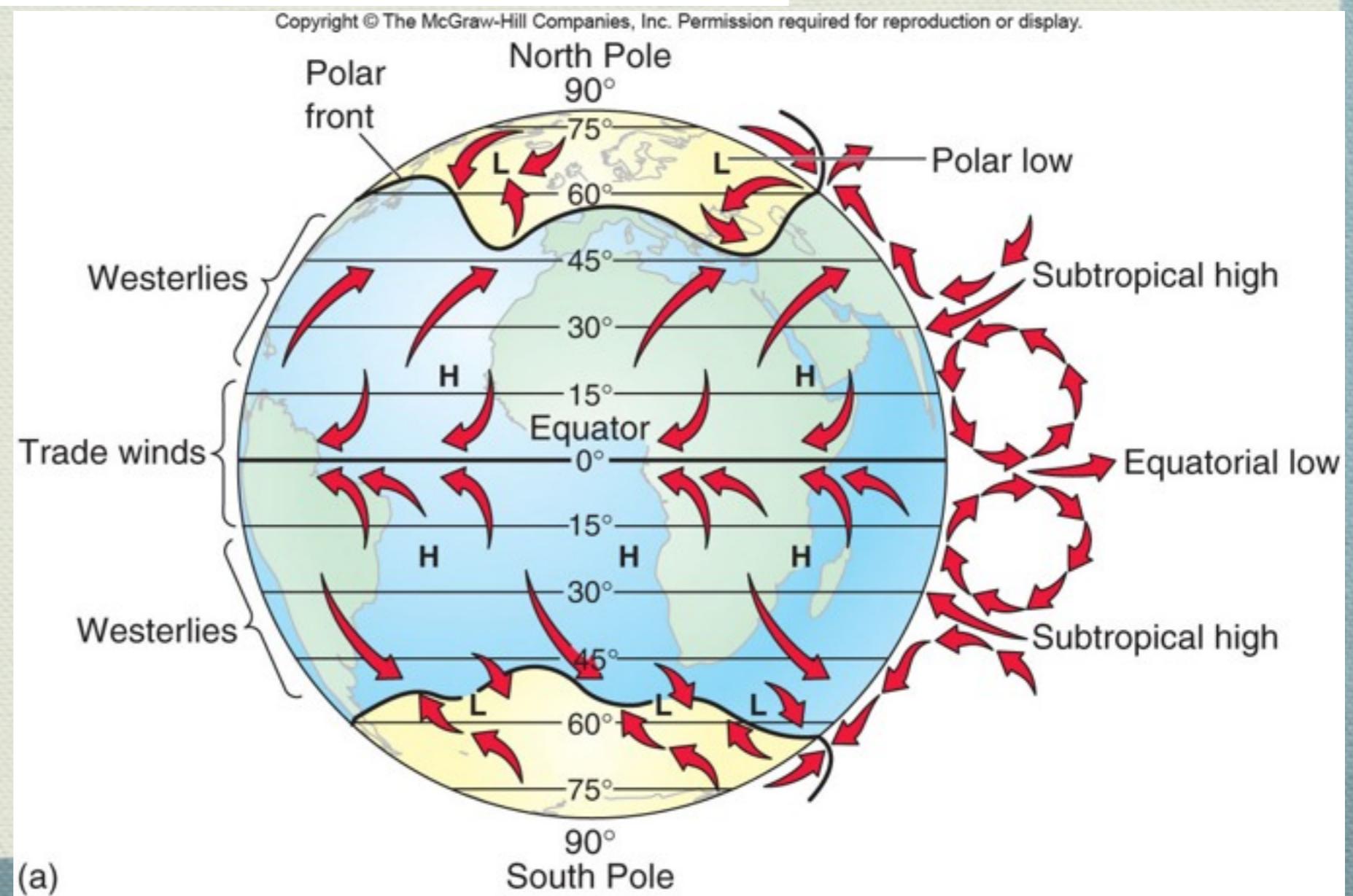


Global Air Circulation

- ◆ Global differences in insolation cause global air pressure differences
- ◆ Equatorial lows = hotter = low pressure belt
- ◆ Subtropical highs = cooler = high pressure ridge
- ◆ Tradewinds and westerlies
- ◆ Monsoons: seasonal winds that bring wet/dry weather



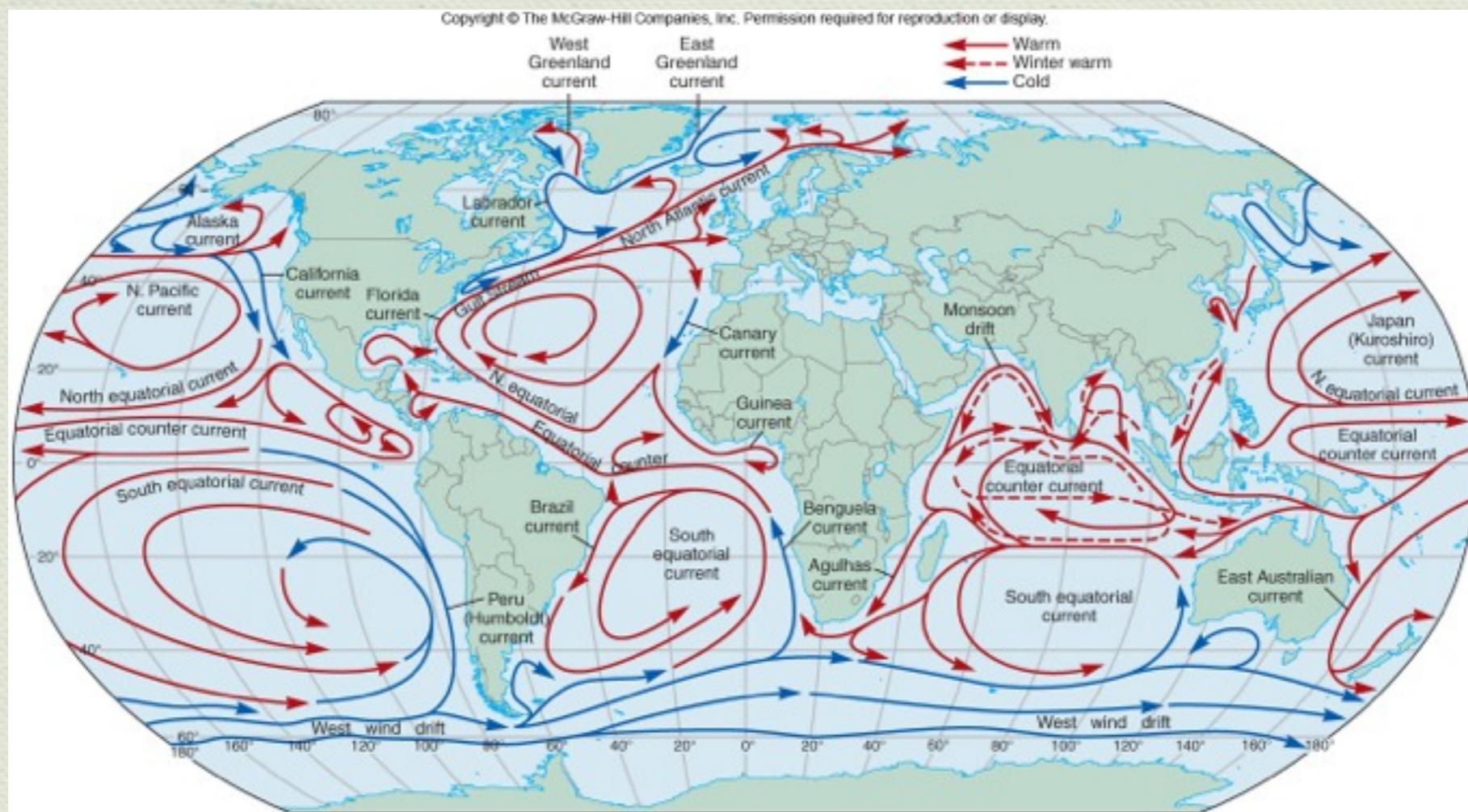
(b)



