REMINDERS

- **Two required essays are due by <u>April 17, 2020</u>.**
- **A late penalty will be applied.**
- ✓ *A third essay may be used for extra credit in place of a "Think Geographically" essay.*

****

ESSAY TOPICS (choose any two):

- **Contributions of a noted geographer, earth scientist or explorer (chapter 1)**
- **Relationship of climate change to a listed current event topic (ch. 2)**
- **Discuss a natural process that is deemed a natural hazard (ch. 3)**

IF YOU MISSED EXAM I YOU NEED TO SEE ME TO ARRANGE A DATE FOR A MAKE-UP EXAM.

- **Extra Credit:** "Think Geographically" Essays from <u>any five</u> of the textbook's **chapters 4-12**.
  - Last day to submit is **May 12.** but it is best to do them as you finish reading a chapter.

- **Any essay may be handed in before the deadline.**
- **Don't wait for the night before to write them!!**

GEOG 101 Part II
People and their Physical Environment

13: Climate and Climate Controls

Chapter 2

Prof. Anthony Grande
Hunter College Geography

PART II: People and their Physical Environment

- ✓ **I. Introduction to the Physical Environment**
- ✓ **II. Earth-Sun Relationship**
- **III. Earth Systems**
  - ✓ A. The Hydrosphere: Oceans
  - ➢ **B. The Atmosphere: Weather and Climate**
  - C. The Lithosphere: Geologic Influences and Landscapes
- **IV. Earth Habitat**
  - A. Biosphere
  - B. Natural Controls and Cycles
  - C. Human Impact
  - D. Natural Hazards
  - E. Earth Resources

CLIMATE DEFINED

- **The average of all weather events at a particular location over a long period of time** (50+ yrs)**.**
  - ✓**Climates change naturally.**
  - ✓**Climates can be altered by people.**

CLIMATE INFLUENCES

❖ **BOTH <u>Earth-Sun</u>** and **<u>Earth Environment</u> factors influence climate development.**

- **latitude**
- **moisture**
- **topography**
- **solar energy**
- **wind direction**
- **ocean conditions**

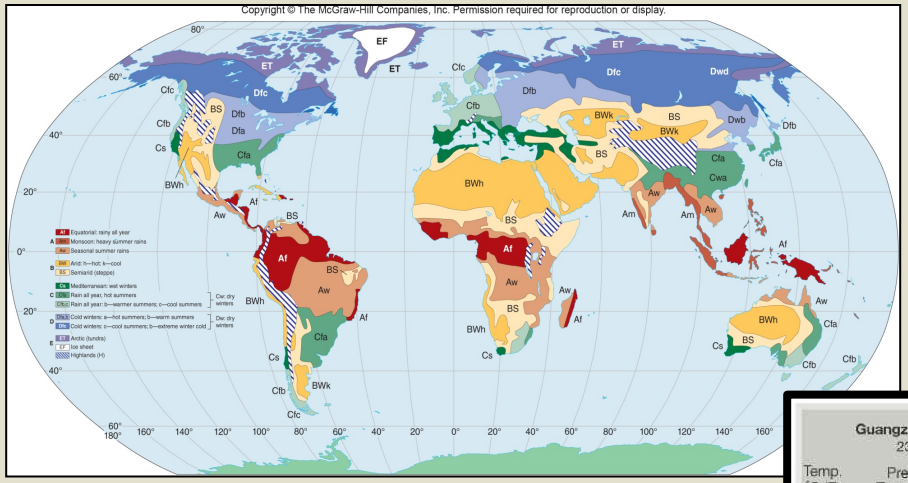
➢ **Climates influence all life on earth as well as human cultural development.**

- **soil development, vegetation, biomes**
- **physical adaptations of animals**
- **culture traits of people** (clothing, architecture, cuisine, sports)
- **development of technology** (to deal with climate)

Two way street: People and their works influence climate, too!

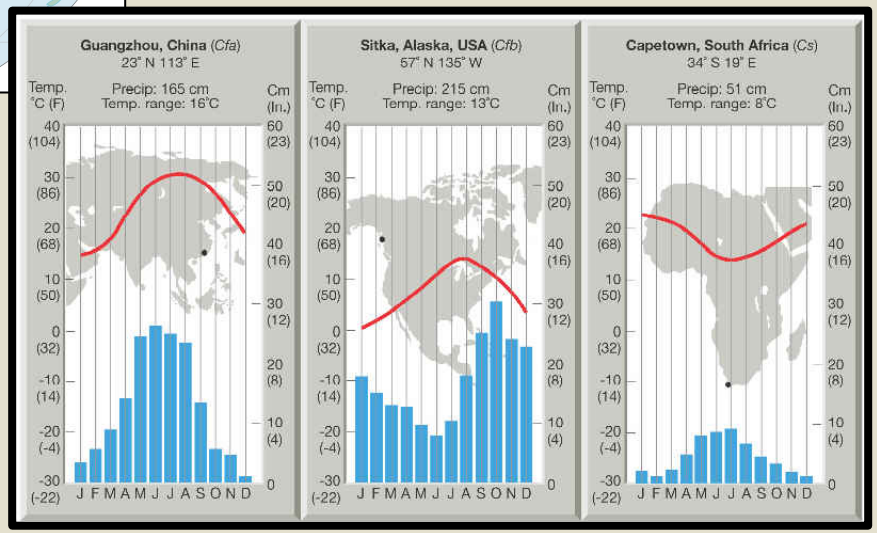
https://www.nytimes.com/2019/03/01/sports/iditarod-climate-change-warming.html

STUDYING CLIMATE

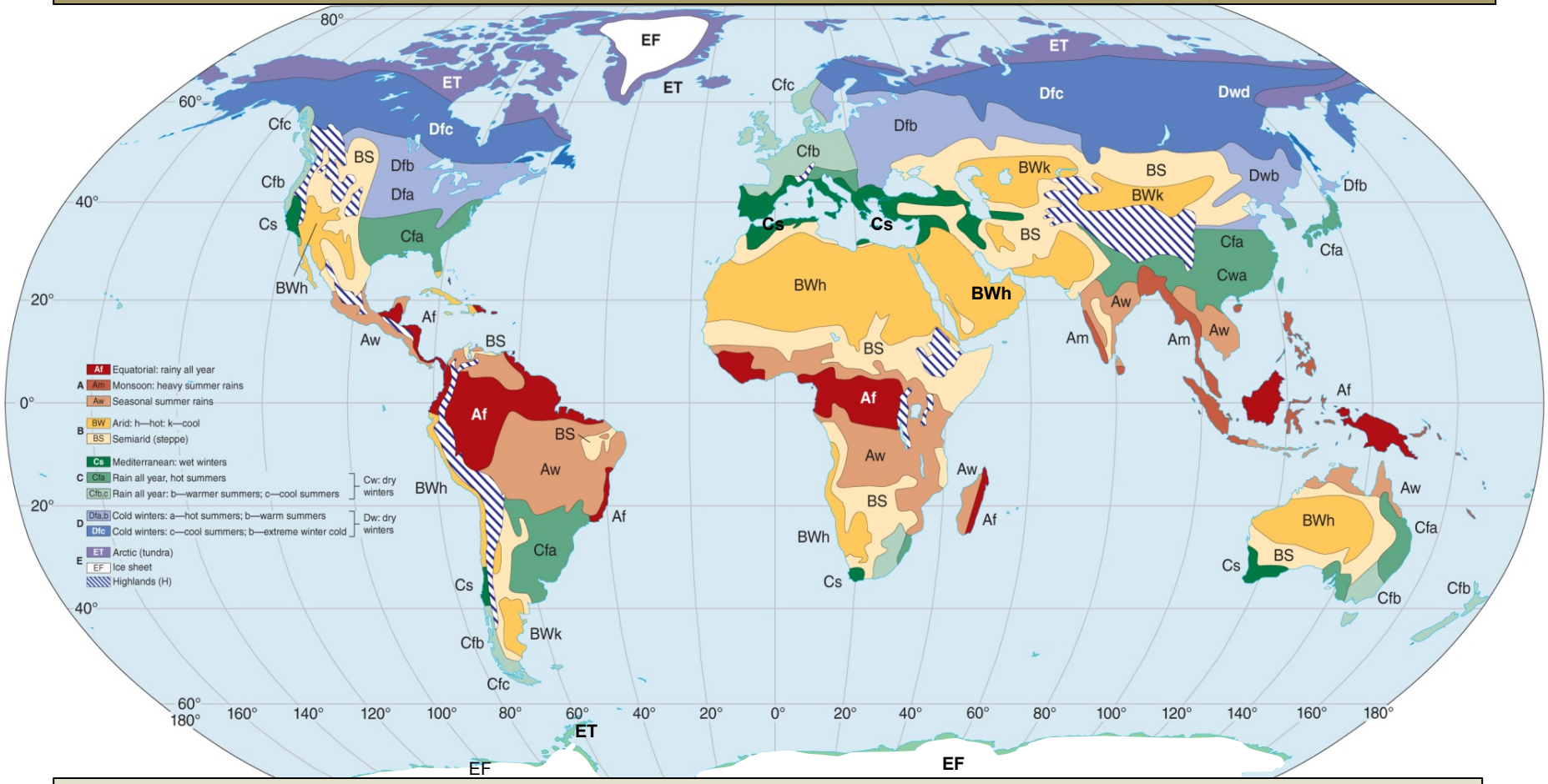


Climate maps show the geographic distribution of averaged data.

❖ **Climographs** give us a snapshot of individual locations.



WORLD CLIMATE MAP



Each colored climate region has a unique combination of temperature, precipitation and hours of sunlight.

CLIMATE CLASSIFICATION

- **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 (evapotranspiration exceeds precipitation)
- **One elevation-related group: H group**

  Highlands (vertical zonation of climate along steep slopes)

CLIMATE GROUPS

TABLE 2.1 in text >>

There are six major categories of climate.

4 are **temperature** based (A,C,D,E groups)

1 is **moisture** based (B group).

1 is **elevation** based (H group).

Each one has a number of subcategories.

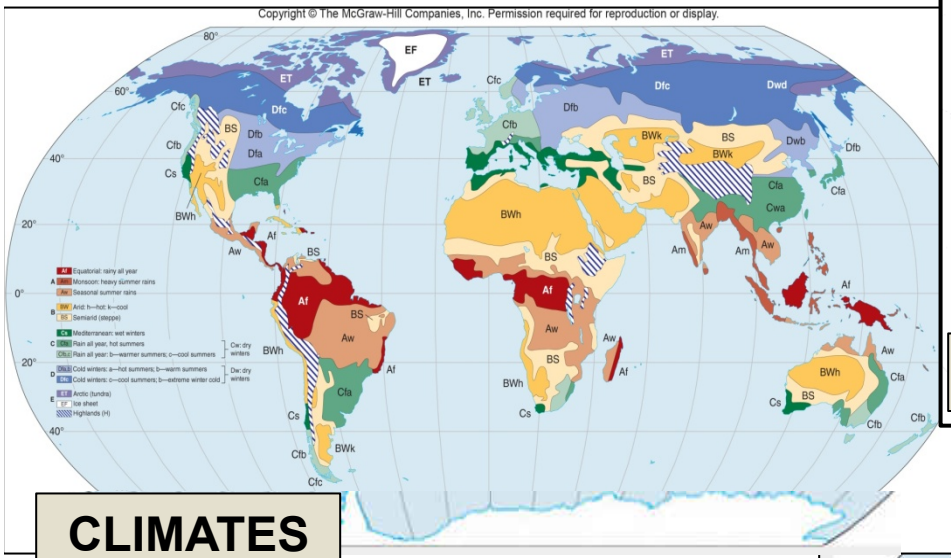
TABLE 2-1 Major Climate Types and Their Köppen Equivalents

