

Melting Ice and Rising Sea Levels as Part of the Unit Lesson on Weather and Climate

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Grade-Level: Elementary, Grades 5-6

Objectives

- Students learn which masses of ice pose the biggest threat for rising global sea levels.
- Students are introduced to climate and weather in small group reading and discussions with the teacher.
- Students understand how predictions, observations and weather data interpretation are accomplished.
- Students perform some investigations related to weather, climate and global warming through
- Students engage in various readings, class discussions, and weather experiments.

Overview

The initial concept of the study on weather and climate introduces students to the rising concerns of the melting polar ice caps and the causes and effects on the world population. Instructors may accomplish introductory studies as they see fit. Students generally are introduced to weather and climate in small group discussions and discuss the importance of diagrams, pictures, symbols, and the scientific process in all lab experiments. The lessons reinforce the scientific process. Students gain a solid understanding of the nature of science; all lab procedures fit the inquiry method of science as a result of consistent focus on the scientific method. This is best accomplished in the early weeks of a new school year and ideally at all grade levels. Students are also directed in the hypothesis statements for two of the three hypotheses or for each science activity. In this activity students may be instructed to work in whole group with little direction on the final hypothesis statement regarding Melting Ice and Rising Sea Levels.

There are three lab experiments to be performed by the students. The first lab is designed by the



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Science Foundation under grant
number EPS-0814372



students while the other two labs center on ice cores and land-locked ice and free-floating ice are teacher-directed. The ice core lab is an instructive and enjoyable activity for students.

Engagement

Classroom viewing of the video/DVD *Extreme Ice* (Dockstader, 2009) with ensuing discussions about how the ice was formed is a good first engagement for this topic. In anticipation of the final lab on which type of ice would cause the most damage to the world's low-lying areas, students are introduced to the concept in this first engagement activity. It will not take much time for students to come to the conclusion that the free floating ice was taking up space in the water and that the land locked ice will cause the most damage. Most students will be willing to get involved in discussions concerning these opening ideas. Students are encouraged to discuss global climate change and its impact on sea level rise

Nevada Science Standards

The science standards addressed in these lessons included:

N5A.1 Students know science progress is made by conducting careful investigations, recording data, and communicating results in an accurate manner;

N8A.4 Students know how to design and conduct a controlled experiment;

N8A.5 Students know how to use appropriate technology and lab procedures safely for observing, measuring, recording, and analyzing data.

ELA standards: cause and effect relationships and drawing conclusions using comparing and contrasting.

Basic Procedure

Three lab experiments were conducted throughout the lesson: one came as a direct result of a class discussion on icebergs. In the second experiment students work with ice cores, and in the final experiment, students conduct the melting of ice and rising sea levels. Students work in



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small groups and record all data into a science journal and conduct an experimental lab on melting ice and rising sea levels.

The students work together as a class to write their hypothesis for the final experiment. After leading the class on the other two experiments students are able to write up a hypothesis for this final lab on their own with minimal direction from the teacher. Encouragement and assistance is provided to students on a case by case basis with the teacher acting more as coach/mentor than direction-giver.

Inquiry Cycle

This study begins with the question, “What is the difference between weather and climate?” and eventually leads to the final question,” Which mass of ice poses the biggest threat to rising sea levels?” Students are given the opportunity to perform three labs throughout this lesson.

Students begin the study of climate and weather by engaging in small group reading and discussions with the teacher. These small groups are asked to discuss the difference between weather and climate through the use of a National Geographic book, Visualizing Weather and Climate (Anderson, 2008), and discuss how scientists, meteorologists specifically, use predictions to learn about weather. It is important that students learn and identify the conditions that create weather and be able to describe the difference between the two.

