

# What is the difference between Weather and Climate?

## Objective

Many people are confused about the difference between weather and climate. This makes understanding the difference between weather forecasts and climate prediction difficult. The following activities are intended to help students understand the difference between weather and climate. In the process, students will also learn about the different factors that influence a regions climate.

## Background

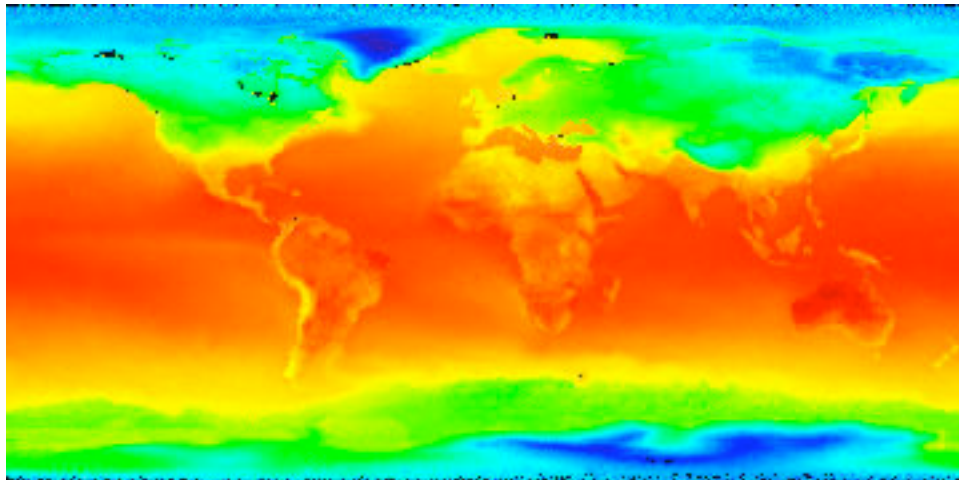
Scientists describe the **weather** at a particular time and place and the **climate** of a particular region using the same characteristics. These characteristics include air temperature, cloudiness, precipitation type and amount, air pressure, and wind speed and direction. The weather can be defined as the current atmospheric conditions of each of these variables for a location. Climate, on the other hand, is the general weather conditions for a location averaged over a long (at least a few decades) period of time. It is often said that the climate is what you expect but weather is what you get. Another way to think about this relationship is that the weather tells you what to wear each day, but the climate helps you figure out what should be in your closet.

## Theory

The climate of any region is influenced by many different but interacting factors. These include latitude, elevation, proximity to large water sources, ocean currents, topography, vegetation and prevailing winds. These climate controls influence the seasonal cycle of average temperature, precipitation, pressure etc. for a region. The following are a few diagrams that can help describe these climate control variables.

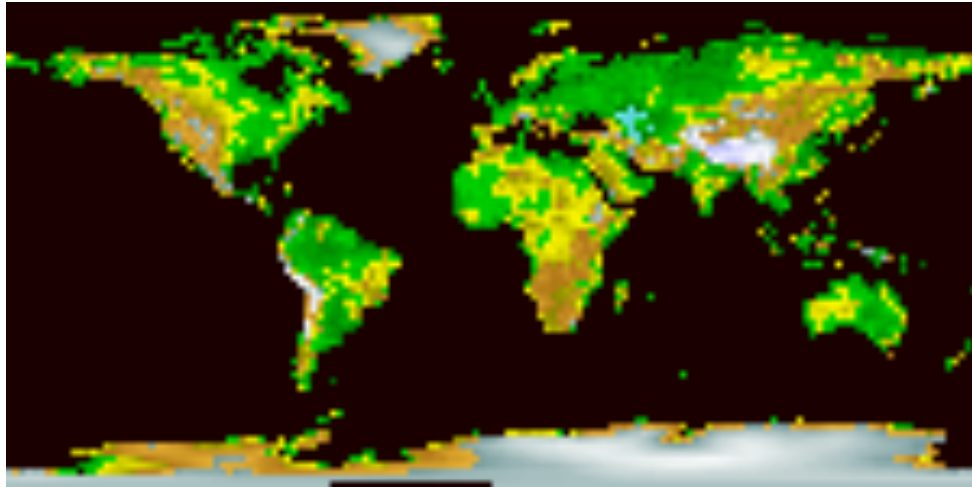
**Latitude** influences **surface temperature**: Temperatures tend to decrease with latitude (i.e. they get lower as you head toward the poles).