Climate Type	Climate Characteristics
A **Tropical: climates that are warm all year**	
Humid tropical	
Af	Tropical, constantly warm and humid, with no dry season
Am	Tropical, constantly warm and humid, but with a short dry season
Seasonally humid tropical	
Aw	Tropical, constantly warm and humid, but with a pronounced dry low-sun season and wet high-sun season
B **Dry climates**	
Desert	
BWh	Hot desert climate
BWk	Cool desert climate
Semiarid	
BSh	Hot semiarid (steppe) climate
BSk	Cool semiarid (steppe) climate
C **Midlatitude climates with warm summers and cool winters**	
Humid subtropical	
Cfa	Humid, warm subtropical climate, with hot summers and no dry season
Cw	Humid, warm subtropical climate, with hot summers and dry winters
Marine west coast	
Cfb	Marine west coast climate, with warm summers and no dry season
Cfc	Marine west coast climate, with cool summers and no dry season
Mediterranean	
Cs	Mediterranean climate, with dry, warm summers and cool, wet winters
D **Midlatitude climates with warm summers and cold winters**	
Humid continental	
Dfa	Humid continental climate, with hot summers, cold winters, and no dry season
Dwa	Humid continental climate, with hot summers and dry, cold winters
Dfb	Humid continental climate, with warm summers, cold winters, and no dry season
Dwb	Humid continental climate, with warm summers and dry, cold winters
Subarctic	
Dfc	Moist subarctic climate, with cool summers, very cold winters, and no dry season
Dwc	Moist subarctic climate, with cool summers and very cold, dry winters
Dfd	Moist subarctic climate, with cool summers, frigid winters, and no dry season
Dwd	Moist subarctic climate, with cool summers and frigid, dry winters
E **Polar climates**	
Tundra	
ET	Tundra climate, with very cool, short summers and frigid winters
Icecap and ice sheets	
EF	Ice cap climate, with temperatures consistently below freezing

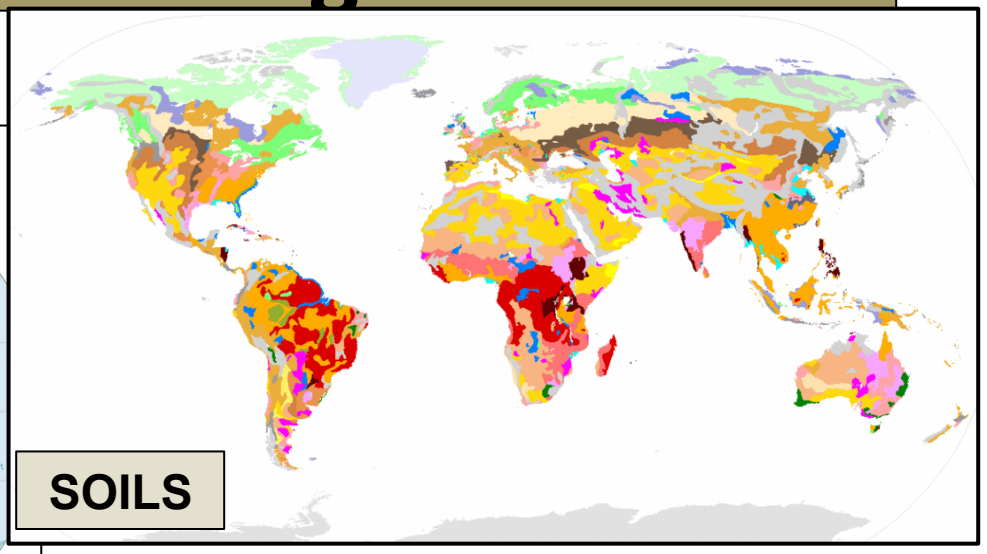
H **Note:** In mountainous areas, large differences in climate occur over short distances, causing detailed climatic patterns that cannot be shown on a world map. These areas are mapped as H, or highlands.

Source: Courtesy Institute for International Economics.

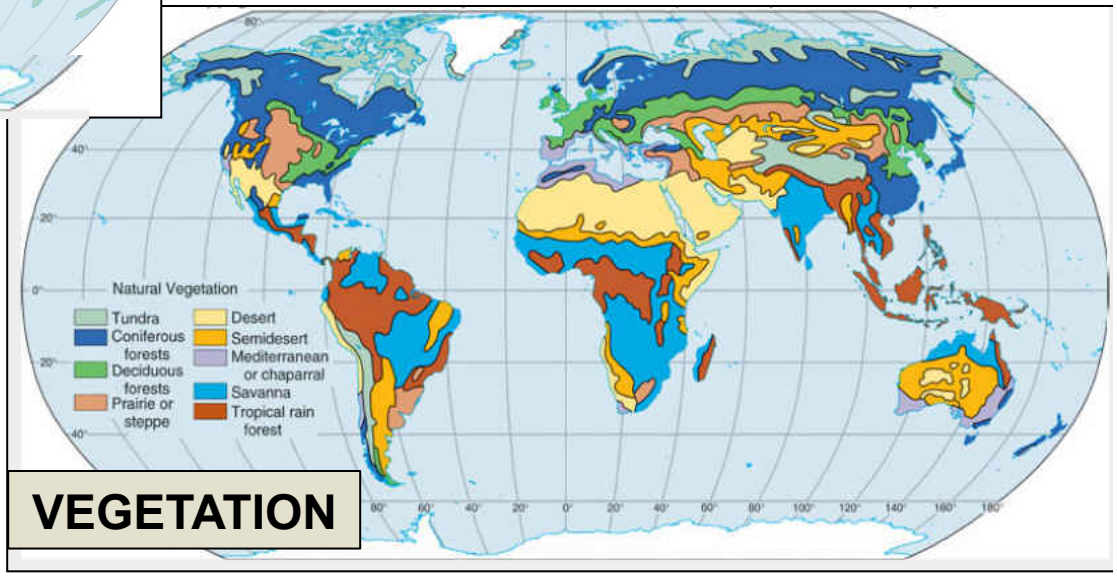
World Distribution of Climate, Soils and Vegetation



CLIMATES



SOILS



VEGETATION

VERY SIMILAR TO EACH OTHER!

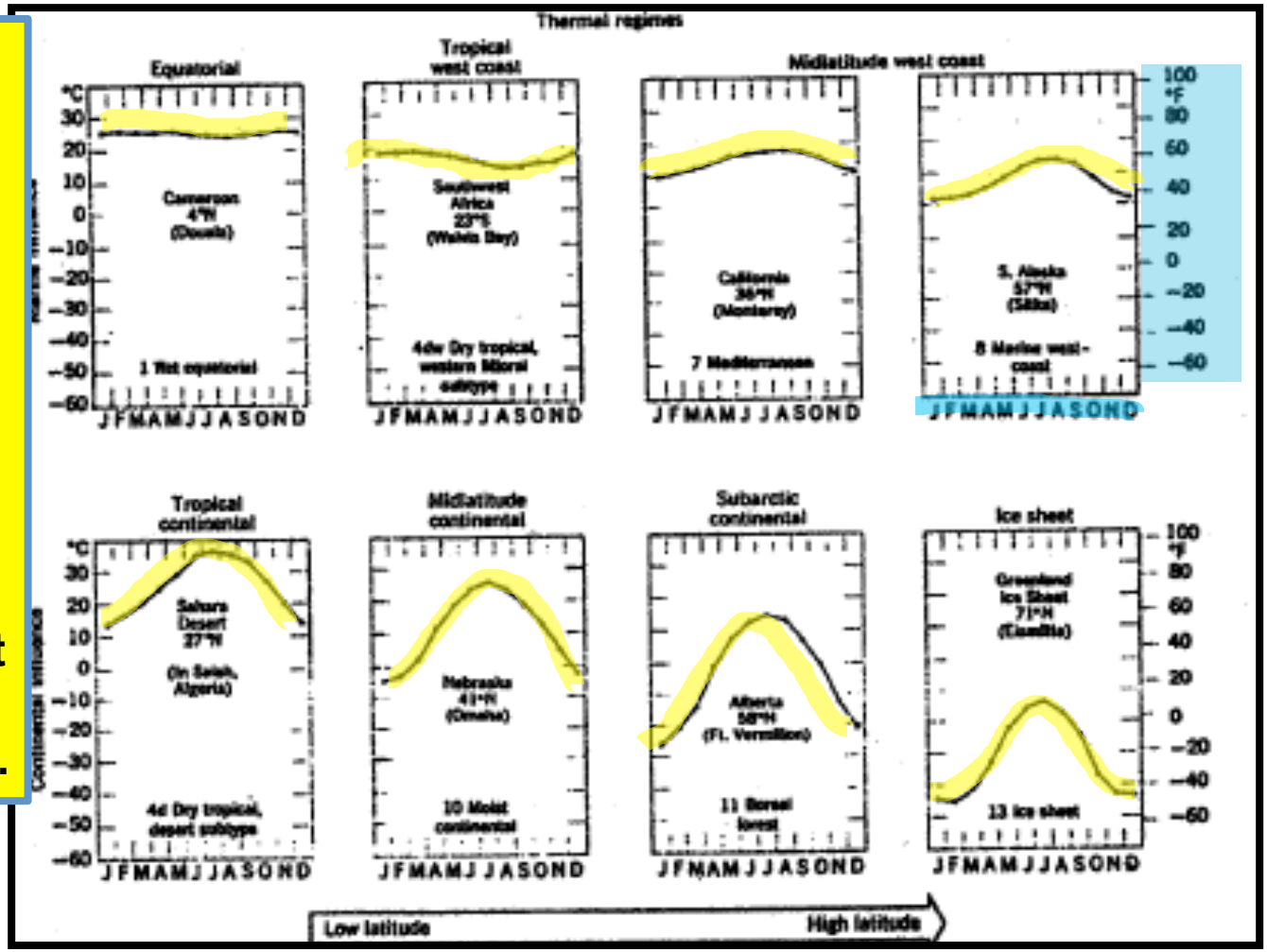
CLIMOGRAPHS

Each CLIMATE REGION has distinct TEMPERATURE patterns .

The lines display the "average monthly temperature".

The shape of lines shows monthly heat distribution.

Together we see when and how much heat is received during the year.

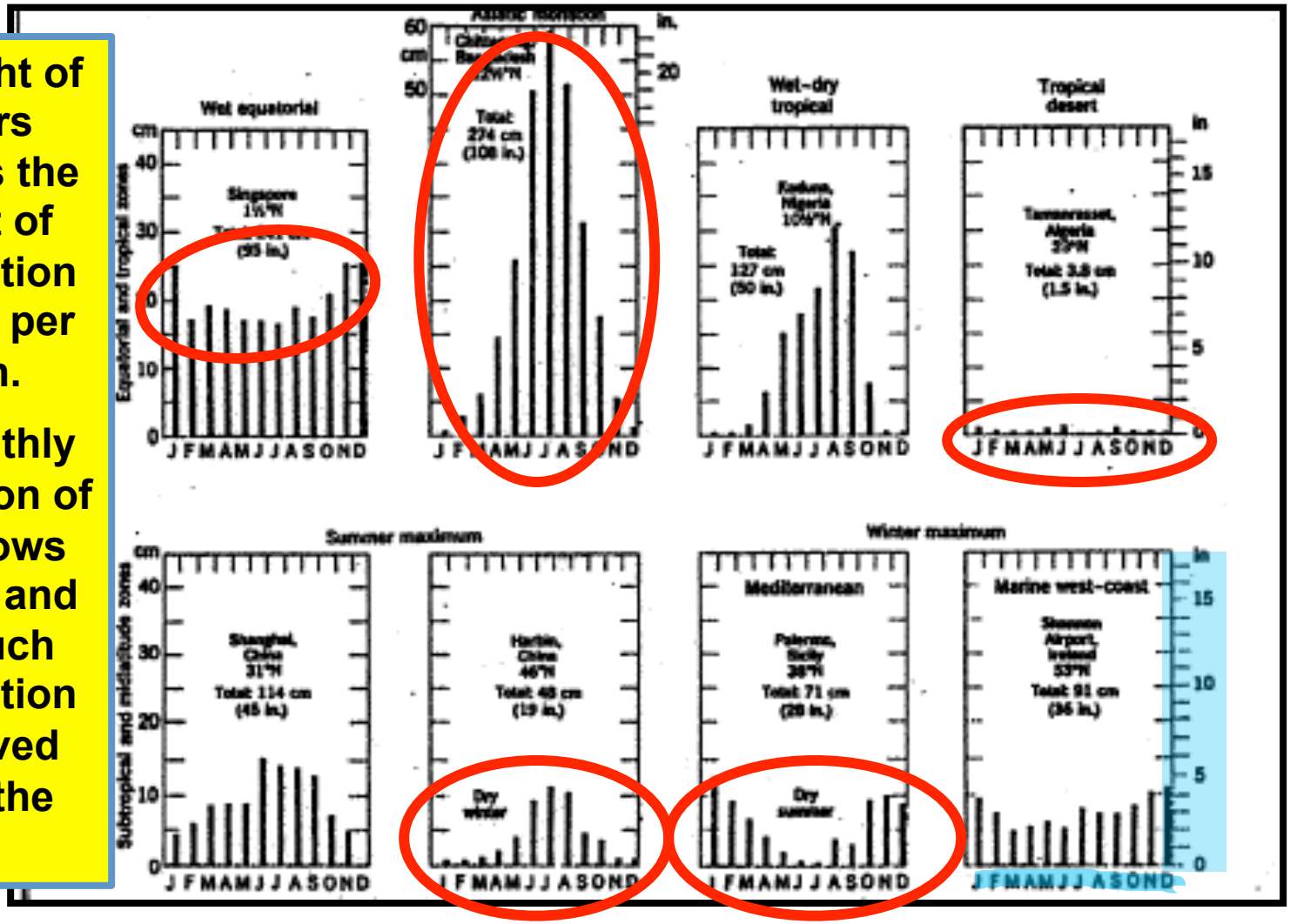


CLIMOGRAPHS

Each CLIMATE REGION has distinct PRECIPITATION patterns.

