

# The Troposphere and Weather

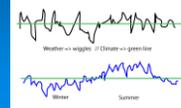
## Difference Between Climate & Weather

### Weather is...

- Short term
- Day-to-day state of the atmosphere
- A temporary condition—today the weather is \_\_\_\_\_
- Meteorology

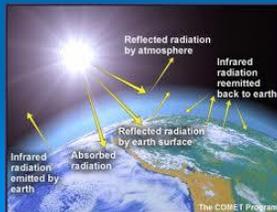
### Climate is...

- Long term
- Periodic
- Cycles in regular, predictable (or at least expected) patterns
- Summer, spring, etc.
- Climatology



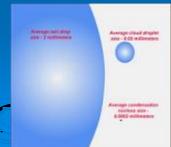
## Factors That Influence Weather

- Atmosphere:
  - Greenhouse effect
  - Water cycle
  - Winds and air mass collisions

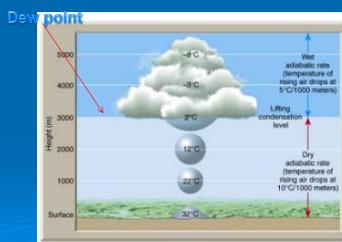
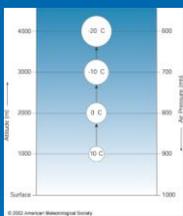


## Interrelation Between Water Cycle & the Atmosphere

- Cloud condensation nuclei—small particles on which cloud droplets condense
  - Natural: Dust storms, volcanic eruptions, pollen, sea salt, respiration, combustion particles (fire)
  - Anthropogenic: combustion particles
- Clouds (water vapor) absorb infrared radiation
- Thick clouds reflect solar radiation (albedo)
- Evaporation cools surfaces

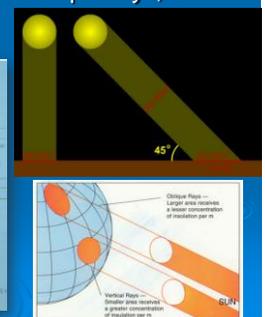
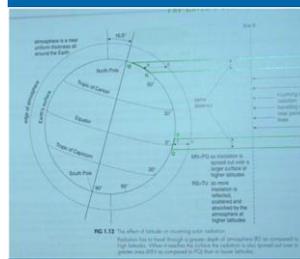


## Cloud & Precipitation Formation



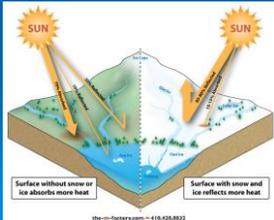
## Factors That Influence Weather

- Latitude: Direct rays vs. oblique rays, snow creates albedo area



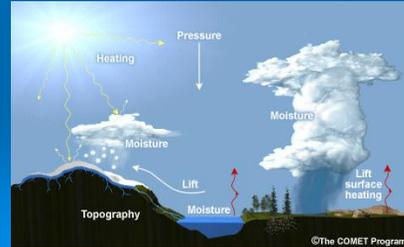
## Albedo

- Albedo is the fraction of sunrays that are reflected back into space
- More reflective surfaces = less retained/absorbed solar energy

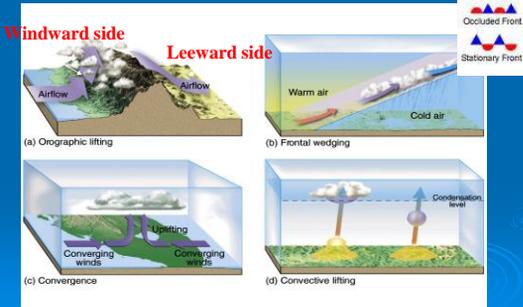


## Factors That Influence Weather

- Topography:
  - Uneven surface ultimately causes winds
  - rain falls on mountain sides closer to oceans

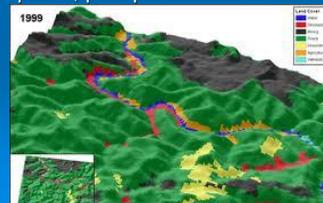


## Four lifting processes



## Factors That Influence Weather

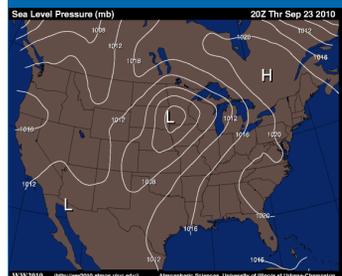
- Human Influence:
  - $\Delta$  in topography  $\rightarrow$  less trees  $\rightarrow$  less oxygen, water & more  $\text{CO}_2$
  - Burning fuels  $\rightarrow$  adds green house gases to atmosphere, puts particulates in atmosphere



