Final Project
Seminars on Science
Climate Change

"Why Are the Glaciers Melting?"

Introduction

Although many of my students have heard of Global Warming or Climate Change at some point they do not have any real understanding of what it actually means. It is the goal of this unit to provide them with both an introduction to Climate Change as well as an opportunity to gain a deeper understanding of some of the less complex concepts of Climate Change. Prior to this unit students will have completed our weather and climate unit and come into this with a relatively strong foundation on which we will be building their knowledge of Climate Change. Due to the age of the students and the complexity that can accompany the science behind Climate Change, the unit I am going to teach will focus on science concepts that will allow my students to obtain an introductory/basic level of knowledge of Climate Change. The key scientific concepts that we will teach are the carbon cycle, greenhouse effect, glacial melting and impact on thermohaline circulation and sea level rise and finally feedback mechanisms.

When teaching the carbon cycle we will focus on how carbon dioxide moves through the atmosphere, water and soil. We will work to understand sources of carbon dioxide as well as sinks or areas where carbon dioxide is stored. In subsequent lessons we will investigate how human actions have added carbon dioxide from areas that are considered long-term reservoirs and the impact of these actions. The main impact we will address will be on the greenhouse effect. Students have already learned about the natural greenhouse effect that keeps our planet hospitable, but we will now look at the greenhouse effect with the addition of more greenhouse gases, mainly carbon dioxide. We will not discuss complex ideas about molecular structure and how carbon dioxide or other greenhouse gases reradiate heat but students will learn that these gases do absorb heat from the Earth and reradiate it back thus warming the planet.

In the melting glacier lessons we will be addressing how the influx of freshwater will change the salinity and thus the density of the ocean water. Students have learned how salinity and temperature of ocean water creates differences in density that drives ocean currents. They will be asked to describe possible outcomes to currents when salinity changes and what this means to the transfer of heat around the planet. In addition to changes to salinity we will focus on the difference between sea ice melting and land ice or glacial melting and its impact on sea level rise. Students will recognize how this difference applies to sea level rise. Students will also analyze data on sea level to understand the scale of change we may be faced with in the future.

The last concept we will address are feedback mechanisms. The focus of this lesson is essentially how feedback systems work and their role in increased warming. We want students to see how Climate Change is a complex concept that effects many of Earth's systems, as one system changes the outcomes from this change cause chain

reactions within other systems. Although more complicated than the other lessons I feel it is very important that students understand how warming is connected to the entire planet and not just melting ice and sea level change. It is in this lesson that students will make connections to parts of the world that they may be much more familiar with.

Define Learners

- Grade Level- sixth grade
- Population Characteristics- Our sixth grade class can be characterized as an urban population. In the four sections that I teach, the classes are heterogeneous in terms of learning ability and ethnicity with most students being bilingual (Spanish/English). The students do not have a strong science foundation upon entering sixth grade.
- Lesson Groupings – The lessons in this unit will have students work in groups of three or four. We will also use whole class instruction to introduce, transition and conclude our lessons.

Standards

Next Generation Science Standards

- MS-ESS3-4

  Construct an argument supported by evidence for how increases in human population and per-capita consumption

  of natural resources impact Earth's systems. [Clarification Statement: Examples of evidence include grade-appropriate databases on human populations and the rates of consumption of food and natural resources (such as freshwater, mineral, and energy). Examples of impacts can include changes to the appearance, composition, and structure of Earth's systems as well as the rates at which they change. The consequences of increases in human populations and consumption of natural resources are described by science, but science does not make the decisions for the actions society takes.]

- MS-ESS3-5

  Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century. [Clarification Statement: Examples of factors include human activities (such as fossil fuel combustion, cement production, and agricultural activity) and natural processes (such as changes in incoming solar radiation or volcanic activity). Examples of evidence can include tables, graphs, and maps of global and regional temperatures, atmospheric levels of gases such as

carbon dioxide and methane, and the rates of human activities. Emphasis is on the major role that human activities play in causing the rise in global temperatures.]

- MS-ESS2-6

  Develop and use a model to describe how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates. [Clarification Statement: Emphasis is on how patterns vary by latitude, altitude, and geographic land distribution. Emphasis of atmospheric circulation is on the sunlight-driven latitudinal banding, the Coriolis effect, and resulting prevailing winds; emphasis of ocean circulation is on the transfer of heat by the global ocean convection cycle, which is constrained by the Coriolis effect and the outlines of continents. Examples of models can be diagrams, maps and globes, or digital representations.] [Assessment Boundary: Assessment does not include the dynamics of the Coriolis effect.]