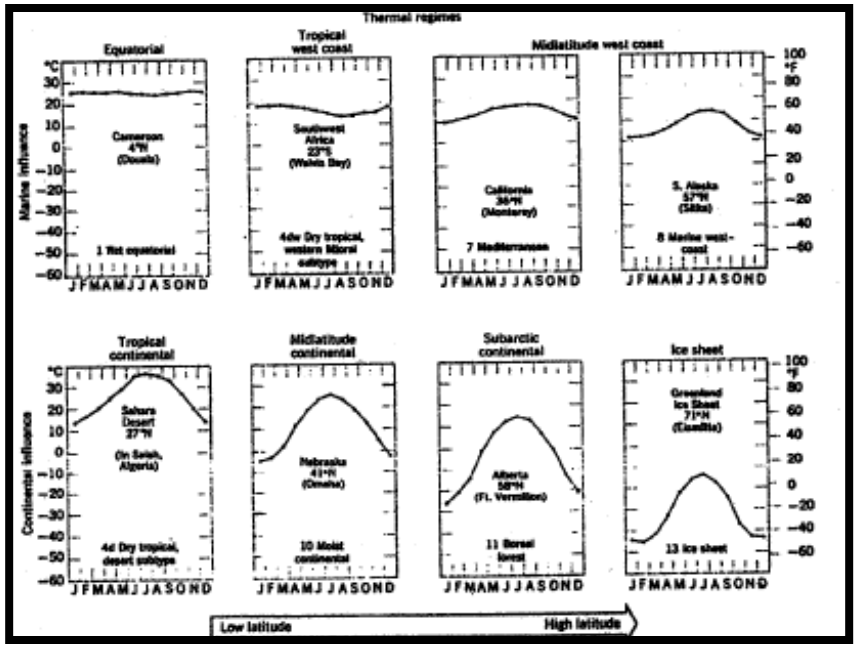
The height of the bars indicates the amount of precipitation received per month.

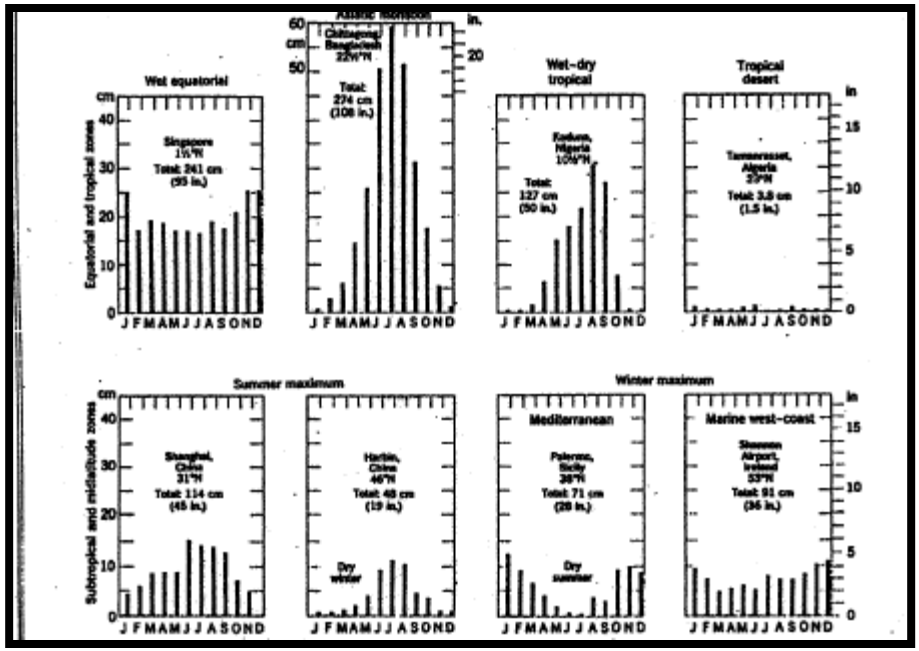
The monthly distribution of bars shows us when and how much precipitation is received during the year.



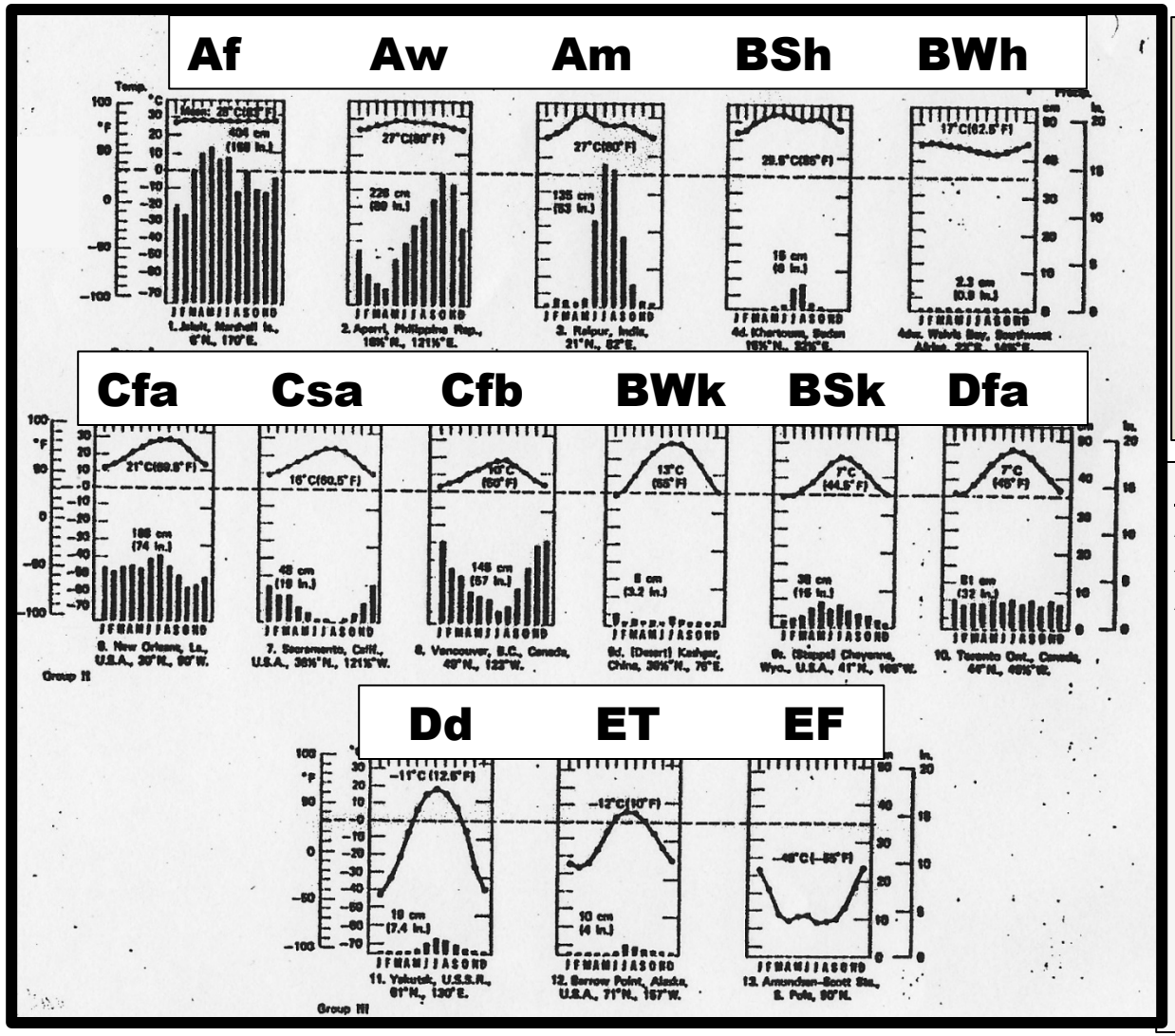
CLIMOGRAPHS

Each CLIMATE REGION has distinct patterns of TEMPERATURE and PRECIPITATION





CLIMOGRAPHS



When temperature and precipitation patterns are combined we get a "snapshot" of that location's climate.

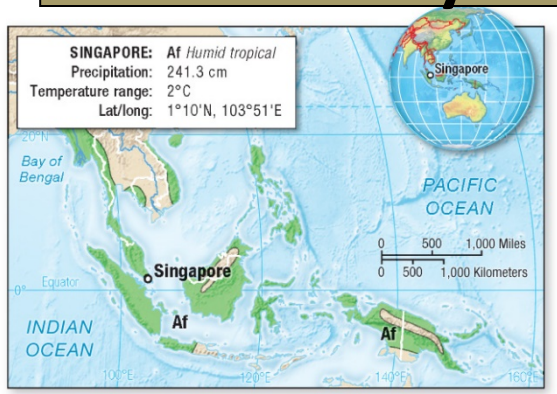
Köppen Classification Symbols Key

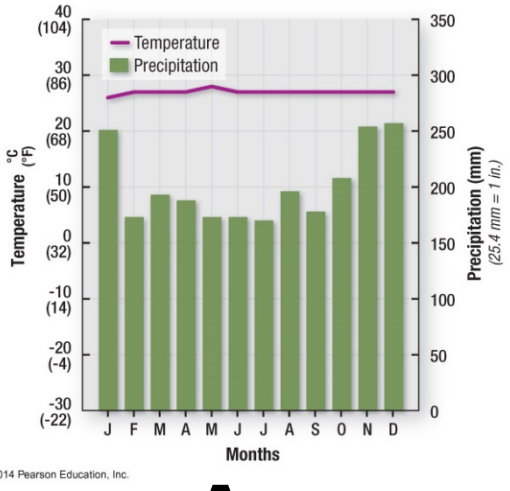
- **Af** = Tropical rainy
- **Aw** = Tropical savanna
- **Am** = Tropical monsoon
- **BSh** = Tropical semi-arid
- **BWh** = Tropical desert
- **Cfa** = Humid subtropical
- **Cs** = Mediterranean dry summer
- **Cfb** = Marine west-coast
- **BWk** = Mid-latitude desert
- **BSk** = Mid-latitude semi-arid (steppe)
- **Dfa** = Humid continental hot summer
- **Dd** = Subarctic
- **ET** = Tundra
- **EF** = Icecap

https://www.usclimatedata.com/ : Climate info for US cities

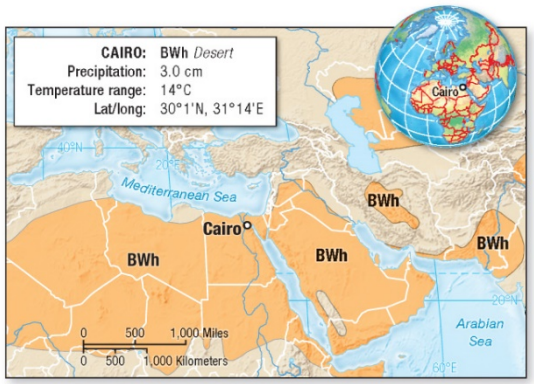
Climographs and Locator Maps
from your textbook

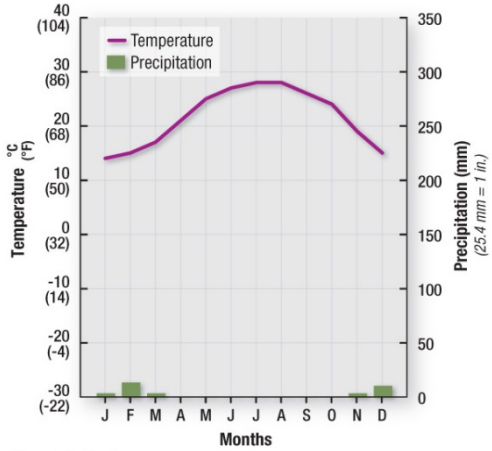
- ✓ Lines show average monthly temperature range.
- ✓ Bars show average monthly precipitation.



