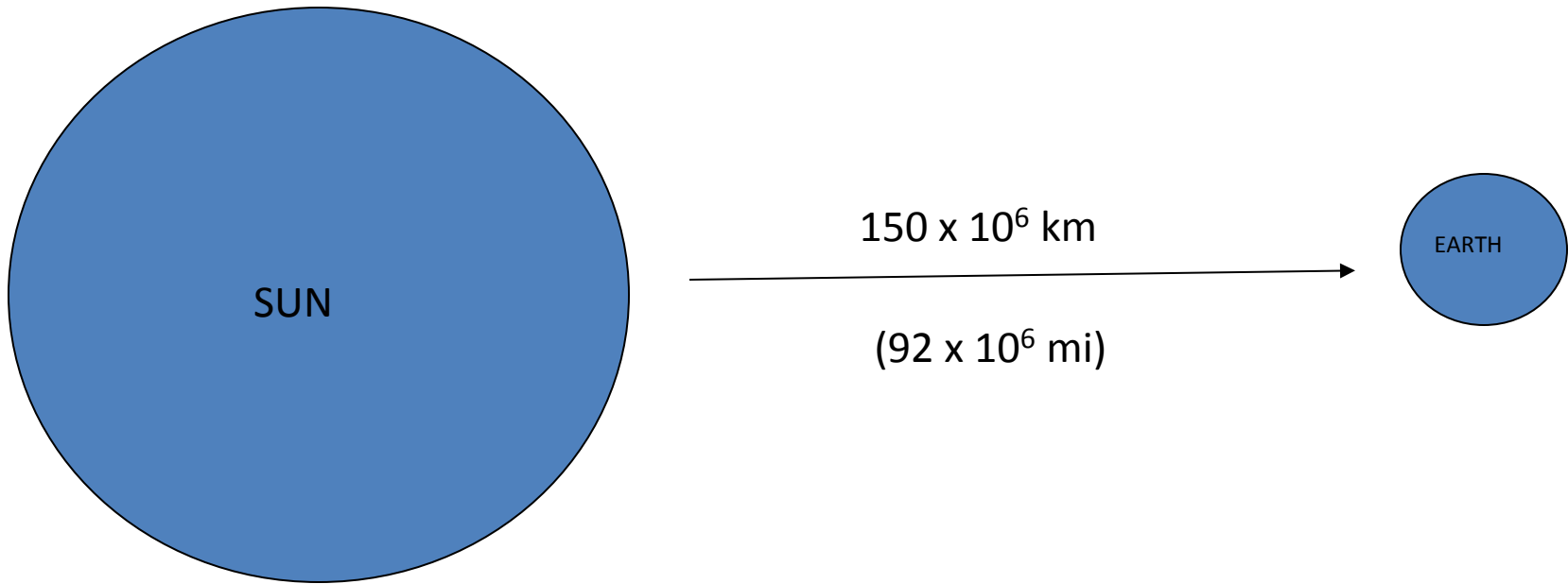


# What factors affect climate?

Dr. Michael J Passow

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



Challenge: If the speed of light is 300,000 km/sec, show how to calculate the time it takes sunlight to reach Earth.

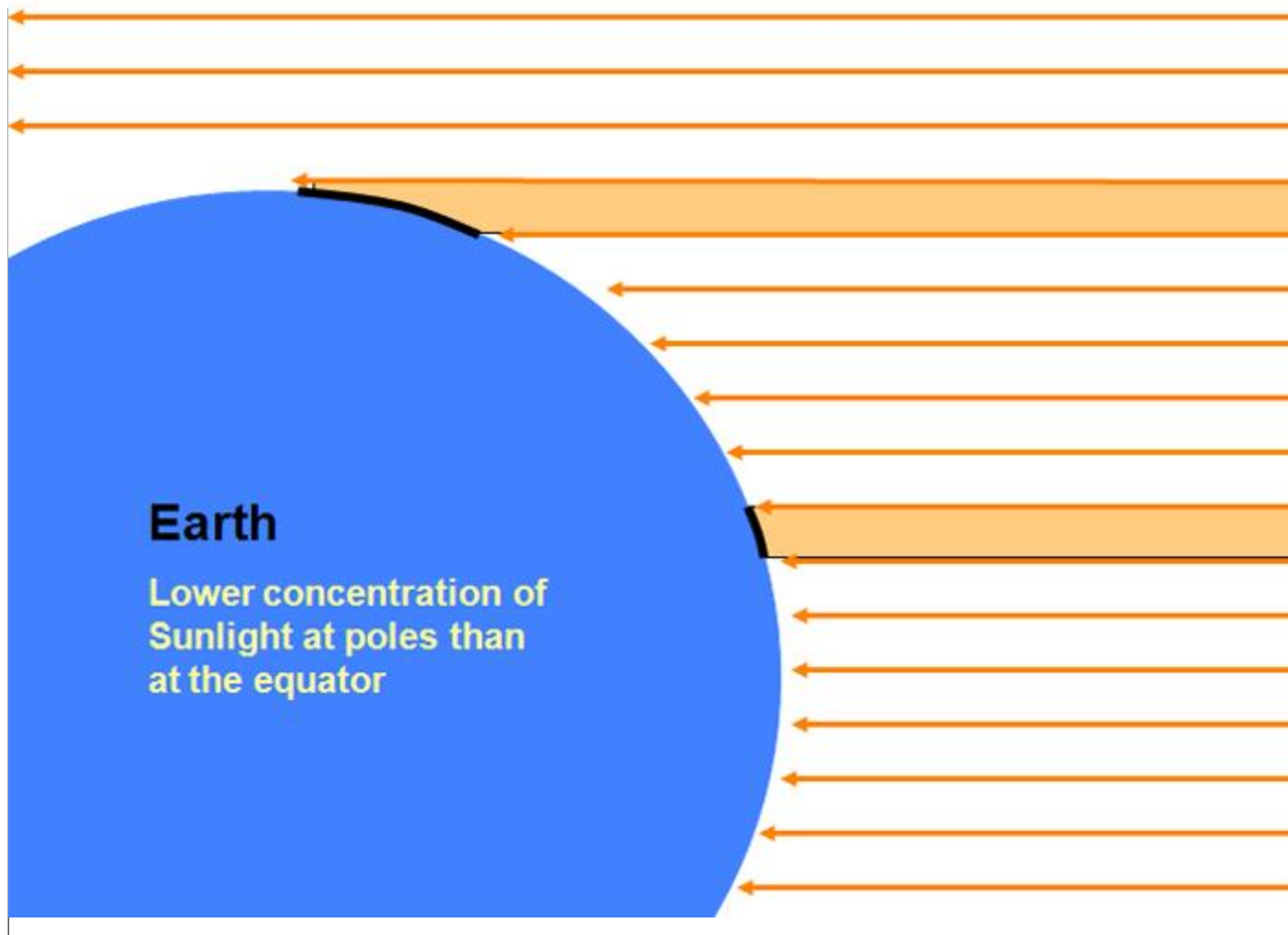
# Important Terms

Do you know what each means?