Topic

This unit on Climate Change is designed to be an introduction. The storyline of the unit begins with a lesson on the carbon cycle. Students will learn how carbon moves into and out of the Earth system under relatively "natural" settings. We than look at the increase of CO2 in the atmosphere of the last century and ask "Why?" We investigate this question and ultimately come to the realization that the human impact on our atmosphere has been overwhelming. Once we understand the cause we move onto the effect. Students will apply their knowledge of the greenhouse effect and revise this understanding with additional inputs of carbon dioxide. As we observe a model showing how the planet warms with more CO2, we look at an effect of this warming, melting ice. As the ice on Antarctica melts we will see changes in ocean salinity around the continent as well as sea level rise. Finally, we attempt to understand how feedback mechanisms will continue to drive future warming. Students will discover how current warming will trigger events that will lead to more warming.

Curriculum Links

Our Climate Change unit follows our Weather and Climate unit. This provides our students with a very strong foundation on which to build an understanding of Climate Change. In our Weather and Climate unit students will have learned about many concepts that are directly linked to Climate Change. These concepts include a deep

understanding of the hydrological cycle, the Sun's impact on the planet including seasonal changes due to angle and orbit, reflection (albedo) and a basic understanding of visible light, ultraviolet and infrared radiation. Students were also introduced to the energy budget and the role the Earth and atmosphere play in keeping the planet warm enough to support life. This idea naturally moved to the role oceans and ocean currents play in weather and climate were students learned about the thermohaline circulation current. With the Climate Change unit students will learn how the events that are occurring are really changing climate on levels that they know and understand.

Following this unit we change gears and move onto our Physics section. However, I am considering spending some time discussing with my class why we continually hear about climate change as a myth or that there is lack of evidence to support it. This area gets complicated so I feel I can explain climate models in relatively simple terms to generate some dialogue in regards to the current debate that is occurring even though we have a growing mountain of evidence.

Scope and Sequence

Lesson 1- Introduction to Carbon in the Earth's system

Time- One hour

Materials

Game dice, station signs

Objectives

1. Students will be able to take their knowledge of atmosphere composition and the greenhouse effect to develop an understanding of the relationship between the two.
2. Students will be able to make and interpret observations from a carbon cycle game to create and revise a model that shows how carbon naturally cycles through the Earth system.
3. Students will be able to describe and give examples of a carbon reservoir.
4. Students will be able to recognize similarities and differences between the carbon cycle and the hydrological cycle.

Assessment

The assessment for this lesson will be on the models of the carbon cycle that the students create. We will use the initial model students create at the beginning of the lesson and compare it to the final model to identify student learning. We will also assess the final model with a rubric to be sure students identify key aspects of the carbon cycle.

Students will also be assessed on the ideas they share during class discussions. These ideas will provide information for me on the level of student understanding.

Part 1

As the initial lesson of this unit Part 1 will be our opportunity to connect our work on climate and weather to climate change. Students will be sitting in their groups of 3 or 4 but we will begin with a whole class discussion. My students have very little background in the area of climate change and global warming so the line of questioning and initial task are designed to determine the level of understanding students have as well as creating a benchmark model we can use as an assessment when we compare it to the final model to determine if our objectives were met.

The following is the basic guide for the opening teacher led discussion:

> "When we were learning about the atmosphere and the greenhouse effect, many you used the term climate change or global warming. Can some of you share with us what you meant by these terms?"

Student responses are expected to be along the lines of a warming planet however most students will not have or be confident enough to supply an explanation as too why the planet is warming. Follow up questions will be used to determine exactly how much students do know and this will be quite variable from one group of students to the next.

> "Well, our goal or our hope is that by the end of our work this week you will be able to answer these questions with a bit more confidence and understanding."

> "If you can refer to the atmosphere composition graph in your notebook, of those gases can you recall the gas that is generally responsible for the greenhouse effect? You can also refer to your greenhouse effect diagram to help you."

As students refer to these diagrams that they constructed in earlier units we will discuss how CO2 is a greenhouse gas. I will also be sure to address to students that there are other greenhouse gases like water vapor and methane but for our purposes this week we will focus on CO2.

> "Where does CO2 come from? Please turn to your group members and brainstorm where you think CO2 comes from."

After a minute or two students will share with the class some of their possible ideas. At this point I would expect only several possible sources.

> "The first task that I would like you to complete independently is to create a model through an illustration/diagram that shows your understanding of the Carbon Cycle."