### Average Surface Temperature



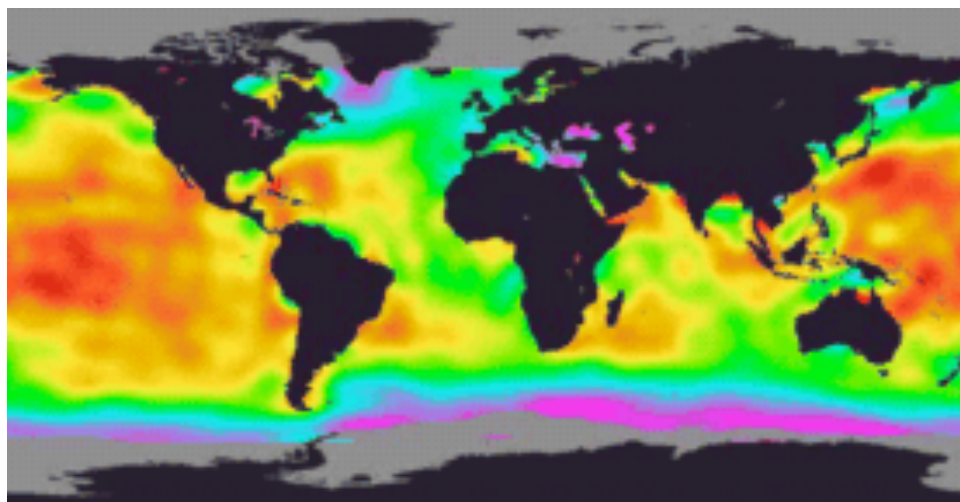
**Elevation** can influence **surface temperature, precipitation, winds and pressure.** For example temperatures tend to be much cooler in the Rocky Mountains than in the Foothills.

### Surface Elevation

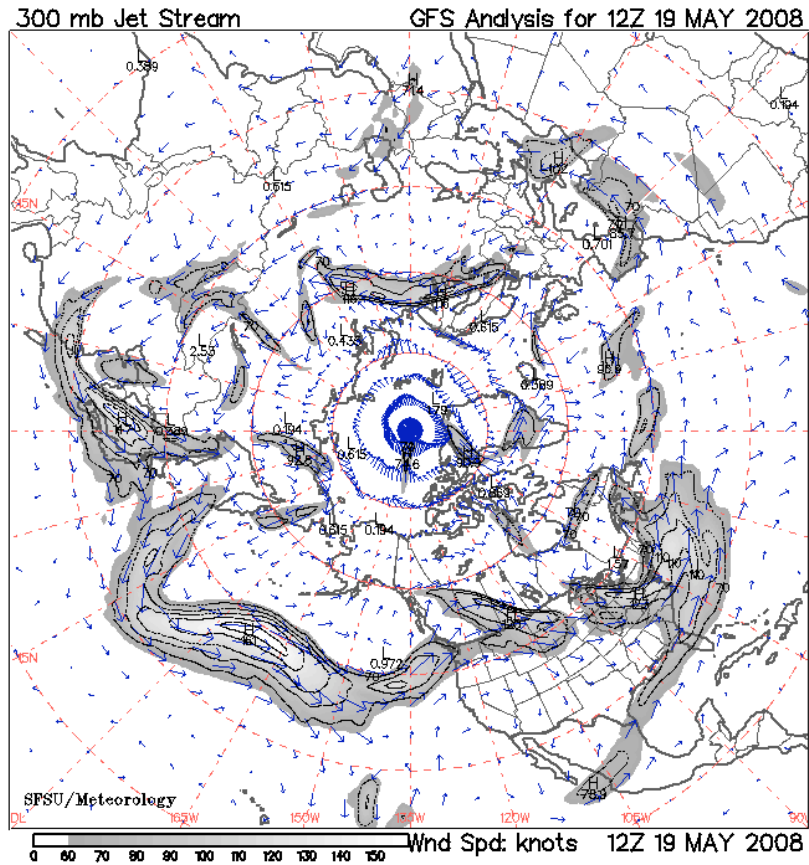


Proximity to large bodies of water and ocean currents can influence precipitation, surface temperatures, and humidity. For example the Gulf Stream transport heat energy to the north atlantic and regulates temperatures in England. Also, coastal areas tend to have much more consistent (or less variable) temperature changes.