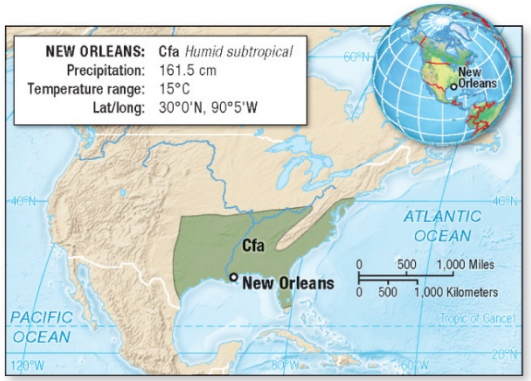


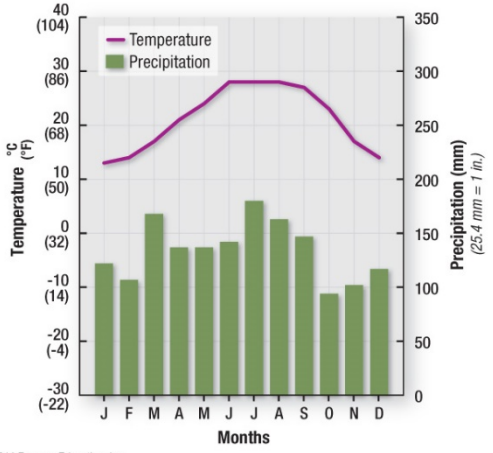
A group





B group

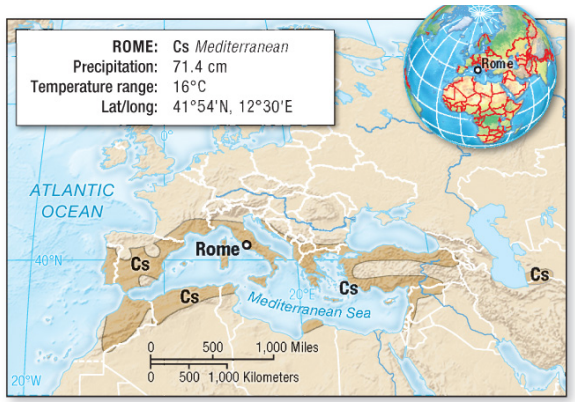


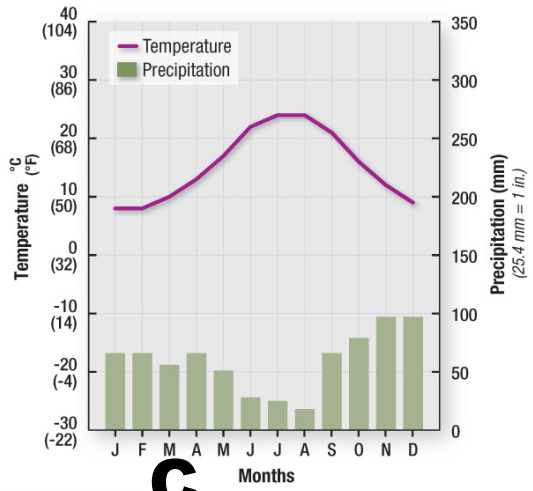


C group

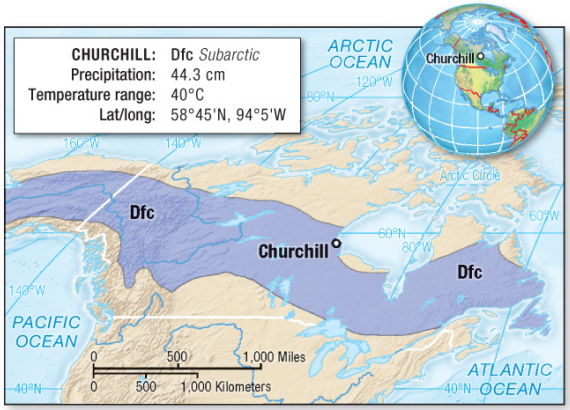
Climographs and Locator Maps
from your textbook

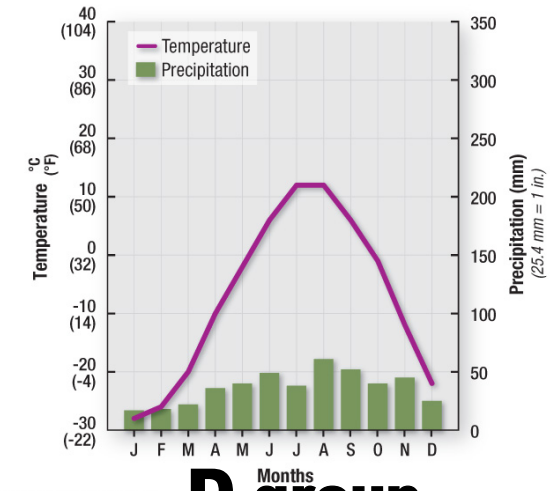
- ✓ Lines show average monthly temperature range.
- ✓ Bars show average monthly precipitation.



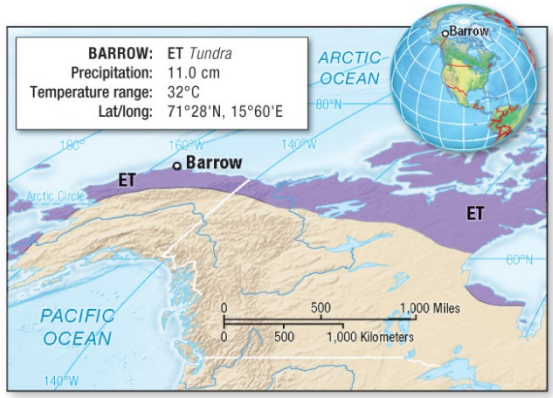


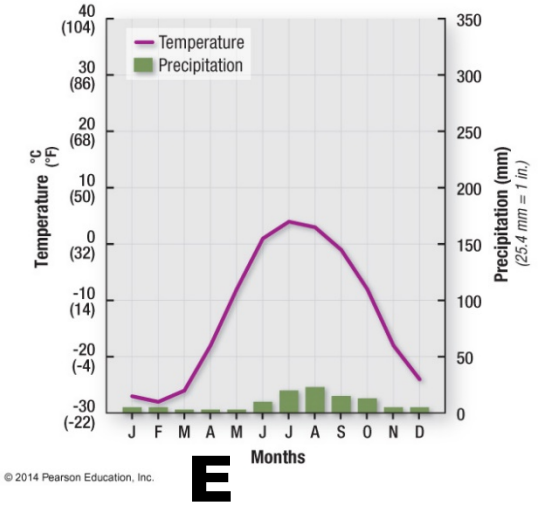
C group





D group





E group

Seven Natural Climate Controls

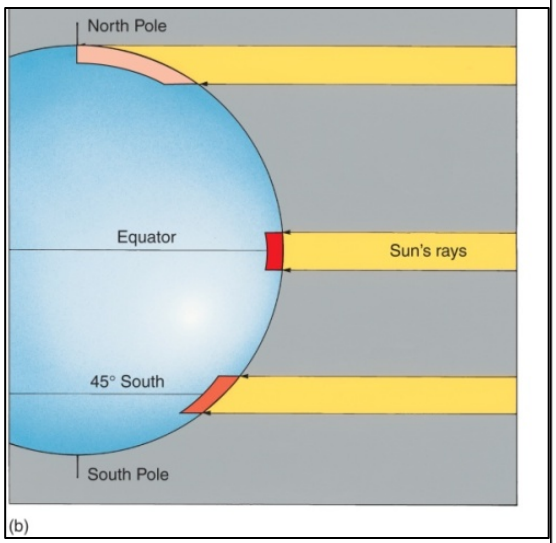
1. **Latitude -** solar energy received, zones of precipitation.
2. **Land vs. water -** different rates of warming and cooling.
3. **Ocean currents -** temperature and direction of flow.
4. **Wind direction -** global/region wind systems.
5. **Topographic barriers -** orientation and height
6. **Elevation -** lapse rate; vertical zonation
7. **Air masses -** source region and characteristics

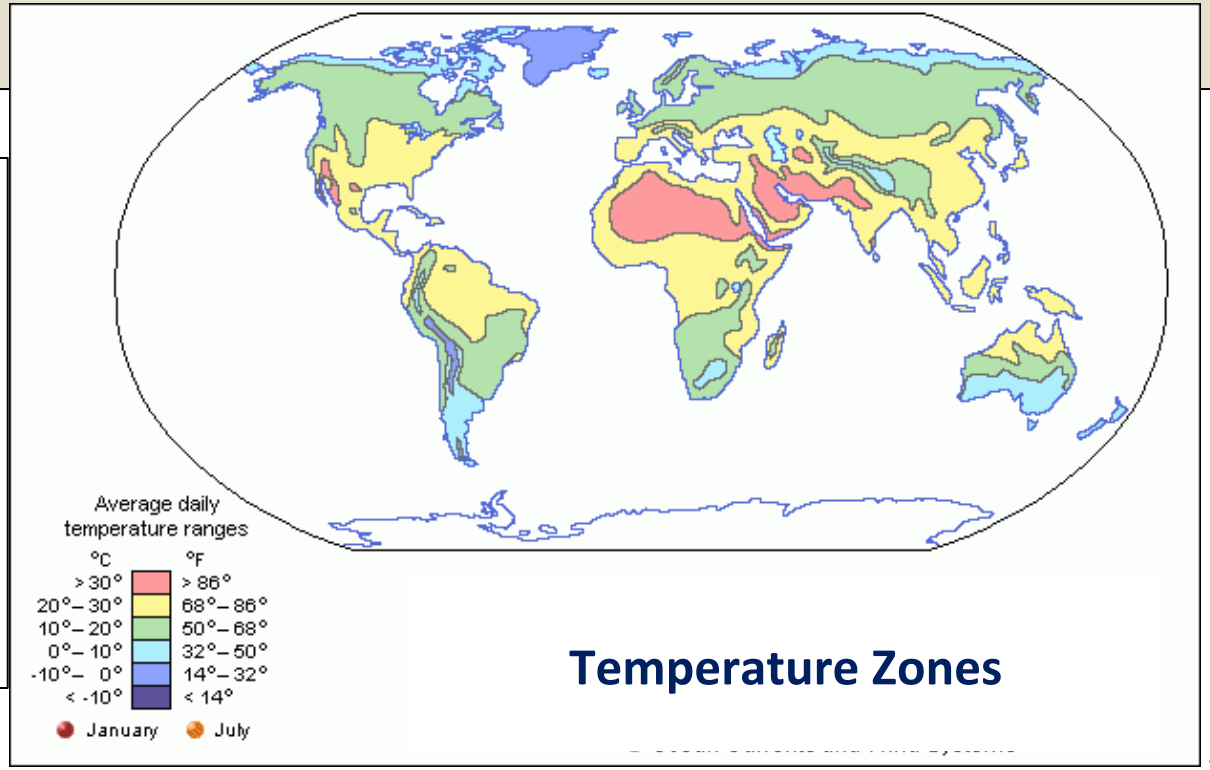
An 8th influence (unnatural) **is the human impact.**

Latitude

There are parallel zones of temperature.