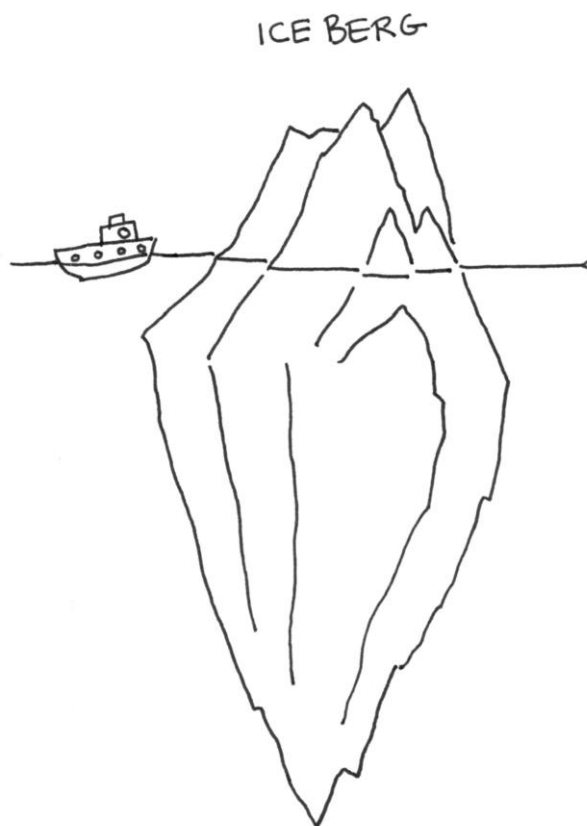
Forming a Hypothesis

Throughout the weather and climate lesson students are directed to follow the entire scientific method throughout the study. Keep the hypotheses and labs simple so students are able to easily discover the answer by the end of the lesson. The hypotheses for the first two labs are discussed by whole group and the labs were done in small groups. The students were given little direction in the formation of the hypothesis for the final lab. Our initial hypothesis centers on the weather and climate.



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The second hypothesis centers on whether the amount of salt affected the melting time of frozen water, while the final hypothesis centers on the melting ice and rising sea levels.

Investigating Our Hypothesis

Lab one:

Does the amount of salt affect the melting time of frozen water?

Follow through with the lab designed by the students at the beginning of the lesson. During the discussion of ice ask students if icebergs were made of salt water or fresh water. When the class is unable to agree on an answer (there *will* be disagreement), invite them devise a lab that can be done in class or at home.

After executing the student-designed lab(s) have the class gather seven empty water bottles and fill each with one cup water and various amounts of salt.

Bottle One remains salt free as the control bottle.

Students add one tsp salt to bottle two, two tsp salt to bottle three, three tsp salt to bottle four, four tsp salt to bottle five, five tsp salt to bottle six, and finally six tsp salt to bottle seven.

The water is frozen and the students begin their observations in the classroom by making sketches and noting the time the lab began.

The bottles are placed outside and the time it takes for the ice to melt is measured.

The ice is checked every hour.



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Help the students to see that the more salt added to the water, the less solid the water froze and the quicker it melted.

Analyzing Data

Students should conclude that the initial lab revealed that the more salt added to the water, the less solid the water froze and the quicker it melted. They realize that icebergs are not made of salt water because if they were they wouldn't last long in the warmer temperatures. Bottle seven had the most salt added and the water in that bottle did not freeze as solid as the other bottles. It also takes less time for the ice to melt in bottle seven. What other ways could they find to test whether or not there is salt in an iceberg?

Investigating Our Hypothesis Part 1

Lab two:

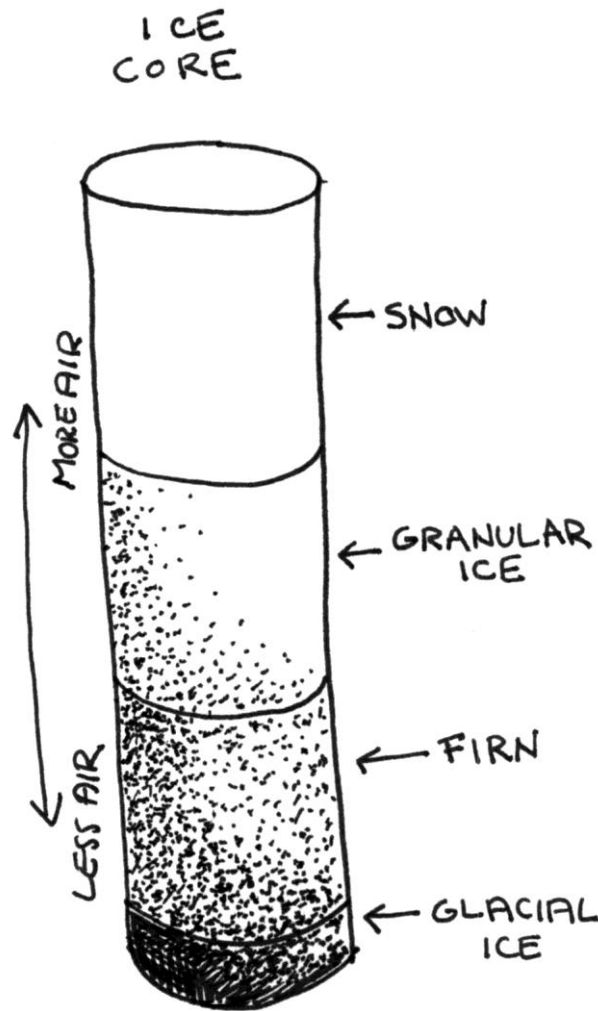
How does an ice core act like a time machine?