### Sea Surface Temperatures and Ocean Currents



Prevailing winds determine which air masses are brought into the region. Air masses influence the temperature of the air being brought into the region and how much moisture is fluxed into the region.



## Materials

- colored pencils
- graph paper
- Climate data - plots of monthly mean maximum, minimum and mean temperature and monthly mean precipitation for your region
- Climate data - table or plot of daily mean maximum and minimum temperature and climatological daily mean precipitation
- thermometers
- rain gauges
- Recent data (short term) - daily maximum and minimum temperature and daily total precipitation.

## Prep Work

- 1) Get climate data for your region. Plots of average daily maximum, minimum, and mean temperature and precipitation can be obtained from : <http://www.cdc.noaa.gov/USclimate/states.fast.html>. Plots as well as the actual data for these variables can be found at <http://www.weather.com> for more locations. Put in your local zip code (or the zip code of the region you are interested in studying) and click on averages at the bottom of the page. Note that daily data can only be obtained in chart format, but monthly data can come in charts or on a plot also daily average precipitation is not available on weather.com.
- 2) Have students measure temperature and precipitation data for a week, month or even the whole school year. Daily observed maximum and minimum temperature and precipitation data can also be obtained from the <http://www.weather.com> website. Put in your local zip code and click on “month” at the top of the page.
- 3) Put the climatological data into excell and plot or have the students plot the climatology on graph paper.

## Activities

Part 1. Compare Climate Data to Recent weather data for a region. Recent data can either be collected by the students or obtained from weather.com (This project is similar to a project provided by NCAR)

First plot the climate data for each day of the observing period in Excell and give to the students (or have them plot this data on graph paper). Climate data describes the “typical” or average weather conditions for a region. The climatology lets you know what weather is expected be like. Ask the students to describe the average weather conditions for the time period of interest for their region. Next, Have the students plot the temperature and precipitation data they have observed (or was obtained from weather.com) on the same plot as the climate data. Have the students discuss about how “typical” the recent weather has been compared to the climate average. Is the recent weather they observed hotter or colder than average? Has it been wetter or drier than normal? What do they notice about the climate pots compared to the weather plots (the recent weather should be much more variable, or should change much faster than the climate data).

Part 2. Compare the Climates of different regions over the United States.

Many different factors such as latitude, elevation, vegetation cover, proximity to large water sources, ocean currents, and prevailing winds influence the climate of a region. Provide

plots of monthly mean maximum, minimum and mean temperature and monthly mean precipitation for different regions in the United States. Also provide information about the latitude, longitude and elevation for the region as well as maps that show the average winds that influence the region. Plots that show average surface temperature as a function of latitude, surface vegetation cover, sea surface temperatures, and local topographic relief are also helpful. Resources for these images can be found under the resources part of this packet.

Have the students discuss the similarities and differences between each regions climate. Do they experience maximum precipitation rates during similar seasons? What is the amplitude of the change in maximum and minimum temperatures for each region (how do maximum and minimum temperatures vary throughout the year)? Then have the students try to determine which climate control factors (elevation, latitude, vegetation cover, proximity to the ocean, prevailing winds) are likely to cause these major differences.

### Part 3. How does Climate influence your wardrobe?

Have the students consider a hypothetical situation where their family is moving to a foreign country for a year. Tell the students to use the foreign regions climate data to figure out what type of clothes they will need to pack for their trip. Since they will be leaving for a year, they must bring clothes with them for each season. Have the students explain their clothing choices.

## Questions/Activities for Summer Teacher Course

1) Use the climatology information of Fort Collins to answer the following questions:

A) What do you expect maximum summer temperatures to be in Fort Collins?