The use modeling as a scientific practice described in the Next Generation Science Standards has been an aspect of the new standards that we have been focusing on throughout the year. We have done a similar lesson with the hydrological cycle so students will need less instruction on the expectations from the models they create in this unit. This first model will be compared to the final model of the lesson to assess student progress and learning. It is expected that the initial models will be basic with only two or three arrows showing the connection between respiration and photosynthesis, but we are always surprised but what students know when constructing models.

Part 2

Based on the conclusions students made when we worked on the hydrological cycle, I expect students to come to the realization that there must be more to this process than what they know. At this point we will introduce some concepts and terms they need to know to complete the Carbon Cycle Game. We will use a PowerPoint presentation to introduce students to photosynthesis, respiration, combustion, decomposition and fossil fuels. Although I would be tempted to go into much greater detail with these ideas, a basic understanding of how CO2 moves is our goal. These concepts are covered in greater detail in subsequent grade levels.

See PowerPoint Presentation

Following the PowerPoint presentation students will complete the Carbon Cycle Game, which is adopted from

http://coseenow.net/mare/files/2012/08/TheCarbonCycleGame_MiddleHighSchool.pdf

In this game students "become" carbon atoms and using Game Dice they move from one station to another and in doing so are introduced to several of the major carbon reservoirs or sinks (atmosphere, surface ocean, ocean plants, ocean consumers, ocean sediment, land plants, freshwater, land consumers and deep particles and deep dissolved). Students will be told that not all of the possible reservoirs are included in this game but will be discussed at the conclusion. In addition students will discover that under natural circumstances carbon can remain in these reservoirs for along period of time. (Students have gone through this type of activity with the hydrological cycle. The procedure is very similar so students should progress relatively quickly through the game. Each station has a specific game dice with various instructions of where students will move to determined by their roll. Each turn students will record their path using different colored beads. Complete game instruction can be found by following the link. When students complete their 15 rolls, they will return to their groups and compare the similarities and differences of their paths. We will pull it together with a group discussion based on the following questions:

"What reservoirs or sinks do you visit the most? Which reservoirs hold carbon for a long period of time? Which hold carbon for a short period of time? Which carbon reservoirs were not included it the game? What processes move carbon from one station to another? What processes move carbon from the atmosphere to ocean sediments?" This last question will be discussed with more detail to emphasize the idea that the ocean is a major carbon dioxide reservoir.

Following the discussion students will be asked to complete a second model that illustrates the information and concepts they received from the presentation and the Carbon Cycle Game. These models will be compared to the original to determine student progress. In addition these models will be assessed to gauge student understanding using a rubric.

The goal of this lesson is for students to gain an understanding of the "natural" carbon cycle. We want them to realize that under normal conditions the Earth has a balanced system that circulates carbon and keeps our planet hospitable. This is important for them to realize as we move onto lesson 2.

Lesson 2 On the Rise

Time- One hour

Materials

Graph of CO2 emissions over last 300 years

Handout for students to record Top 5 emitters of CO2 and greenhouse gases.

Objectives

1. Students will be able to to interpret a graph of CO2 increase and develop questions about their observations to drive a group discussion.
2. Students will generate possible explanations for the increase in CO2 they observed.
3. Students will develop an understanding of the mechanisms that are responsible for CO2 emissions on a large industrial scale and a personal scale.
4. Use data to draw the conclusion that the current rise in CO2 is directly connected to human causes.

Assessment

Students will be assessed with this post-lesson question:

> "From the information that you have learned from this lesson, do you think it is possible that the increase in CO2 could be caused by something other than human actions?"
>
> Students will be expected to demonstrate how well they understand the correlation between human actions and the rise in CO2 in the atmosphere. Students will be expected to identify other sources of CO2 but recognize that the levels of CO2 being released could not be from these natural causes.
>
> Students will also be assessed on the ideas they share during class discussions. These ideas will provide information for me on the level of student understanding.

