

LP 1

Introduction to Climate Change

# of Days	2		
Prior Knowledge	Students will likely know about different weather phenomena, but may confuse weather and climate.		
Lesson Objective	Students will be able to identify the relevance of studying climate change and differentiate between elements of weather and climate. Students will be able to identify main parts of a graph. Students will be demonstrated understanding of evidence and claims.	Language Goals/Demands	Students will be able use different terms to relate components of the climate system and weather to each other. Demands: Definitions - Students must be able to recognize keywords that identify definitions; Concept Map - Students must know the difference between and be able to use nouns and verbs. Standards: Reading 2.3, 2.4, 2.5, 2.8 (Article Analysis) Listening & Speaking 1.2 (Article Analysis) Writing 2.3.c (Concept Map)
Lesson Assessment	Concept Map, Graphin' It Up activity	Changes for Next Time	
(Benchmarks or Standards)	E6.a, E6.b		
Materials Needed	Student handouts, powerpoint slides, computer, projector, internet connection	What Worked Well	
Time	Learning Task or Activity	Method & Notes	
Day 1			
30 min	<p>Lesson Hook</p> <ul style="list-style-type: none"> - Tell students that they are about to start a three week unit on climate change. - Climate change is a big issue in the news, but why is it such a big deal? - You will read a one-page article about the impact of climate change. (The article is adapted from an article about sea level rise on small Pacific island nations) - Students will read in small groups and then discuss the article using the provided questions. - Make sure you have students think about whether this will impact them or not. -Watch video on Tuvalu 	<p>SMALL GROUPS</p> <p>See 1.1.1 for Article</p> <p>See 1.1.2 for Activity</p> <p>See Slide 1.1.3 for Article Vocabulary</p> <p>http://www.youtube.com/watch?v=BNql8BiAijw&feature=related (video on Tuvalu)</p>	

8 min	<p>Sea Level Impact in the Bay Area</p> <ul style="list-style-type: none"> - Here is a map of the sea level rise that could take place here in the Bay Area. (Show Google Map Image of Sea Level Rise) - Show students the current sea level and then have them make predictions about how much rise it will take to flood certain areas close to their school 	<p>WEB DEMO</p> <p>Google Maps Sea Level Rise http://flood.firetree.net/?ll=43.3251,-101.6015&z=13&m=7 (Find the North America Map and Zoom in on your coastal area. Start with 0 meters sea level rise so that students have a baseline and then increase in increments of your choice).</p>
15 min	<p>Defining Weather and the Climate System</p> <ul style="list-style-type: none"> - Tell students that over the next three weeks you will learn more about how climate is changing and the impacts of this change. - But first, we have to make sure we understand exactly what weather and climate are. 	<p>LECTURE/POWERPOINT</p> <p>See Slides 1.1.4</p>
10 min	<p>Weather or Climate Activity</p> <ul style="list-style-type: none"> - Teacher will have students identify whether the phenomenon are weather or climate - Write each on the board OR teacher may put up posters with phenomenon listed. Students write "weather" or "climate" for each. 	<p>See 1.1.5 Weather or Climate Activity</p>
HW	<p>HW sheet 1.1.6.</p>	<p>HOMEWORK</p>
Day 2		
5 min	<p>BW: in journals: define climate, define weather. Which layer of the atmosphere is where weather occurs?</p>	<p>INDIVIDUAL SEAT WORK</p> <p>Hand out 1.2.1 Reading on Atmosphere- read and discuss as group</p>
10 min	<p>Consequences of Global Warming (or Climate change) is extreme weather and weather events (wildfires, floods)</p>	<p>Activity 1.2.0 - have students share skits and discuss</p>
15 min	<p>Evidence and Claims</p> <ul style="list-style-type: none"> - Explain that one way of "doing science" is to make claims and find/use evidence (proof). Review definition then show videos and have students complete the worksheet. 	<p>VIDEO PRESENTATION</p> <p>Use 1.2.2 Claims and Evidence</p> <p>tornado: http://www.youtube.com/watch?v=oJlfAGC8G8w&feature=relmfu drought: http://www.youtube.com/watch?v=u9s_A0G7oUU&feature=related rainstorm: http://www.youtube.com/watch?v=ugK4AsMEVsg blizzard: http://www.youtube.com/watch?v=gqi0K1CaWXI&feature=related wildfire: http://www.youtube.com/watch?v=yujOhGio_BE</p>
10 min	<p>Graphing and Data</p> <ul style="list-style-type: none"> - Students discuss the answers to the questions on their worksheet while examining the projected graph. 	<p>GROUP DISCUSSION AND STUDENT WORK</p> <p>Use 1.2.3 Whole Class Graph</p> <p>Use 1.2.4 Student Worksheet Graph Reading</p>

