Atmospheric Pressure and Wind

Wind Essentials
- Air Pressure
  - Force exerted in all directions by gas molecules in the atmosphere
  - Measured using a barometer
  - Changes in any one of pressure, temperature, and density of atmosphere affect the other two

Wind: horizontal movement of air
- Anemometer - measures wind speed
- Wind vane - measures wind direction
- Named by direction it is coming from

Driving Forces Within the Atmosphere
- Gravity - force that pulls an object toward the center of the Earth
- Pressure Gradient Force - horizontal rate of pressure change, representing the "steepness" of the pressure slope; direct effect on speed of wind. "High" and "Low" pressure are relative conditions, depending on the pressure of adjoining areas.
- Coriolis Force - apparent deflection of objects moving about the surface of the Earth; to right in Northern Hemisphere and to left in Southern Hemispheres. Proportional to speed of object.
- Friction Force - resistance encountered when wind moves about the surface of the Earth, diminishing with altitude and does not exist above 5000 feet.

Pressure Gradient
- Density - Amount of matter in a unit volume
- Isobars - Lines connecting points of equal pressure
- Ridge - Area of high pressure that connects two areas of low pressure
- Trough - Area low pressure that connects two areas of high pressure
Pressure + Coriolis + Friction

500 mb Pressure Map

Atmospheric Patterns of Motion
- Primary High-Pressure and Low-Pressure Areas
- Upper Atmospheric Circulation
- Local Winds
- Monsoonal Winds

Global Barometric Pressure
General Circulation of Atmosphere

- Intertropical convergence zone (ITCZ) – zone of convergence and weak horizontal air flow. Also known has bostrums because early sailing ships would often becalmed. Approximately parallels equator.
- Trade winds – winds covering most of the Earth between 25° N and 25° S latitude. Particularly prominent over oceans. Dominate more of the globe than any other wind system.
- Subtropical Highs – centered at about 30° latitude. Weather is nearly always clear, warm, and calm. Anti-cyclonic, divergent clockwise in Northern Hemisphere and counterclockwise in Southern Hemisphere. Known as Horse Latitudes.
- Westerlies – winds flow basically from west to east around the world between 30° and 60° north and south latitudes.
- Subpolar Lows – zone of low pressure at about 50° – 60° latitude. Zone of conflict between cold polar easterlies and warm westerlies.
- Hauroras – from polar highs to 60° north and south. Cold, dry, and variable.
- Polar Highs – situated over both polar regions. Typically anti-cyclonic.
Local Winds

- **Land-sea breezes**
  - A convectional circulation caused by differential heating of land and water surfaces.

- **Mountain-valley breezes**
  - A convectional circulation caused by differential heating of higher versus lower elevations.

- **Katabatic winds**
  - A wind that originates in cold upland areas and cascades toward lower elevations under the influence of gravity.

Mountain Valley Breezes

- **Valley Breeze**
  - An up-slope flow during the day

- **Mountain Breeze**
  - A down-slope flow during the night

Katabatic Winds

- **Mistral** - Cold, high-velocity wind that sometimes surges down the slopes of the Alps toward the Mediterranean
- **Chinook** - Localized downslope wind of relatively dry and warm air that moves down the leeward slope of the Rockies.
- **Santa Anas** - High speed, high temperature, and extremely dry prompting wildfires in California.

Monsoonal Winds

The Dynamic Ocean
Ocean water movements

Surface circulation
- Ocean currents are masses of water that flow from one place to another
- Surface currents develop from friction between the ocean and the wind that blows across the surface
- Huge, slowly moving gyres

Three main gyres
- North Pacific Gyre
- South Pacific Gyre
- North Atlantic Gyre

Surface circulation
- Deflected by the Coriolis effect
  - To the right in the Northern Hemisphere
  - To the left in the Southern Hemisphere
- Four main currents generally exist within each gyre

Importance of surface currents
- Climate
  - Currents from low latitudes into higher latitudes (warm currents) transfer heat from warmer to cooler areas

Upwelling
- The rising of cold water from deeper layers
- Most characteristic along west coasts of continents
- Brings greater concentrations of dissolved nutrients to the ocean surface

Deep-ocean circulation
- A response to density differences
- Factors creating a dense mass of water
  - Temperature - cold water is dense
  - Salinity - density increases with increasing salinity
- Called thermohaline circulation
Ocean water movements

- Deep-ocean circulation
  - Most water involved in deep-ocean currents begins in high latitudes at the surface
  - A simplified model of ocean circulation is similar to a conveyor belt that travels from the Atlantic Ocean, through the Indian and Pacific Oceans and back again