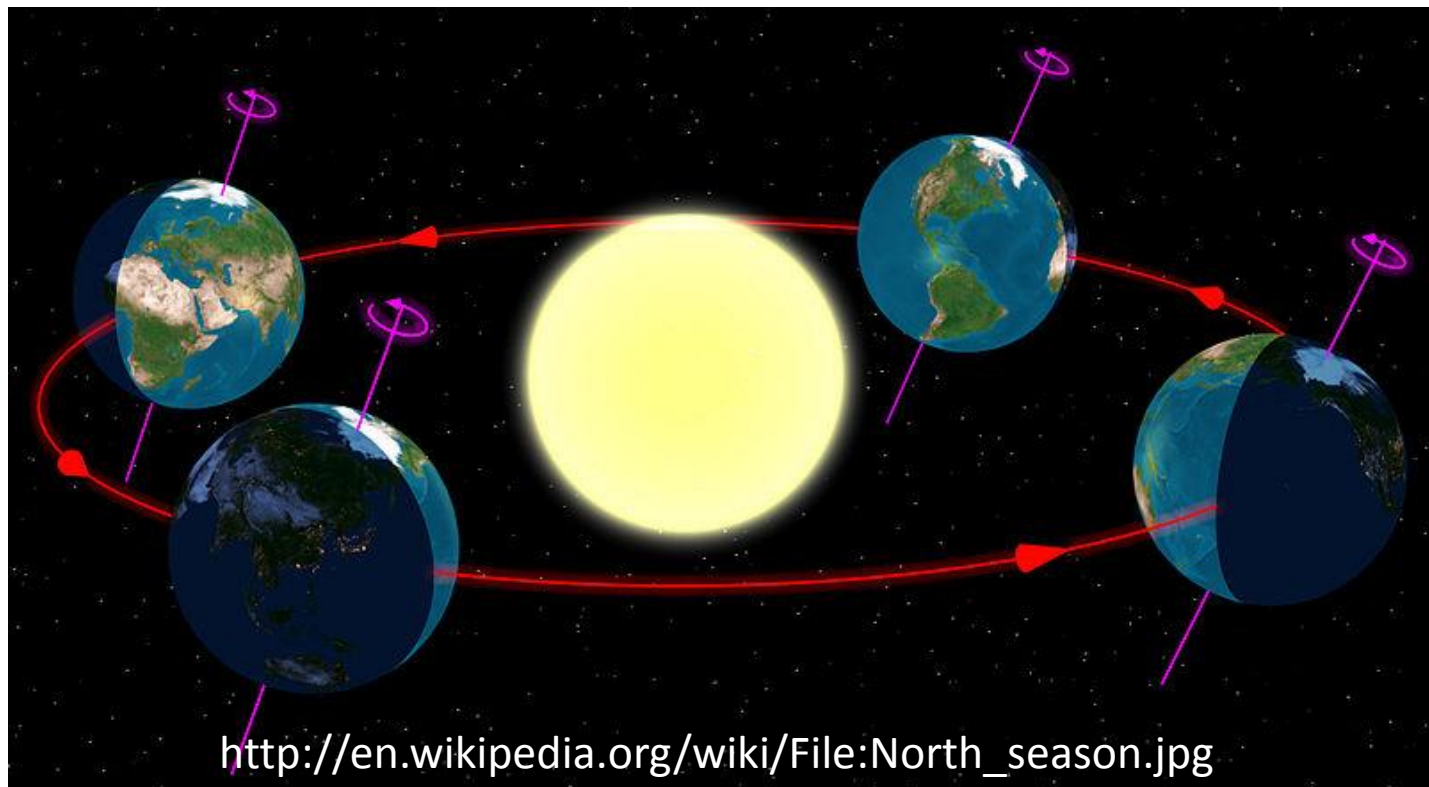
- Energy
- Radiation
- Convection
- Conduction
- Latitude
- Longitude
- Evaporation
- Condensation

# 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?



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”
- Winter monsoon  
“dry season”



