

# Seminole County Water Atlas Learning Kit

## Climate Change & Extreme Weather Lesson Plan

*Students investigate consequences and responses to climate change-induced severe weather.*

*Water Atlas Curriculum Lesson 48*

**Lesson Summary:** In this lesson, students will investigate the relationships between the effects of climate change and extreme weather.

**Grade Level:** High School (9<sup>th</sup>–10<sup>th</sup> Grade)

**Time Allotted:** Three class periods of 50 minutes each (does not include site visit).

### Performance Objectives

*References are to the Next Generation Sunshine State Standards (2007).*

#### Social Science

- SS.912.G.5.1 Analyze case studies of how the Earth's physical systems affect humans.
- SS.912.G.5.2 Analyze case studies of how changes in the physical environment of a place can increase or diminish its capacity to support human activity.
- SS.912.G.5.3 Analyze case studies of the effects of human use of technology on the environment of places.
- SS.912.G.5.4 Analyze case studies of how humans impact the diversity and productivity of ecosystems.
- SS.912.G.5.5 Use geographic terms and tools to analyze case studies of policies and programs for resource use and management.
- SS.912.G.5.6 Analyze case studies to predict how a change to an environmental factor can affect an ecosystem..
- SS.912.G.6.5 Develop criteria for assessing issues relating to human spatial organization and environmental stability to identify solutions.

#### Language Arts

- LA.910.2.2.3 The student will organize the information to show understanding or relationships among facts, ideas, and events (e.g., representing key points within text through charting, mapping, paraphrasing, summarizing, comparing, contrasting, or outlining);
- LA.910.4.2.2 The student will record information and ideas from primary and/or secondary sources accurately and coherently, noting the validity and reliability of these sources and attributing sources of information.
- LA.910.3.5.1 The student will prepare writing using technology in a format appropriate to the purpose (e.g., for display, multimedia).
- LA.910.3.5.2 The student will include such techniques as principle of design (e.g., margins, tabs, spacing, columns) and graphics (e.g., drawings, charts, graphs).
- LA.910.3.5.3 The student will share writing with others, or submit writing for publication.

- LA.910.4.2.2 The student will record information and ideas from primary and/or secondary sources accurately and coherently, noting the validity and reliability of these sources and attributing sources of information;
- LA.910.4.2.3 The student will write informational/expository essays that speculate on the causes and effects of a situation, establish the connection between the postulated causes or effects, offer evidence supporting the validity of the proposed causes or effects, and include introductory, body, and concluding paragraphs.
- LA.910.5.2.1 The student will select and use appropriate listening strategies according to the intended purpose (e.g., solving problems, interpreting and evaluating the techniques and intent of a presentation);
- LA.910.5.2.2 The student will research and organize information for oral communication appropriate for the occasion, audience, and purpose (e.g., digital presentations, charts, photos, primary sources, webcasts);
- LA.910.5.2.5 The student will research and organize information that integrates appropriate media into presentations for oral communication (e.g., class discussions, entertaining, informative, persuasive, or technical presentations).

### **Prior Knowledge**

No prior knowledge necessary.

### **Topic Overview**

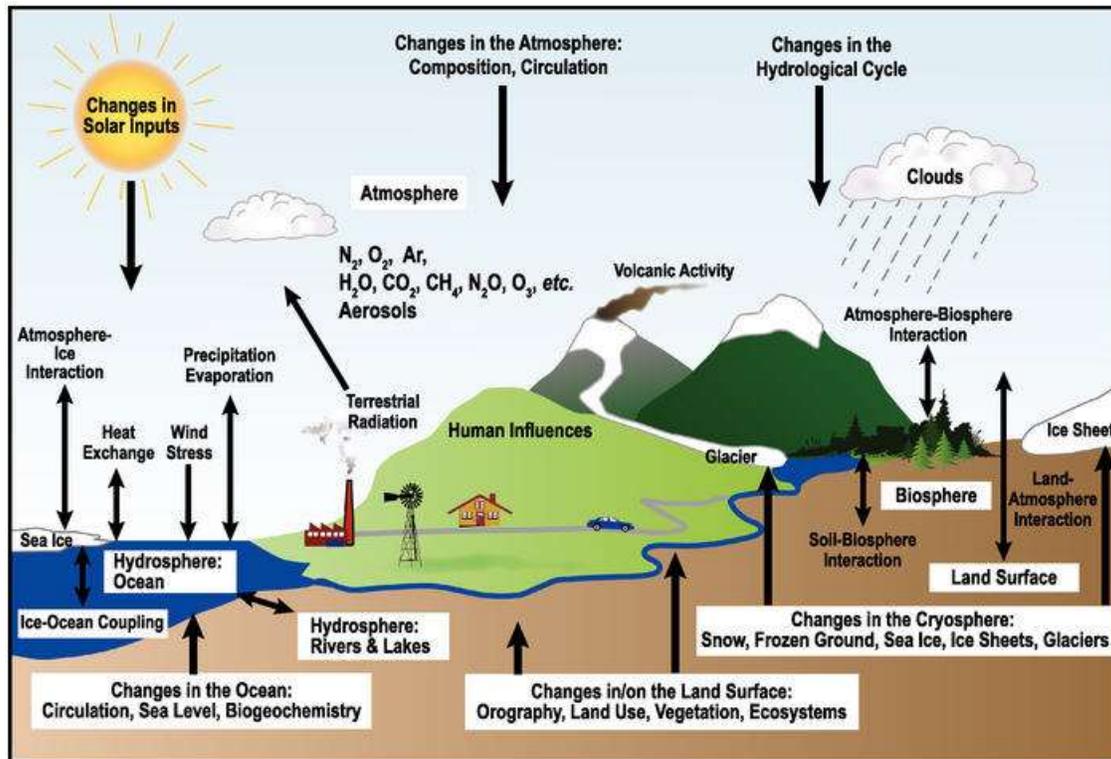
Hurricanes are the extreme weather example most often mentioned in conjunction with climate change, but tornadoes, wildfires, droughts, floods, heat waves, and freezes can also threaten the well-being of central Florida residents. Students will investigate the potential effects of these events on built and natural environments, commerce and society.