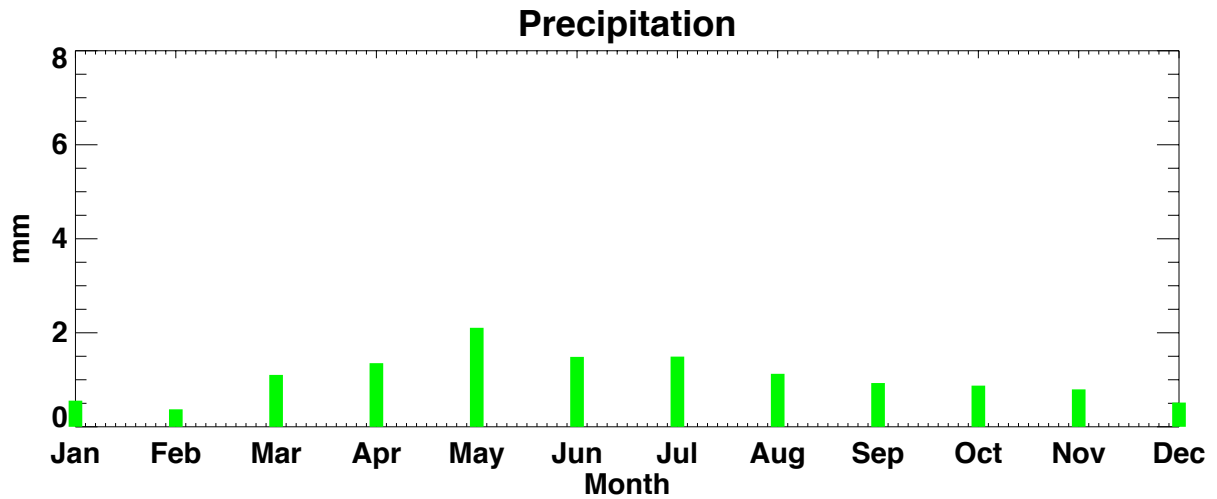
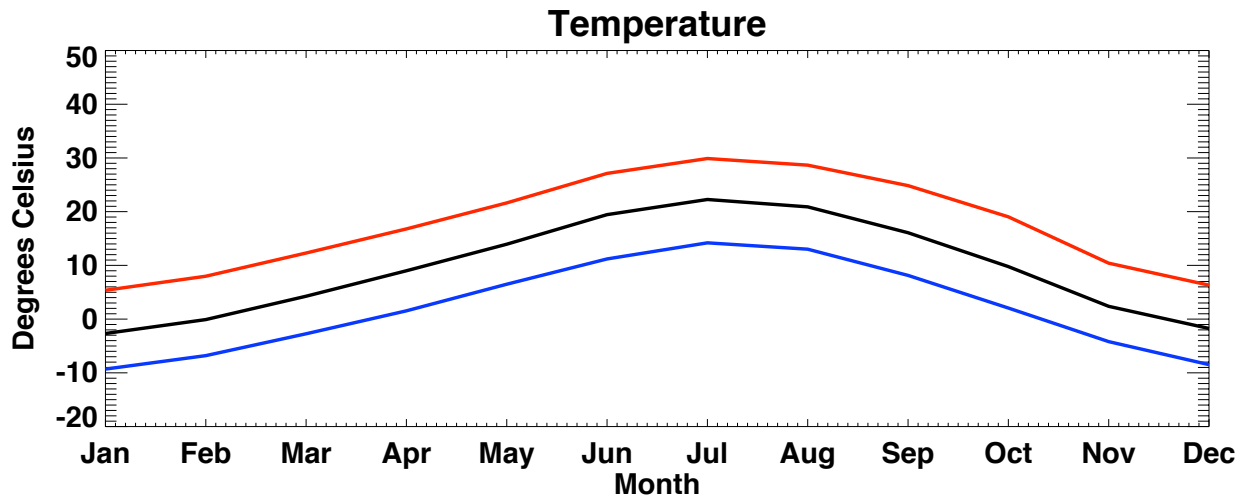
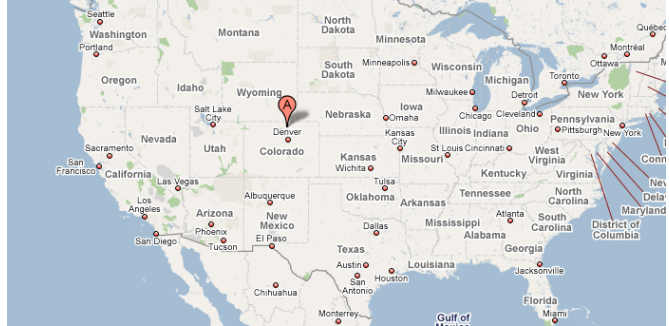
B) What do you expect minimum summer temperatures to be in Fort Collins?

