**Water Cycle Webquest**

**Lesson Overview**: This online lesson has been designed to teach students about Earth’s water cycle. It should take about 45 minutes to complete and could be finished as a homework assignment if the student has access to a computer with Internet access. This lesson can be done individually or in small groups, and includes a capture sheet that can be modified to meet the needs of your classroom.

**Learning Objectives:**

* Explain how scientists can learn about Earth’s water cycle using satellite technology.
* Describe the processes that a droplet of water goes through as it moves through Earth’s four systems.
* Generate and communicate ideas about how movements of water and wind can affect weather and climate.
* Explain how we use freshwater resources in our daily lives and describe where this water comes from.
* Look at actual data sets and use these to describe the movement of energy and matter on Earth’s exterior.

**Next Generation Science Standards:**

**3rd to 5th grade”**

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| 4-ESS2-2 | Analyze and interpret data from maps to describe patterns of Earth’s features. |
| 5-ESS2-1. | Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact. |
| 5-ESS2-2. | Describe and graph the amounts of salt water and fresh water in various reservoirs to provide evidence about the distribution of water on Earth. |
| MS-ESS2-1. | Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process. |
| MS-ESS2-4. | Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity |
| MS-ESS2-5. | Collect data to provide evidence for how the motions and complex interactions of air masses result in changes in weather conditions. |
| 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 |
| MS-ESS3-1. | Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes |
| MS-ESS3-2. | Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects |
| HS-ESS2-2. | Analyze geoscience data to make the claim that one change to Earth's surface can create feedbacks that cause changes to other Earth systems. |
| HS-ESS2-5. | Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes. |
| HS-ESS3-5. | Analyze geoscience data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth's systems. |

**Materials:** computers with Internet access (see Teacher Notes for additional information on setting up and organizing computer usage), Student Capture sheet, (one per student), headsets (optional, as there are several video clips with audio in this webquest)

**Engage:** Ask students where they water that they drink comes from and generate a discussion about how we get the water that we use in our daily lives. Inquire about how water resources are used in our daily lives (i.e. drinking, watering crops, generating power, etc.) At this point, don’t worry about giving the students the answers, but rather generate curiosity and get a feel for their pre-existing background.

**Explore:** Tell the students that they will complete a webquest in which they will explore various aspects of the Earth’s water cycle, as well as how we use freshwater resources in our daily lives. They will also learn about a NASA mission that is currently studying global precipitation, called GPM (Global Precipitation Measurement). They should have a Student Capture sheet to use to write their answers on, and will interact with many different websites and data sets.

**Explain:** As a result of interacting with the material in this webquest, students will learn how much water on Earth is actually freshwater, how we will use satellite technology to explore Earth’s water cycle and measure global precipitation, why gaining that information is important to civilization, how water moves through Earth’s water cycle, the importance of the ocean to our water cycle, see and interpret data sets that show how Earth’s ocean currents and winds move water vapor around Earth, the interactions of Earth’s systems as water changes state and moves through them, how the average person in the US uses freshwater resources, how clouds form, and why understanding the water cycle is vital to knowing about weather, climate, and natural resources.

**Evaluate:** Students will complete a Student Capture sheet that includes short answer responses and a brief constructed response that explains how a drop of water moves through Earth’s four systems. In addition to using this as an evaluation tool, the teacher can elicit oral responses from students as they interact with the webquest and upon completion.

**Elaborate/Extend:** There are a great many activities that students could complete to learn more about the water cycle. They could construct and use a model of Earth’s water cycle and use it to demonstrate how energy and matter moves through Earth’s systems. They could use software, such as Inspiration, and develop a concept map to illustrate the water cycle and freshwater resources.

Here are some links to other resources that they could explore to increase their understanding of Earth’s water cycle:

* There are many great resources at this site which focus on understanding Earth’s water cycle: <http://pmm.nasa.gov/education/water-cycle>
* MyNASAData lesson for 5-7th grade students, “How Does the Earth’s Energy Budget Relate to Polar Ice?” <http://mynasadata.larc.nasa.gov/lesson-plans/lesson-plans-middle-school-educators/?page_id=474?&passid=101>
* The GLOBE Program’s “Earth System Science Posters” activity: <http://www.globe.gov/teaching-and-learning/materials/earth-system-science-posters>

**Teacher Notes:**

* Classroom Organization: It is possible for this activity to be completed in a one computer per classroom setting, although it is ideal to have each student be able to use their own computer to enable them to have a chance to interact with the various websites as their own speed. If you have students with special needs in your classroom and want to utilize some Universal Design for Learning techniques, you could pair students and have one student read and the other student write or develop another pairing technique to meet your unique students’ needs. Some students may require more time to complete this webquest, and thus it can be assigned as a homework assignment. This could also be assigned as an introductory lesson in a “flipped classroom” setting to have students learn and interact with this information before they come to class.
* Answer Key: If you would like a copy of the answer key, please request one using this link- <http://pmm.nasa.gov/education/contact>
* Student Capture Sheet- The Student Capture sheet has been made available in Word to enable the teacher to modify it to meet their students’ needs. (When I have done this lesson, I add lines for students to write in their answers as I have found they are less likely to “cut and paste” and more likely to synthesize the information as they form a written response.) Teachers may want to add “pre-assessment” questions, and perhaps even use the written paragraph as a “post-assessment” activity.