15 min	<p>Concept Map Introduction</p> <ul style="list-style-type: none"> - Handout Concept Map Instructions - Explain that students will be making a concept map throughout the unit. - Make sure students write in pencil 	<p>LECTURE</p> <p>See 1.2.5 Concept Map Instructions</p>
10 min	<p>Graphin It Up!</p> <ul style="list-style-type: none"> - Students individually complete worksheet to learn skills on how to read graphs which essential in later lessons. 	<p>INDIVIDUAL WORK</p> <p>Use 1.2.6 Graphin It Up!</p>
HW	<p>Pass out Homework</p> <p>Questions and Reading on personal connection to climate change</p>	<p>HOMEWORK:</p> <p>Use 1.2.7 Questions</p> <p>Use 1.2.8 Reading</p>

1.0: Lesson Plan 1 – Introduction to Climate Change

Teacher Guides

- 1.1.1 – Student Hook Article
- 1.1.2 – Questions for Hook Article
- 1.1.3 – Article Vocabulary Slides
- 1.1.4 – Weather and Climate System Slides
- 1.1.5 – Weather or Climate activity
- 1.1.6 – Homework
- 1.2.0 – Reading on Atmosphere
- 1.2.1 – Skit Directions
- 1.2.2 – Claims and Evidence Video Activity
- 1.2.2 – Extreme Weather Claims and Evidence sheet
- 1.2.3 – Whole Class Graph
- 1.2.4 – Activity Sheet for students
- 1.2.5 – Concept Map Instructions
- 1.2.6 – Graphin’ It Up
- 1.2.7 – Homework Questions
- 1.2.8 – Homework Reading

Videos and Websites

Google Map Sea Level Rise

<http://flood.firetree.net/?ll=43.3251,-101.6015&z=13&m=7>

Tuvalu video:

<http://www.youtube.com/watch?v=BNql8BiAijw&feature=related>

FOR CLAIMS AND EVIDENCE

tornado: <http://www.youtube.com/watch?v=oJlfAGC8G8w&feature=relmfu>

drought: http://www.youtube.com/watch?v=u9s_A0G7oUU&feature=related

rainstorm: <http://www.youtube.com/watch?v=ugK4AsMEVsg>

blizzard: <http://www.youtube.com/watch?v=gqi0K1CaWXI&feature=related>

wildfire: http://www.youtube.com/watch?v=yujOhGio_BE

Lesson 1.1.1

Rising sea levels threaten small Pacific island nations

Adapted from article by Jonathan Adams

Published: Thursday, May 3, 2007

Word Bank: *atoll, submerged, encroaching, unusable, evacuated, refugees, potable, agriculture, erosion, dependence*

Dire **climate change** predictions may seem like science fiction in many parts of the world. But in the tiny, sea-swept Pacific nation of Tuvalu, the crisis has already arrived. Tuvalu is a Polynesian island located about halfway between Hawaii and Australia. It's neighbors to Samoa and Fiji.

Tuvalu consists of nine low-lying **atolls** totaling just 26 square kilometers, or 10 square miles, and in the past few years the "king tides" that peak in February have been rising higher than ever. Atolls are lagoons, circled by coral. Waves have washed over the island's main roads; coconut trees stand partly **submerged**; and small patches of cropland have become **unusable** because of **encroaching saltwater**.

The government and many experts already assume the worst: Sometime in the next 50 years, if rising sea-level predictions prove accurate, the entire 11,800-strong population will have to be **evacuated**.

The ocean could swallow Tuvalu whole, making it the first country to be wiped off the map by **global warming**.

Many nations in the Pacific may have similar fates. They depend on **low-lying** coastal areas for living space, cropland and tourism. For them, even conservative estimates of rising waters look set to make life on the islands increasingly nasty, crowded and very, very wet.

This may also produce environmental **refugees** who must flee their island home for safety.

"Entire Pacific islands disappearing is indeed dramatic," said Asterio Takesy, director of the Pacific Regional Environment Program, based in Apia, Samoa. "But a complete loss of livelihoods from decreased fisheries, damaged coral reefs, tourism affected by dengue epidemics, and **agriculture** destroyed because of changing rain patterns - surely these are just as worthy of our attention."

The region already faces a witches' brew of problems that environmentalists say are being worsened by climate change: **coastal erosion**, saltwater intrusion onto cropland and tourist sites, shortages of **potable** water, disease, and dependence on sugar-packed, processed food imports.