C) What do you expect average precipitation rates to be during the summer in Fort Collins?

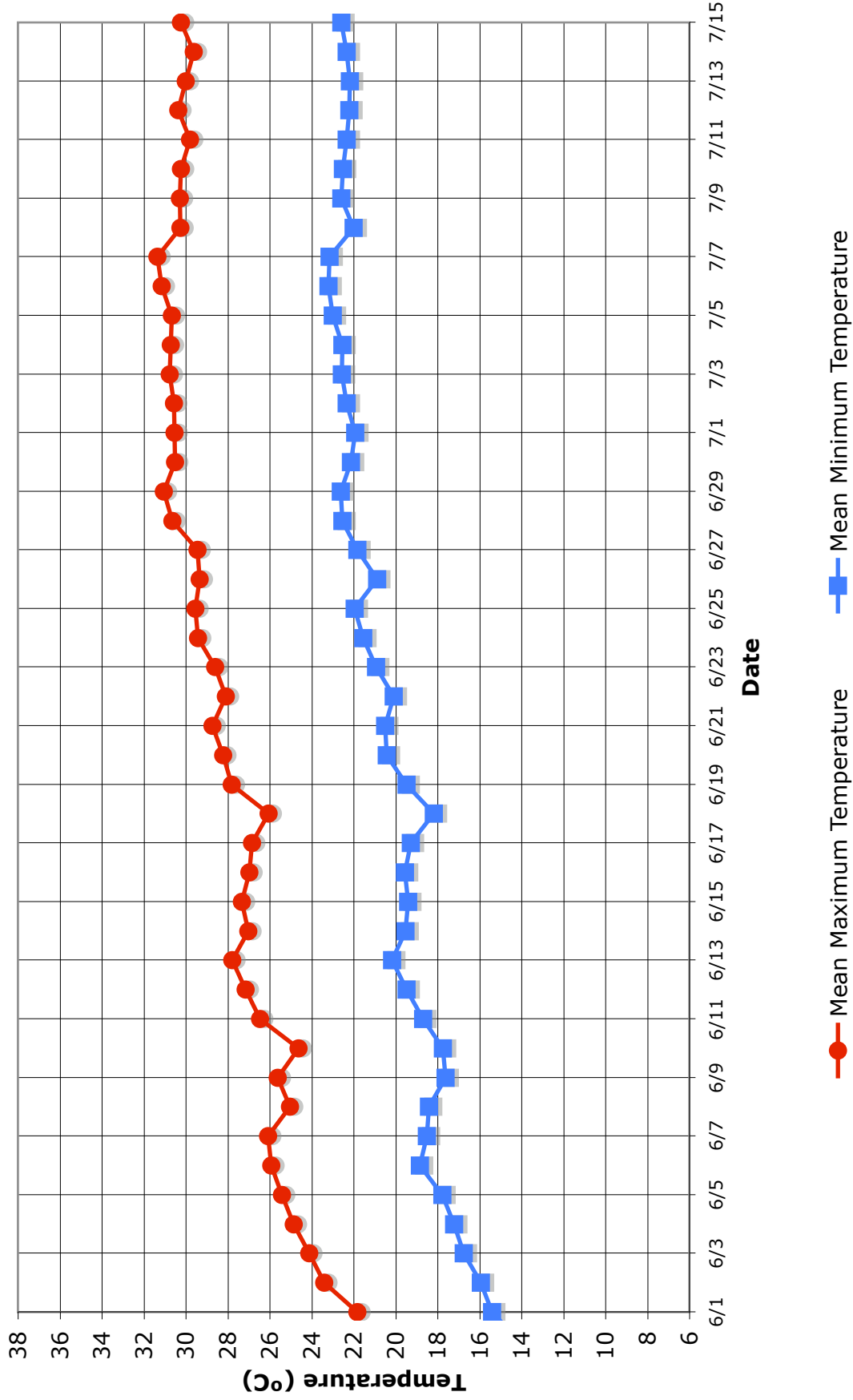
2) How does the most recent Fort Collins weather compare to the average climate for Fort Collins? Has it been warmer than average? Cooler? Has it been wetter or drier than average (plot the information from Table 1. on the the graph in Graph 1 to help answer this question)?