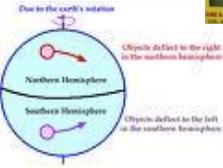
## Global & Local Wind Systems

- <http://www.youtube.com/watch?v=uBqohRu2RRk>
- Wind – caused by differences in horizontal air pressure (High to low)
- Uneven heating of earth's surface creates pressure differences
  - Solar energy basis of wind energy
- Wind controlled by
  - Pressure-gradient force
  - Coriolis force
  - Friction

## Pressure-gradient force



# Coriolis Effect on Horizontal Direction

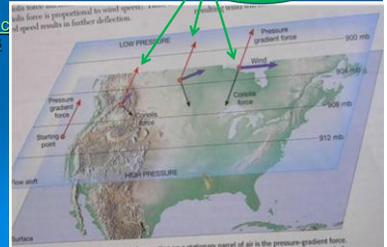


Degree of deflection due to Coriolis forces are stronger at higher latitudes and stronger winds.

# The Different Forces That Affect Winds

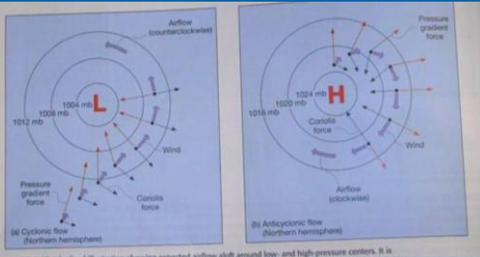
- Aloft air = Less friction
- Wind speeds increase until Coriolis force = pressure-gradient force
- <http://www.youtube.com/watch?v=aeY9tY9vKQs>
- Ultimately, winds travel parallel to isobars
- Steep pressure gradient = strong winds

P-G force causes winds to move perpendicular to force



- Circular isobars means winds follow circular path to be parallel to isobars
- Notice direction of L and H pressure system in Northern Hemisphere

Cyclone – Low Pressure center, winds travel to left (same as Earth's rotation)



# Notice the direction of wind of the two pressure systems.

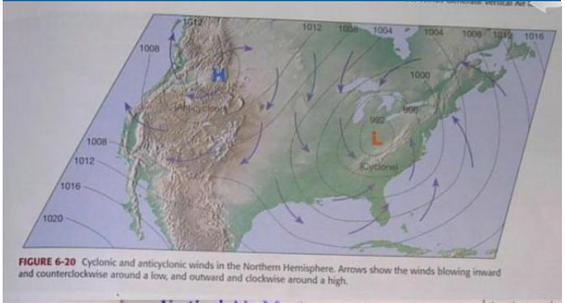


FIGURE 6-20 Cyclonic and anticyclonic winds in the Northern Hemisphere. Arrows show the winds blowing inward and counterclockwise around a low, and outward and clockwise around a high.

# Four lifting processes

Windward side

Leeward side

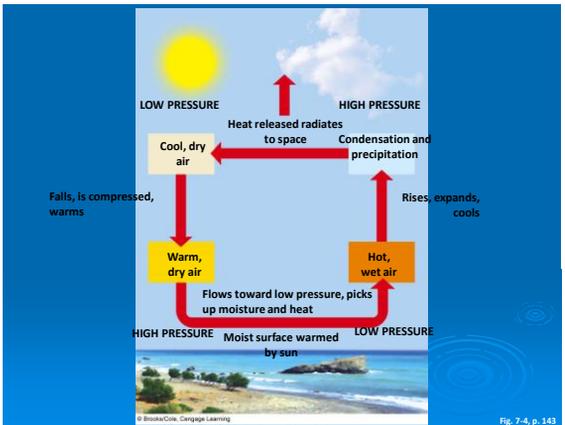
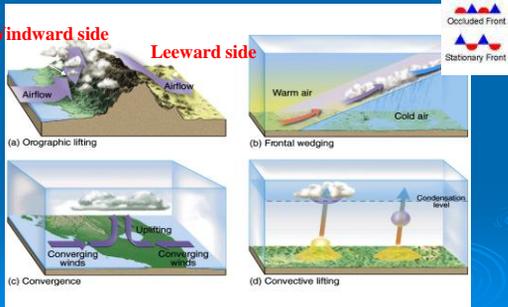


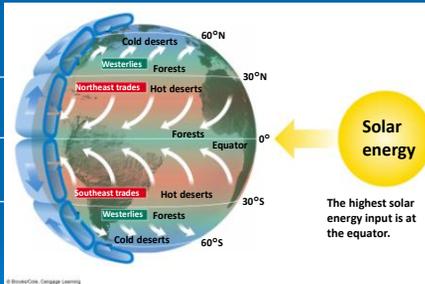
Fig. 7-4, p. 143

## Global Air Circulation

Air cools and descends at lower latitudes.