1.1.2 Activity

TASK CARD 1: READING ABOVE THE SURFACE

Directions: With your group, discuss the following questions:

- 1) WHO is this article about?

- 2) WHAT is the problem?

- 3) WHEN is it taking place? Are there other important dates mentioned in the article?

- 4) WHERE is it taking place?

- 5) WHY is the problem occurring?

Final Task: As a group, decide on a title for this article. Make sure someone in your group writes it down.

Article Vocabulary

- Refugees – A person who flees their home for safety reasons.
- Atolls – coral island that circles a lagoon
- Lagoon – shallow body of water
- submerged – completely under water
- Unusable- cannot be used

Article Vocabulary

- Encroaching – moving in or approaching
- Evacuated – removed from a place of danger
- Global-warming – rise in average temperature of earth's oceans and atmosphere
- Low-lying – Places that are lower in elevation than nearby places.

Article Vocabulary

- Agriculture – science of farming, producing crops and raising livestock (animals)
- coast – land near a shore (by the sea, ocean)
- erosion – to destroy over time (to wear away)
- potable – suitable for drinking

Climate System and Weather

We often hear the words climate and weather, but we often fail to realize the relationship between weather and the climate system. In order to understand the climate system, it is important to understand what a 'system' is.

It might be helpful to use an illustration. Think about a bicycle. If you took the bike apart and had each of the pieces laying in your driveway, the bicycle would not be very useful. However, when the pieces are assembled, even though no new pieces are added, the bicycle allows you to travel great distances in a short amount of time. You can think of the bicycle as a system. It has many parts that work together to produce something new – in this case a mode of transportation.

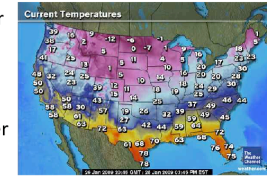
Climate systems are similar. The climate system is made up of many different factors including the Earth's water, clouds, atmosphere, and temperature that work together to produce weather.

Weather

Weather refers to:

The state of the atmosphere in a particular place and time.

Weather occurs over short time periods. The weather predictions usually cover days or weeks.



Types of Weather

- What terms do you associate with weather?



Ask students to think of things that they associate with weather. Perhaps it is helpful to make a list on the board.

What Causes Weather?

- Weather is an expression of the climate system.
- The climate system is the interaction of the atmosphere, biosphere, and other parts of the Earth that determine weather at a time or place



The Atmosphere



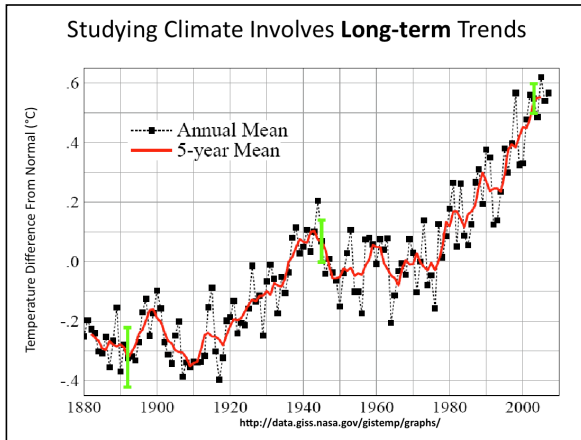
The Biosphere



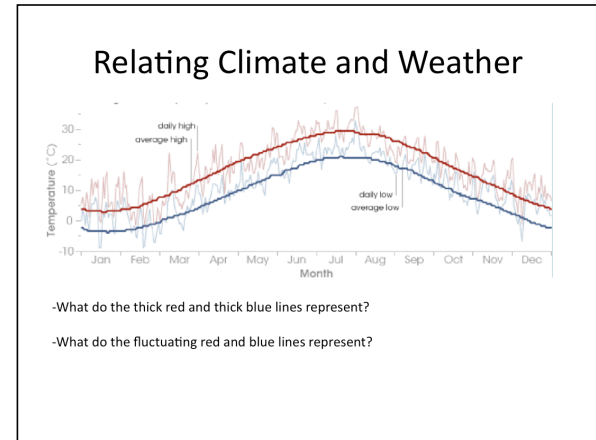
The Oceans

A system is the interaction of different parts that produce something new.

Teacher's Note: This is probably a new way for students to think about weather or climate. It might be good to have students rephrase in their own language what they think it means for the weather to be an expression of the climate system.



Looking at weather change involves only days, weeks, or months. Studying climate change requires studying long-term trends, often times 30, 50, or 100 years. (Students don't need to understand this graph, but they should just recognize the time frame that shows the climate. This graph will come up again in LP 4)



Here is a graph that relates the climate and weather.