# Climatology for Fort Collins, Colorado

Latitude: 40.45°N Longitude: 105.5°W  
Elevation: 5003 ft  
Maximum Temperature: 31.4°C  
Minimum Temperature: -12.5°C  
Mean Annual Precipitation: 1.06 mm



# Temperature Climatology for Fort Collins





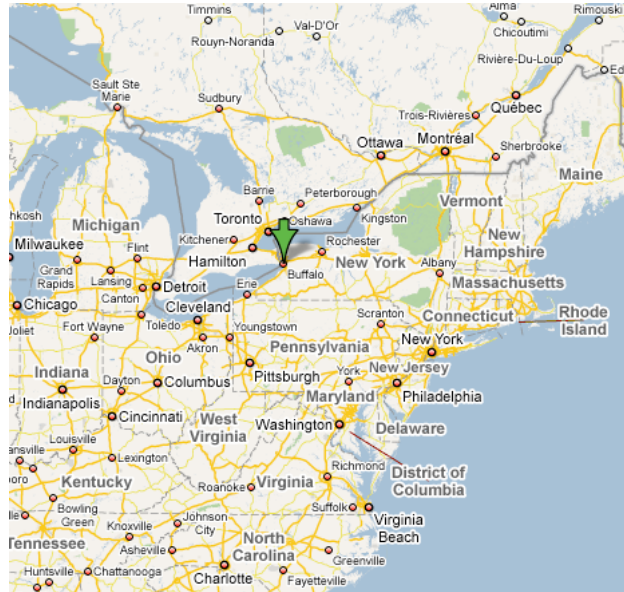
Recent Fort Collins Weather.

<b>Date</b>	<b>Minimum Temperature (°C)</b>	<b>Maximum Temperature (°C)</b>	<b>Total Precipitation Amount (mm)</b>
June 1	28	9	0
June 2	31	11	0
June 3	27	13	4.8
June 4	19	11	7.4
June 5	17	8	21.1
June 6	27	7	0
June 7	21	7	0
June 8	22	10	0.5
June 9	24	7	0
June 10	32	7	0
June 11	21	7	0
June 12	22	7	0
June 13	27	6	0
June 14	32	8	0
June 15	29	12	0
June 16	24	16	0
June 17	32	12	0
June 18	29	13	0
June 19	28	14	0
June 20	28	12	1
June 21	31	10	0
June 22	32	11	0
June 23	28	11	0
June 24	33	11	0
June 25	32	13	0
June 26	32	14	0
June 27	31	14	0
June 28	28	15	0
June 29	29	9	0
June 30	34	12	0
July 1	31	16	1
July 2	31	14	1.8
July 3	25	13	0
July 4	35	13	0

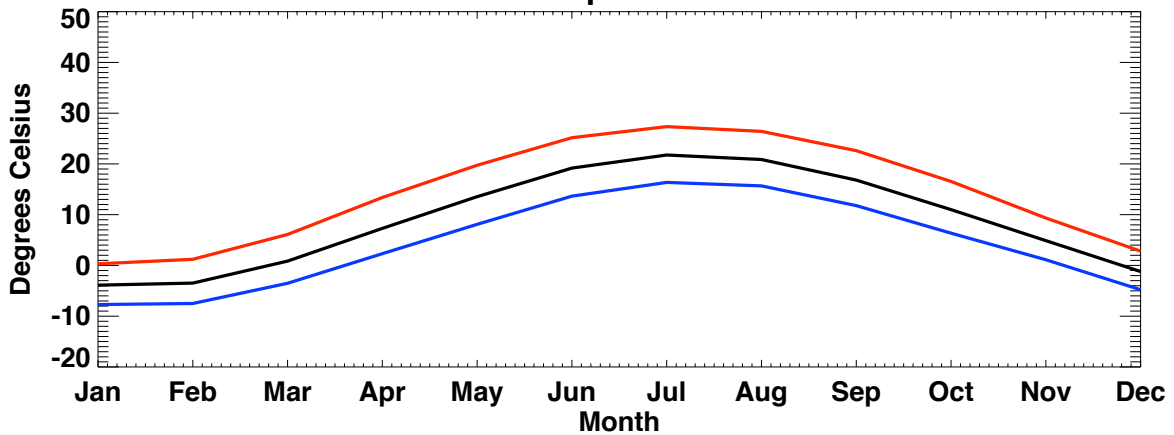
3) Summarize the major differences in climate between Buffalo New York and North Bend Oregon.? Which climate control factors do you think cause the major differences between these regions? (Hint: They are at the same latitude, but they are influenced by different air masses)