Warm air rises and moves toward the poles.

Air cools and descends at lower latitudes.



## Weather and Biomes

## Weather: A Brief Introduction



- Weather is a local area's short-term physical conditions such as temperature and precipitation.

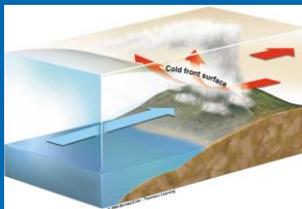
## Warm fronts

- Warm, moist Air. Less dense, rises over cool air. As it rises, the air cools, & water condenses into clouds & may fall as rain (cloudy skies / drizzle)



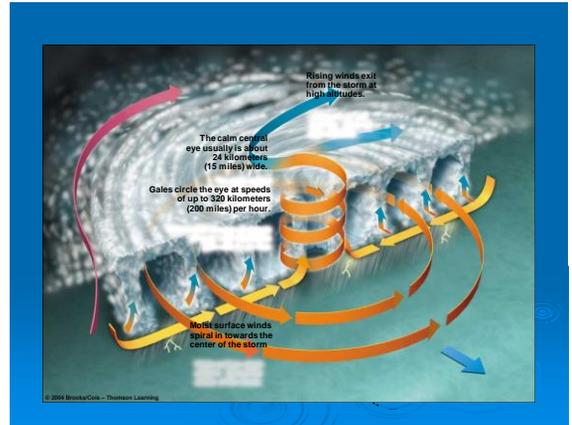
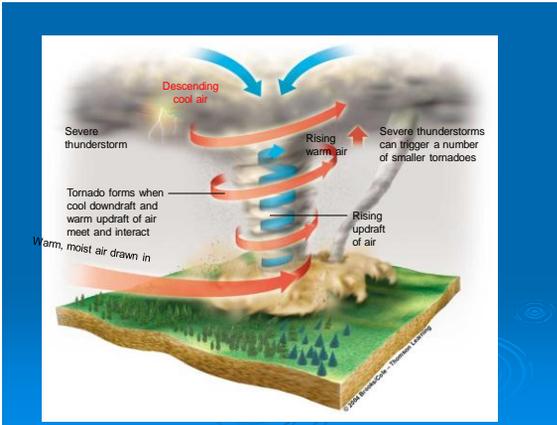
## Cold Fronts

- Cool, dry air. More dense, wedges underneath warm air near the ground-causing rapidly rising warm air.
- Produces towering thunderheads & thunderstorms.



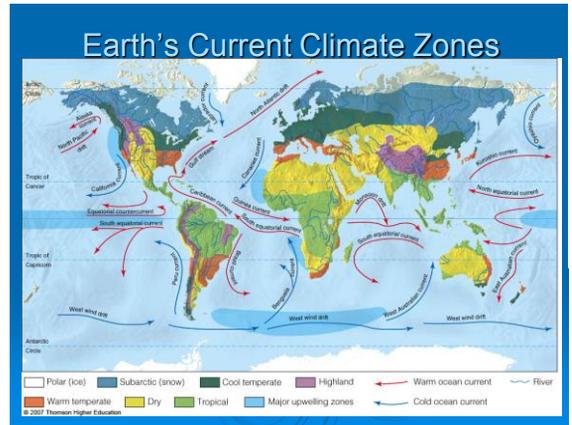
## Pressure changes

- High Pressure System: cool dense air that descends towards the earth's surface, becoming warmer → fair weather as long as a high pressure mass remains.
- Low Pressure System: Warm air of low density rises & expands as it cools.
  - Dew Point: temp at which condensation takes place & forms clouds
  - may lead to further condensation (condensation nucleus) into rain drops (or snow, sleet, etc) → Precipitation



## CLIMATE: A BRIEF INTRODUCTION

- Climate is a region's average weather conditions over a long time.
  - Latitude and elevation help determine climate.