Have students work in pairs to look at the graph to understand that weather is an expression of the climate system. It might be helpful to scaffold it in the following way:

1. Define the x and y-axis. What do they represent?
2. What does an individual point on this graph represent?
3. What do the two different colors represent?
4. What is the trend in the thick lines?
5. What is the trend in the wavy lines?
6. Which lines do you think represent weather and which represent climate?

At this point it is important to tell students that climate is usually measured in 30 year periods. This is not an exact number, but is rather a convention used by scientist.

Notice that long-term averages, here the climate, is represented by the thick red (highs) and blue (lows) lines.

Each day's or months weather may not be exactly like the long-term climate, but it fluctuates with the trend shown by the climate line.

Why is the Climate System Important?

- The climate system determines the weather. The weather affects many of our daily decisions.
- Climate affects long-term decisions by humans.
- Climate affects long-term trends in plants and animals.

Ask students why understanding the climate system might be important.

Once you connect the weather system to climate. Ask how the weather affects decisions that students make.

Activity 1.1.5

Weather or Climate

Directions: Read the following statements and write “weather” or “climate” or “both”

- 1) The year 1976 was one of the hottest on record.
- 2) 1992 was one of the coldest summers on record.
- 3) Cities near the ocean tend to be wet.
- 4) Florida is hotter than Alaska.
- 5) It might snow in Florida tomorrow.
- 6) It rained on May 8.
- 7) It is supposed to rain this weekend.
- 8) Today it was colder than usual.
- 9) Germany is a cold country.
- 10) Summer is hot.
- 11) The highest recorded temperature of all time was 136 degrees Fahrenheit in Libya.
- 12) It rains every October.

KEY:

W, W, C, C, W, W, W, WC, C, C, W, C

1.1.6 Homework

If you weren't in school today, what would you choose to do?

Describe a weather event (for example: fog, a thunderstorm, hurricane, a tornado, or another weather event) that you would like to know more about. Why?

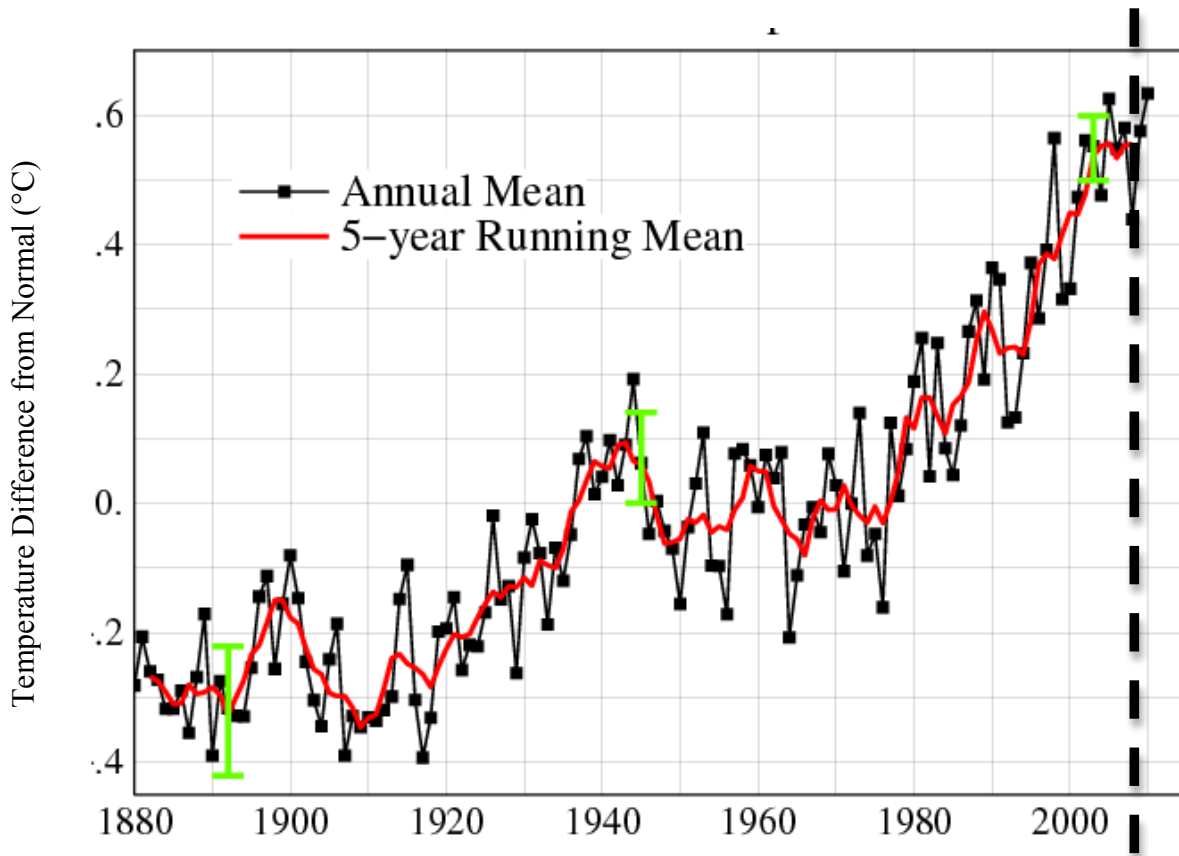
After a warm, sunny weekend, Joes wakes up Monday morning and notices that it is cloudy and cold. This is an example of (circle one):