Students are given the opportunity to work with small ice cores. Students are directed to discover how ice cores act like time machines. Prior to the lab students are given information regarding how scientists use ice cores to discover information about weather patterns over time. Students are to work in small groups making observations about the general description of the cores and use their notes to answer a list of questions. The year given at the beginning of the lab was the same year given in the 2011 EPSCoR Summer Institute, 1955. Students would easily understand that year as the year of the atomic bomb testing in the Pacific Ocean and could use what they learned about weather patterns and jet streams in the book Visualizing Weather and Climate (Anderson, 2008). Students worked in small heterosexual groups with an ice core approximately 20 cm in height. Each group was given a year to begin and after counting the layers the groups were able to determine how old their ice core was, what each layer represented, what an ice core is, and how it can be used as a time machine. Each group made measurements,



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sketches and completed a series of questions.

At the conclusion of the lab a whole group discussion was held.

Analyzing Data

Using the initial lesson about weather and climate students discover that the layers represent two different times during each year. Using the initial year of 1955, gives the class a starting point. Discuss with them that 1955 was a year in which an event had happened that could be measured. Discuss catastrophic events throughout history and how that information is trapped in the ice. It is important that students understand that scientists do not use any random year but one in which there is some important data that can be pulled from the cores and that 1955 was the year of atomic bomb testing in the Pacific Ocean. Once they understand that, they are

able to understand how a single ice core could date as far back as thousands of years just by looking for important data that would be trapped in the cores.

Investigating Our Hypothesis Part 2

Lab three:

Which ice poses the biggest threat for rising global sea levels?

Students are to read articles about global warming through the use of Feeling the Heat (Time for



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Kids, 2011). This article, discusses how the world, as a whole, is warming up and that the ice is melting at an alarming rate. The article also relates that mapmakers made a mistake when the 13th Edition of the Times World Atlas (National Geographic Society, 2011) reported that 15% of Greenland's permanent ice cover had melted 15%. Students are asked to discuss how incorrect information can be harmful as well as beneficial to the general public. Students are alerted to the growing issue that some critics do not agree that global warming is the threat that researchers have claimed and that the loss of 15% was exaggerated and that even 1% isn't significant and shouldn't be seen as a big threat. A discussion/debate can be planned for later class sessions when more information has been presented.

This final lab centers on the overall concept of rising sea levels from melting ice. Through this experiment students will see that salt water that land-locked ice will cause the most damage because the free floating ice is taking up space in the water but the sea levels will rise significantly when the land-locked ice melts.

Students are to work in small groups. Three groups work with land-locked ice while the other three work with free-floating ice. Each group is given a small plastic container. The land-locked ice groups build their land (which represents land rising out of the ocean) with clay and place it into the container. Students build small houses and added clay people to their land. They then place a chunk of ice (made of five ice cubes) on top of their land. All groups pour one cup water in the container. The free floating groups add five loose ice cubes to their one cup water. They make an initial observation by measuring the water in their containers. Containers are set aside for the remainder of the day and another measurement is made the following day. Most students are able to determine that the land locked ice containers were going to overflow so they may take precautions to place several paper towels under their containers to soak up the overflow. It is a good idea to monitor their discussion and see if they will recognize this might happen. The ice in the free-floating containers melts faster and will not show any rise in "sea" levels.



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Analyzing Data

When the water levels begin to rise in the land-locked containers students realize that it would be the loss of land-locked ice that would cause the most damage. Free floating ice is taking up space in the water and will not cause the water to rise. Have students write down all their observations and keep the discussion about the differences between the two systems alive.

Extending Our Theories

Students are encouraged to look beyond what is done in the classroom and to discuss this problem with their parents. They are also encouraged to watch the weather patterns now that they have some understanding of weather and climate, to look up information and to look at it with a critical eye. Students should be encouraged to watch for signs of weather and climate changes throughout the remainder of the school year and bring in evidence of extreme weather for class discussions.

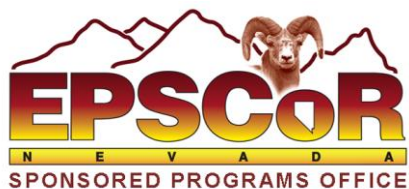
Integration of the Nature of Science in the Lesson

Students are introduced to science lessons by reading in small groups and learning the difference between weather and climate. Students learn that scientists do not just make wild guesses about the weather but look into history to discover what has happened over time using various strategies. This lesson can stress that an ice core is like a time machine and how important this information is. Students make scientific observations during three labs and are constantly reminded of the creative process involved in the creation of the salt water melting time lab and working together as a team to work through the scientific process/method. It is important to set the foundation by introducing the scientific process so students have a basis for studying science and a reason for testing and experimenting with different types of ice.