# Climatology for Buffalo, NY

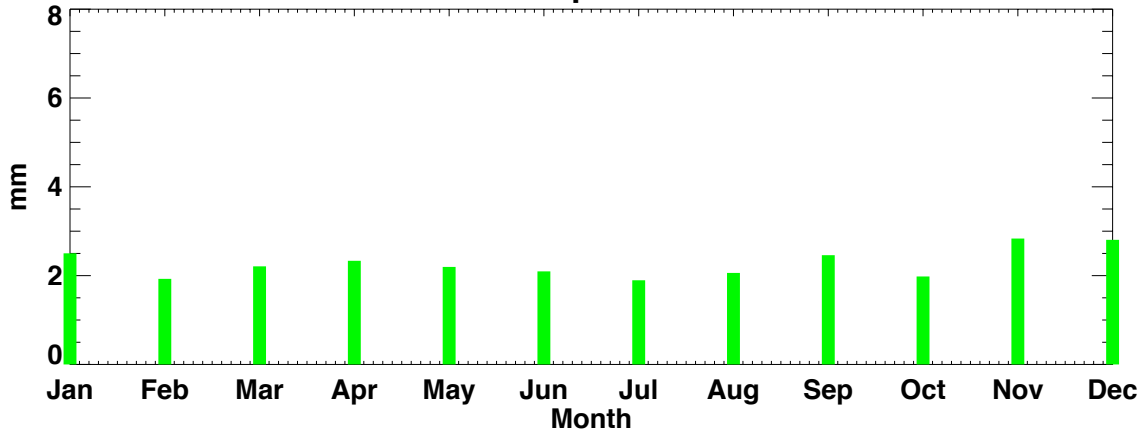
Latitude: 42.91°N Longitude 78.87°W  
Elevation: 712 feet  
Maximum Temperature: 28.2°C  
Minimum Temperature: -9.3°C  
Mean Annual Precipitation: 2.3 mm