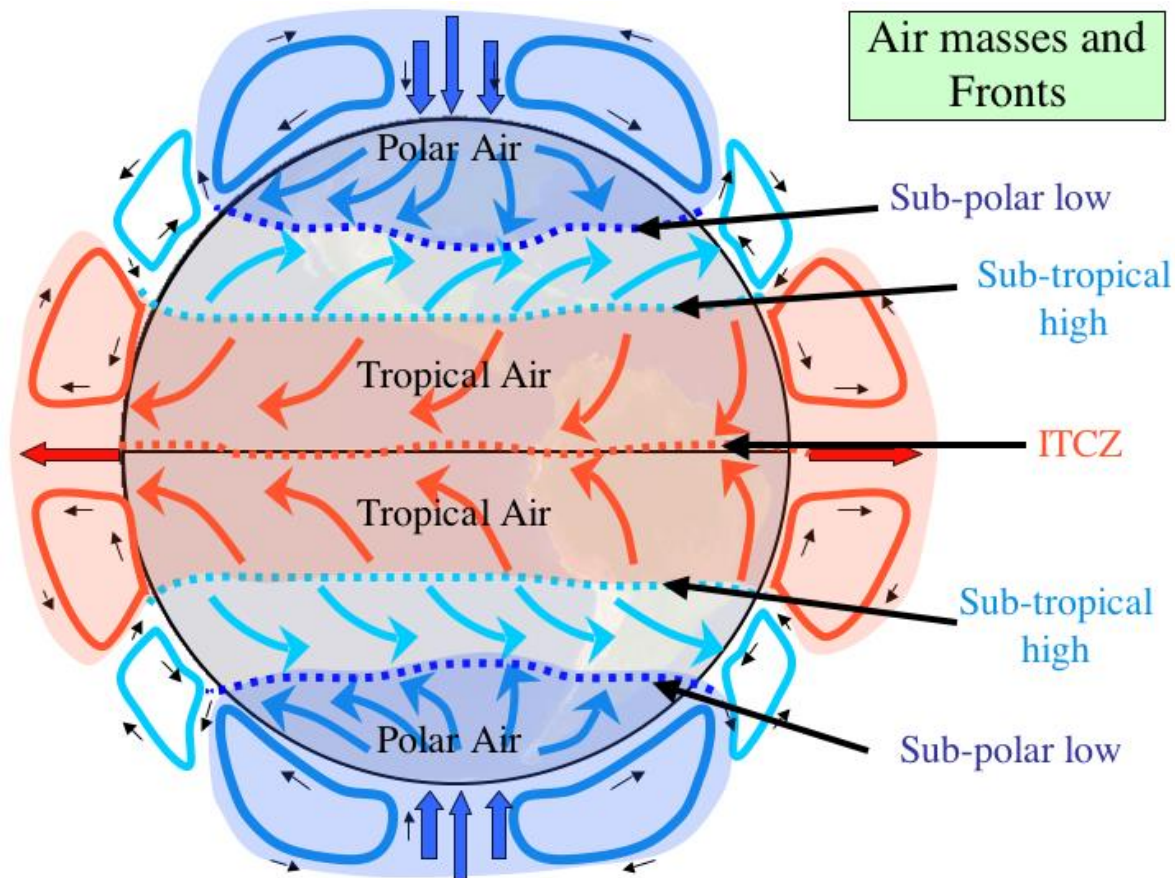
<http://www.thegeminigeek.com/wp-content/uploads/2009/06/monsoon.jpg>



[http://www.cse.unsw.edu.au/~andrewt/i/dry\\_season\\_fire\\_full.jpg](http://www.cse.unsw.edu.au/~andrewt/i/dry_season_fire_full.jpg)

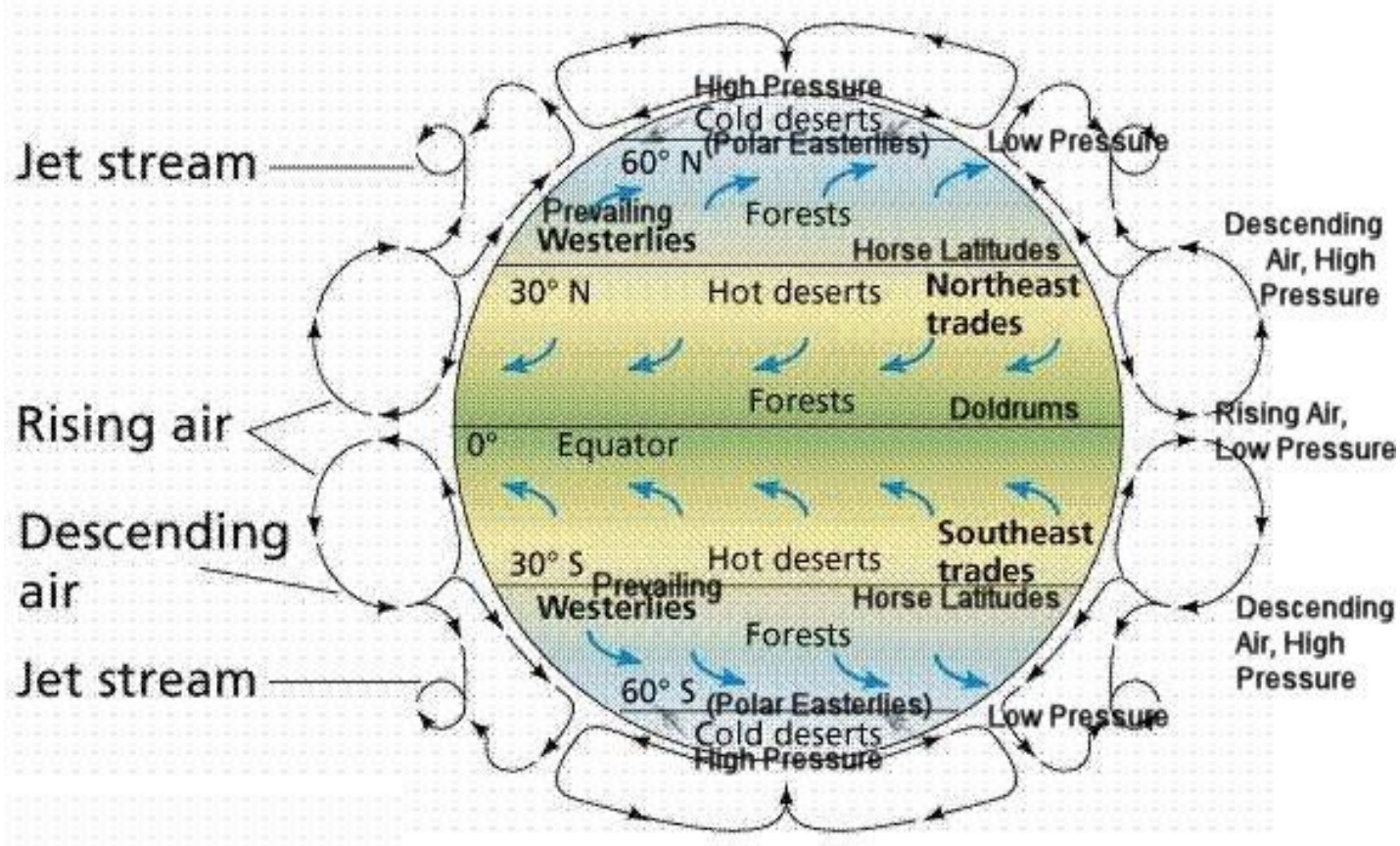
# Atmospheric Circulation

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 (and even than this 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
  - Kilimanjaro (Africa)