Weather

Climate

Explain your answer.

Draw what you expect the following graph to look like to the right of the dotted line.



What are some important words that you see on the graph?

What do think this graph shows?

The Earth's Atmosphere

What is the atmosphere?

Hold your hand in front of your face, and breathe deeply in. Now gently blow outward towards your fingers. What do you feel? Does it feel cool and tingly? What you felt blowing past the tips of your fingers is commonly referred to as air. Air is one of the primary things that makes life on Earth possible. But what is air? Air is a synonym for atmosphere. The Earth's atmosphere or air is made up of a variety of gases and other particles.

The Earth's atmosphere extends outward to a distance of approximately 6,000 miles. However, the bulk of that atmosphere is compressed into the first 16 miles. The higher that one travels the less compressed the atmosphere becomes, and the less pressure there is exerted on the items in that atmosphere. Imagine that you are swimming in a giant pool of steel marbles. The deeper you go into the marbles the heavier the marbles become. This is because there are more marbles on top of you, and more weight pushing down on your body. The higher you go, the lighter they become.

Layers of the atmosphere

In order to better understand our atmosphere scientists have divided it into several layers. These layers are divided based on the characteristics of the gases found at that height. Imagine a layered cake. A layered cake is made out of layers of different ingredients. The first layer might be cake. On top of that a cook could put a layer of pudding. On top of that layer they perhaps could put another layer of cake mix, followed by a layer of whip cream, and so forth. Each layer in our atmosphere is a sphere covering the entire globe.

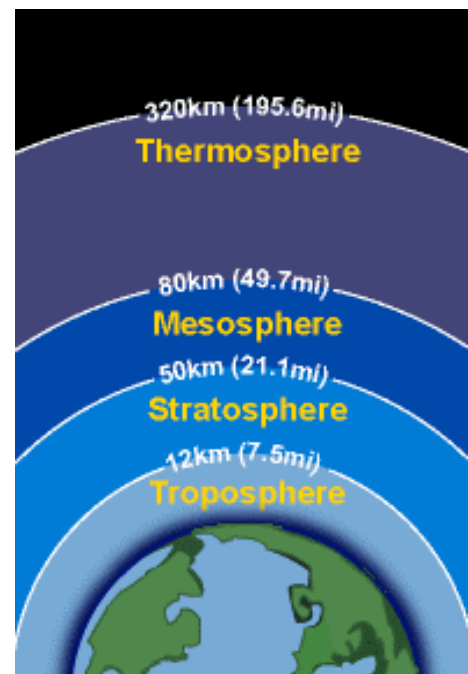
The first layer of the atmosphere is fortunately not made out of cake but instead out of the gases that we breathe everyday. This layer is called the troposphere. On average the troposphere extends from the surface of the Earth upwards to an altitude of 7 miles. The troposphere is the layer that we live in and where all weather occurs. The next layer of our atmosphere is called the stratosphere. Above the stratosphere lies the mesosphere, followed by the thermosphere.

It is important that you understand a few things about these layers. First of all, even though scientists have given special names to the boundary between each layer, this does not mean that there is an actual clearly visible border. If you were traveling up through the atmosphere in a rocket ship, you would not see any sudden changes as you went from one layer to the next. Instead, the change is gradual. The troposphere slowly changes, mixing with the stratosphere. The higher you travel the less and less the air around you will resemble the air found in the troposphere and the more and more it will resemble the air found in the stratosphere.

