

WaterViz Investigation 5 Facilitator Guide

Weather vs. Climate

Weather: When we observe weather, we are looking at current or recent changes in the atmosphere. Weather events like tornados or blizzards will have an immediate effect on the local environment.

- a. Think of an example of a weather event where you live. How did it affect the local environment?
- b. Short-term weather data helps you decide what clothes to wear today. Do you need rain boots, a jacket, or shorts?

Climate: Spans much longer periods of time (at least 30 years). This long-term data helps you to know what clothes you should have in your closet, but it does not give us specific details about what the weather will be like on a specific day. We can study climate in local areas, larger regions, and even global climate trends.

- a. All over the world, observers and automated sensors measure weather conditions.
- b. Over time, scientists can use these data to determine long-term average conditions and understand climate.
- c. Studying climate allows us to make predictions about the average yearly snowfall in a region.
- d. We might make long-term observations such as increases in hurricane intensities over decades.

For additional resources on climate and climate change, please visit [The National Centers for Environmental Information](#) and the Climate Literacy and Energy Awareness Network [CLEAN - a Collection of Climate and Energy Education Resources](#).

Long-term Hubbard Brook Data

Remember, WaterViz uses animated art and music to represent real-time water cycle data. We can look back at the data collected over many years to learn about and understand climate trends and even to make predictions about future trends. In this investigation, you will analyze 60 years of data collected at Hubbard Brook. We have explored data presented as a news article, animated art, music, and graphs. In this investigation, data is provided in tables

Investigation 5 Worksheet. Analyzing Data Tables

Average values (temperature, precipitation, streamflow) are reported for each decade from 1960-2019; hourly measurements are averaged to get the daily averages, these values are averaged to get the yearly average, then the average yearly data are averaged to get the decade averages.

Temperature

The Fahrenheit scale ($^{\circ}\text{F}$) is often used to report temperature in the United States, but scientists more commonly use the Celsius scale ($^{\circ}\text{C}$).

| Decade (10-year period) | Average Annual Temperature ($^{\circ}\text{F}$) | Average Annual Temperature ($^{\circ}\text{C}$) |
|----------------------------|--|--|
| 1960-1969 | 41.2 | 5.1 |
| 1970-1979 | 41.5 | 5.3 |
| 1980-1989 | 41.5 | 5.3 |
| 1990-1999 | 42.3 | 5.7 |
| 2000-2009 | 42.8 | 6.0 |
| 2010-2019 | 44.3 | 6.8 |

Describe any trends you notice in the temperature measurements:

- From 1960-2019, the average annual temperature increased.
- The average annual temperature was the same from 1970-1979.
- The largest increase was in the most recent decade of data reported.

Precipitation

Inches (in) are often used to report rainfall in the United States, but scientists more commonly use millimeters (mm).

| Decade (10-year period) | Average Annual Precipitation (in) | Average Annual Precipitation (mm) |
|----------------------------|--------------------------------------|--------------------------------------|
| 1960-1969 | 48.0 | 1219 |
| 1970-1979 | 54.6 | 1387 |
| 1980-1989 | 50.8 | 1291 |
| 1990-1999 | 54.8 | 1393 |
| 2000-2009 | 56.8 | 1444 |
| 2010-2019 | 59.8 | 1519 |

Describe any trends you notice in the precipitation measurements:

- From 1960-2019, the average annual precipitation increased.
- The average annual precipitation decreased in the 1980's compared to the previous decade.
- The largest increase in average annual precipitation was in the 1970's.

Streamflow

| Decade (10-year period) | Average Annual Streamflow (mm) |
|----------------------------|-----------------------------------|
| 1960-1969 | 703 |
| 1970-1979 | 900 |
| 1980-1989 | 806 |
| 1990-1999 | 925 |
| 2000-2009 | 938 |
| 2010-2019 | 976 |

Describe any trends you notice in the streamflow measurements:

- From 1960-2019, the average annual streamflow increased.
- The average annual streamflow decreased in the 1980's compared to the previous decade.
- The largest increase in annual streamflow was in the 1970's.

Building a 3D Model

1. Partners/teams will build a 3D model of one or more of the water cycle component data sets. The instructions on the worksheet are written for using paper straws inserted into a foam block. You could also select different materials such as pipe cleaners/wiki sticks on paper, Legos, etc.).
2. Preparing the foam block.
 - a) One straw will be used to represent each decade of data.
 - b) Straws will be arranged sequentially from 1960 to 2019.
3. Preparing the straws.
 - a) It is important to insert straws to the same depth in the block.
 - b) Make a mark on each straw to indicate the depth the straw will be inserted into the block.
 - c) Use the table to determine the length each straw should extend from the block (conversion factors are included below the table, but different conversion factors could also be used).
 - d) Important: When measuring the length of the straws, place the 0 cm mark of the ruler on the mark you made on the straw in step 3b.
 - e) Use art supplies to decorate the straws before assembling the model.

Note: Use the table below to determine the length (cm) that each straw should extend from the block.

| Decade | Temperature (T) | Precipitation (P) | Streamflow (SF) |
|-----------|-----------------|-------------------|-----------------|
| 1960-1969 | 10.2 cm | 12.2 cm | 7.0 cm |
| 1970-1979 | 10.6 cm | 13.9 cm | 9.0 cm |
| 1980-1989 | 10.6 cm | 12.9 cm | 8.0 cm |
| 1990-1999 | 11.4 cm | 13.9 cm | 9.3 cm |
| 2000-2009 | 12.0 cm | 14.4 cm | 9.4 cm |
| 2010-2019 | 13.6 cm | 15.2 cm | 9.8 cm |

Conversion Factors:

Temperature: 2 cm of straw represents 1 degree Celsius

Precipitation and Streamflow: 0.01 cm of straw represents 1 mm of water

Discussion Questions:

1. Does your 3D model represent a long-term or short-term picture of the water cycle data at Hubbard Brook?
2. Think back to the trends you noticed in the data tables for temperature, precipitation, and streamflow. Do the 3D models show the same trends or different trends? Explain.
3. What is one advantage of using a 3D model to represent climate data?
4. What is one difference you would expect if you had used data collected where you live to create your 3D model?