(a)

Ocean Currents

- ◆ Water temperature and wind currents
- ◆ Impact coastal weather

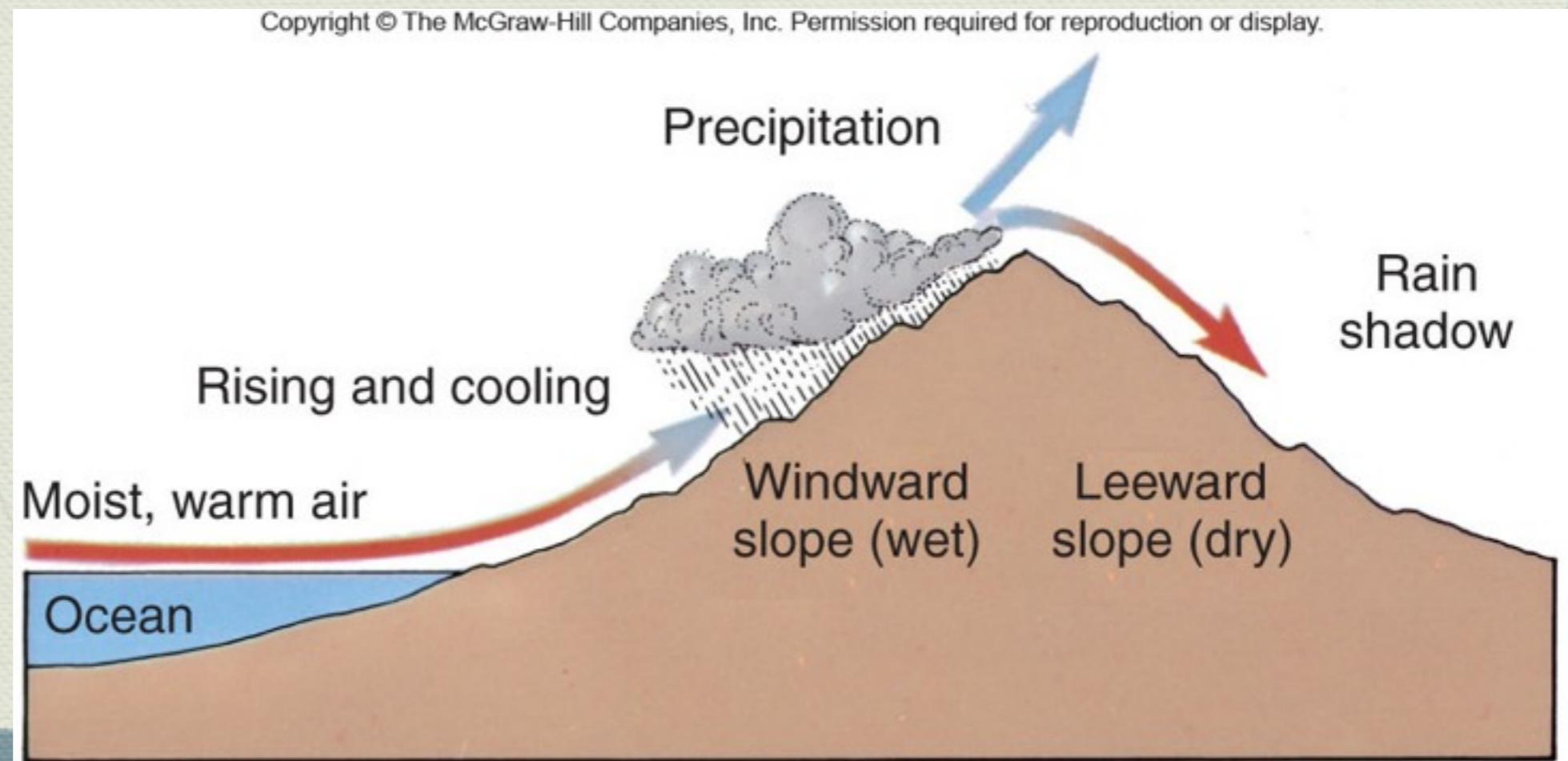


Moisture in the Atmosphere

- ◆ Rising air expands due to lower air pressure
- ◆ As air expands and rises it cools ($PV=nRT$)
- ◆ Cooler air can hold less water (lower saturation point)
- ◆ When temperature drops below dew point, excess water vapor condenses into droplets
- ◆ Droplets suspended by air movement form clouds
- ◆ Droplets too heavy for air resistance fall as precipitation