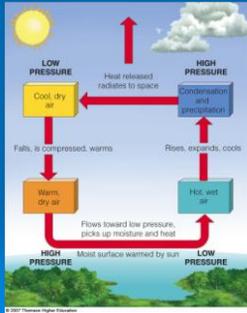
## Solar Energy and Global Air Circulation: Distributing Heat

- Global air circulation is affected by the uneven heating of the earth's surface by solar energy
- Seasonal changes in temperature and precipitation.

## Coriolis Effect

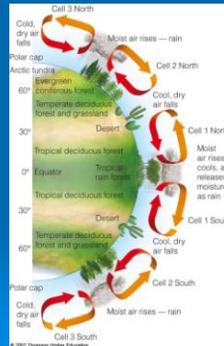
- Global air circulation is affected by the rotation of the earth on its axis.

## Convection Currents



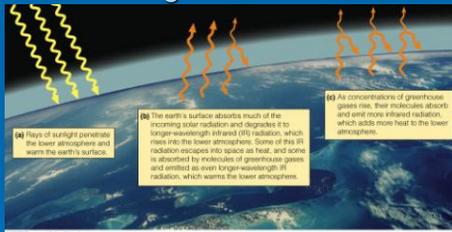
- Global air circulation is affected by the properties of air, water, and land.

## Convection Cells

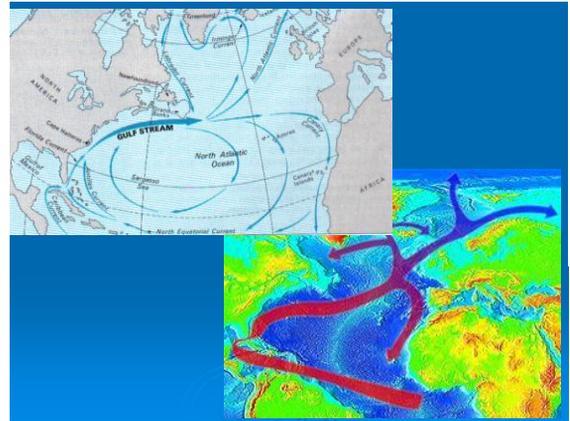


- Heat and moisture are distributed over the earth's surface by vertical currents
- Form six giant convection cells at different latitudes.

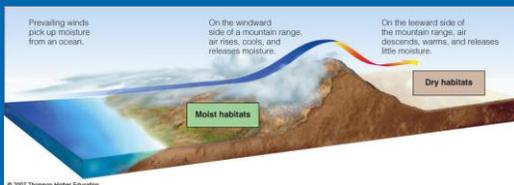
## Ocean Currents: Distributing Heat and Nutrients



- Ocean currents influence climate by distributing heat from place to place and mixing and distributing nutrients.



## Topography and Local Climate: Land Matters

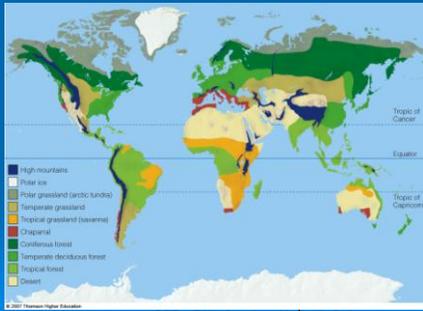


- Interactions between land and oceans and disruptions of airflows by mountains and cities affect local climates.

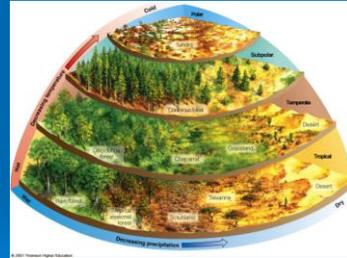
## BIOMES: CLIMATE AND LIFE ON LAND

- Different climates lead to different communities of organisms, especially vegetation.
  - Biomes – large terrestrial regions characterized by similar climate, soil, plants, and animals.
  - Each biome contains many ecosystems whose communities have adapted to differences in climate, soil, and other environmental factors.

## BIOMES: CLIMATE AND LIFE ON LAND



## BIOMES: CLIMATE AND LIFE ON LAND



- Biome type is determined by precipitation, temperature and soil type

## BIOMES: CLIMATE AND LIFE ON LAND



- Parallel changes occur in vegetation type when we travel from the equator to the poles or from lowlands to mountaintops.