

**GEOG 101 Part II
People and their
Physical Environment**

**13: Climate and
Climate Controls**
Chapter 2

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**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

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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.

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CLIMATE INFLUENCES

❖ BOTH Earth-Sun and Earth Environment factors influence climate development.

- latitude
- solar energy
- moisture
- wind direction
- topography
- 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!

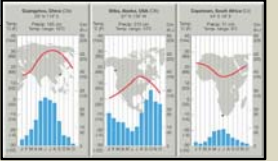
<https://www.nytimes.com/2011/03/30/sports/figliarod-climate-change-warming.html>

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STUDYING CLIMATE

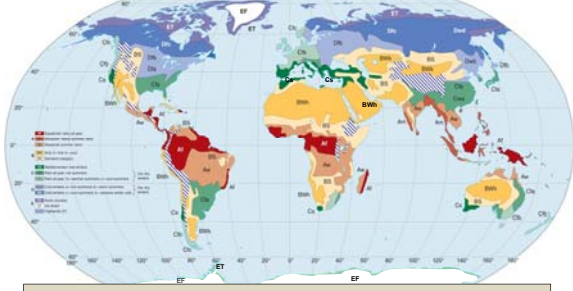
 Climate maps show the geographic distribution of averaged data.

❖ Climographs give us a snapshot of individual locations.



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WORLD CLIMATE MAP



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

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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.

Climate Type	Climate Characteristics
Tropical: constant day and 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
Dry summer	
Desert	
BWh	Hot desert climate
BWk	Cool desert climate
Semi-arid	
BSh	Hot semi-arid (steppe) climate
BSk	Cool semi-arid (steppe) climate
Subtropical: constant day, warm summers, and cool winters	
Humid subtropical	
Cfa	Humid, warm subtropical climate, with hot summers and no dry season
Cfb	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
Cfb	Marine west coast climate, with cool summers and no dry season
Mediterranean	
Csa	Mediterranean climate, with dry, warm summers and cool, wet winters
Csb	Mediterranean climate, with warm summers and cool, wet winters
Humid continental	
Dfa	Humid continental climate, with hot summers, cold winters, and no dry season
Dfb	Humid continental climate, with warm summers, cold winters, and no dry season
Dwa	Humid continental climate, with hot summers and dry, cold winters
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
Dfd	Moist subarctic climate, with cool summers and very cold, dry winters
Dfb	Moist subarctic climate, with cool summers, light winters, and no dry season
Dfb	Moist subarctic climate, with cool summers and light, dry winters
Polar: constant day	
Tundra	
ET	Tundra climate, with very cool, short summers and light winters
Ice cap and ice sheets	
EF	Ice cap climate, with temperatures constantly below freezing
Highland	
Hf	Humid highland climate, with large differences in climate below over short distances, during detailed climate patterns that cannot be shown on a world map. These areas are grouped as C, D, or E, depending on the climate type.

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
 Cfb = Marine west-coast summer
 Csa = Mediterranean dry summer
 Csb = Mediterranean dry winter
 Dfa = Humid continental hot summer
 Dfb = Humid continental warm summer
 Dwa = Subarctic hot summer
 Dwb = Subarctic warm summer
 Dsa = Subarctic hot winter
 Dsb = Subarctic warm winter
 Dfa = Humid continental hot summer
 Dfb = Humid continental warm summer
 Dwa = Subarctic hot summer
 Dwb = Subarctic warm summer
 Dsa = Subarctic hot winter
 Dsb = Subarctic warm winter
 Dfa = Humid continental hot summer
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 Dwa = Subarctic hot summer
 Dwb = Subarctic warm summer
 Dsa = Subarctic hot winter
 Dsb = Subarctic warm winter

<https://www.usclimate.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

- Latitude** - solar energy received, zones of precipitation.
- Land vs. water** - different rates of warming and cooling.
- Ocean currents** - temperature and direction of flow.
- Wind direction** - global/region wind systems.
- Topographic barriers** - orientation and height
- Elevation** - lapse rate; vertical zonation
- 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.