Types of Precipitation

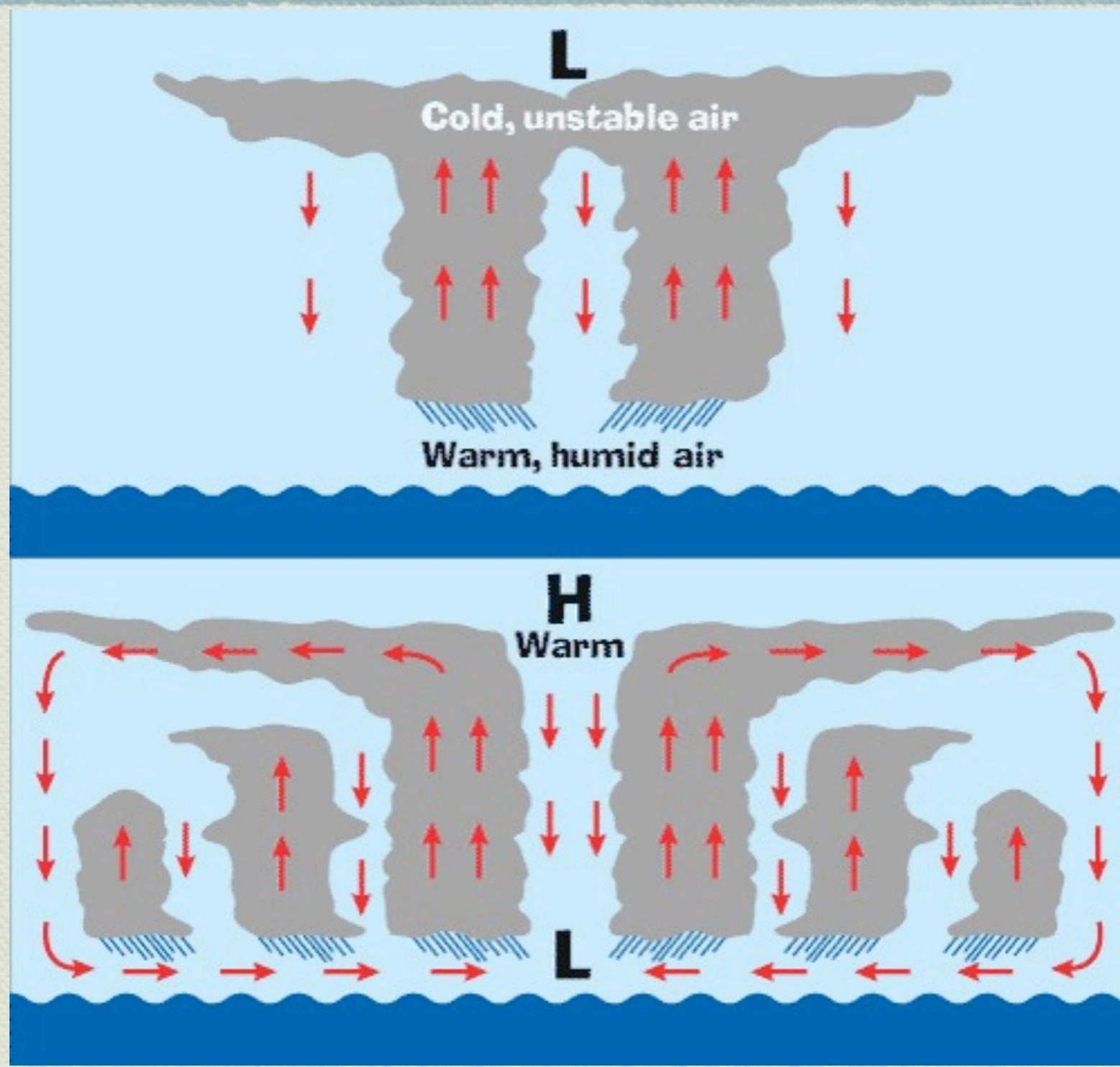
- Convectional: warm, moisture-laden air rises and T drops below dew point (saturation temperature)
- Orographic: warm, moisture-laden air forced over mountains causing it to cool
- Cyclonic: warm front hits a cold front and the warm front moves over the cold front



