The Hydrologic Cycle and Hurricanes:
The Water Cycle Boogie!

Subject: Science

Grade Level: 4th – 8th Grades

Rationale or Purpose: This activity introduces the concept of the water, or hydrologic, cycle as it follows the journey of a water molecule through a hurricane. Students will create a model of the water cycle to help them understand the process.

Source of Lesson: *Hot Science – Cool Talks* CD-ROM # 44: "Is Climate Change Increasing Hurricane Activity?"

Materials:

- 2 glass jars, about the size of a medium mayonnaise jar (mouths must be the same size)
- masking tape
- a few small rocks to symbolize "earth"
- water

Lesson Duration: 30 – 55 minutes

TEKS Objectives:

4th Grade Science 112.6
(11C) identify the Sun as the major source of energy for the Earth and understand its role in the growth of plants, in the creation of winds, and in the water cycle.

5th Grade Science 112.7
(6B) identify the significance of the water cycle

6th Grade Science 111.22
(1A) demonstrate safe practices during field and laboratory investigations
(1B) make wise choices in the use and conservation of resources and the disposal or recycling of materials
(2A) plan and implement investigative procedures including asking questions, formulating testable hypotheses, and selecting and using equipment and technology
(2B) collect data by observing and measuring
(2C) analyze and interpret information to construct reasonable explanations from direct and indirect evidence
(14B) identify relationships between groundwater and surface water in a watershed
(14C) describe components of the atmosphere, including oxygen, nitrogen, and water vapor, and identify the role of atmospheric movement in weather change

7th Grade Science 111.23
(1A) demonstrate safe practices during field and laboratory investigations; and
(1B) make wise choices in the use and conservation of resources and the disposal or recycling of materials.
(2A) plan and implement investigative procedures including asking questions, formulating testable hypotheses, and selecting and using equipment and technology;
(2B) collect data by observing and measuring;

(2C) organize, analyze, make inferences, and predict trends from direct and indirect evidence;
(2D) communicate valid conclusions; and
(2E) construct graphs, tables, maps, and charts using tools including computers to organize, examine, and evaluate data.
(4A) collect, analyze, and record information to explain a phenomenon using tools including beakers, petri dishes, meter sticks, graduated cylinders, weather instruments, hot plates, dissecting equipment, test tubes, safety goggles, spring scales, balances, microscopes, telescopes, thermometers, calculators, field equipment, computers, computer probes, timing devices, magnets, and compasses; and
(14A) describe and predict the impact of different catastrophic events on the Earth;
(14C) make inferences and draw conclusions about effects of human activity on Earth's renewable, non-renewable, and inexhaustible resources.

8th Grade Science 112.24.
(3A) analyze, review, and critique scientific explanations, including hypotheses and theories, as to their strengths and weaknesses using scientific evidence and information
(3C) represent the natural world using models and identify their limitations
(10B) describe interactions among solar, weather, and ocean systems
(12B) relate the role of oceans to climatic changes
(12C) predict the results of modifying the Earth's water cycles

Background Information:

On our planet, water is a limited resource that gets constantly recycled in four main processes: **Evaporation** (and **transpiration** in plants), **Condensation**, **Precipitation**, and **Accumulation**. In the process of evaporation, water molecules from oceans, rivers, lakes, groundwater, streams, etc. are heated up by the sun, and converted into water vapor. Transpiration is a similar process where the sun's heat draws water from plant leaves. This is sort of like plant sweat! When this warm water vapor gets re-cooled up in the high atmosphere, it re-liquefies and condenses into clouds. If so much water has condensed in the clouds that the air can no longer hold it, water precipitates, or falls back to Earth in the form of rain, sleet, or snow. Lastly, this fallen precipitate will gather, or accumulate, in lakes, rivers, groundwater, or oceans, and the whole process cycles again!

How does this relate to hurricanes?

The sun radiates energy to Earth and some of it gets absorbed by the oceans. This heat is removed from the ocean by evaporation and carried high into the atmosphere with the rising water vapor. In the cooler upper atmosphere, the water vapor condenses into clouds and releases its heat. The energy absorbed by the atmosphere in this process of evaporation over the tropical oceans is what causes hurricanes during the summer months.