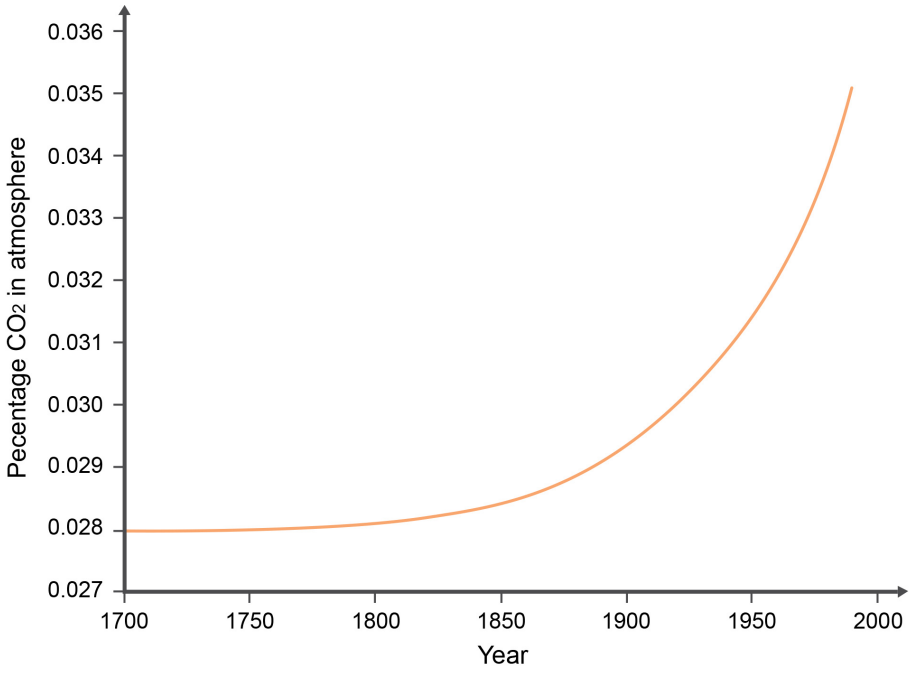
We will begin lesson 2 with a series of questions to bridge lesson 1 and 2. Using the models and ideas students developed we will begin with a group discussion.

> "If we look at our models, can we make any comparisons to the model of the Hydrologic cycle we worked on several weeks ago?"

Through this question we would like students to recognize that both cycles are not actually cycles but both carbon and water can move through various stations and often remain in some for quite a bit of time. Secondly and most importantly we would like students to recognize that from the model we created, there is no new input of water or carbon, whatever is here on the planet remains. This observation may not be as obvious so I may lead the discussion in this direction.

> "In the water cycle we do not have any additional water being added, this is also the case in the carbon cycle, or is it?"

At this point student groups will be given the following graph (this is a simplified graph of CO2 in the atmosphere but I feel is more appropriate for all of my students):



http://www.bbc.co.uk/staticarchive/751fc904560eadbdb1798807c76d4e9b9abbf7a4.gif

Student groups will be asked to evaluate the graph and make observations about the levels of CO2 in the atmosphere. Student groups will share-out their observations as well as a hypothesis that can be explored to determine the increase in CO2. I do not know what to expect from students but we will direct the discussion to fossil fuels.

> "What source of CO2 was not included in the Carbon Cycle game?"

We will discuss that we left fossil fuels out of the game on purpose to show a more natural movement of carbon without the influence of anthropogenic sources.

> "Based on your observations, when do we see a rapid increase in CO2? In your groups brainstorm some possible explanations as to why."

This will lead to a brief discussion of the Industrial Revolution that they will learn about in seventh grade Social Studies. From this discussion the goal is for students to understand that much of the CO2 we are concerned about comes from the burning of fossil fuels. The next activity will allow students to discover the top 5 emitters of CO2 and other greenhouse gases in our local area. Using the EPA's Facility Level Information on Greenhouse gases Tool (FLIGHT) students will be able to find the facilities in NJ (maybe NY also due to our proximity) that have the highest greenhouse gas emission as well as facilities that have the highest CO2 emissions. Students will complete the "Top Five" worksheet that is found on the listed website. Students will also identify the type of facility (energy, industry/manufacturing etc.) that the members of their top five are. Using the Greenhouse Gas Emissions by Sector pie graph handout we will summarize what type of facilities are the major producers of greenhouse gases.
http://www.epa.gov/climatestudents/documents/mapping-emissions.pdf

Following this discussion of the Top Five lists, I will pose the following:

> "We have discovered some facilities that produce a great deal of CO2 and other greenhouse gases. These facilities are found all over the country and around the world. However, we too are responsible for producing large amounts of CO2."

Students will work in their groups to list as many ways as they can in which they feel responsible for CO2 emissions. After a minute or two they will each visit a carbon footprint calculator to get an idea of what we are capable of on a day-to-day basis. The goal of this will be to introduce students to the idea that we have all played a role in the rise in CO2 and that our lifestyle choices have consequences. It is also an opportunity for them to see areas in which they can make changes.

http://mothersagainstclimatechange.com/kidscarboncalculator.php

When students complete their footprint calculator, we will add up each student and myself to see how much CO2 we produce as a class and estimate how much we produce as a school population.