- Snow-capped peaks in Peru, near the equator



[http://travel.mongabay.com/pix/peru/aerial-andes-Aerial\\_1026\\_3164.html](http://travel.mongabay.com/pix/peru/aerial-andes-Aerial_1026_3164.html)

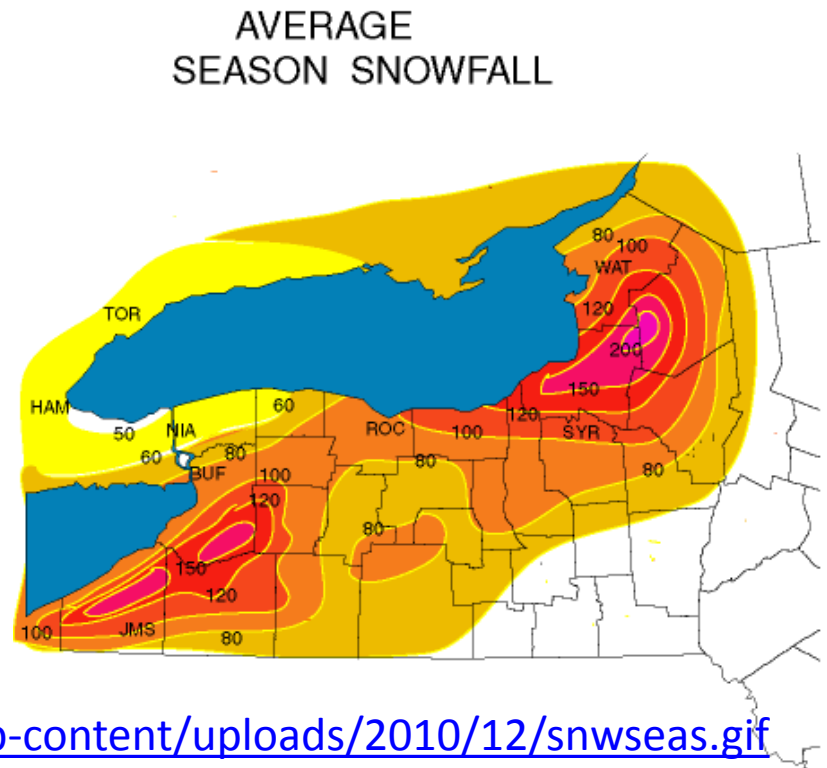
# Topography



- 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. Some areas where this occurs are the Cascades in the Pacific Northwest and the Sierra Nevadas. Behind these are “rain shadow deserts.”

