Physical Geography III of the United States and Canada

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Physical Geography

The physical landscape (natural environment) **sets the stage for human use** (cultural landscape). **We need to be aware of aspects of the physical environment that affect landscape development:**

- ✓ **geologic processes (tectonic/gradational)**
  (Any Questions on Glaciation or Glacial Processes?)
- ➢ **atmospheric processes: Weather/Climate**
  - **water resources (surface/underground)**
  - **soils (formation/fertility)**
  - **natural vegetation (a result of all of above)**

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Definitions

What is the difference between weather and climate?

❖ **Weather** :
State of the atmosphere at any one point in time.
➢ Composed of **4 elements:** **TEMPERATURE**, **AIR PRESSURE**, **WIND** and **MOISTURE**.
- Each of the four is dependent on the others.

❖ **Climate**:
Average of all weather statistics over a long period of time (more than 50 yrs).

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Climate Regions of the US & Canada

Climates develop as a result of the **interaction** of **atmospheric**, **topographic** and **oceanic** conditions.

From Birdsall, *Regional Landscapes of the US&C, 7th ed.*

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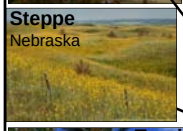
Climate Landscapes of the US & Canada

All the major groups are found here!!



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Temperature Variables

❖ **Temperature varies with:**
- **Latitude**: energy received changes c.1°F for each degree of latitude
- **Altitude**: changes +/-1°F for each 300 ft of elevation
- **Bodies of water**: water is slow to heat up and slow to cool down

❖ **Temperature affects air pressure** which in turn creates **wind** because of the pressure differential.
- ✓ ***WIND** = Air moving from areas of higher pressure to areas of lower pressure.*

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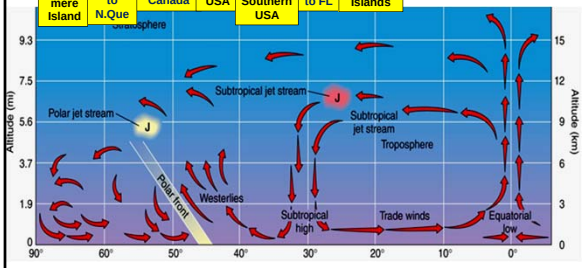
Global Belts of Air Pressure and Wind Systems

Elles-mere Island | Alaska to N.Que | Southern Canada | N tier USA | Central, Southern USA | S. TX to FL | Hawaiian Islands



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Earth-Sun Relationships

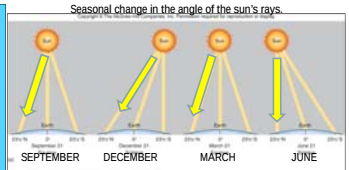
The US & Canada has a great range of latitude.

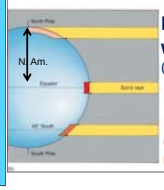
➢Solar energy received varies with latitude.

- Its intensity at a latitude and time of year (season) corresponds to **the angle of the sun's** rays as they hit the surface.
- Intensity controls heating which in turn affects pre-cipitation and vegetation.

The climates of the US&C are so different.

Seasonal change in the angle of the sun's rays.





Low angle, weak rays = cold (Arctic region)

High angle, intense rays = hot (Subtropical and tropical regions)

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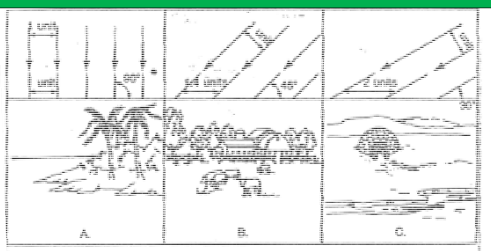
Angle of Sun's Rays



TROPICAL — S. Florida, Hawaii

MID-LATITUDE — California-Virginia

SUBARCTIC — Alaska - Baffin Is.