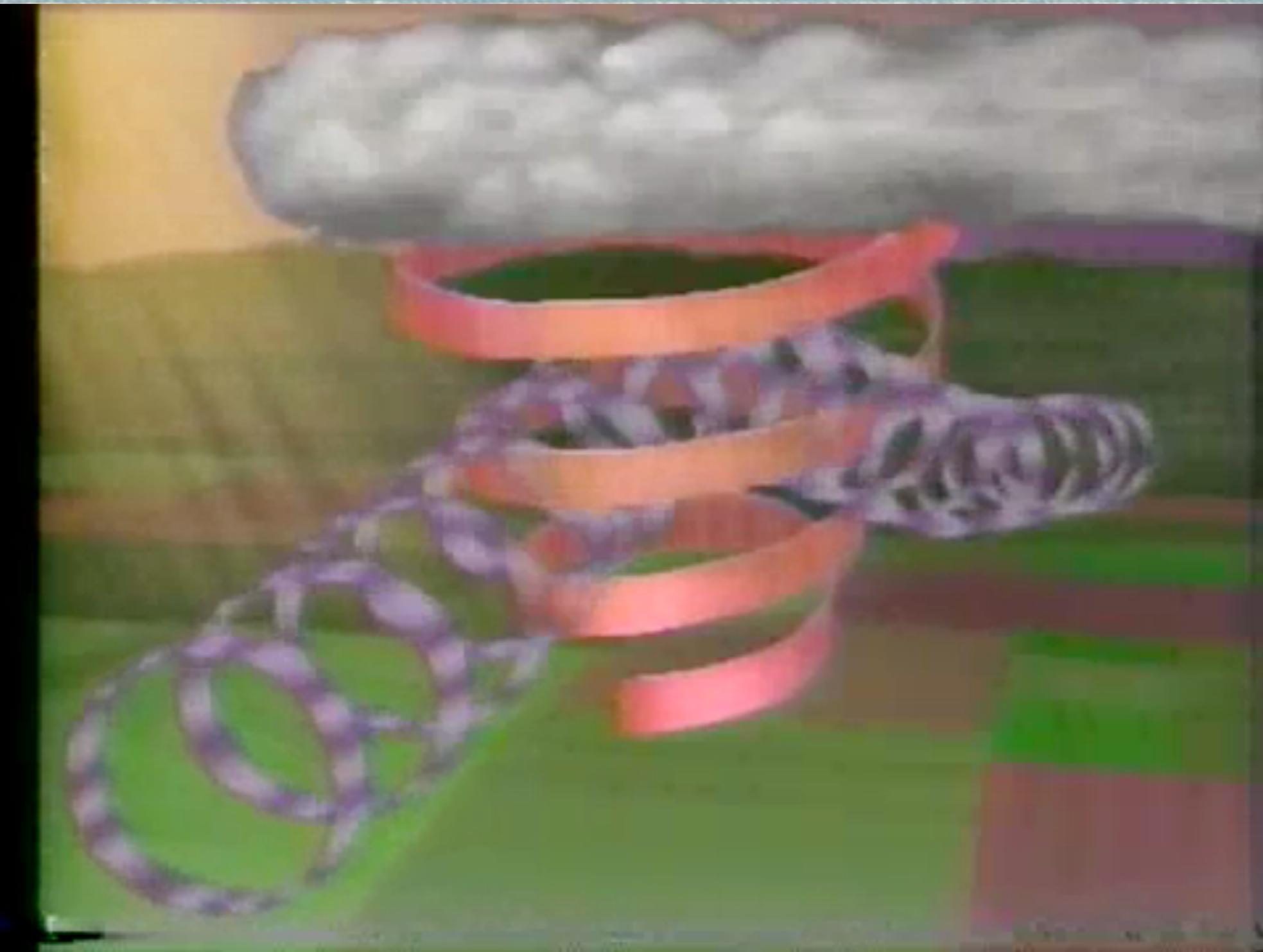
Cyclones, Hurricanes, Typhoons



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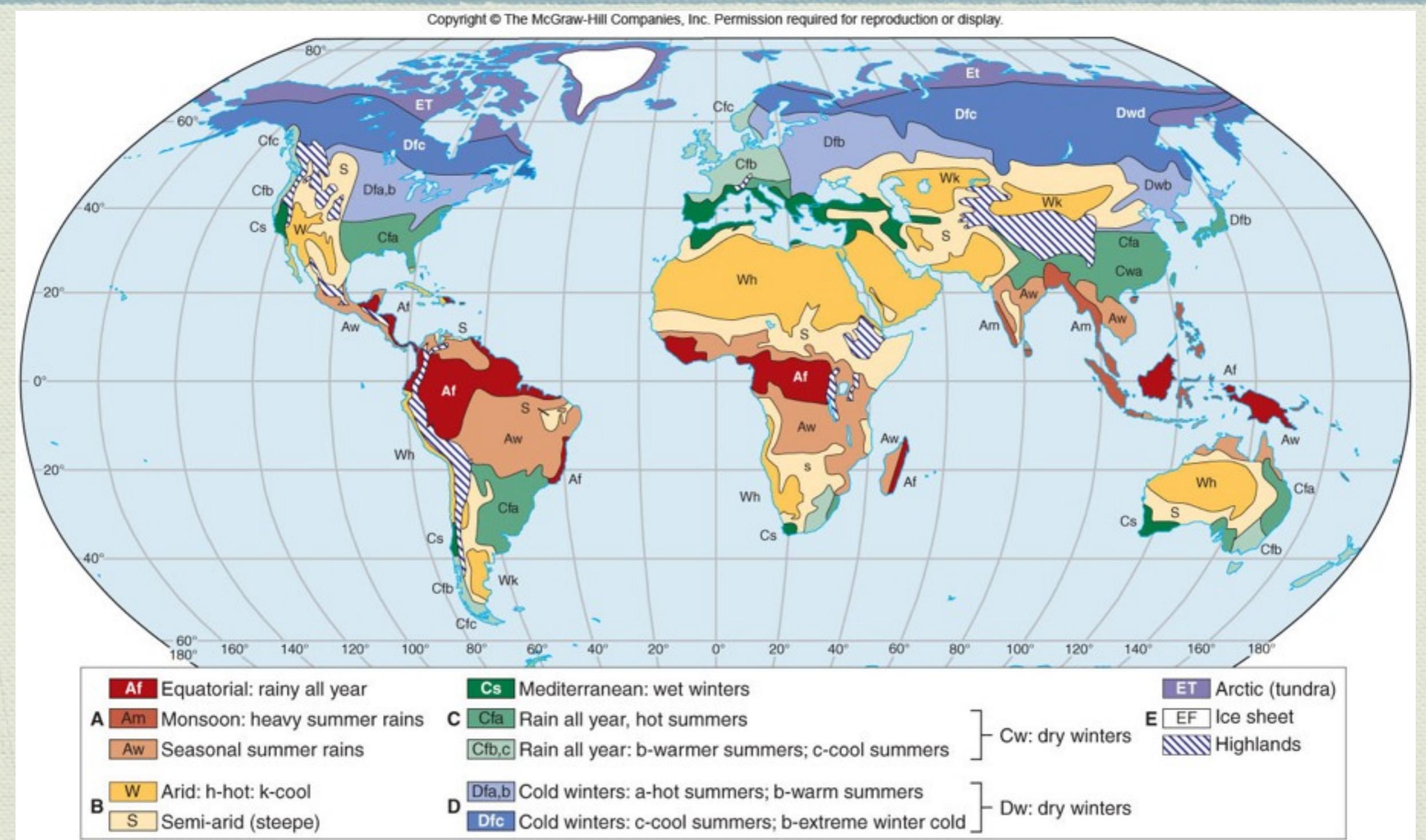
Tornadoes



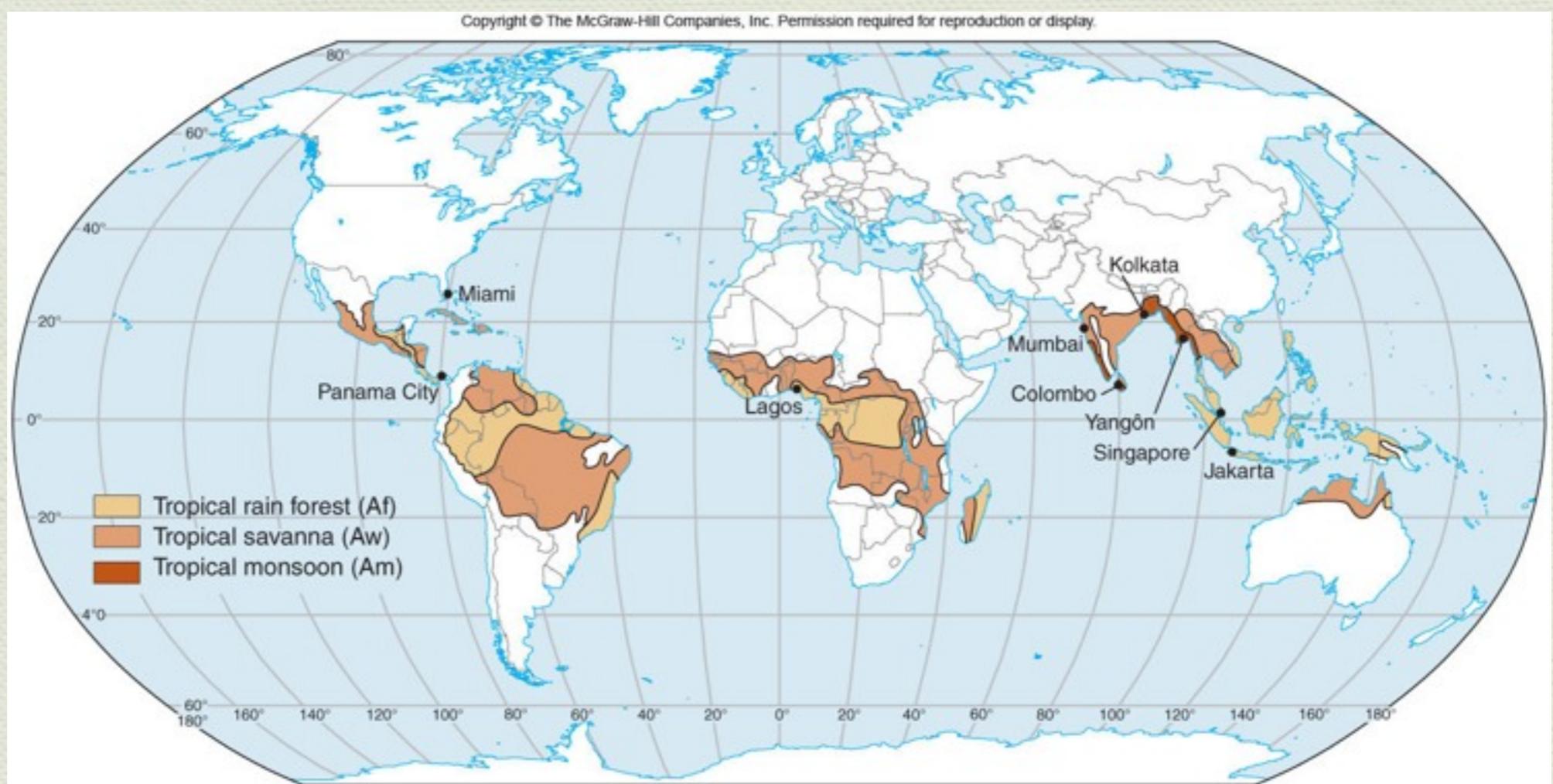
Climate Regions

- ◆ Climate: seasonal and annual weather conditions
- ◆ Primarily defined by temperature and precipitation
- ◆ Köppen system: vegetation, temperature, precipitation
 - A. tropical
 - B. dry
 - C. mild midlatitude
 - D. midlatitude with cold winters
 - E. polar
 - F. highland