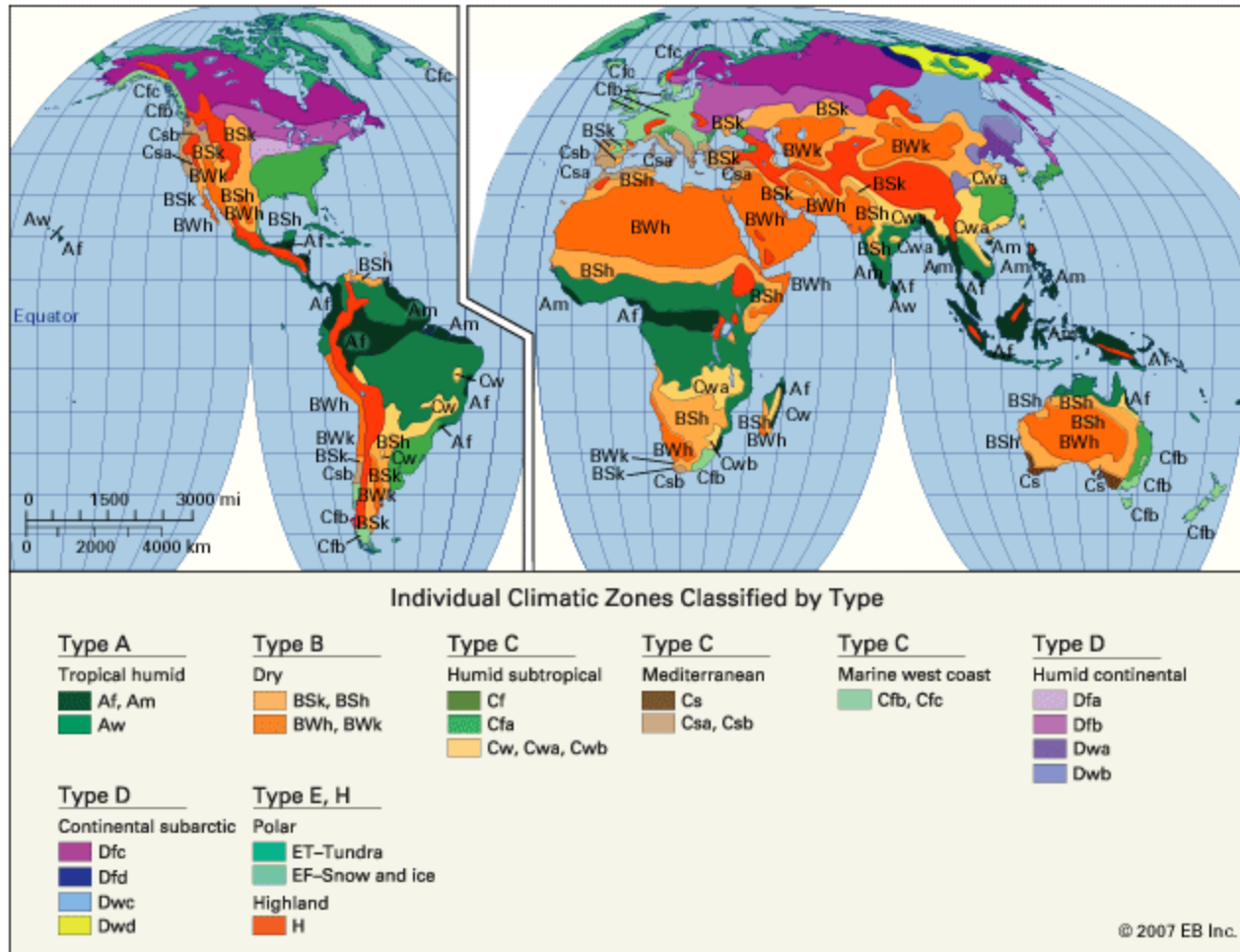
# Water Bodies

- 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

## Köppen Climate Classification



# What kind of climate do we have in NY and NJ?

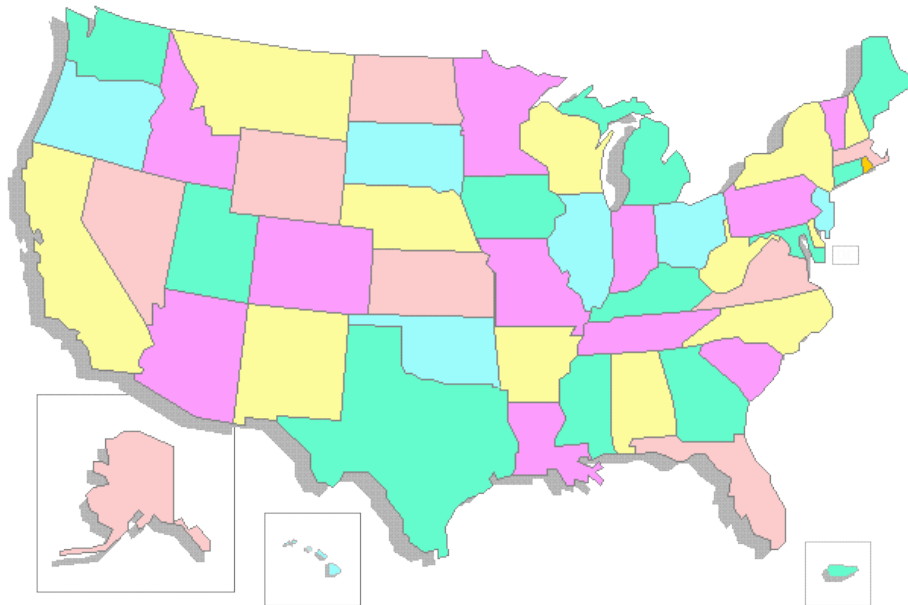
- Mild winters with coldest month below 18 C but above -3 C
- We are described as “Humid mid-latitude with mild winter”
- Koppen system: Cfa
- Climatologists study “**normals**” and “**anomalies**” (how far away values are from the expected value)
- Good for “Big Picture,” but we need to look more closely for the “good stuff”

# National Climate Data Center

[www.ncdc.noaa.gov](http://www.ncdc.noaa.gov)

- Official US government climate source
- “New” Normals posted 1981 – 2010

<http://ggweather.com/normals/>







# NOAA

## NATIONAL CENTERS FOR ENVIRONMENTAL INFORMATION

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION



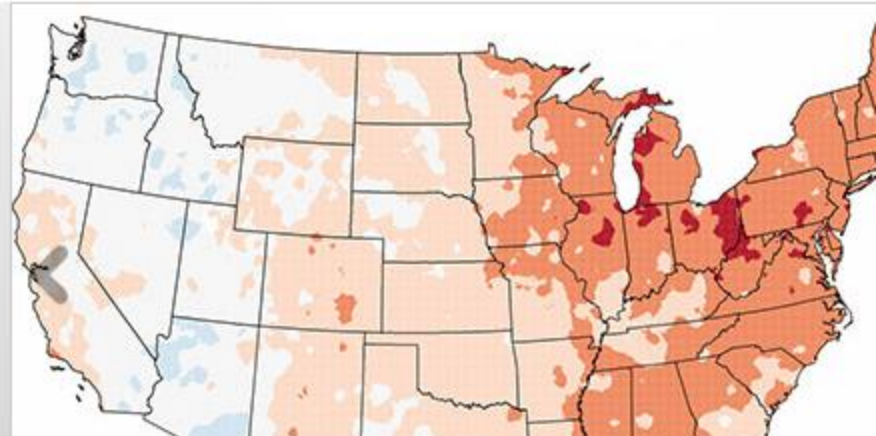
Formerly the National Climatic Data Center (NCDC)... [more about NCEI](#) »

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NOAA's National Centers for Environmental Information (NCEI) is responsible for preserving, monitoring, assessing, and providing public access to the Nation's treasure of climate and historical weather data and information. [Learn more about NCEI](#) »

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- [I want to search for data at a particular location.](#)
- [I want quick access to your products.](#)
- [I want to see your monthly climate reports.](#)
- [I want to find a specific dataset.](#)
- [I want to know about climate change and variability.](#)



### Assessing the U.S. Climate in September 2016

The September temperature averaged across the contiguous U.S. was 67.2°F, 2.4°F higher than the 20th century average.

1 2 3 4 5

### HIGHLIGHTS

#### Upcoming Events, Products, and Services

View a complete listing of the upcoming products and

### NEWSROOM



#### September 2016 Regional Climate Impacts and Outlooks

We're announcing the release of the Regional Climate Impacts and Outlooks summaries for September 2016.