Solar energy received varies with latitude.
It is most intense in the tropics and weakest in the polar regions.





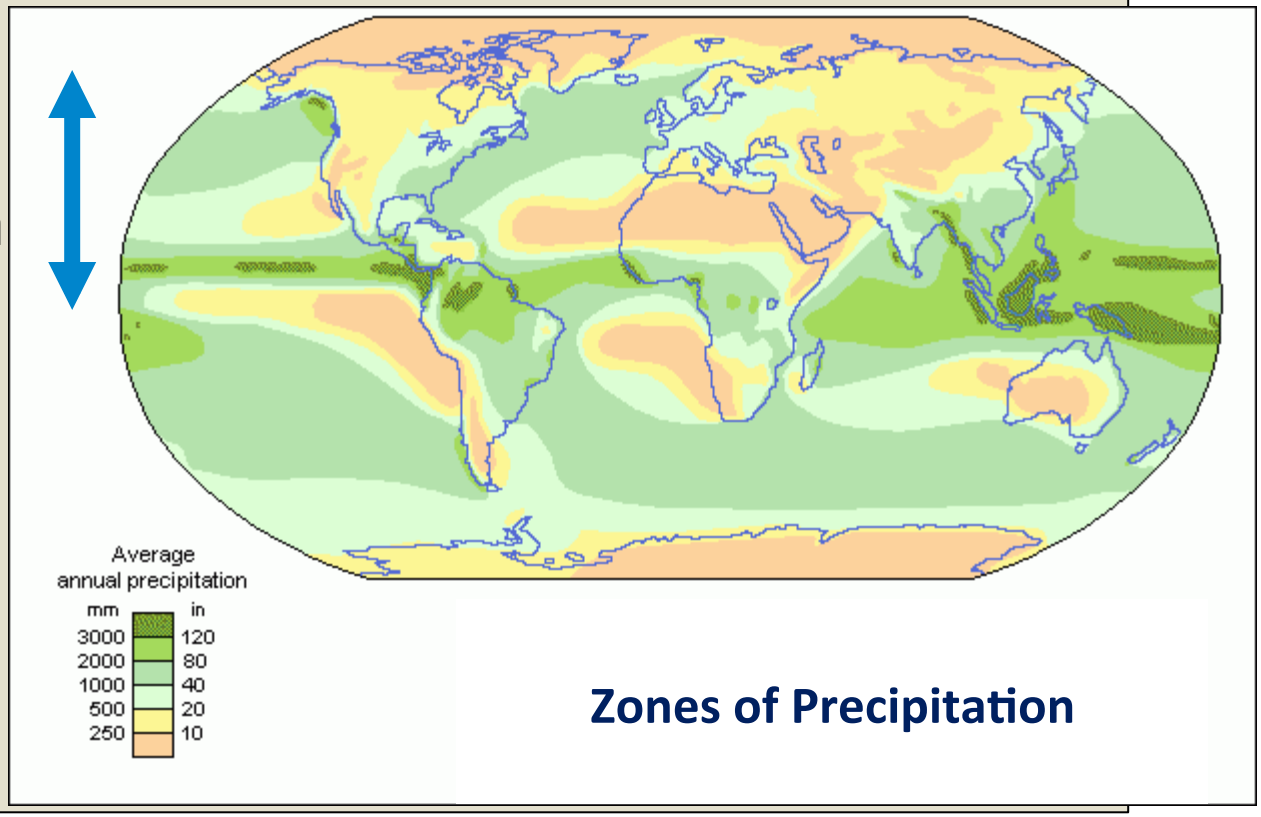
Temperature Zones

Latitude

Zones of precipitation are parallel latitudinal (east-west) **bands <u>except</u> for areas of tall north/south trending mountains.**

Precipitation zones move north and south with the seasons (following the vertical rays of the sun).

Air rises and sinks around the cells creating zones of precipitation

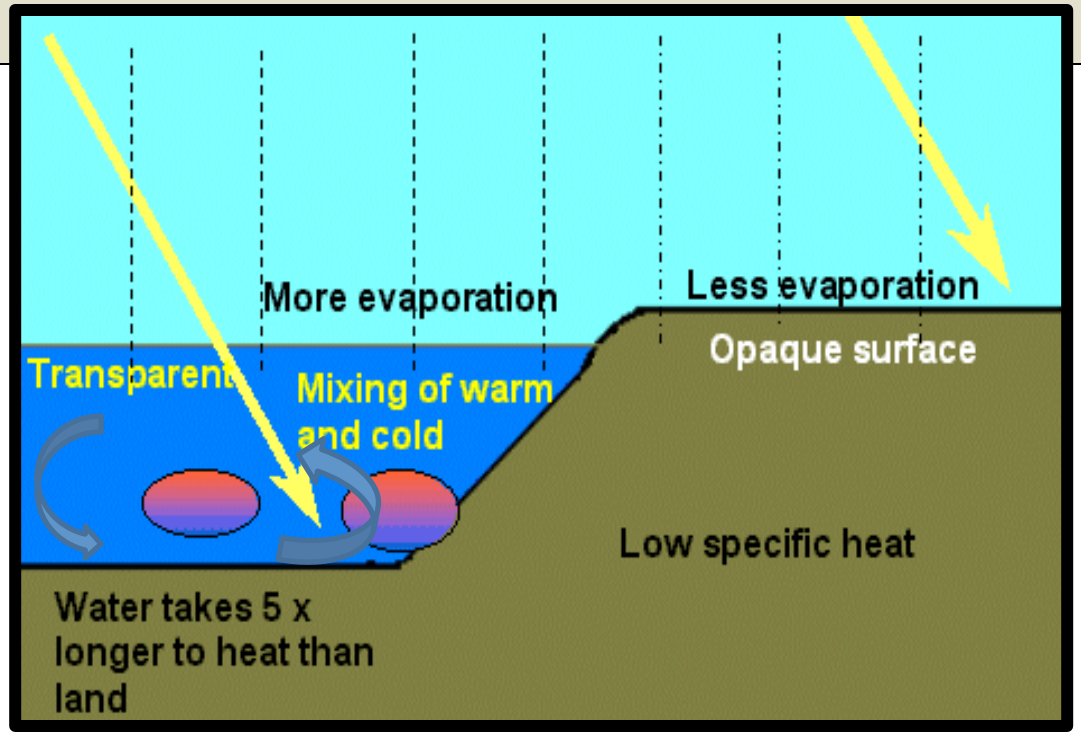


Zones of Precipitation

Land vs. Water

- Land (continental area) heats up and cools off more quickly than does water (marine area).

❖ **Water acts to moderate a climate**

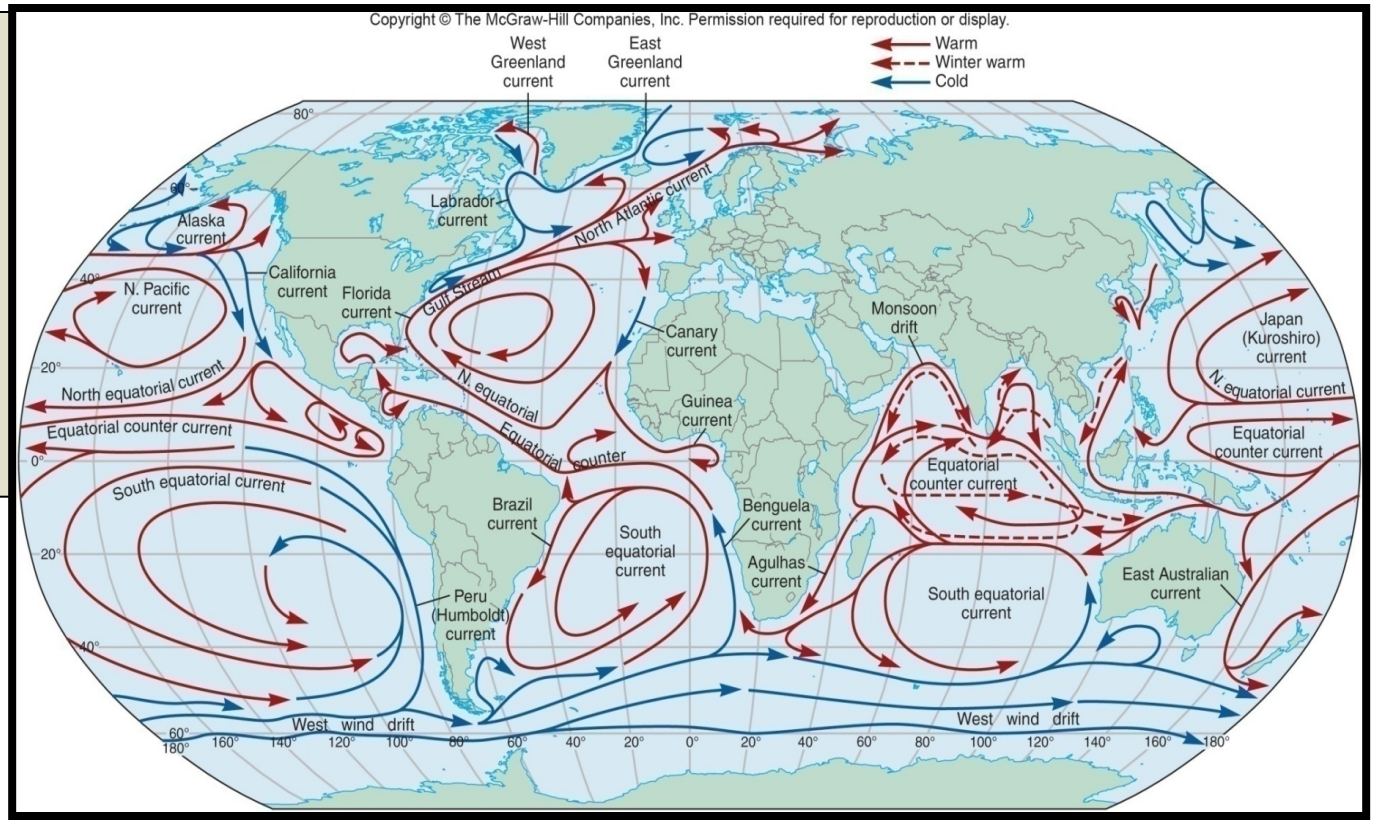


Land vs. Water

Land (continental area - Yakutsk) heats up and cools off more quickly than does water (marine area - Reykjavik).

