Optional Addendum: Weather and Climate

Unit Essential Question

How do we know human activity is influencing climate, and what can we do about it?

Introduction

This optional task serves to transition students from their understanding of weather to an exploration of climate. If you use this task, teach it before this unit's Lift-Off Task. In this task, students will distinguish between climate and weather. The essential difference between climate and weather is the timing. Weather describes conditions on a day-to-day basis in a specific area. Climate describes the average conditions in a general region over a long period of time. Climate is what we expect due to past history and weather is what we actually get due to the current atmospheric conditions. Although climate changes very slowly, it does change, and human activities can influence that change. In the end, the ways that we impact the climate today will be the legacy we leave for future generations.

Objectives

Students will be able to

Content

- Describe the difference between weather and climate.

Science and Engineering Practices

- Analyze data about weather and climate.

Equity and Groupwork

- Rephrase and build on others' ideas during group discussion.

Language

- Discuss data and come to a consensus.

Academic Vocabulary

- climate
- climate change
- weather

Timing

This task can be completed in 1 class period (based on 45-minute periods).

- Part I • What Is the Difference between Weather and Climate? (0.5 class period)
- Part II • Data Analysis: What Is the Difference between Weather and Climate? (0.5 class period)

Student Materials

per group

- Optional: computer to watch the video clips in small groups rather than as a class

Teacher Materials

- Computer to show video clips to class (or, have students watch the video clips in small groups)
- "Optional Addendum: Weather and Climate" digital slide presentation
- Video clips:
  - *Climate vs. Weather* (1:59): https://youtu.be/1s8eGd7THoo
  - *Weather vs. Climate* (1:21): https://youtu.be/ukIIA2D0BUU
- 2 "Weather" and 2 "Climate" signs to put up in the corners of the classroom

Background Knowledge

Weather is what we actually see day to day: sunny, rainy, snowy, or foggy days. Weather describes conditions on a specific day in a specific area. Weather models move forward from seconds to minutes to days; they are seen on TV every day.

Climate describes the average conditions in a general region over a long period of time. Although climate changes very slowly, it does change, and humans have an impact on that change. As such, we need to think about what we are doing to alter the climate and how our actions will affect future generations.

Differences between weather and climate:

Weather	Climate
• An instantaneous atmospheric condition	• An average atmospheric condition
• Can change rapidly, within even less than an hour	• Is sustained over a period of 30 years, as defined by the World Meteorological Organization (WMO)
• Prevails over a small area	• Prevails over a large region
• Has only limited predictability	• Is almost constant
• Depends primarily on density (temperature and moisture) differences between one place and another	• Depends on latitude, distance to the sea, vegetation, presence or absence of mountains, and other geographical factors

Part I • What Is the Difference between Weather and Climate?

1. Organize students into their project groups. Recommended: Designate student roles and review the norms.

2. Open the "Optional Addendum: Weather and Climate" digital slide presentation.

   - Introduce the presentation by showing the title slides (Slides 1–2).
   - Show Slide 3 and have students watch the two weather versus climate videos (either as a class or in groups).

3. Ask students to turn and talk with their group members about the differences between weather and climate and to determine whether each statement provided in the Student Edition is an example of weather or climate.

4. Put signs up to identify two corners of the room as "weather" corners and two corners as "climate" corners. *Note: Two corners are provided for weather and climate so the corners don't get too crowded. Students can choose either weather corner or either climate corner.*

5. Ask students to stand up and move to the middle of the room. Instruct students that after you read the weather or climate statement, they should move to a corner that best fits their interpretation of the statement. Tell students to be ready to give a reason for why they chose the corner they did.

6. Read the statements from the Student Edition (provided below) and give students time to move to their respective corners.

   - After each statement, ask three or four students to give reasons for their choice of weather or climate. Students' answers may be the same or similar; the goal is to have as many students as possible orally communicate the characteristics of weather and climate. If one or more students are in a corner not chosen by the majority of students, be sure to ask their reason—they may have an interpretation of the statement that makes sense.

   a. It rained on May 8.
   b. Germany is a cold country.
   c. Summer is hot.
   d. The news says it is supposed to rain this weekend.
   e. Florida is hotter than Alaska.
   f. That was an amazing lightning storm last night.
   g. Cities near the ocean tend to be wet.
   h. It might snow in Tahoe tomorrow.
   i. Today it was colder than usual.
   j. 1992 was one of the coldest summers on record.
   k. A hurricane is predicted to hit tomorrow.
   l. The highest recorded temperature of all time was 136°F in Libya.
   m. It rains every October.