### NCEI PARTNERS



Climate.gov  
science & information for a climate-smart nation



weather.gov





National Oceanic and Atmospheric Administration's

## National Weather Service

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MOS Prod

GFS-LAMP Prod

Climate

Past Weather

Predictions

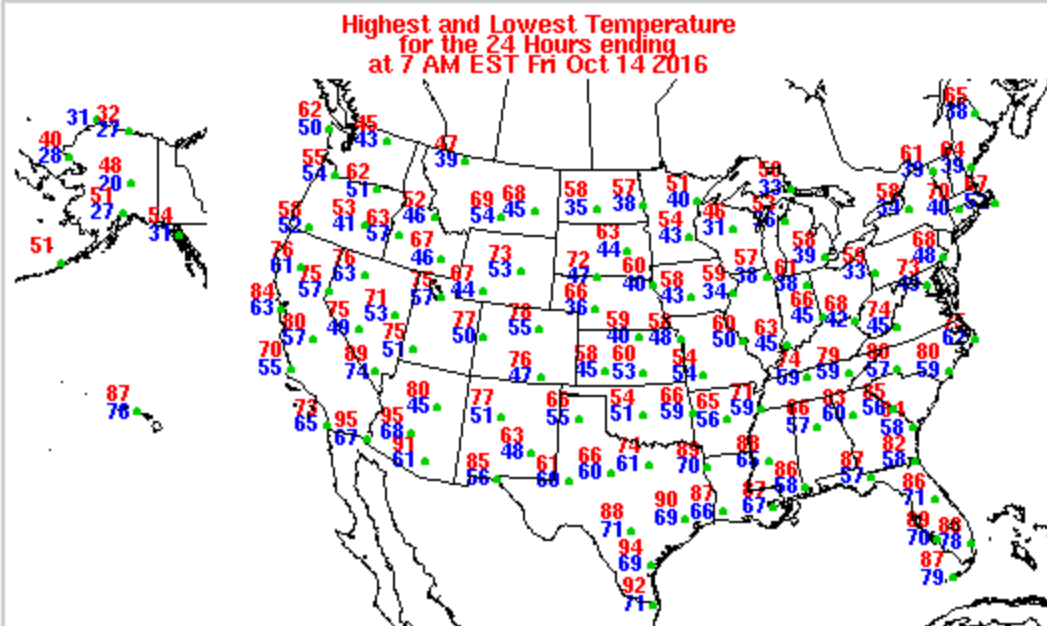


Visit the National Weather Service [Climate Services Web Page](#)  
for the latest information about what Climate Services is doing for you!

Click on the map below to obtain local climate information.

Access the product through the "Select Climate Outlook" drop down menu above the national map.

Warnings & Forecasts	Graphical Forecasts	National Maps	Radar	Water	Air Quality	Satellite	Climate
Select Recent Observations ▼ Go			Select Climate Outlook ▼ Go				





# Northeast Regional Climate Center

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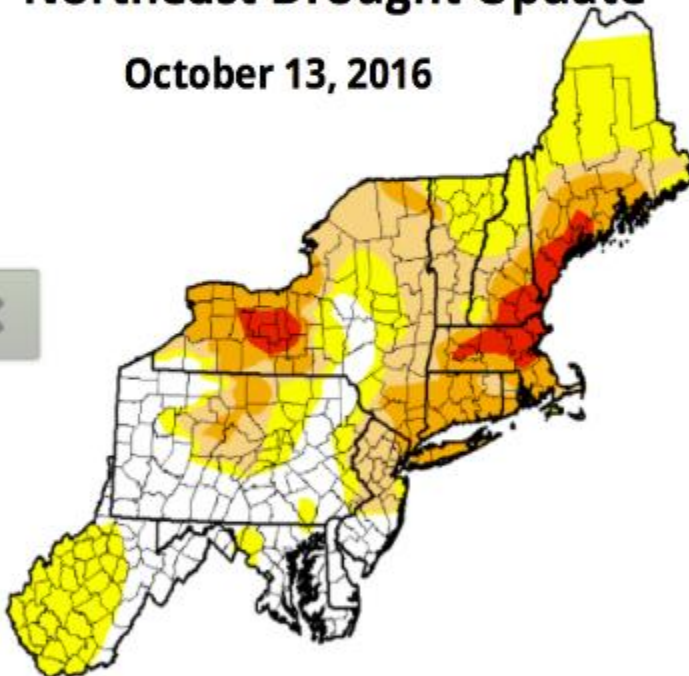
Blog

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We appreciate any feedback:  
[nrcc@cornell.edu](mailto:nrcc@cornell.edu)

## Northeast Drought Update

October 13, 2016

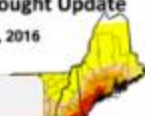


New York-Central Park Area, NY (Thre

Daily Data	Observed
Maximum temperature	60
Minimum temperature	45
Average temperature	52.5
Precipitation	0.04
Snowfall	0.0
Snow depth	0
Month-to-Date	
Average temperature	50.3
Total precipitation	0.20
Total snowfall	0.0
Year-to-Date	
Average temperature	43.7
Total precipitation	11.79
Snowfall since July 1	32.1

## WEBSITE HIGHLIGHTS

Northeast Drought Update  
October 13, 2016



## Northeast Drought Update

The Northeast Drought page offers a weekly update of the current conditions, including conditions and impacts, as well as precipitation anomalies.

c.cornell.edu





# Northeast Regional Climate Center

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We appreciate any feedback:  
[nrcc@cornell.edu](mailto:nrcc@cornell.edu)

## The Ithaca Climate Page

Normal	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Max Temperature (°F)	31.3	34.0	42.0	55.5	67.4	76.0	79.9	78.6	71.3
Min Temperature (°F)	15.4	16.5	23.1	33.9	43.5	53.3	57.7	56.3	44.0
Avg Temperature (°F)	22.3	25.3	32.6	44.7	55.4	64.6	68.8	67.4	57.7
HDD (base 65)	1291	1113	1006	612	317	96	30	44	210
CDD (base 65)	0	0	0	3	20	85	148	120	100
Precipitation (inches)	2.08	1.98	2.64	3.29	3.19	3.99	3.83	3.63	3.54
Snowfall (inches)	17.6	14.2	11.7	3.4	0.0	0.0	0.0	0.0	0.0

These normals are based on data for the period 1981-2010. Normals are updated every [for Environmental Information](#).





# ONJSC

at Rutgers University

Office of the New Jersey State Climatologist · Rutgers University · 5A Joyce Kilmer Avenue · Lucy Stone Hall B224 · Piscataway, NJ 08854

## Home

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[New Jersey Forecast](#)  
[National Forecast](#)  
[NOAA Climate Watch](#)

### NJ

[Current Conditions](#)  
[Current Forecasts](#)  
[Climate Information](#)