To assess student understanding of the information we have learned in this lesson students will be asked the following question that will be completed and handed in to be graded:

"From the information that you have learned from this lesson, do you think it is possible that the increase in CO2 could be caused by something other than human actions?"

The goal of this question is that students will recognize from lesson 1 that there are natural causes that add and remove CO2, but the data that they discover points to the burning of fossil fuels as the only possible cause of this increase. We want to emphasize and make sure students realize that we have caused this problem and we have to do something about it.

Lesson 3 Melting Ice

Time- One hour

Materials

Graph of temperature increase

Objectives

1. Students will be able to analyze the CO2 graph and a temperature increase graph and identify the correlation between them as a cause and effect.
2. Students will collect data on sea level increase and changes in salinity to explain the cause and effect of melting ice in Antarctica.
3. Students will predict how melting ice will affect the thermohaline circulation current.
4. Students will design an experiment or demonstration to show the difference between melting sea ice and melting land ice.

Assessment

Students will be assessed on how well they demonstrate their understanding by answering the following questions at the completion of the lesson:

1. Based on the data you recorded and the graphs you created, how would you describe the change in conditions that may occur in the ocean water around Antarctica?
2. Predict how this change will affect the thermohaline circulation current. You may use a diagram to illustrate your prediction.
3. Design an experiment that can be done to show the effect on sea level from sea ice melting and land ice melting. Why did we use land ice in our activity?

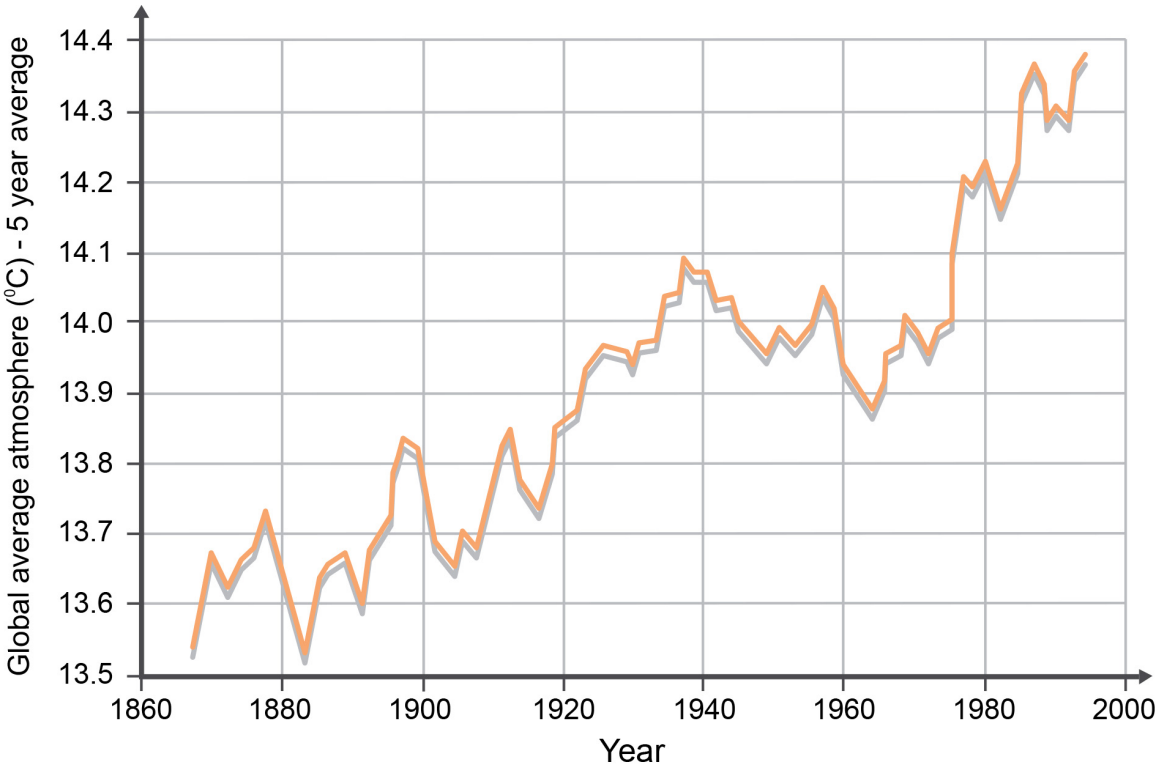
Students will answer each question independently.

Students will also be assessed on the ideas they share during class discussions. These ideas will provide information for me on the level of student understanding.