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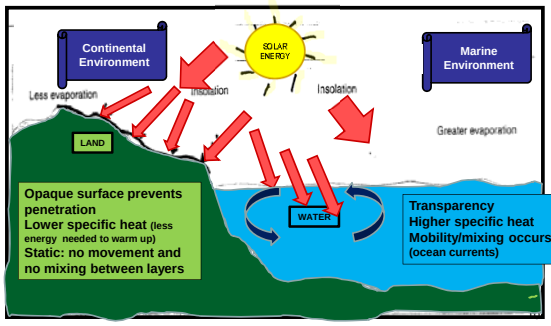
Land vs. Water

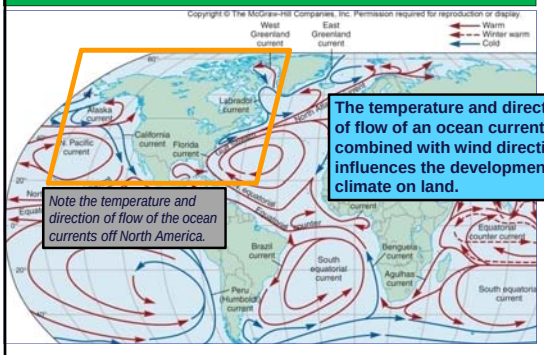
Land heats up and cools off faster than water. **Why?**



Opaque surface prevents penetration
Lower specific heat (less energy needed to warm up)
Static: no movement and no mixing between layers

Transparency
Higher specific heat
Mobility/mixing occurs (ocean currents)

SURFACE OCEAN CIRCULATION



The temperature and direction of flow of an ocean current, combined with wind direction, influences the development of climate on land.

Note the temperature and direction of flow of the ocean currents off North America.

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Elevation and Vertical Zonation

❖ **Temperature changes by 3½°F per 1000 ft of elevation** (lapse rate).

- Every 5,000 ft in elevation is equal to 750 miles of latitude.
- Elevation creates **vertical zonation of climate** on the slopes of high landmasses.
- It is designated as an "**H**" climate on the maps.

➢ **The greatest number of zones is found in the tropics. Only one zone exists in the polar region.**

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Precipitation Variables

❖ **Precipitation varies with:**

- **Elevation** (orographic cooling)
- **Wind-facing slope** (windward = wet side; leeward = dry side/rain shadow)
- **Source areas** (weather fronts, evaporation from lakes and ocean)
- **Atmospheric heating and cooling** (evaporation and orographic cooling)

❖ **Three types of precipitation:**

✓ **Convectional**
✓ **Orographic**
✓ **Cyclonic (frontal)**

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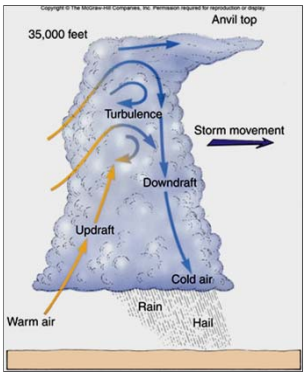
Types of Precipitation

CONVECTIONAL precipitation is heat generated



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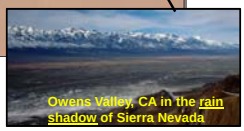
Types of Precipitation

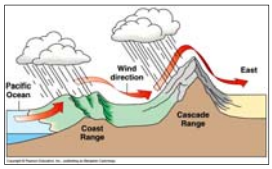
OROGRAPHIC precipitation is landform generated.



Orographic Precipitation

Clouds on the **windward** side of Kauai Is., Hawaii.

➢ The windward side of islands and mountains is wetter than the lee side.