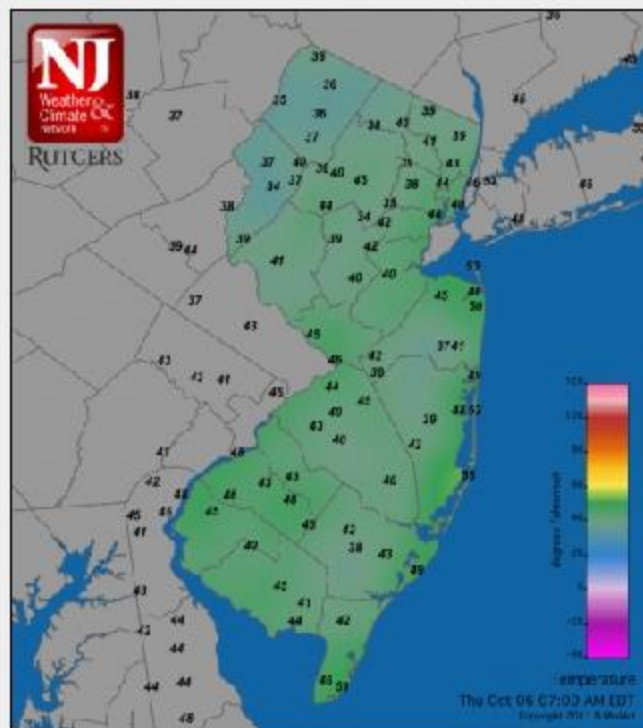
### US

[Current Conditions](#)  
[Current Forecasts](#)  
[Climate Information](#)

### Other

[Coastal](#)  
[Observations](#)  
[El Niño/La Niña](#)  
[Hurricanes](#)

### Latest from the NJWxNet



### Frequently Updated Climate Data

[Monthly and Annual Statewide \(1895-Present\)](#)

[Monthly Station](#)

[Monthly Maps](#)

[Winter 2010-2011 Snow Event Totals](#)

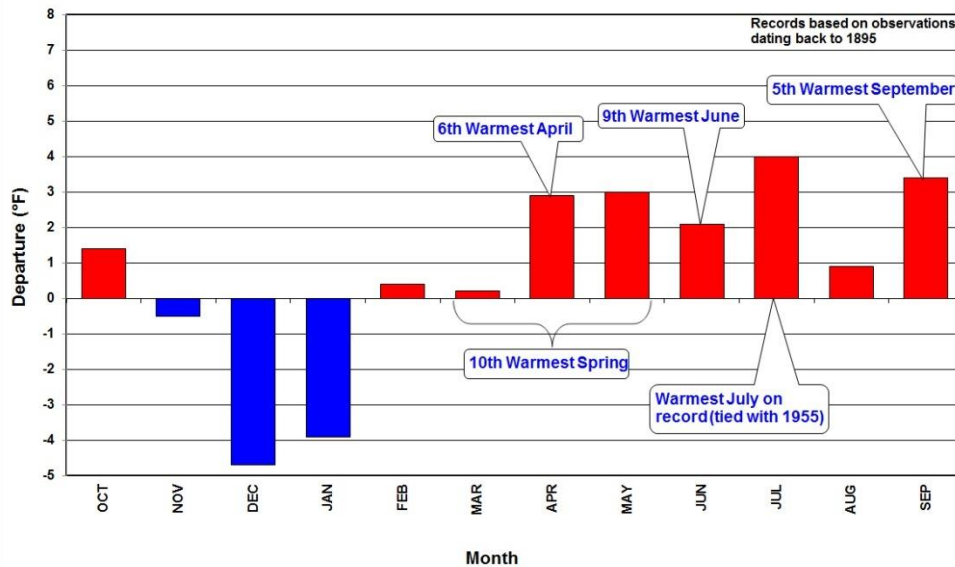
### Latest News



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

### NJ Monthly Temperature Departures (October 2010 - September 2011)

Departures calculated from differences between observed monthly temperatures and 1981-2010 monthly averages

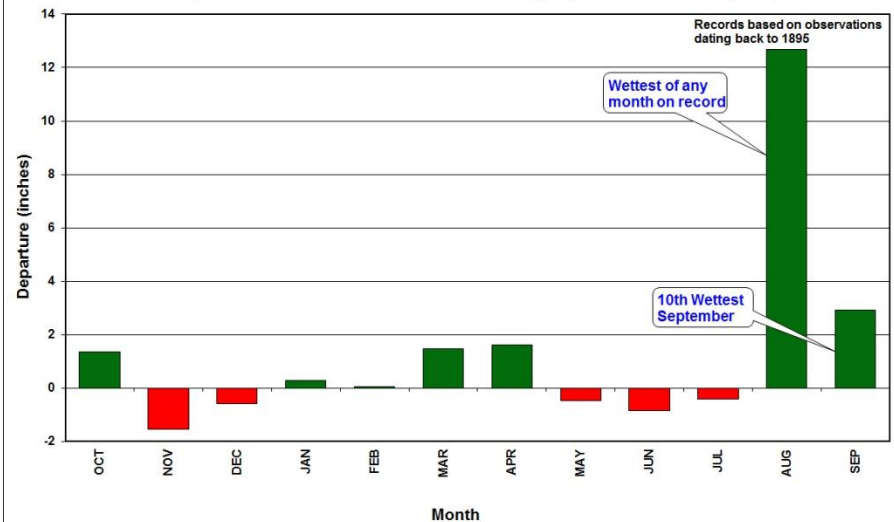


Examples of annual climate patterns, shown with bar charts

“discontinuous data”

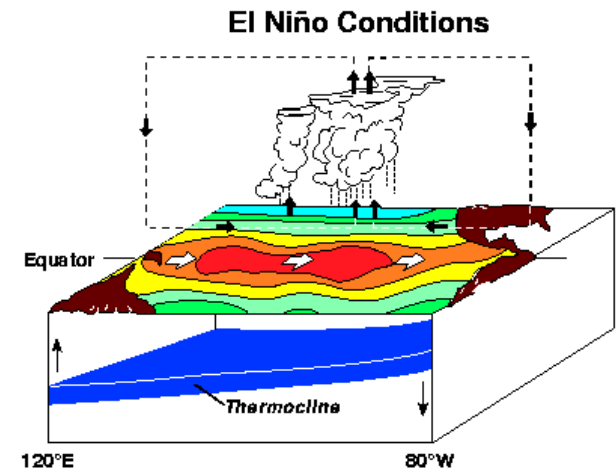
### NJ Monthly Precipitation Departures (October 2010 - September 2011)

Departures calculated from differences between observed monthly precipitation and 1981-2010 monthly averages