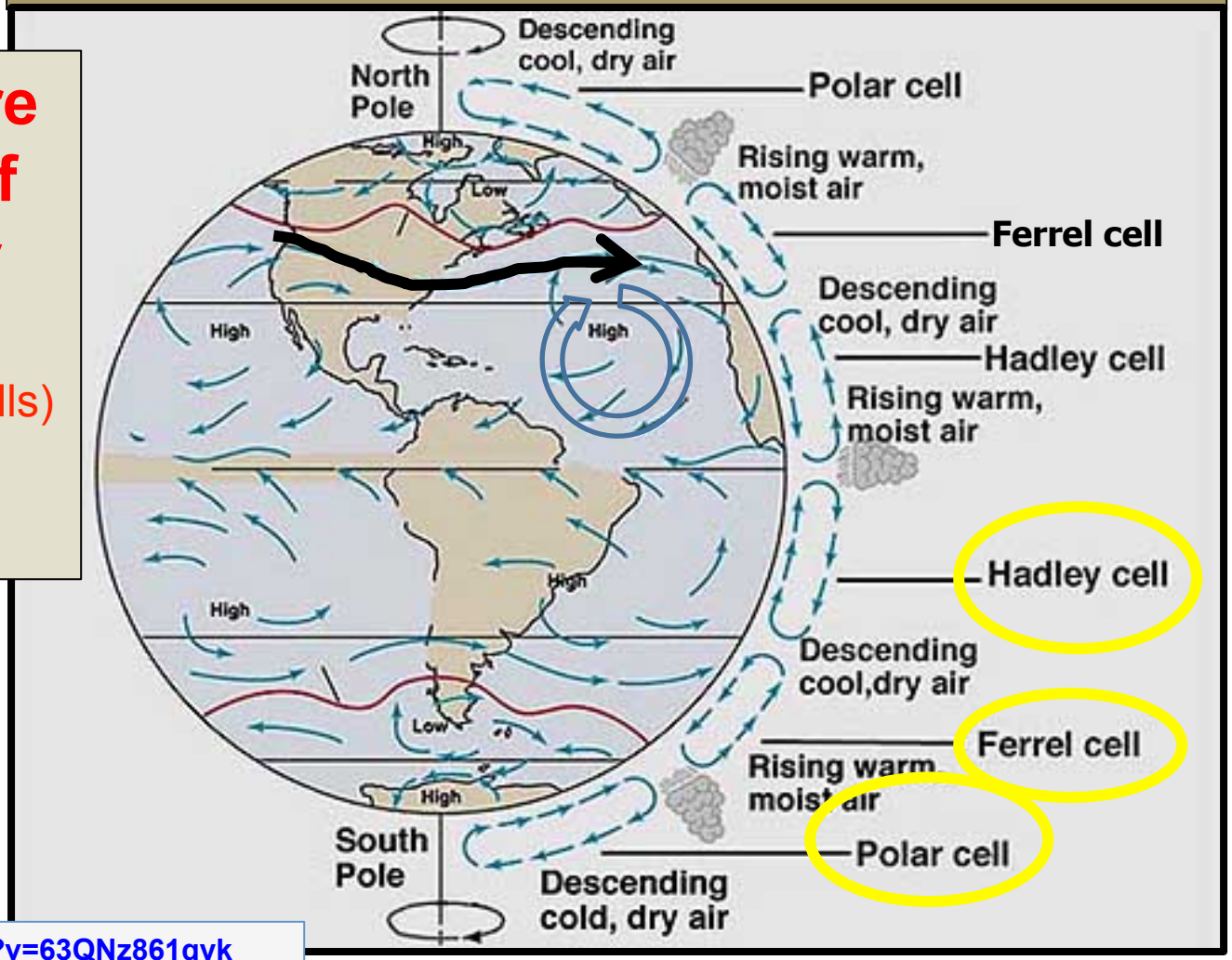
Surface Ocean Circulation

The temperature and direction of ocean currents influences the development of climate on land.



Wind Direction

The temperature and moisture of air is moved by wind systems,
both vertically (see cells) and
horizontally (arrows).



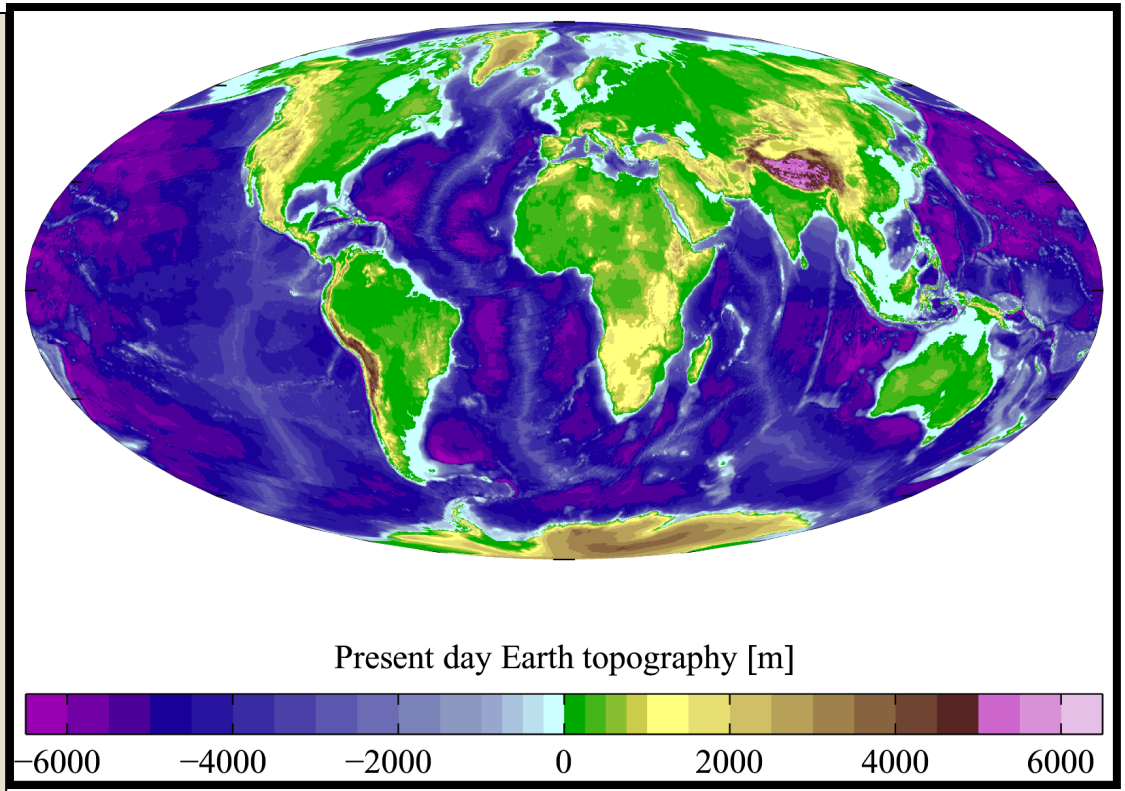
https://www.youtube.com/watch?v=63QNz861qyk

https://www.e-education.psu.edu/earth111/node/752

Topographic Barriers

The orientation and height of topographic barriers influences climate development.

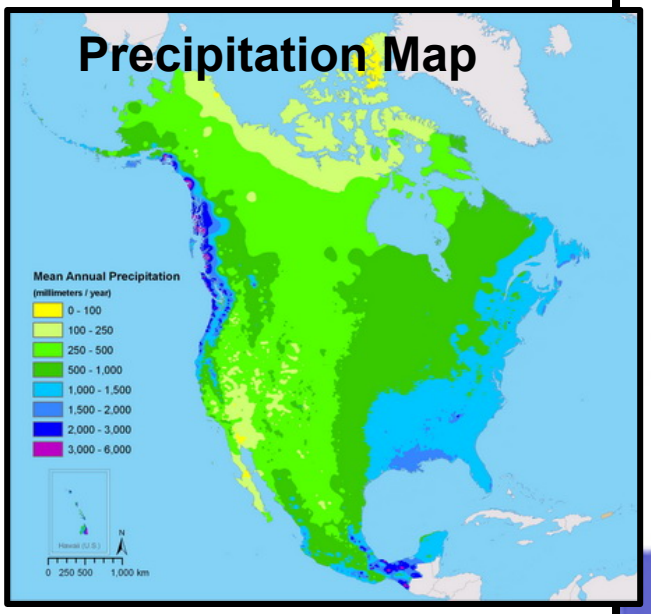
- ✓ Mountains and high plateaus block the flow of wind and moisture
- ✓ Higher elevations trigger precipitation and create dry “rain shadows.”

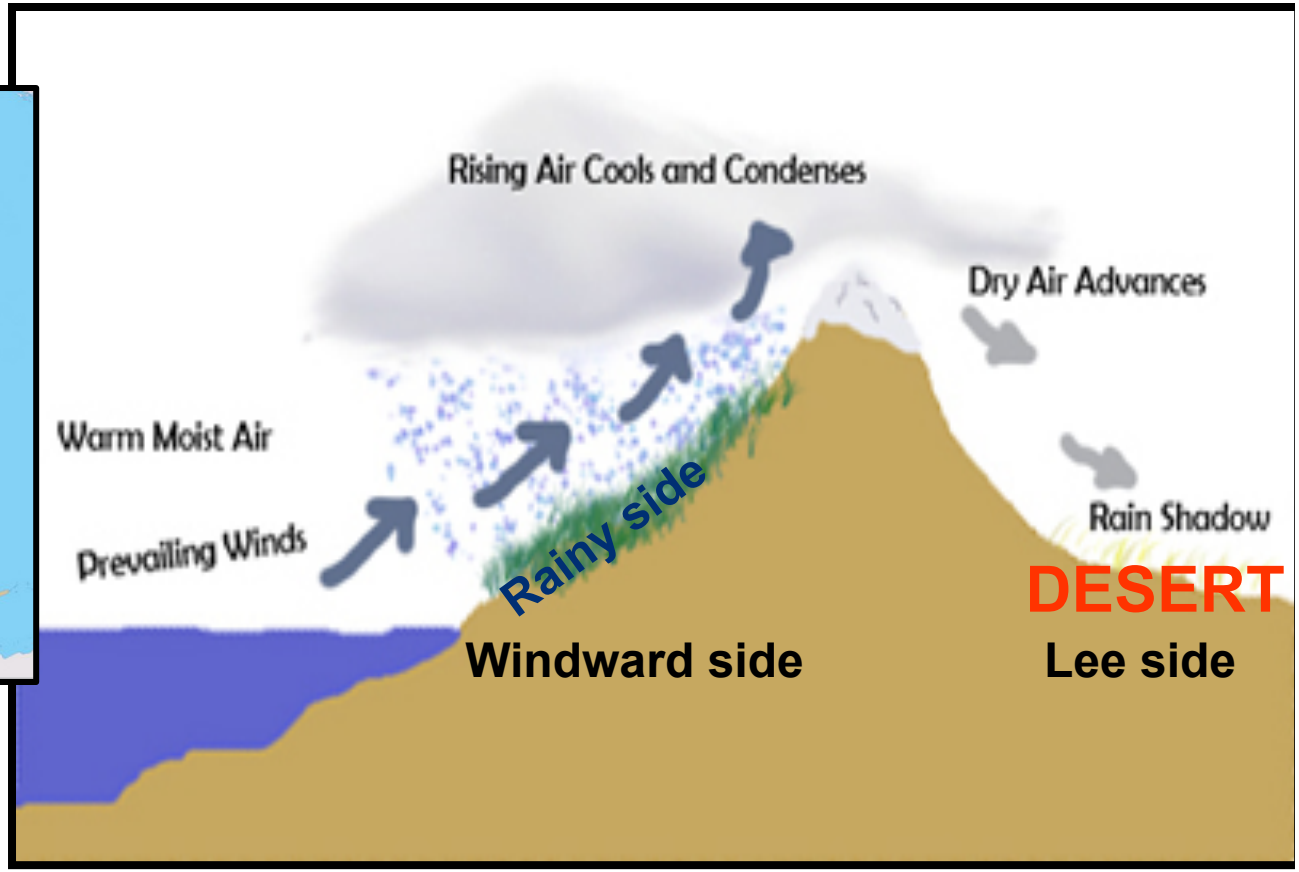


Lower elevation north-south mountain chains have a greater effect on climate than higher elevation east-west mountain chains.

Topographic Barriers

Topographic barriers create desert areas on their lee side.