The Ozone Layer

An important gas in the stratosphere and mesosphere is ozone. Ozone is a molecule made up of three oxygen atoms. This gas is mainly found in a layer of the atmosphere commonly referred to as the ozone layer. The ozone layer lies approximately 9 miles above the surface of the Earth, and continues onward to about 30 miles above Earth's surface. This gas has the unique ability to absorb the Sun's ultraviolet radiation. Like a giant sheet of sunscreen it protects animals and plants from getting too much of the Sun's brutal ultraviolet rays. Without this protection conditions on this planet would be very hazardous to life forms.

Adapted from: <http://www.kidsgeo.com>



1.2.1 Skit Directions

WEATHER and CLIMATE CHANGE

If weather were to become more intense and uncomfortable, how would that affect you, your friends and your family?

-What is an example of weather becoming more intense and uncomfortable?

- long periods without rain (drought)
- lots of rain
- intense heat
- bigger, badder hurricanes
- big blizzards

Requirements of skit:

- everyone needs to have a role
- everyone needs to say a line

Be prepared to share your "Extreme Weather Skit" with the class

1.2.2

Claims and Evidence

Claim: a statement of something as a truth.

Evidence: proof of something

EXAMPLE:

Claim: It is summertime

Evidence: It is hot, it's sunny, it's the middle of July (in the summer)

Directions: For each weather condition, write evidence from the video to support the claim.

CLAIM: There is a drought.

EVIDENCE:

CLAIM: There is a blizzard.

EVIDENCE:

CLAIM: We are in the middle of a period of intense heat.

EVIDENCE:

CLAIM: There was a severe rainstorm yesterday.

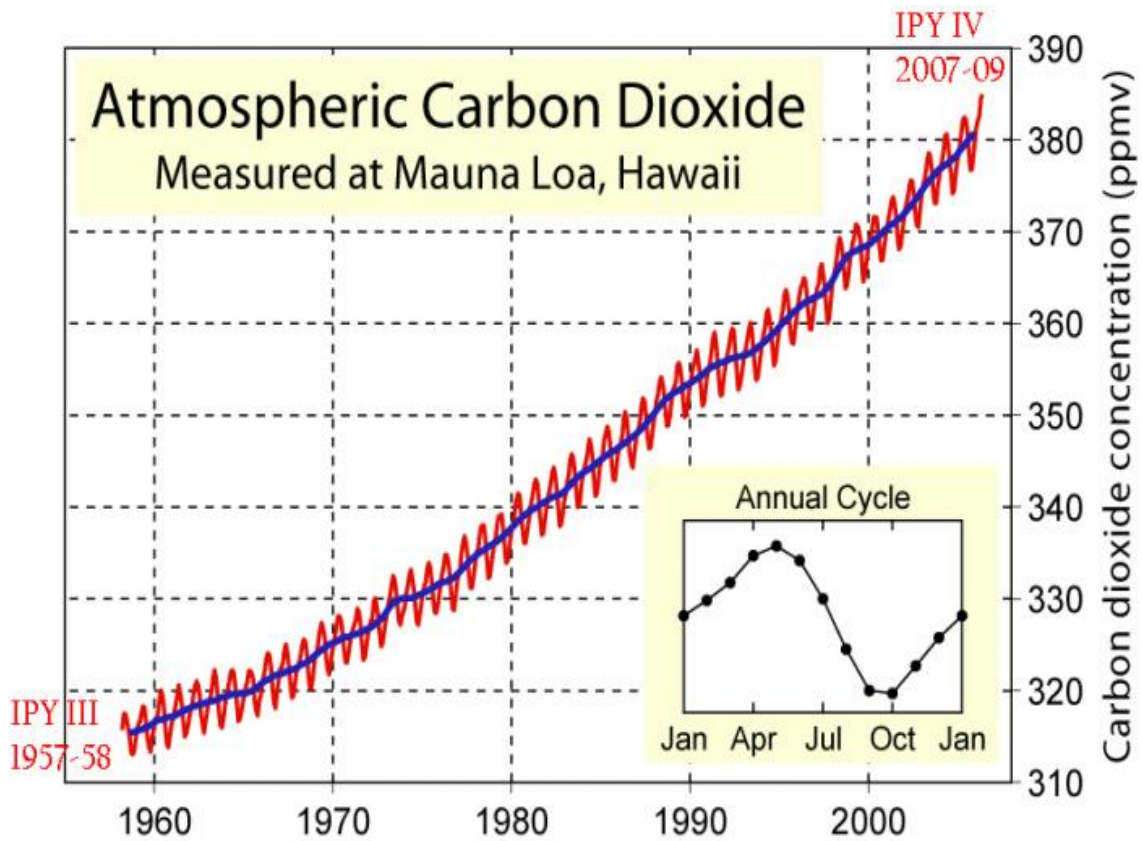
EVIDENCE

CLAIM: There was a tornado .