Köppen Climate Classification



Tropical Climates

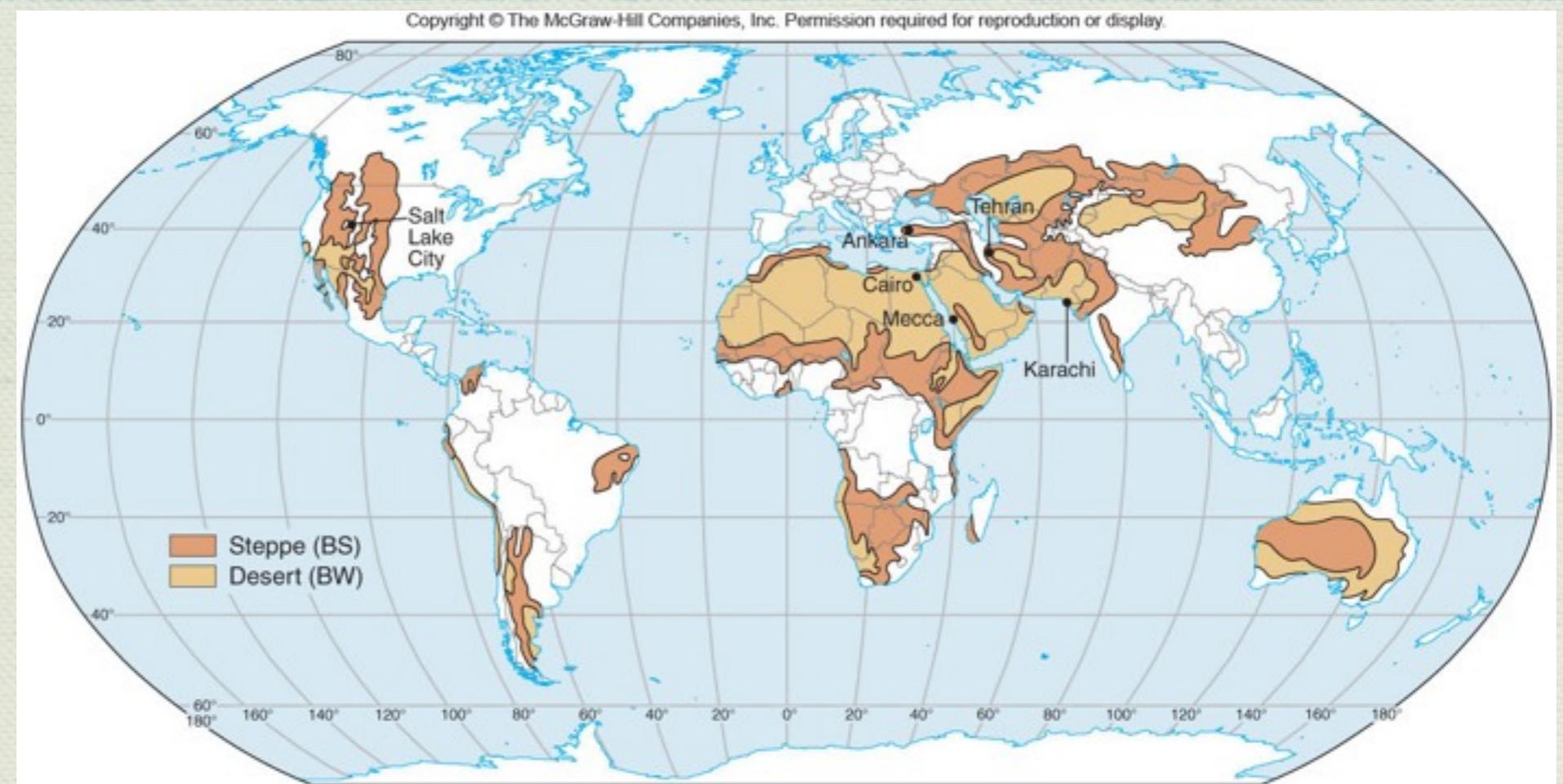


◆ Hot

◆ Humid

◆ Dense vegetation

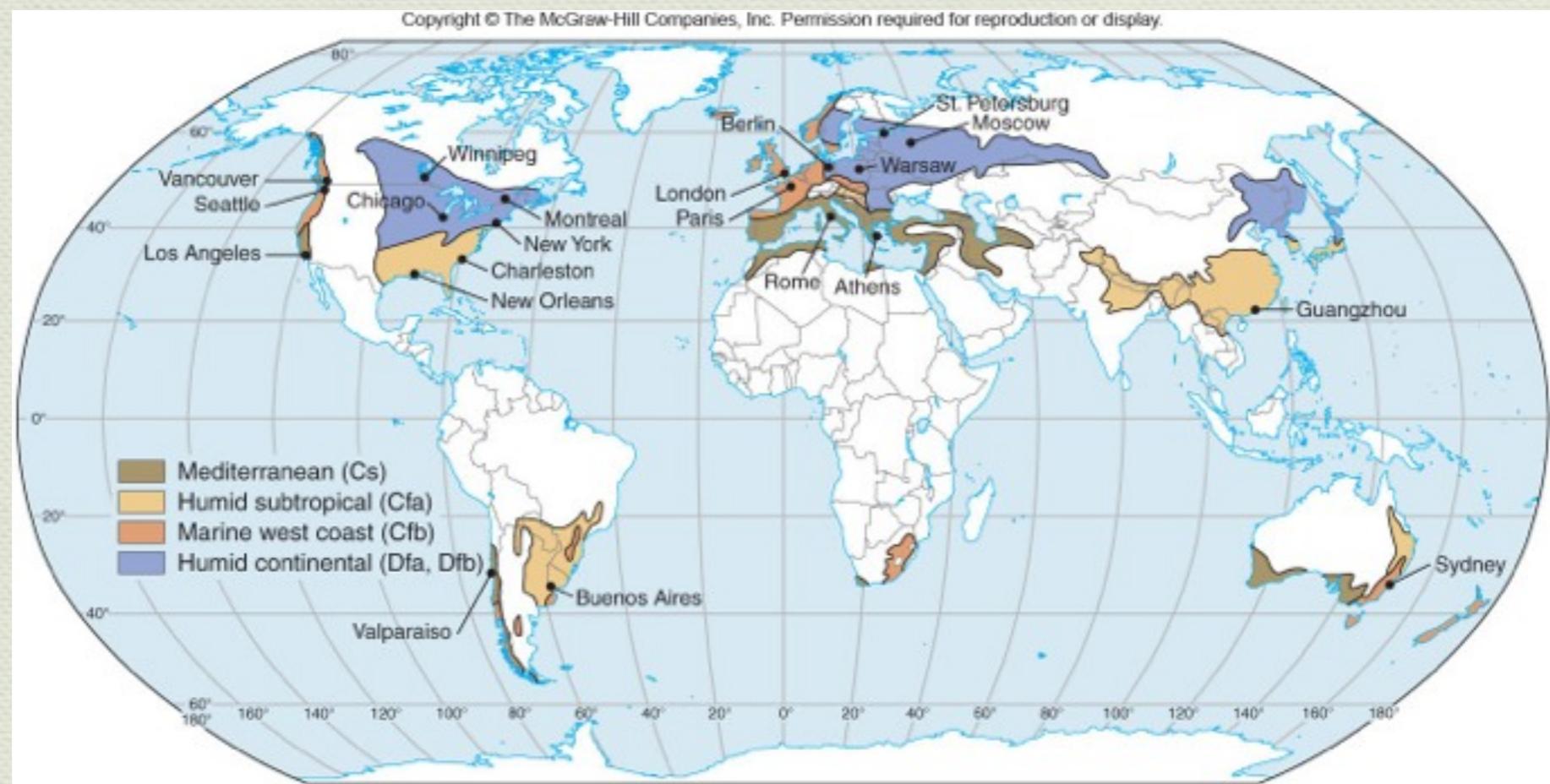
Dryland Climates



- ◆ Hot/Dry or
- ◆ Moderate (seasonal) temperature and rainfall