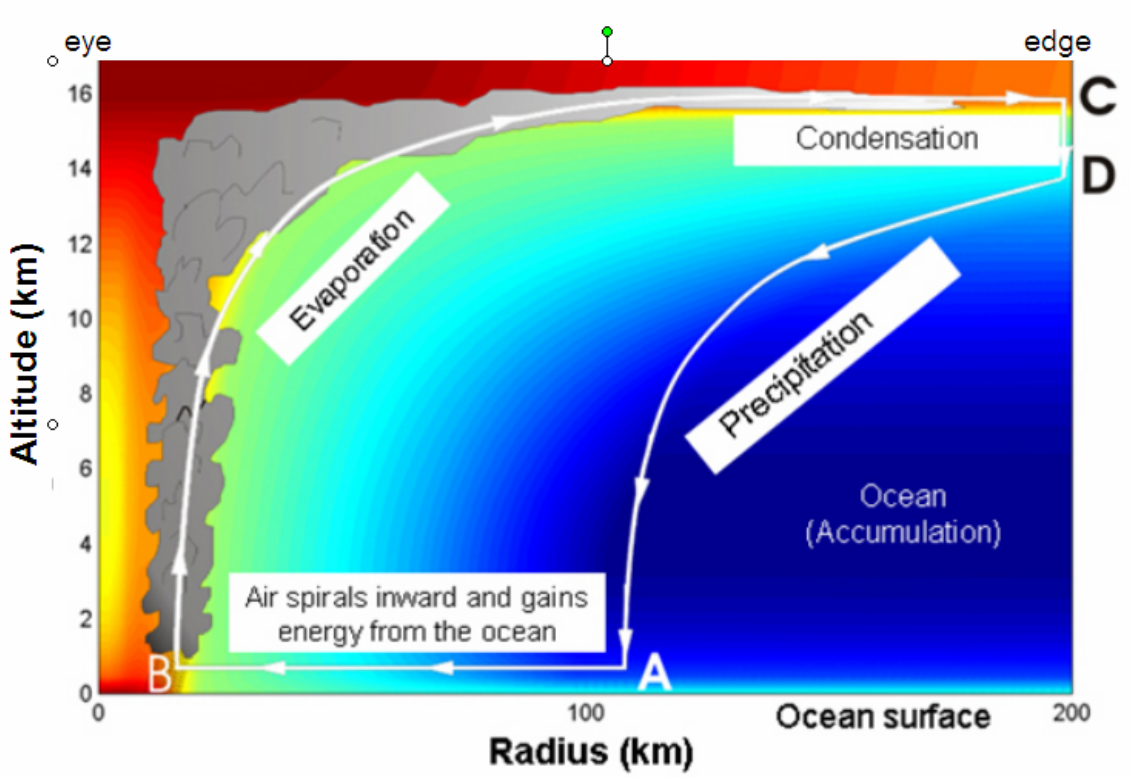

Figure 1. The Water Cycle of a Hurricane. The colors depict the entropy distribution; cooler colors indicate lower entropy. Loosely, this means the total heat content of the air, so blue = cool air and red, orange, and yellow = hot air. Adapted from figure 10.2 in *Divine Wind: The History and Science of Hurricanes.*

Procedure:

1. Students will work in teams of two to gather materials listed above and follow the following procedures.
2. Place a few rocks at the bottom of one of the jars, then add enough water to cover the rocks half way.
3. Next, invert the second jar over the mouth of the first, and tape together with masking tape.
4. What is a key component to the water cycle? The sun! Place the small hydrologic models outside in the sun.

This model will enable students to witness condensation drops gathering on the upper jar, get denser, and then precipitate back into their accumulated 'pond.'

Ideas for Data Collection and Analysis:

- Have students to keep a journal, recording their predictions, lab procedures, conclusions, diagram of the hydrologic model, etc.
- Create concept maps of the water cycle
- Encourage questions and connections
- Relate water cycle specifically to hurricane formation and why there is so much rain associated with hurricanes