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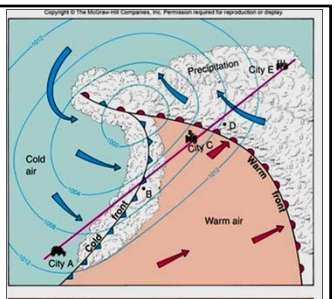
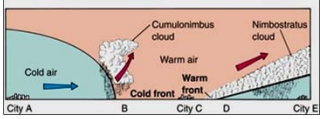
Types of Precipitation

CYCLONIC or **FRONTAL precipitation is air mass generated.**

Precipitation occurs at the boundary (front edge) of air masses where there is a conflict between **cold air and warm air.**





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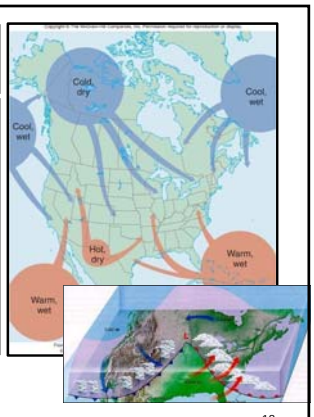
Air Masses

❖Every air mass has **unique** characteristics of **temperature** and **moisture** and imparts those characteristics to the area it is over.

✓Air masses are designated by their source area.

✓Atmospheric instability occurs along air mass boundaries (transition zone.)



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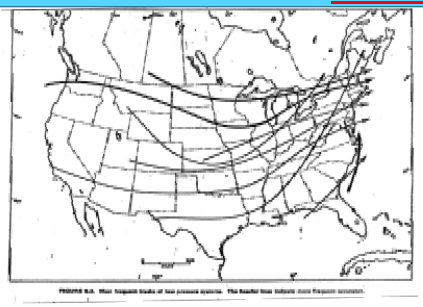
Storm Tracks

Predominant wind direction and movement of air masses across North America is from west to east.



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Climate Regions of the US & Canada

Climates develop as a result of the **interaction** of **atmospheric**, **topographic** and **oceanic** conditions.

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CLIMATE CLASSIFICATION

based on the Köppen System

Four temperature-based groups:

- **A group**: tropical (winterless)
- **C group**: subtropical (mild winter)
- **D group**: continental (severe winter)
- **E group**: polar (summerless; extremely cold)

One moisture deficiency-based group:

- **B group:** arid and semi-arid (evapo-transpiration exceeds precipitation)

One elevation-related group:

- **H group:** highlands (vertical zonation of climate on steep slopes)

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Climate Controls Recap

Climate development of the US&C is influenced by one or more of the following factors:

1. **Latitude** – amount of solar energy received
2. **Land** vs. **Water** – heat exchange differences
3. **Ocean Currents** – temperature; flow direction
4. **Wind** – direction; characteristics
5. **Topography** – orientation; height
6. **Elevation** – lapse rate, vertical zonation
7. **Air Masses** – source region; characteristics

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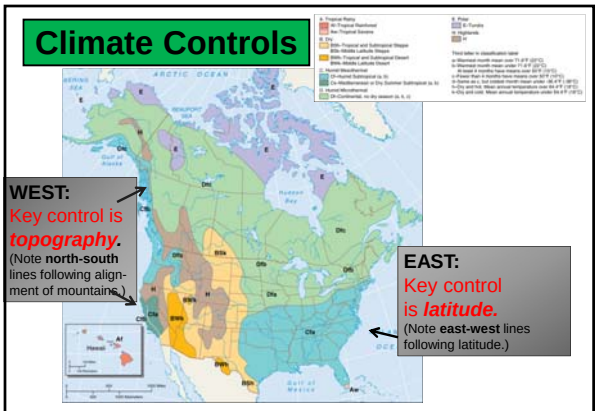
Climate Controls



WEST: Key control is ***topography***. (Note **north-south** lines following align-ment of mountains.)

EAST: Key control is ***latitude.*** (Note **east-west** lines following latitude.)