To bridge lesson 2 and lesson 3 we begin with this question:

> "With all of this CO2 and other greenhouse gases being released into the atmosphere, what is the effect on the planet?"

Students have learned about the natural greenhouse effect that keeps our planet warm but few will connect the increase in CO2 to increased warming. Student groups will then be given the following graph:



http://www.bbc.co.uk/staticarchive/204e75d93f216849ee95dbd06aae35302c9e93d6.gif

It is my hope that as students observe this graph they will recognize the increasing trend and its similarity to the CO2 graph. If they do not, I will instruct them to take out the CO2 graph and analyze them together to draw conclusions and answer the following question:

> "Is there a relationship between CO2 and global average temperature? If so, what do you think the relationship is?"

Following the discussion students will use a simple model that shows how the increase in greenhouse gases exaggerates the greenhouse effect and warms the planet surface. Students will be able to manipulate the amount of gases in the system and record the resulting temperature change in their notebooks with the graphs.
http://concord.org/stem-resources/greenhouse-gases

We continue with the following:

> "We have seen that CO2 levels have been increasing and you know why. We can now explain how this rise in CO2 warms the planet. In your group, brainstorm what effects this warming will or is having on the planet."

Students have had an introduction to glaciers and glacial melting from viewing "Chasing Ice" so we expect this to be a common response but this is another opportunity for students to demonstrate some of their knowledge or lack of knowledge about climate change. Students will share some of their ideas.

Following the discussion of student ideas I will pose the following question:

"What will happen to the water around Antarctica as the climate changes?"
To answer this question we will conduct the "Antarctica Melting" activity from http://coseenow.net/antarctica/Activity%201%20Melting%20Glaciers.pdf

Students will be given an "ice sheet" to represent land ice on Antarctica. The ice will be on top of a rock and will be colored blue for observations. Students will place the ice sheet into a plastic container and add 1000ml of salt water to represent the ocean. Students will be given a time period (50 years ago, present and 50 years from now. Fifty years ago will receive no additional heat source, present will receive a heat source 45 cm above the ice and the future will have a light source 30 cm above the ice to represent additional heating.

Students will make observations and record increase in sea level rise as well as change in salinity using the salinity index from the website. Students will make observations at 0 minutes, 15 minutes and 30 minutes. Students will record their data in a table in their notebooks. After 30 minutes students will collect data from other time periods and represent the changes in sea level and salinity with line graphs.

To assess student understanding each student will be asked to answer the following questions:

4. Based on the data you recorded and the graphs you created, how would you describe the change in conditions that may occur in the ocean water around Antarctica?
5. Predict how this change will affect the thermohaline circulation current. You may use a diagram to illustrate your prediction.
6. Design an experiment that can be done to show the effect on sea level from sea ice melting and land ice melting. Why did we use land ice in our activity?

Lesson 4 Rising Seas
(*The idea of thermal expansion of water may be a little over the heads of our sixth grade students. We will just focus on the overall effect of rising seas in this lesson*.)

Time- One hour

Materials

Graphs of sea level rise for selected cities

Map of U.S. and world map

Objectives

1. Students will analyze data of sea level rise and identify trends in sea level increase around the country.
2. Students will predict what the current rate of sea level rise will be in the next 100, 150 and 200 years in their selected cities.
3. Students will be able to discuss how sea level rise will affect populations of people living in these areas.

Assessment

For this lesson students will be assessed in groups. Groups will demonstrate their understanding of these concepts by completing the following tasks:

1.Describe how sea level rise will affect the people living in these areas.

2. Predict how much sea level would rise if the trend continued for 100, 150 and 200 years.

Students will also be assessed on the ideas they share during class discussions. These ideas will provide information for me on the level of student understanding.

We will bridge lesson 3 and 4 by having one of the students conduct their experiment to demonstrate how sea ice melting compares to land ice melting and the effect they have on sea level.

Following the student demonstration and discussion on sea ice and land ice we will discuss other areas that scientists are concerned about melting other than Antarctica (Greenland).

We will then ask student the following:

"From what we have learned about sea level rise so far, do you think we will experience any significant increase in the United States? If so how much do you think the oceans will rise and in where?"

I am not sure about this but I suspect that my students will either think we have not experienced sea level rise or that it has increased or will increase by several feet. To clarify some of the misconceptions about this concept we will conduct the sea level rise activity.

Student groups will receive a graph showing sea level rise over a specific time period (time varies from graph to graph) for one of six cities. The cities include Portland, ME,

Charleston, SC, Key West, FL, Galveston, TX, San Francisco, CA, Seward, AK and Hilo, HI.