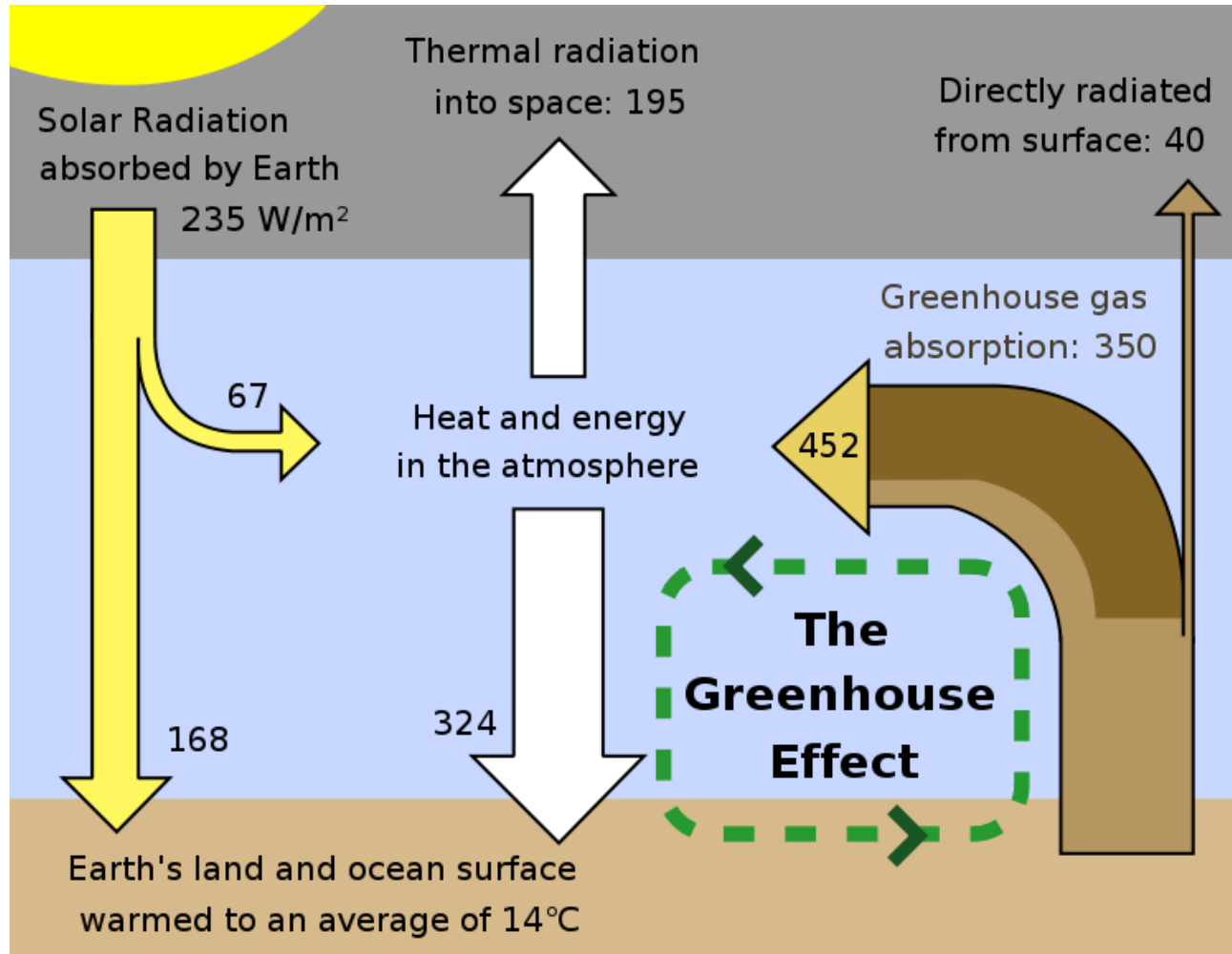


# What Are Some Natural Processes That Can Affect Climate?

- 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



# What Human Impacts Can Affect Climate?

- Release of “Greenhouse Gases”
- “Urban Heat Islands”
- Pollution
  
- IPCC (Intergovernmental Panel on Climate Change) and National Climate Assessment reports on potential impacts on Society



ipcc

INTERGOVERNMENTAL PANEL ON climate change



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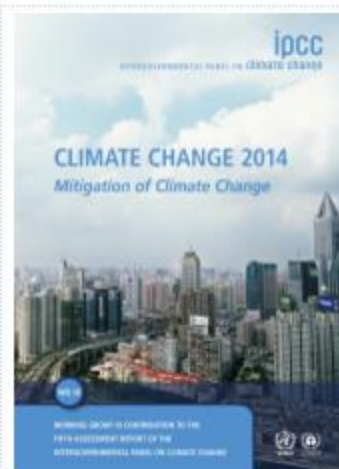


## Fifth Assessment Report (AR5)

EN | FR |

Search AR5 Re

The decision to prepare a Fifth Assessment Report (AR5) was taken by the members of the IPCC at its 28th Session (09-10 April 2007, Budapest, Hungary). Following the election of the new IPCC Bureau at the 29th Session of the IPCC (31 August - 04 September 2007, Geneva, Switzerland) and discussions about future IPCC activities at the 30th Session of the IPCC (21-23 April 2009, Antalya, Turkey), a Scoping Meeting was held (13-17 July 2009, Venice, Italy) to develop the scope and outline of the AR5. The resulting [outlines](#) for the Working Group contributions to the AR5 were approved by the 31st Session of the IPCC in Bali (26-29 October 2009).



## Factsheets in all UN Languages

- [What is the IPCC?](#)
- [How does the IPCC select its authors?](#)
- [What literature does the IPCC assess?](#)
- [How does the IPCC review process work?](#)
- [How does the IPCC approve reports?](#)
- [How does the IPCC deal with alleged errors?](#)
- [Timeline - highlights of IPCC history](#)



# National Climate Assessment



## Highlights

Explore highlights of the National Climate Assessment including an Overview, the report's 12 overarching findings, and a summary of impacts by region.



## Full Report

Explore the entire report covering changing climate, regions, cross sector topics, and response strategies in full.

→ EXPLORE HIGHLIGHTS

→ EXPLORE THE REPORT



# Takeaway Points

- Climates result from many factors, some 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 impact climate over short- and long-time scales
- Global climate will change in this century, with major impacts on society, including you!