Elevation

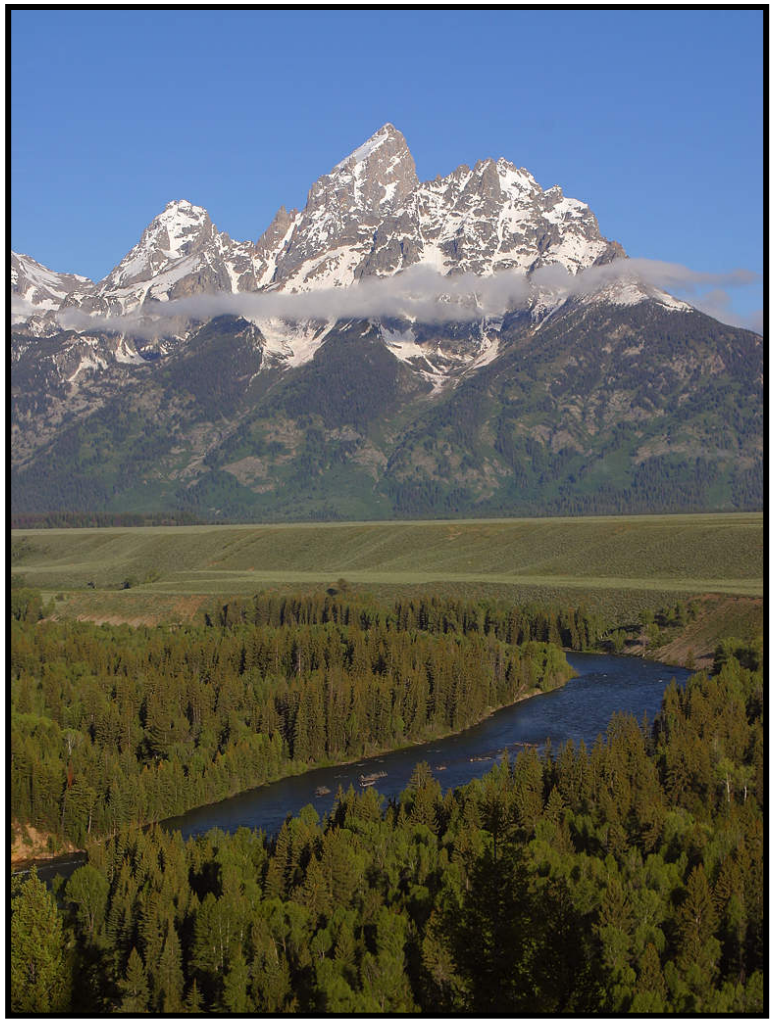
The elevation of land affects temperature.

- ✓**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. Therefore it can snow at the top of high mountains in the tropics.

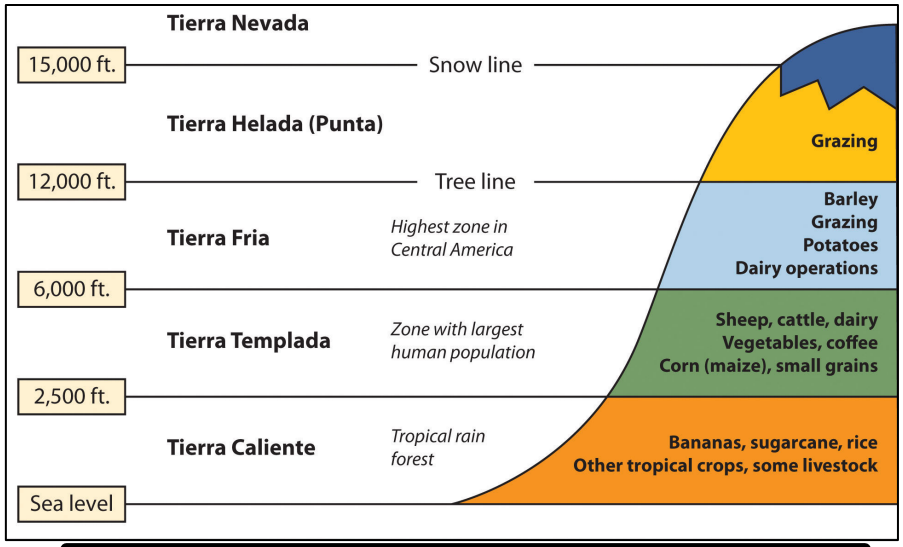
- ❖**Elevation creates Vertical Zonation of Climate** along the slopes of large, high landmasses.

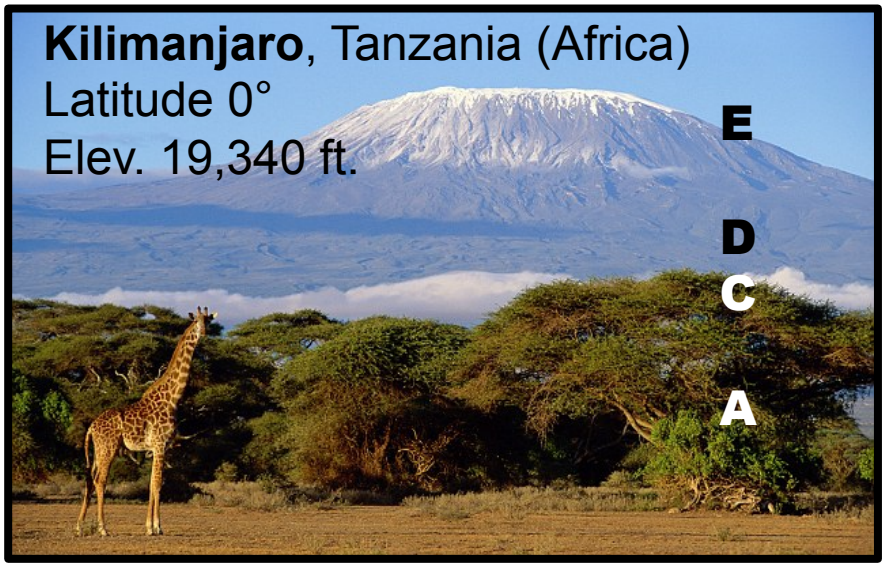
Vertical Zonation of Climate

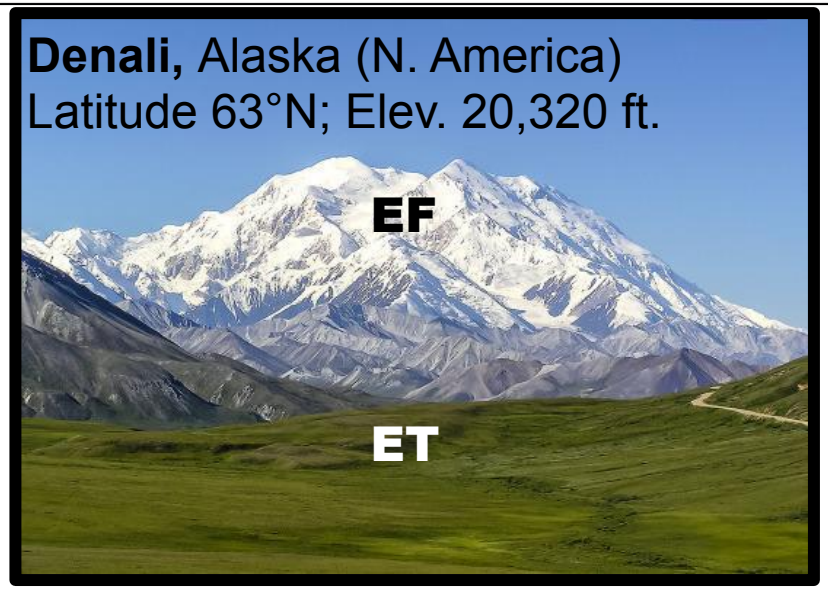


- **Temperature changes by 3½°F per 1000 ft of elevation *(lapse rate)*.**
- **The greatest number of zones is found in the tropics and only one in the polar region.**

Vertical Zonation of Climate



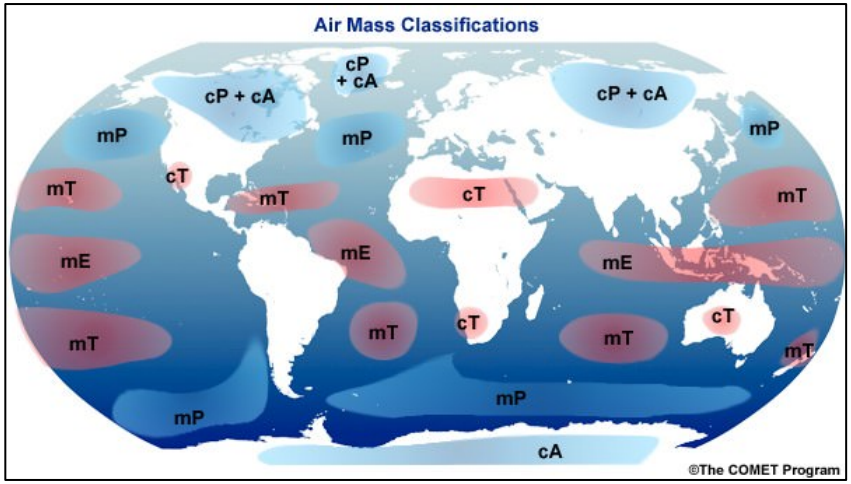


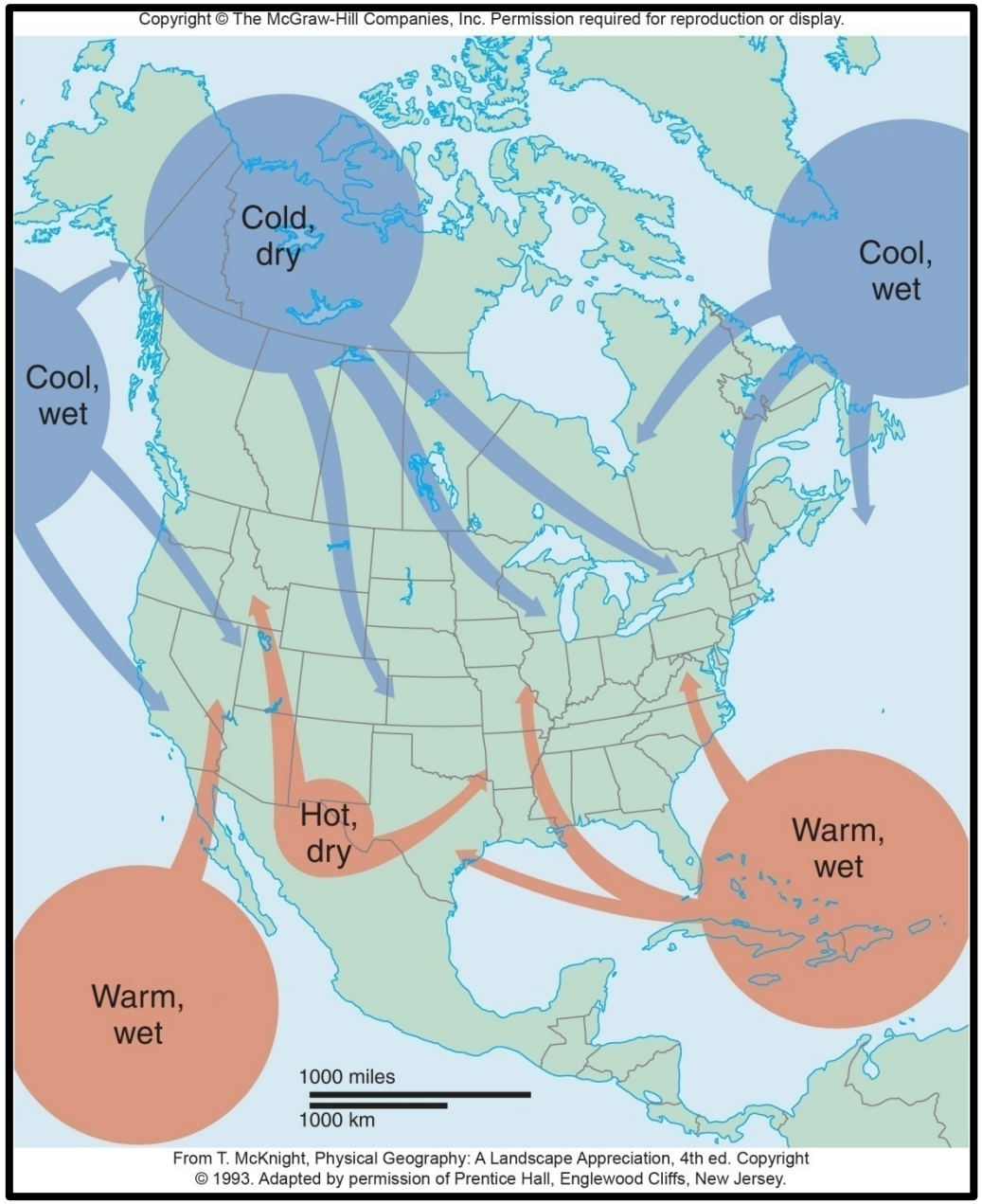


- **As you ascend a mountain climate characteristics and vegetation change.**
  - The greatest number of zones is found in the tropics
  - Only **one** zone in the polar region.