EVIDENCE:

Graph 1.2.3

Graph Activity for Climate Change Curriculum



1.2.4 Student worksheet

What is this? Steps for looking at a graph

1. What is the title of the graph?
2. What is on the x-axis (horizontal)?
3. What is on the y-axis (vertical)?
4. What does the key tell me?
5. What do the shapes and colors tell me?
6. What are the units in the graph?
7. What patterns do I see?
8. What are the lines showing me?
9. If there is more than one line, how are the lines related to each other?

1.2.5 Concept Map Instructions

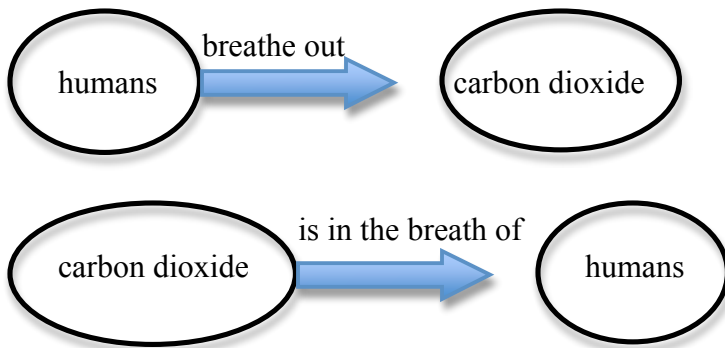
You are going to create a concept map over the next 3 weeks. A concept is a general idea or notion formed about a particular thing. A concept map is a visual representation of your understanding of the different parts that make up a concept. This concept map will focus on climate change. Every few days you will get a few new concepts to add to your map.

Key parts to a concept map:

- concepts
- linking lines with arrows
- linking phrases

The concepts are words that represent a thing or idea. You will be linking concepts with a line which has an arrow. On top of the line you will write a linking phrase that completes a sentence. For example, if you were given the words ‘trees’ and ‘birds’, you might write a linking statement ‘Birds build nests in trees’ with the arrow pointing to trees or a statement “trees are homes to birds” with the arrow pointing towards birds.

Example:



Start your concept map in the center of your paper and make the font small, but legible. You will be adding about 25 more concepts over the course of the unit. **Please use pencil.**

If you can't make a complete phrase on the arrow, feel free to put it a complete sentence using both concepts at the bottom of the page.

First Words for your Concept Map:

Climate System

Weather

Atmosphere

Also add to your concept map:

Two factors that you think affect the climate

Complete Concept Map Word List:

LP 1

Climate System

Weather

Atmosphere

2 other words (temperature, variation)

LP 2

Sun

Earth

Energy Budget

Albedo

Long wave radiation

Short wave radiation

LP 3

Greenhouse gases

Carbon Dioxide

Water Vapor

Methane

Nitrous Oxide

Atmosphere

Temperature

Mitigation

Power Plant

Nuclear Power

Wind

Fossil Fuel

Sinks

Forests

Oceans

Renewable Energy

LP4

Sea Level Rise

Glacial Cover

Ice Cores

LP5

No concept mapping as of now
(adaptation, mitigation, land ice)

LP 6

No concept mapping as of now
(consensus, evidence)