Possible answers:

Letter	Statement	C = Climate W = Weather
a	*It rained on May 8.*	*W*
b	*Germany is a cold country.*	*C*
c	*Summer is hot.*	*C*
d	*The news says it is supposed to rain this weekend.*	*W*
e	*Florida is hotter than Alaska.*	*C*

f	*That was an amazing lightning storm last night.*	*W*
g	*Cities near the ocean tend to be wet.*	*C*
h	*It might snow in Tahoe tomorrow.*	*W*
i	*Today it was colder than usual.*	*W*
j	*1992 was one of the coldest summers on record.*	*C*
k	*A hurricane is predicted to hit tomorrow.*	*W*
l	*The highest recorded temperature of all time was 136°F in Libya.*	*W*
m	*It rains every October.*	*C*

7. Have students write a brief response to the question in the Student Edition:

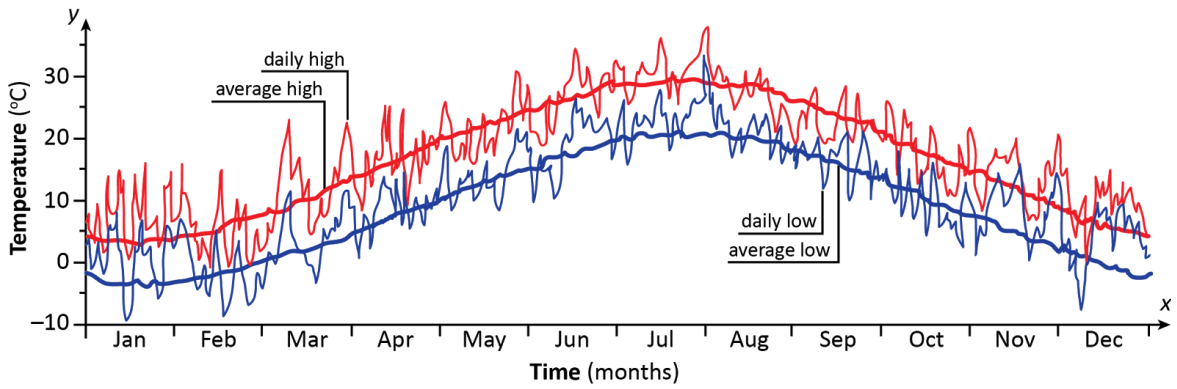
   If your principal asked you what the difference between weather and climate was, what would you tell him or her?

Part II • Data Analysis: What Is the Difference between Weather and Climate?

1. Continue with Slides 4 and 5. Walk through the analysis of both graphs with students.

   - Slide 4 emphasizes that when scientists study climate, they look at decades rather than days of data. To emphasize this point, ask students to look at the *x*-axis and determine how many years the graph shows.
   - Ask students whether they think temperature has increased since 1880 or decreased, and how they know.
   - Slide 5 shows the graph that is in the Student Edition. Ask students to use the questions in their Student Edition to help them analyze this graph. At this point, tell students that climate is usually measured in 30-year periods. This is not an exact number, but rather is a convention used by scientists.

Comparing Weather and Climate Data



   - What does the *x*-axis tell you? What does the *y*-axis tell you?
     The x-axis tells you the month from January to December. The y-axis tells you the temperature in degrees celsius.
   - What does an individual point on this graph represent?
     It depends. A point on the thick lines represents the average temperature based on data collected over time; a point on the squiggly line represents the specific temperature at that time of year.

- What do the two different colors represent?
  Red shows the highest daytime temperatures, and blue shows the lowest temperatures.
- What is the trend in the thick lines?
  Generally, the temperatures are lower in the winter and higher in the summer.
- What is the trend in the wavy lines?
  The trend is like the one in the thick lines, but with a whole lot more variability.
- Which lines do you think represent weather and which represent climate?
  Weather = squiggly, Climate = thick lines.
- In summary, what does this graph tell you about the relationship between weather and climate?
  Climate tells you what the temperature usually is at a certain time of year, while weather tells you what the temperature actually was at that time.

2. End the class by connecting weather and climate to climate change using Slides 6–8.
   - Slide 7 emphasizes why climate change should matter to students.
   - Slide 8 asks students to think about these ideas from a personal level.

Assessment

Collect the Student Editions and science notebooks and assess Part II using the "Analyzing and Interpreting Data" row of the Science and Engineering Practices Rubric.