What factors affect climate?

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Energy from the Sun (mostly light and heat) **radiates** to Earth

![Diagram of Sun and Earth with distance](image-url)
Reminder of Key Terms

• Energy
• Radiation
• Convection
• Conduction
• Latitude
• Longitude
• Evaporation
• Condensation
Earth is a 3-D sphere

• How does the intensity of insolation change as latitude increases?

• Why does the intensity of insolation change as latitude increases?
Earth

Lower concentration of Sunlight at poles than at the equator
Most regions outside the Tropics have warm and cold seasons because Earth’s axis is tilted and receive different amounts of insolation.
Regions within the Tropics often have climates with wet and dry seasons

- Summer monsoon—“rainy season”


http://www.cse.unsw.edu.au/~andrewt/i/dry_season_fire_full.jpg
Atmospheric Circulation

Variations in heating and cooling, and Earth’s rotation (Coriolis effect) produce three general climate zones in each hemisphere.
The atmosphere is actually more complicated than the simple model

http://universe-review.ca/I09-15-circulation2.jpg
Elevation

• The higher the elevation, the cooler the temperature
• Even in low latitudes (near the equator)
  --Andes
  --Himalayas
  --Kilamanjaro (Africa)

• Snow-capped peaks in Peru, near the equator

Topography

- As air rises up the windward side of a mountain, it cools and becomes saturated. As it sinks down the leeward side, it warms and dries. Areas where this occurs are the Pacific Northwest and the Sierra Nevadas. Behind these are “rain shadow deserts.”
Water Bodies

• Proximity (nearness) to ocean
• The Jersey Shore and similar places have cooler summers and warmer winters (smaller range) because they are near the ocean
• Greater range inland (middle of the continent)

• Proximity to large lakes (Great Lakes)
• “Lake-effect snow”
Classifying Climates – The Koppen System

[Image of the Koppen Climate Classification map]

Individual Climatic Zones Classified by Type

Type A
Tropical humid
- Af, Am
- Aw

Type B
Dry
- BSk, BSh
- BWh, BWk

Type C
Humid subtropical
- Cf
- Cfa
- Cw, Cwa, Cwb

Type C
Mediterranean
- Cs
- Csa, Csb

Type C
Marine west coast
- Cfb, Cfc

Type D
Humid continental
- Dfa
- Dfb
- Dwa
- Dwb

Type E, H
Continental subarctic
- Dfc
- Dfd
- Dwc
- Dwd

Polar
- ET-Tundra
- EF-Snow and ice

Highland
- H

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http://www.britannica.com/EBchecked/media/95795/The-major-climatic-groups-are-based-on-patterns-of-average
What kind of climate do we have?

- Mild winters with coldest month below 18 C but above -3 C
- We are described as “Humid mid-latitude with mild winter”
- Koppen system: Cfa

- Climatologists study “normals” and “anomalies” (how far away values are from the expected value)
National Climate Data Center
www.ncdc.noaa.gov

• Official US government climate source
• “New” Normals posted 1981 – 2010
http://ggweather.com/normals/

• New Jersey’s Climate Data
Frequently Updated Climate Data

- Monthly and Annual Statewide (1895-Present)
- Monthly Station
- Monthly Maps
- Winter 2010-2011 Snow Event Totals

Latest News

A backyard deck with furniture floats up onto a fence behind a pool destroyed by flood waters during flooding in Lincoln Park (Morris County) on September 8. Photo by Jerry McCrea/The Star-Ledger
Examples of annual climate patterns, shown with bar charts “discontinuous data”

http://climate.rutgers.edu/stateclim/
What Natural Processes Can Affect Climate?

• Volcanic eruptions
• Solar Activity
• Earth Motions (very long term)
• Ocean Circulation
  > General current patterns
  > El Nino-La Nina conditions
The “Greenhouse Effect” – Natural, but enhanced by Human Activity

Solar Radiation absorbed by Earth: 235 W/m²

Thermal radiation into space: 195

Directly radiated from surface: 40

Heat and energy in the atmosphere: 324

Greenhouse gas absorption: 350

Earth's land and ocean surface warmed to an average of 14°C
What Human Impacts Can Affect Climate?

• Release of “Greenhouse Gases”
• “Urban Heat Islands”
• Pollution

• IPCC (Intergovermental Panel on Climate Change) issues reports on potential impacts on Society
Takeaway Points

• Climates result from many factors, such permanent (such as elevation) and some changing cyclically (such as seasonal insolation)
• Climates can be described and classified by annual temperature and moisture patterns
• Natural and human-induced factors can impact climate
• Global climate will change in this century, with major impacts on society, including you!