Students will first analyze the graph and recognize the trend. They will then estimate the average annual sea level change by approximating the start value, the end value and subtracting them and dividing by the number of years. Sea level rise will be in millimeters.

Groups will then share their data with the class and we will summarize our findings on a map of the U.S. As a class we will discuss areas that are experiencing increases or decreases in sea level.

Students will then be asked to:

1. Describe how sea level rise will affect the people living in these areas.

2. Predict how much sea level would rise if the trend continued for 100, 150 and 200 years.

This summary and the lesson students will complete is found at:
http://www2.vims.edu/bridge/DATA.cfm?Bridge_Location=archive0910.html

Lesson 5 Feedbacks

Time- One hour

Objectives

1. Students will be able to demonstrate an understanding of feedback mechanisms.
2. Students will be able to identify and construct an explanation that demonstrates an understanding of the relationship between feedback systems and climate change.

Assessment

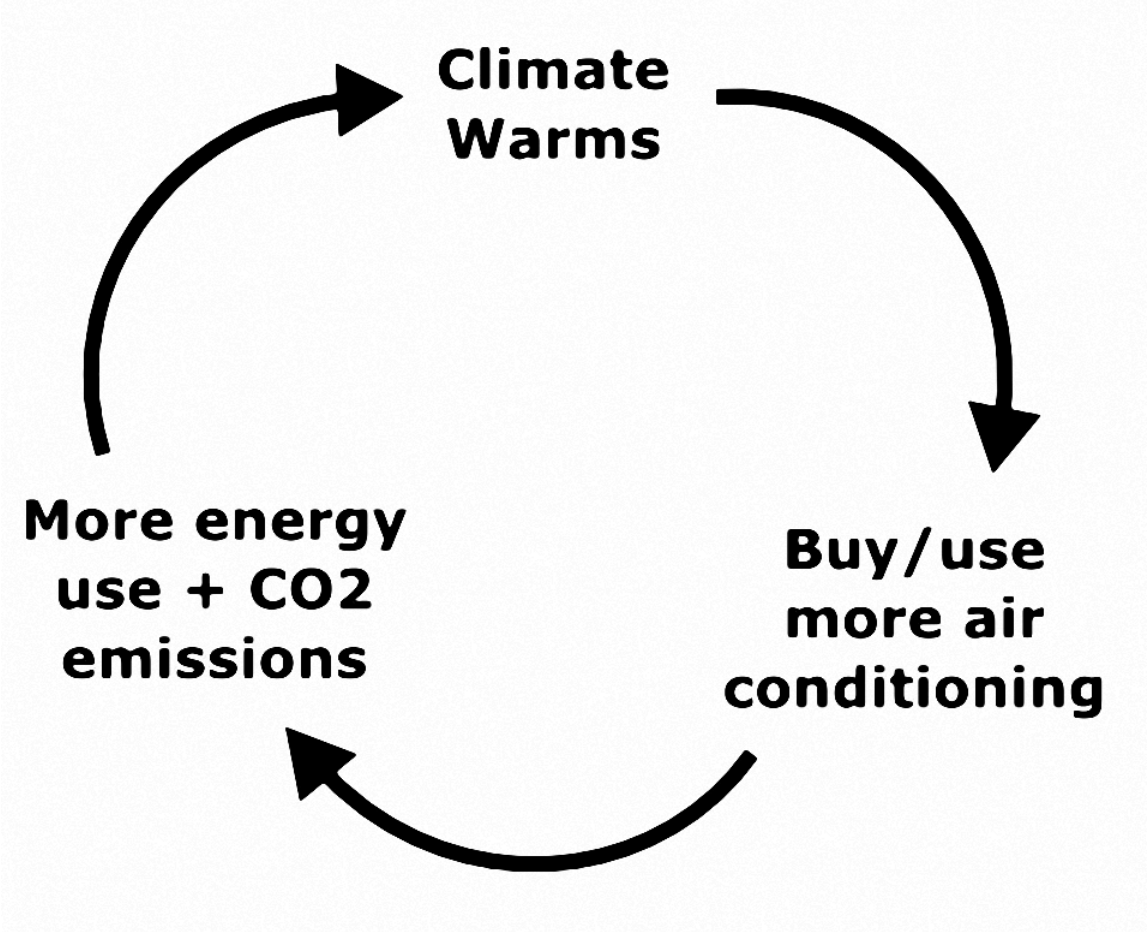
Student groups will be assessed on their presentations of their chosen feedback loop. This will be assessed using a rubric.

