

Lesson Topic: The Ocean Influences Earth's Climate (Earth's Systems, Hydrosphere Unit)

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| Standards | <p>ESS2.A Disciplinary Core Idea: Earth's major systems, the atmosphere, hydrosphere, geosphere, and biosphere, interact in multiple ways to affect Earth's processes.</p> <p>ESS2.A Disciplinary Core Idea: The ocean influences climate.</p> <p>ESS2-1 Crosscutting Concept: A system can be described in terms of its components and their interactions.</p> <p>ESS2-1 Science & Engineering Practice: A model can be used as an example to describe ways in which the atmosphere, hydrosphere, geosphere, and/or biosphere interact.</p> |
| Materials | <p>Science notebooks and pencils Water cycle physical models (American Educational Water Cycle Model), chilled lids, clouds, stands (set up with ice in clouds, and warmer water in A's ocean than B's ocean). Ice Warm water Food coloring Thermometers Masking tape to tape lids closed A & B labels for the physical models Towels Index cards Smartboard word splash: evaporation, condensation, precipitation, run-off, heat source Computers: <i>NBC News, Flooding in Louisiana</i>, and <i>USGS Interactive Water Cycle</i>, accessed from class website: http://blogs.socsd.org/kchristieblick/science/earth-science/hydrosphere-all-washed-up/water-cycle/ .</p> |
| Instructional Outcomes | <p>Teaching Points:</p> <ul style="list-style-type: none">● The atmosphere affects the hydrosphere, and the hydrosphere affects the geosphere and biosphere.● Global warming is altering Earth's water cycle, which is having an impact on people.● The ocean influences climate by altering the water cycle process.● Creating and using models (physical, conceptual, computer) helps us understand complex concepts, such as the interaction between the atmosphere and hydrosphere. |

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| | <p>Learning Objectives:</p> <ul style="list-style-type: none"> ● Students will be able to draw and label a conceptual model of the water cycle. ● Students will create a cause-and-effect chain illustrating how global warming is increasing precipitation in some areas, due to warmer ocean water. |
| <p>Rationale</p> | <ul style="list-style-type: none"> ● If children understand how Earth’s systems interact, they are better able to understand that when one system changes it causes a change in another of Earth’s systems. ● If children understand that global warming is altering Earth’s water cycle in ways that impact people’s lives, they are more likely to take steps to help slow down global warming. |
| <p>Introduction (5 min)</p> | <p><i>(Physical water cycle models are set up at each table before beginning of class. Teacher gathers students on rug with science notebooks and pencils.)</i></p> <p>Today we’re going to explore the hydrosphere more in depth. Who remembers studying the water cycle in 3rd grade?</p> <p>Turn-and-talk: What is the water cycle? How does it work?</p> <p>Throughout today’s lesson, I want you to think about how the water cycle impacts your life, in both good and bad ways.</p> <p>Turn-and-talk: What if the cycle changes in some way? What might cause it to change? How could it change? How would it affect you?</p> |
| <p>Lesson (16 min)</p> | <p>1) Today, you’re going to use the physical models again, but this time you’ll be looking at a closed system at work. Keep the lids on. Look through the sides, or wherever you can see inside the miniature world the best. First let’s observe model A. Discuss with your group what’s happening inside and why.</p> <p>Students take their science notebooks and pencils with them and go to their table groups. They discuss what’s happening inside the models.</p> <p>What do you observe in Model A? Look through the sides as you tap on the lid. What happens? What happens next? (It’s difficult to see, due to the evaporation and subsequent condensation on the plastic, but children will recognize the water cycle:</p> |

evaporation, condensation, precipitation, and run-off.)

2) In your science notebook, draw a conceptual model of this water cycle. Be sure to use scientific labels (Teacher points to word splash on Smartboard), and arrows to show the action.

Now write a little description of what's happening at each stage. Discuss it with your table group. Make sure everyone agrees.

Formative Assessment: Teacher circulates, assessing who needs extra guidance.

3) Now observe Model B. Compare what's happening in Model B with Model A. Discuss possible reasons for the differences.

Teacher leads class discussion, as groups hypothesize what might be the reason for so little evaporation (and subsequent lack of precipitation).

How could we find out if your hypotheses are correct? Teacher allows students to open the lids and compare the temperatures of the oceans, revealing that A's ocean water is warmer than B's ocean water.

How does water temperature affect the amount of rain we get? (The warmer the ocean, the more evaporation, the more rain.) **What warms ocean water? Can you guess where this line of reasoning is headed? What does all of this have to do with global warming?**

4) Ask students to come to rug and watch NBC News segment about a recent rainstorm in Louisiana (2016). This type of prolonged heavy rain is unusual for this area. Global warming is causing intense rainstorms like never before in many places around the world. It's causing climates to change because it's altering the water cycle.

5) Let's see if you can work out how it's happening. Use all your background knowledge to draw a 6-step cause-and-effect chain: global warming to flooding.

Formative Assessment: Teacher circulates, assessing who needs extra guidance.

With the students' help, the teacher writes the chain on the Smartboard:
Global warming → warmer ocean → increased evaporation → increased precipitation → fiercer rainstorms → flooding.

Half-Way Teaching
Point (12 min)

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| | <p>Extension: If time, teacher may want to have students visit USGS's <i>Interactive Water Cycle</i> website. This extends information about the water cycle, and helps students to see the complexities of the water cycle.</p> |
| Closure & Student Self-Assessment (7 min) | <p>How can we reduce the number of fierce rainstorms? Think about the cause to come up with an answer. Turn-and-talk. (Slow down global warming.) Teacher sums up the lesson and students' ideas.</p> <p>Teacher hands out an index card to each student. Write your name. Explain why some parts of the U.S. are having this weird, wacky weather with torrential rainstorms. You can also write if you're confused about any part, or what else you wonder about the water cycle. It's your Exit Ticket.</p> <p>Extra credit: Teach a parent about what you learned today (without using your science notebooks). Ask her/him to write down the explanation (or the cause-and-effect chain). Write your name on it. If s/he is correct, YOU get the extra credit.</p> |