- ◆ Steppes: shrubs and grasses

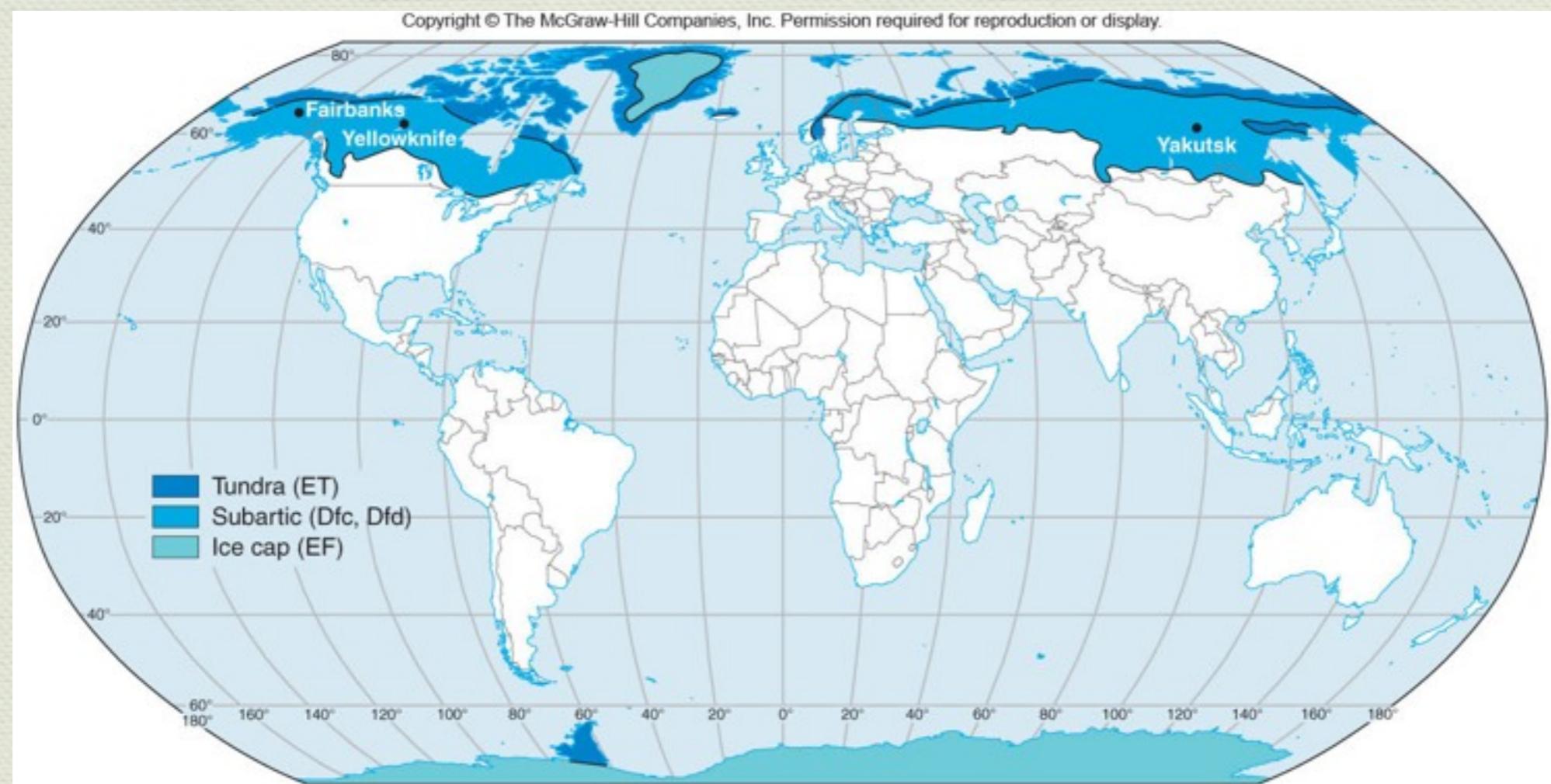
Humid Midlatitude Climates

- ◆ Warm to hot summer, cold to moderate winter
- ◆ Humid and rainy to dry summers, precipitation in winters
- ◆ Deciduous trees, shrubs, conifers