Students will also be assessed on the ideas they share during class discussions. These ideas will provide information for me on the level of student understanding.

We will begin this final lesson with the following introduction:

"Throughout this unit on climate change you have learned why and how the climate is changing and some of the major effects of this change (melting ice and sea level rise). To complete this section you will now discover one of the more complicated

yet significant aspects of Climate Change, the feedback mechanism. The following image will be used to explain (very simply) what a feedback mechanism is:



http://all-geo.org/highlyallochthonous/wp-content/uploads/2012/06/aircondfeedback.png

Students will then be given a choice of feedback loops to select from, ice/albedo, warming/water vapor, and warming/permafrost, warming/clouds. Once they select a feedback loop they will research how this feedback loop functions and they will create a model (diagram) that shows their understanding of this mechanism. I will be guiding groups to facilitate their discoveries and help them better understand the feedback mechanism. They will give a short presentation to the class explaining their findings and diagram. Following these presentations the class will have an open discussion about the complexity of feedbacks and what these feedbacks mean for future warming.

Evaluation of Lessons

The lesson included in this unit will be evaluated based on the level of understanding that students achieve. The goal of the unit is to provide students will an introduction level of instruction on Climate Change. At the conclusion of this unit I want my students to be

able to have an age appropriate scientific discussion about climate change. At the conclusion of each lesson students should not only be able to meet the listed objectives but also they should be able to ask questions that go beyond what we learned in the lesson. This would demonstrate a high level of understanding and students would not only get the lesson they would be able to apply what they have learned to seek and gain deeper understanding. If students do not demonstrate this level of understanding then I feel the lessons were not completely effective.

References

Carbon Cycle Game
http://coseenow.net/mare/files/2012/08/TheCarbonCycleGame_MiddleHighSchool.pdf
Antarctic Melting
http://coseenow.net/antarctica/Activity%201%20Melting%20Glaciers.pdf
Greenhouse Gas Emissions
http://www.epa.gov/climatestudents/documents/mapping-emissions.pdf
Carbon Footprint
http://mothersagainstclimatechange.com/kidscarboncalculator.php
Sea Level Rise
http://www2.vims.edu/bridge/DATA.cfm?Bridge_Location=archive0910.html
Greenhouse Effect model
http://concord.org/stem-resources/greenhouse-gases
Next Generation Science Standards
http://www.nextgenscience.org/

Conclusion

I believe the unit that has been developed provides a good storyline for my sixth grade students to follow. The lessons are designed to flow from one concept to the next so students' ideas are able to grow along with the lessons. As an introduction to climate change the lessons cover the main concepts students need in order to understand the information they see and read about outside of our classroom. The goal of the unit is to develop a better understanding so they can have valid discussions and offer scientific evidence to support their arguments about these issues. We also want to establish a strong foundation of climate change knowledge that can be applied as students progress through school. When students learn about ecology in grade eight, we hope they will apply their understanding of climate change to better understand how it will affect species and habitats around the world.

The idea of teaching climate change is itself a challenge. I say this because of the current design we have in our district. Students in the sixth grade are taught Earth Science which includes climate and weather and now Climate Change. Currently this is the only time they will be taught this material unless they choose an Environment Science elective class in high school. This puts a lot of pressure on me to cover more than my students or I are capable of. I will want to go into greater depth on most concepts but I

must realize that the students will not be able to process much of the higher-level material. This is why the lessons designed only go so far, but the desire to go further will be quite strong. This is an issue we must address as we work towards adapting the new standards and evolve our curriculum.

A second challenge I may experience will be the time it takes to complete the unit. This really depends on the efficiency that students have in absorbing the material. I have found that my current group of students tends to take a bit longer with challenging concepts and lessons that would normally take a class are stretched to two classes. If this occurs I must continually refocus the group to the concept at hand in order for students to maintain a high level of concentration and understanding.

The final challenge I feel we may have is one I am both excited for yet nervous about as well. The unit is embedded with a tremendous amount of opportunity for student discourse. The quality of this discourse is to be determined but will be a measure of student understanding. If the lessons do not provide students with quality learning experiences, the discourse will be mostly teacher led. However, I feel pretty confident that our class discussions will be compelling.

As we discuss in our course about how we can better educate our students about Climate Change, I feel one thing we can definitely do is inform our students about climate and the mechanisms behind it. This unit on climate change follows our unit on climate and provides a perfect opportunity for students to be successful in learning the significance of climate change. By first learning the mechanisms that drive climate (ocean, atmosphere, sun, wind) students can apply that information and gain a deep understanding of the environmental changes they will experience in their lifetime.