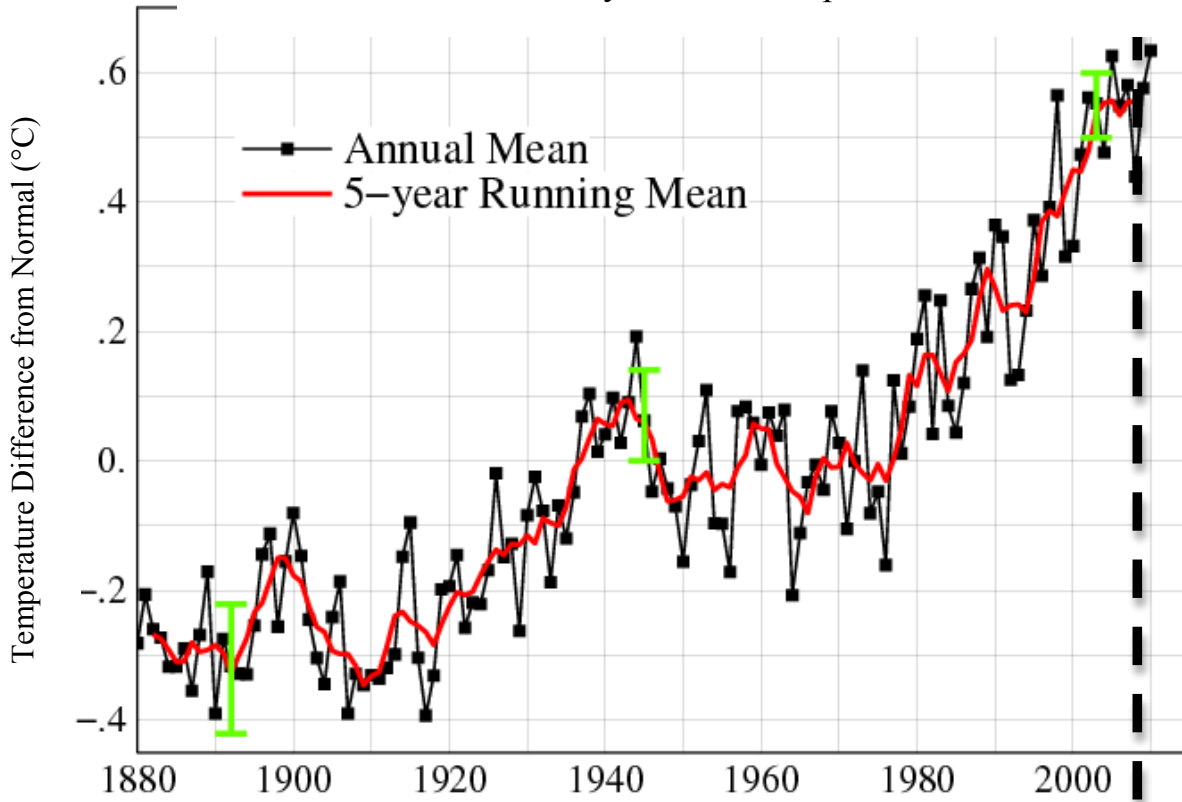
LP 7

No concept mapping as of now
(strategy, carbon emissions, transportation,
electricity, biofuel)

1.2.6 Student worksheet

GRAPHIN' IT UP!

Rise in annual mean and 5-year mean temperature since 1880's



What is on the x-axis? What is on the y-axis?

What are the 3 most important words that you see on the graph?

What do the solid and dotted lines show? How are they different?

What patterns do you see?

Draw what you expect the graph to look like to the right of the dotted line.

1.2.7 Homework Questions

1. You go on a trip in a car and leave the car in the hot summer Sun for several hours while you are out and about.

a. When you return, will the temperature inside the care be hotter, colder, or the same temperature as outside? Why?

b. What if anything could you have done to make the care more comfortable when you returned? Why do thin this would have helped?

2. What activities do you like to do outside?

3. What are things you have done that have a good or bad effect on you surroundings (the environment)? Explain how these actions have had good or bad effects?

What do we have to do with climate change?

It may seem hard to believe that people can actually change the Earth's climate. But scientists know that the things people do that send greenhouse gases into the air are making our planet warmer. Once, all climate changes occurred naturally. However, during the Industrial Revolution, we began altering our climate and environment through agricultural and industrial practices.

The Industrial Revolution was a time when people began using machines to make life easier. It started more than 200 years ago and changed the way humans live. Before the Industrial Revolution, human activities released did very little to affect gases into the atmosphere, but now through population growth, fossil fuel burning, and deforestation, we are affecting the mixture of gases in the atmosphere.

Since the Industrial Revolution, the need for energy to run machines has steadily increased. Some energy, like the energy you need to do your homework, comes from the food you eat. But other energy, like the energy that makes cars run and much of the energy used to light and heat our homes, comes from fuels like coal and oil - fossil fuels. Burning these fuels releases greenhouse gases.

To perform many of these functions, you need to use electricity. Electricity comes from power plants. Most power plants use coal and oil to make electricity. Burning coal and oil produces greenhouse gases.

Other things we do send greenhouse gases into the air too. The trash that we send to landfills produces a greenhouse gas called methane. Methane is also produced by the animals we raise for dairy and meat products. Whenever we drive or ride in a car, we are adding greenhouse gases to the atmosphere. And, when factories make the things that we buy and use everyday, they too are sending greenhouse gases into the atmosphere.

When Do YOU Send Greenhouse Gases into the Air?

Whenever you . . .

- *Watch TV*
- *Play a video game*
- *Use the air conditioner*
- *Listen to an iPod*
- *turn on a light*
- *Use a hair dryer*
- *Ride in a car*
- *Microwave a meal*

. . . You are helping send greenhouse gas into the air.

How could we change our habits to reduce the amount of greenhouse gases we send into the atmosphere?