Air Masses

The source region and the annual characteristics of temperature and moisture impart unique conditions to the land masses.





RECAP: 7 CLIMATE CONTROLS

1. **Latitude -** solar energy received, zones of precipitation
2. **Land vs. water -** different rates of warming and cooling
3. **Ocean currents -** temperature and direction of flow
4. **Wind direction -** global and region wind systems
5. **Topographic barriers -** orientation and height
6. **Elevation -** lapse rate; vertical zonation
7. **Air masses -** source region and characteristics

http://wps.prenhall.com/wps/media/objects/616/631756/abcontrol/pages/question.html

Extra Credit for Exam II

Extra credit atlas exercise for EXAM II focuses on climate and climate controls.

It is available on the Course Home Page.

http://www.geo.hunter.cuny.edu/courses/geog101_grande/index.html

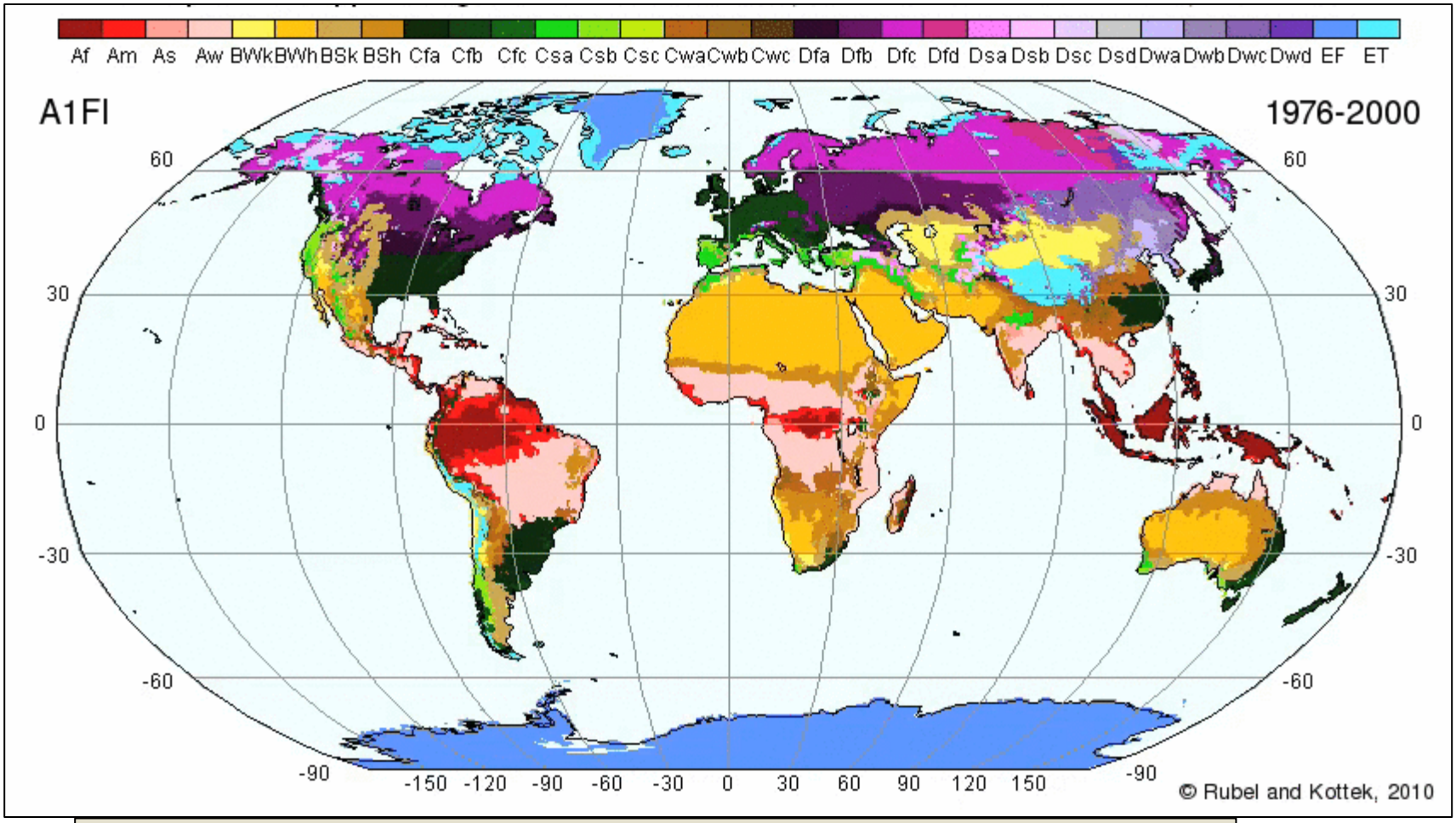
Submit answers no later than Tues., March 31, 2020.

Remember to include your name on the sheet.

Free tutoring in the Science Learning Center can help you with the extra credit assignment and exam preparation.

Climate Change Scenario
1976-2100

See end of chapter 2

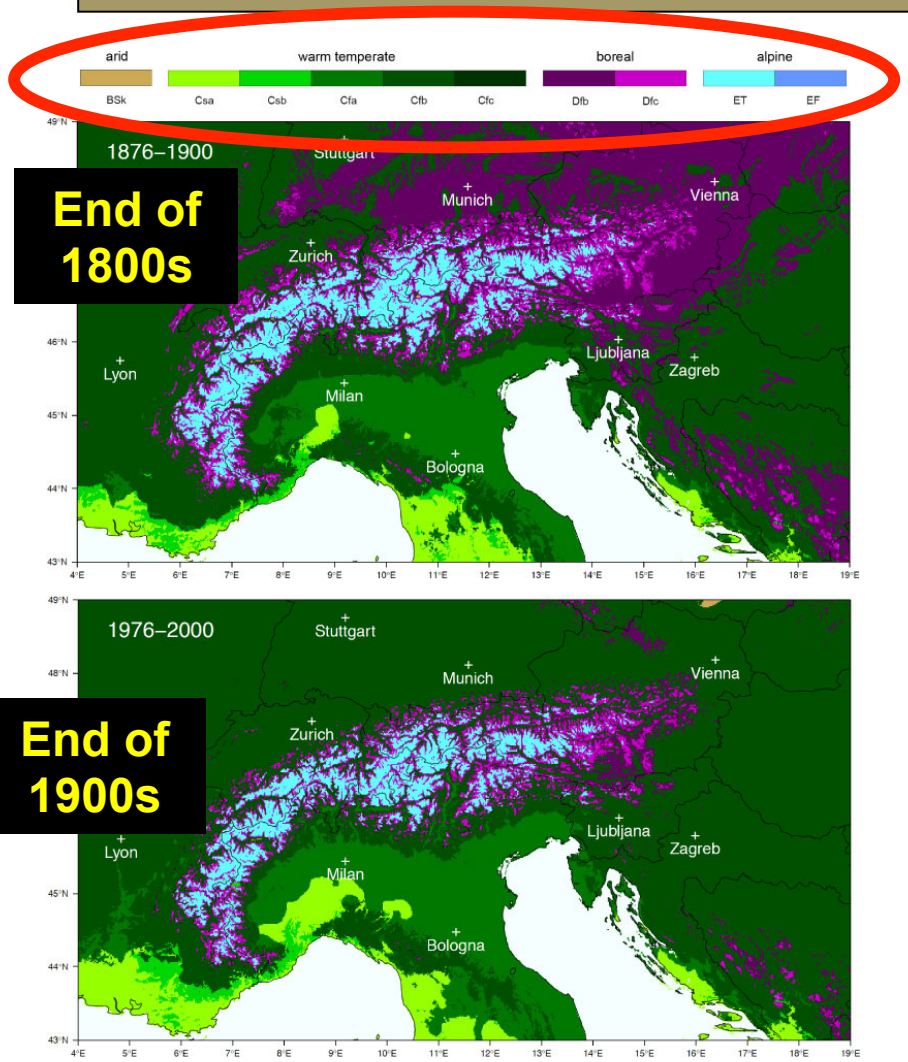


http://koeppen-geiger.vu-wien.ac.at/ : Climate change animation 1976-2100

Human-influenced Climate Change: Sea Levels

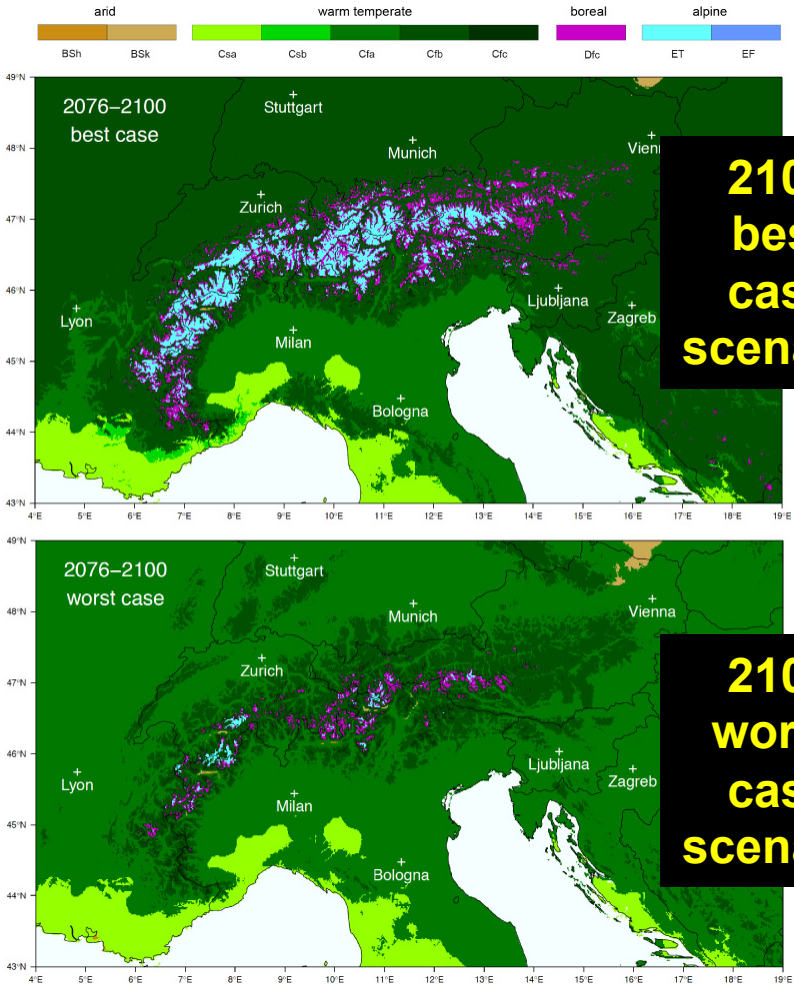
- We will talk about human impact in a couple of weeks including the **Green House Effect** and its relationship to global climate change. Here are some scenarios focusing on a warming earth and sea level rise.
  - **What happens if the Earth Warms 1°-2°C?** https://www.youtube.com/watch?v=9GjrS8QbHmY (2.5 min)
  - **What if all the ice on Earth melted: What would the continents look like?** https://www.youtube.com/watch?v=VbiRNT_gWUQ (2.75 min)
  - **Coastal Ghost Forests** *(NYTimes Oct. 9, 2019)* https://www.nytimes.com/interactive/2019/10/08/climate/ghost-forests.html

Global Warming and Snow Cover in the Alps



End of 1800s

End of 1900s



2100 best case scenario

2100 worse case scenario

http://koeppen-geiger.vu-wien.ac.at/alps.htm

REMINDER

- **Required essay topic using Chapter 2 can now be done.** (Or it may be used for extra credit in place of a "Think Geographically" essay.)

Theme: *Relationship of climate change to one of the following current event topic.*

1. the spread of disease (must be climate related; coronavirus COVID-19 is ***not*** *climate related).*

2. the occurrence of severe weather phenomena related to climate change.

3. the effect of climate change on global food supply related to changes in output (yields).

See guidelines.

N E X T

The Lithosphere:

Geologic Influences