During this lesson students are given the opportunity to use reading strategies such as cause and effect, and predicting. Students use various vocabulary words in their writing and are held accountable for those words in class discussions. Integrating reading and language arts into science indicates a need for science to be taught to reinforce the use of non-fiction and



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informational texts. Take the opportunity to read in small groups and discuss vocabulary, clarify information, and process on differentiated levels the unit of weather and climate.

Differentiated Instruction

All students in the class are included in the labs and class discussions. Notes are given and projected on the active board. Students are encouraged to write all directions in their journals, some were given oral instructions one-on-one. All procedures are done in small groups and students are encouraged to work together assisting all students in their group. Materials are presented in whole-group or in small group discussions. The beginning of the series is done in small groups in leveled reading groups. Only one pre-made worksheet is used and that is discussed within a small group and worked on together within the group with teacher led discussions and directions. Student work is accepted in their journals in the form of writing, sketches and pictures. Having a T.A. or volunteer parent in the class during activities helps by providing more time for explaining concepts on a one-on-one basis. Instructor and volunteer circulate around the room and assist when necessary and where needed. Students benefit from the one-on-one assistance when writing up the scientific method as well as reviewing the material on the post-test. Circulating the room and assisting when asked also encourages students to be independent and work as a group working out the answers within their individual groups. Students will often ask other groups what they had discovered and they often compare notes and this should be encouraged. Students are encouraged to participate fully within their group and when whole group discussions are held. Make use of your ELA person at the school and integrate this unit into the ELA block to give the class additional insight on the reading and ELA standards.

Assessment Strategies

At the beginning of the lesson ask students to explain what they knew about weather and climate. In small groups discuss the difference and have each student write the definition of the words on 3x5 cards to keep with other vocabulary words. These words are revisited weekly. All students have a large ring with cards attached that include all vocabulary words and their definitions that



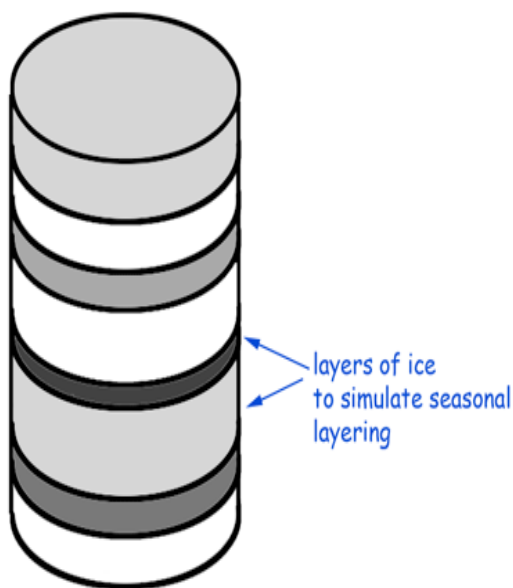
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they have been learning all year. Use of a pre-test at the beginning of the unit is always a great idea when many new vocabulary words will be introduced. Students are graded on participation, notes, and their journals. Make certain to have students learn the usefulness of journals for all subjects and use them extensively for all notes. Depending on the level of understanding and maturity, students may present their findings and conclusions to the class.

Additional Information for Teachers

Make sure to prepare ice cores ahead of time if you choose to do this lab.



Make 3 sets of ice cores for each group of 3 students: Pour a 3 cm column of water into the orange juice can and place can in freezer. Mix food coloring with water to make a grayish color. Remove can from freezer when the water is frozen and pour a 1cm column of the gray water on top of the original 3-cm column of water. Place in freezer until the second layer is frozen. Continue pouring and freezing alternating clear and gray water into the can until the can is full in the following order: 2 cm clear water, up to 1 cm gray water, 4 cm clear, up to 1 cm gray, 5cm clear, and one cm gray. Label the can "Core 1" and label the bottom and top of the can. Repeat this procedure for the other two ice cores using varying amounts of clear water, and 1 cm of gray water. Label the cans "Core 2" and "Core 3," and label each bottom and top (French J., n.d.).

Alter the labs that you find on-line to fit the needs of your class and the time constraints for this unit. Teaching this lesson as a unit on weather and climate in order to provide a progress grade for science for my students works well or it can be used with the unit on earth science.



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The first time through may involve lot of prep time for this lesson. Subsequent lessons won't involve so much time preparing for the unit. Students learned the value between the difference of weather and climate and the use of various types of reading material to integrate the lessons.

When the students are allowed to prepare their own lab with the frozen salt water, their enthusiasm goes up. They like the freedom to prepare and present the lab.

Being able to have time in the computer lab for students to investigate some web sites and to do some web surfing on related areas is a bonus. If possible have students do more research and use their computer skills to get a solid basis for this unit. Use this opportunity to incorporate note taking skills and journaling as well as small group discussions rather than whole group discussions after viewing the video. Students can also get the opportunity to write up a quiz for the video and come up with a question for the Climate 101 web site.

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