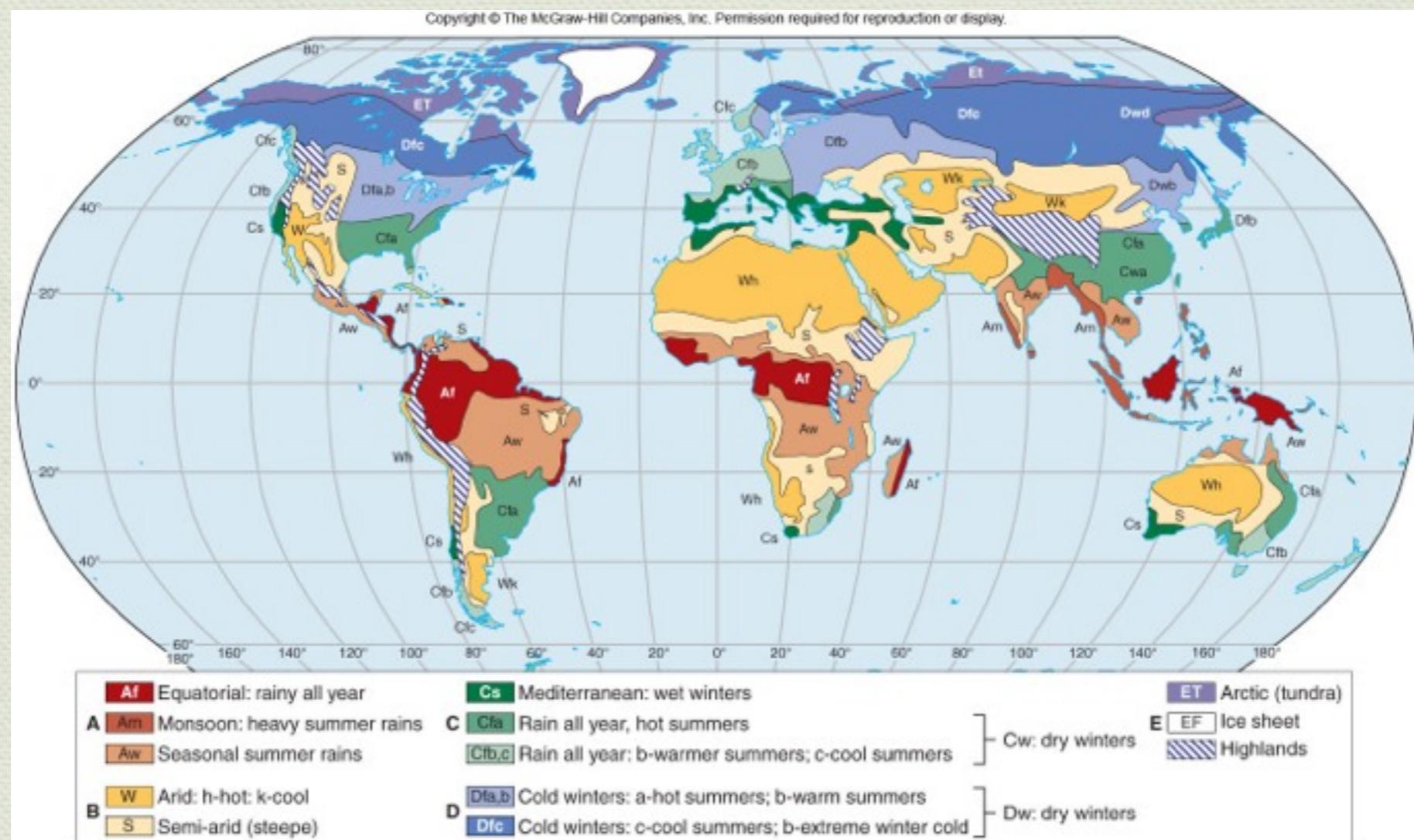


Arctic and Subarctic Climates

- ◆ Cool to very cold
- ◆ Light precipitation
- ◆ Tundra to barren



Highland Climates



- ◆ Lower temperatures
- ◆ Varied conditions depending on location and mountain features