Average Yearly Temperature

<https://www.youtube.com/watch?v=mbgslGJ5fgc>: one min. loop

Temperature Zones

Latitude

Zones of precipitation are parallel latitudinal (east-west) bands **except** 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 atmospheric cells (associated with the global belts of air pressure), creating the moving zones of precipitation.

Shifting 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**

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Land vs. Water

Located at the same latitude.

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

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Surface Ocean Circulation

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

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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=63ONz861qvk>

<https://www.youtube.com/watch?v=Ye45DGkqUE>

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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 on their windward side and create dry "rain shadow" conditions on the leeward side.

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Topographic Barriers

Topographic barriers create desert areas on their leeward side.

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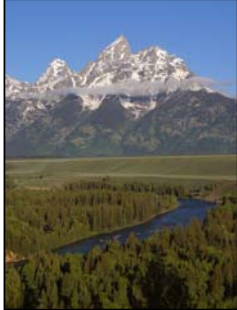
Elevation

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.

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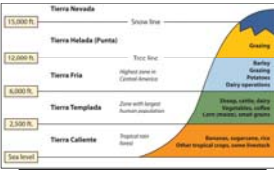
Vertical Zonation of Climate



- 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.

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Vertical Zonation of Climate



Kilimanjaro, Tanzania (Africa)
Latitude 0°
Elev. 19,340 ft.

E
D
C
A

➤ 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.

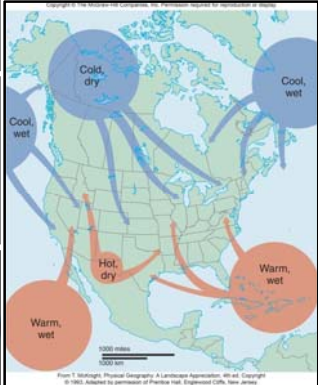
Denali, Alaska (N. America)
Latitude 63°N; Elev. 20,320 ft.

EF
ET

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Air Masses

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



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RECAP: 7 CLIMATE CONTROLS

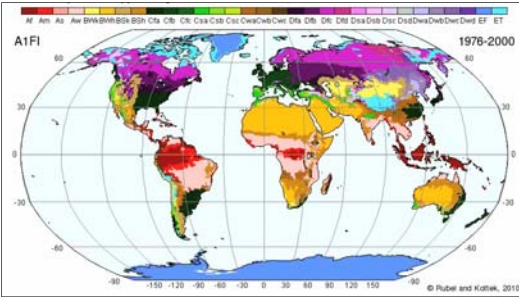
1. **Latitude** - solar energy received, zones of precipitation
2. **Land vs. water** - different rates of warming and cooling
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4. **Wind direction** - global and region wind systems
5. **Topographic barriers** - orientation and height
6. **Elevation**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

[Review and Study Guide: http://wps.prenhall.com/wps/media/objects/616/631756/abcontrol/pages/question.html](http://wps.prenhall.com/wps/media/objects/616/631756/abcontrol/pages/question.html)

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Climate Change Scenario 1976-2100

See end of chapter 2



<http://koepfen-geiger.wu-wien.ac.at/> : Climate change animation 1976-2100

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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>

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Global Warming and Snow Cover in the Alps

<http://koepfen-geiger.vu-wien.ac.at/alps.htm> 32

Global Cooling

- ❖ **Global cooling is also part of climate change.**
- The map shows maximum ice coverage c. 18,000 yrs. ago. Sea level was lower and more land was dry. Compare the continental outlines; note the linked islands.
- Ice Age ended 11,000-12,000 yrs ago.

VIDEOS

- [What Causes an Ice Age? - YouTube](#)
- [The Geography of the Ice Age - YouTube](#)
- [The Biogeography of the Ice Age - YouTube](#)

➤ Each video is about 14 min. long. They provide background material for those of you interested in climate change and changing earth environment: landforms and biodiversity.

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NEXT

The Lithosphere: Geologic Influences

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