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Precipitation Regions of the US&C

Annual precipitation is influenced by:

- ✓landforms
- ✓ocean currents
- ✓wind direction
- ✓air masses

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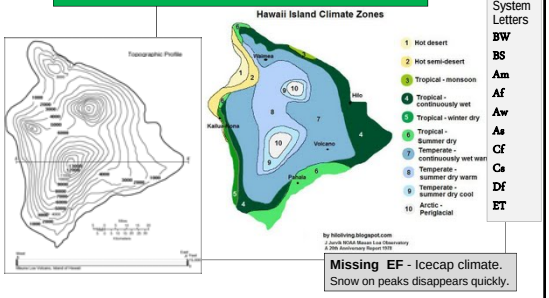
Climates on the Island of Hawaii



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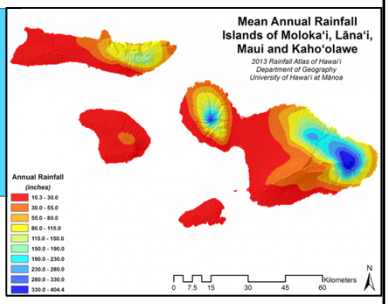
Rainfall Distribution

The amount of rainfall received on the islands varies with elevation and proximity to moisture-bearing winds.

Low elevation areas are dry.



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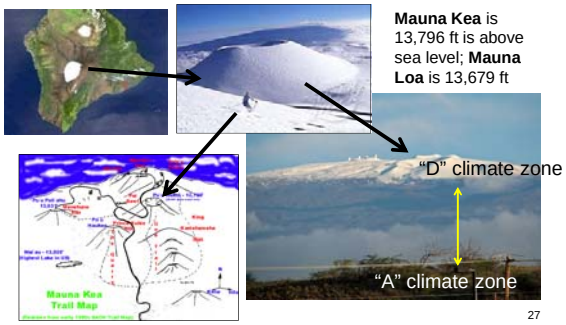
Vertical Zonation of Climate

SNOW in HAWAII



Mauna Kea is 13,796 ft is above sea level; **Mauna Loa** is 13,679 ft

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Microclimates

❖ **Microclimates develop locally due to changes in an area's physical characteristics.**

- ▶ **Rural areas** – local conditions change as an area goes from forest to large farmstead to suburb
- ✹ **Urban areas** – artificial conditions
  - Concrete and asphalt surfaces (warmer)
  - Limited soil and vegetation (less humid)
  - Tall buildings (shadows and wind channels)
- ▪ **Temperature inversions** – temperature does not decrease with elevation
  - ▪ Frequently occurs in valleys (esp. the N-S valleys)
  - ▪ Warm air rises until it meets air of equal temperature
  - ▪ Warm air "cap" prevents the exchange of air and keeps the air (along with any pollutants) within the valley

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Growing Season

Growing season is a significant determinant to the geography of crops and the location of agriculture.

❖ The average number of days between the **last killing frost** of the spring and the **first killing frost** of the autumn.

- ➢ It has a direct impact on plant, animal and insect life.
- ➢ Its length is very important in agriculture because different crops require different amounts of time to grow to maturity (ripen).

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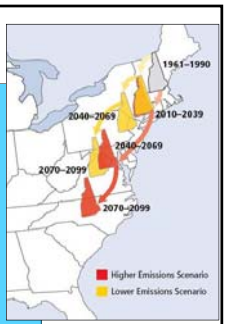
Global Warming

As the earth warms, an area's ***equivalent* latitude** position will move toward the equator.

- ✓ Growing seasons will lengthen.
- ✓ "Southern" flora/fauna of the US will migrate into the northern states; northern biomes will exist in Canada.
- ✓ Warm-climate diseases and insects will spread northward, especially if winter temperatures do not drop below freezing for extended periods of time.



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Global Warming (cont'd)

- ✓ **Global warming will melt the glaciers.**
  - Sea level will rise.
  - Areas along the coast will become under water.
- ✓ **Coastal areas will see greater erosion from waves year-round.**
- ✓ **Winter storms will increase in both number and intensity.**
  - There will be an increase in snow storms.

❖**Eventually, all landscapes will be altered.**

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Postcards from Milder Winters

Global warming will change the visible landscape by creating a new natural situation that will elicit a human response to the new conditions.

➢*This would be also true with **global cooling** and the onset of a mini ice age.*

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NEXT LECTURE

Water,
Soils
and
Vegetation

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