## Temperature

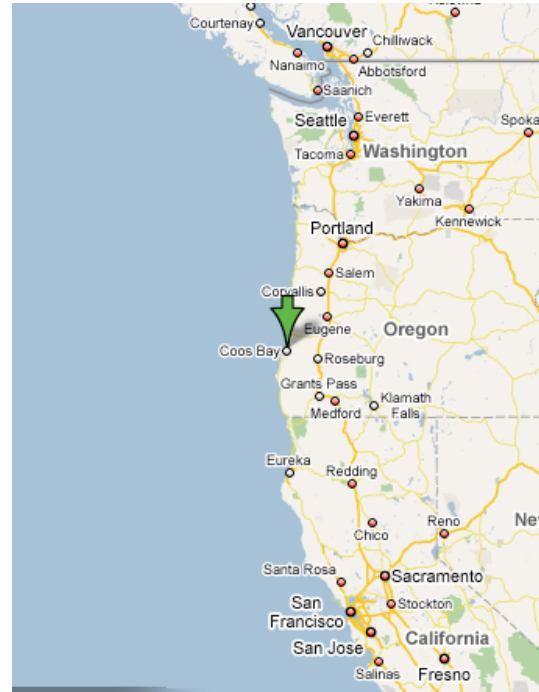


## Precipitation

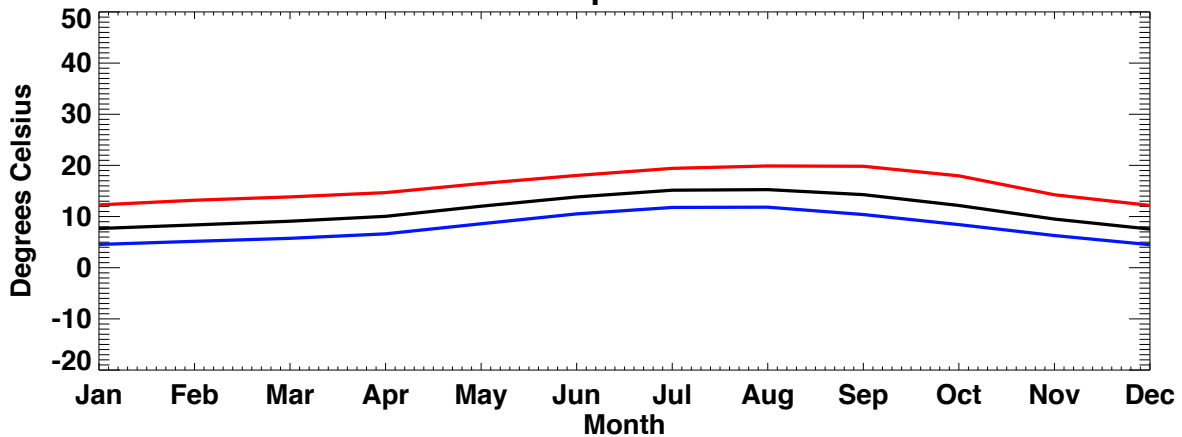


# Climatology for North Bend, OR

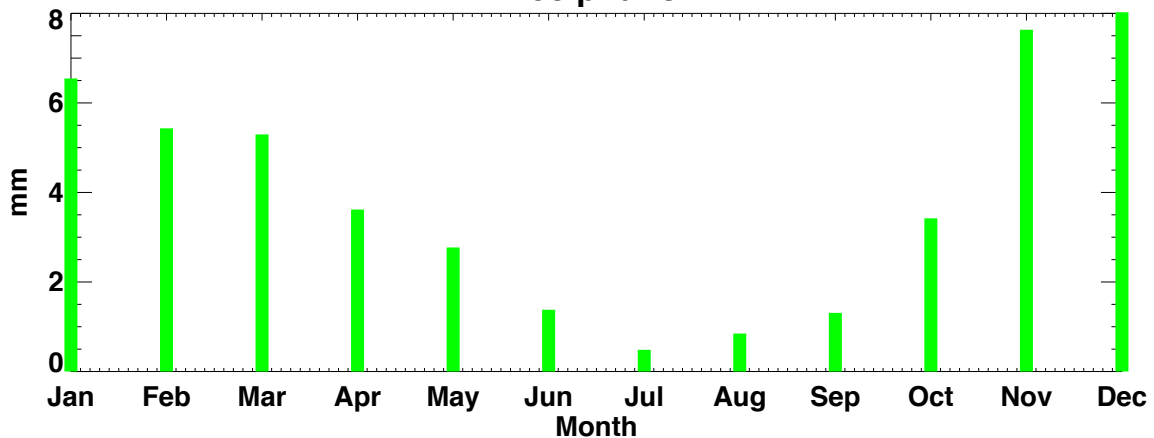
Latitude: 43.5°N Longitude 124.2°W  
Elevation: 10 feet  
Maximum Temperature: 20.9°C  
Minimum Temperature: 3.2°C  
Mean Annual Precipitation: 3.9 mm



## Temperature



## Precipitation



4) Your and your family are Moving to China for a year. Using the climate charts describe the average climate for Beijing. What types of clothing will you need to bring with you for the year based on this climatology? How would this wardrobe change if you were moving to Sydney Australia?

# Climatology for Beijing, China

Latitude: 39.55°N Longitude: 116.2°E  
 Elevation: 43.5 m  
 Maximum Temperature: 32.0°C  
 Minimum Temperature: -9.8°C  
 Mean Annual Precipitation: 1.77 mm