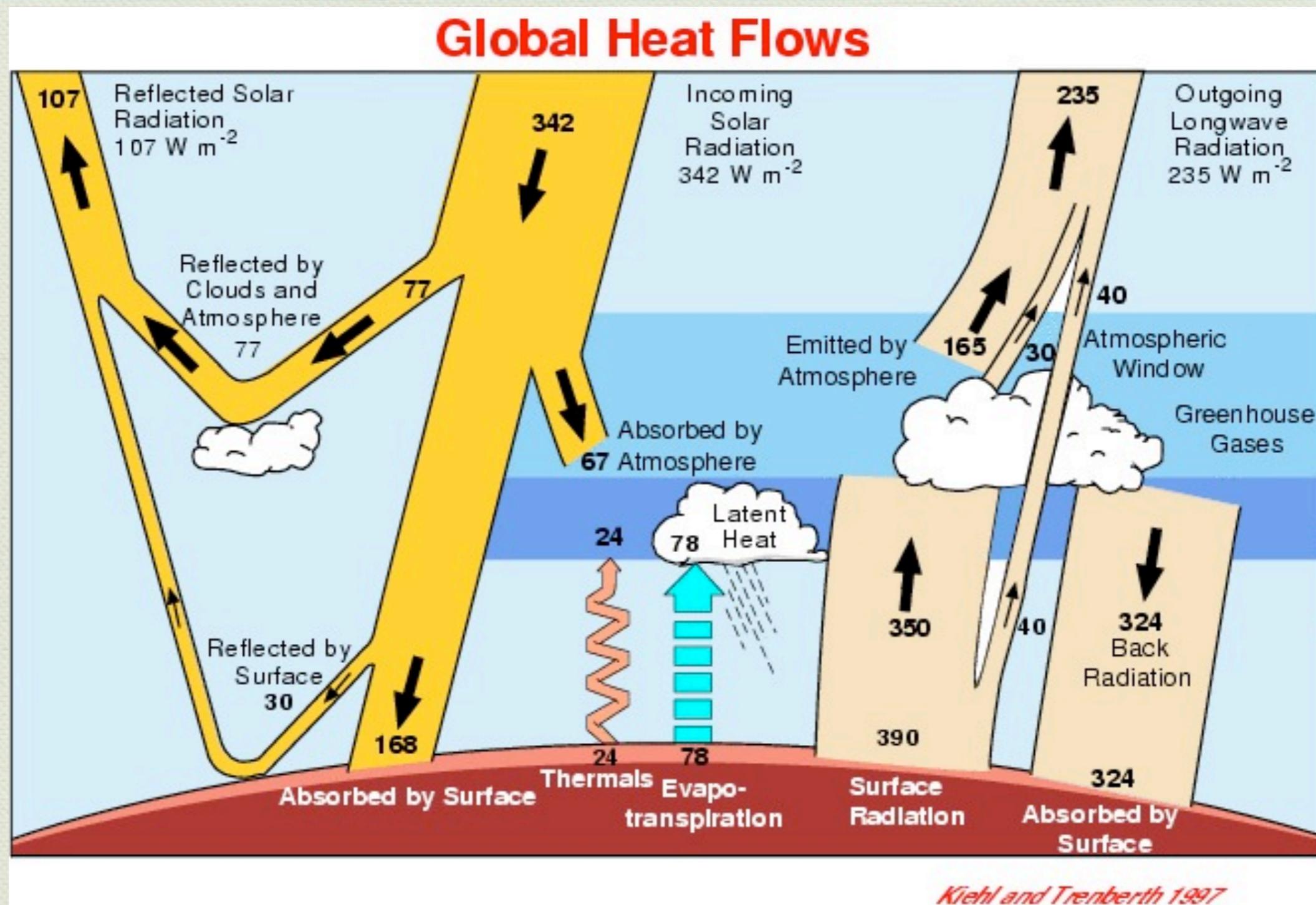
Climate Change

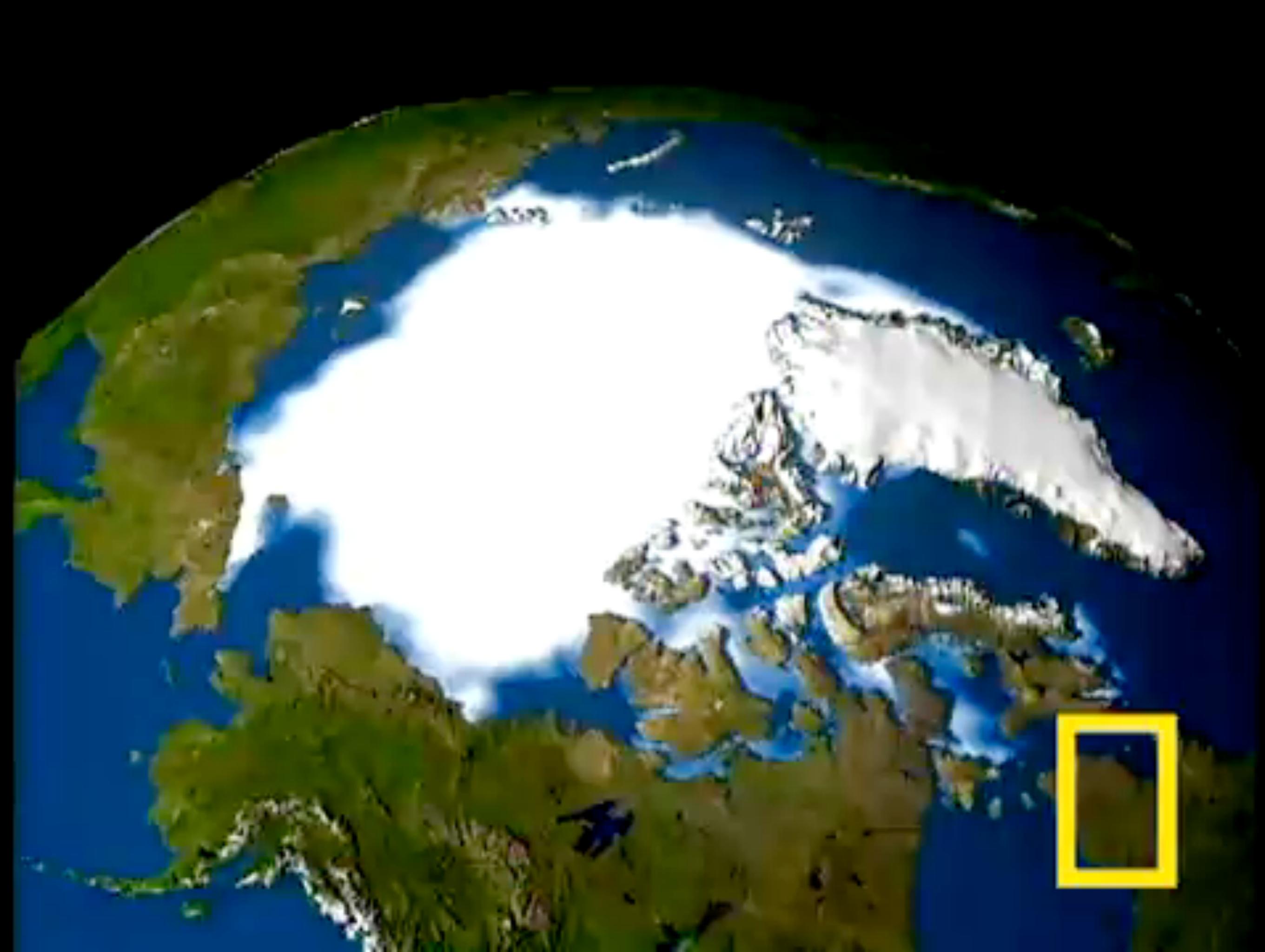
- ◆ Long term (geologic time)
 - ◆ Atmospheric conditions
 - ◆ Earth's tilt
 - ◆ Elliptical orbit
- ◆ Short term (human time)
 - ◆ Volcanoes
 - ◆ Asteroids
 - ◆ Atmospheric conditions?



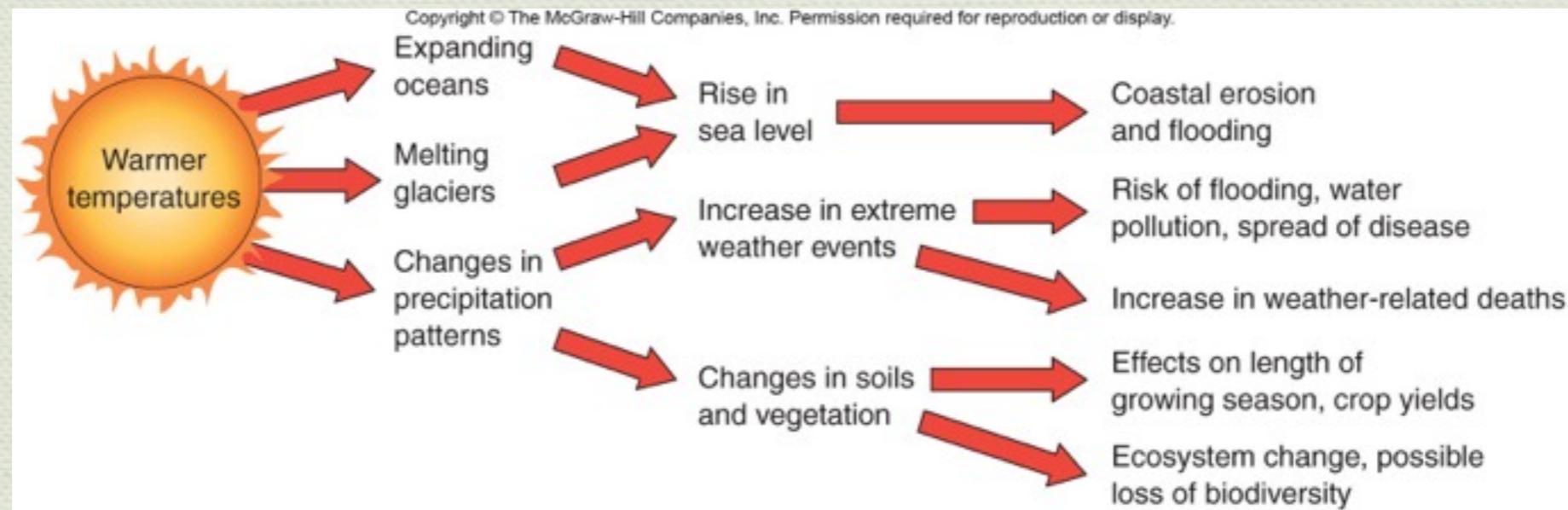


Greenhouse Effect





Global Warming



Quiz

Research Papers

- ◆ Describe your topic in 1-2 sentences.
- ◆ Explain the geographic nature of your topic and why geographic thinking might inform your understanding of the topic.
- ◆ What is the time and place in which it is situated?
- ◆ What are some physical and social characteristics of the place(s) and time(s) in which it is situated?
- ◆ What types of information sources are appropriate for this topic?