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Schematic view of the components of the climate system, their processes and interactions.  
(Source: Intergovernmental Panel on Climate Change, 2007)

## Key Vocabulary

### Atmosphere

A band of gases enveloping the Earth's surface. Ninety-nine percent of its mass is concentrated within 20 miles of the earth's surface, and its two largest constituents (in the lowest part) are nitrogen (about 78 percent) and oxygen (about 21 percent).

### Biosphere

Part of the Earth's surface and atmosphere that contains the entire terrestrial ecosystem, and extends from ocean depths to about six kilometers (3.7 miles) above sea level.

### Carbon dioxide (CO<sub>2</sub>)

A colorless, odorless, poisonous gas resulting from fossil-fuel combustion and the breakdown of organic matter.

### Climate

The long-term average of conditions in the atmosphere, ocean, and ice sheets and sea ice described by statistics, such as means and extremes.

### Climate change

A change in the state of the climate that can be identified (e.g., by using statistical tests) by

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changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer. Climate change may be due to natural internal processes or external forces, or to persistent anthropogenic (human-caused) changes in the composition of the atmosphere or in land use.

### **Cryosphere**

The component of the Earth's system that is frozen water, including snow, permafrost, floating ice, and glaciers. It is directly related to ocean sea-level, and therefore is indirectly related to changes in the atmosphere and biosphere.

### **Drought**

An extended period without rain: technically, a period in which [rainfall](#) is 70 percent below average for three weeks or longer.

### **Geosphere**

The "solid" portion of the earth, including water masses; the lithosphere plus the hydrosphere. Above the geosphere lies the atmosphere and at the interface between these two regions is found almost all of the biosphere, or zone of life.

### **Global warming**

A projected increase in the global mean [temperature](#) of as much as five degrees Fahrenheit that may occur by the end of the 21st century, caused by the increase in [greenhouse gases](#) that trap heat in the Earth's atmosphere.

### **Greenhouse effect**

The warming of the Earth's atmosphere that may be taking place, caused by the buildup of [carbon dioxide](#) and other gases in the atmosphere since the Industrial Revolution of the late 1800s.

### **Greenhouse gases**

Gases such as [carbon dioxide](#), methane, chlorofluorocarbons, and nitrous oxides that accumulate in the atmosphere and may be contributing to [global warming](#).

### **Hydrosphere**

The combined mass of water found on, under, and over the surface of the Earth. It includes all the Earth's water found in the oceans, glaciers, streams, lakes, the soil, groundwater, and in the air.

### **Sea-level rise**

The rise in the world's oceans that may be occurring as a result of [global warming](#).

### **Temperature**

The temperature is a measure of the internal energy that a substance contains and is the most measured quantity in the atmosphere.

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### Weather

The state of the atmosphere with respect to wind, [temperature](#), cloudiness, [moisture](#), [pressure](#), etc. Weather refers to these conditions at a given point in time (e.g., today's high temperature).

### Materials

- Computers with Internet access
- Video camera (optional, for videos)
- Poster board, markers, paper, printer (optional, for poster sessions)

### References

These references can be found in the Seminole County Water Atlas [Digital Library](#):

Borisova, Tatiana, Norman Breuer, and Roy Carriker. [Economic Impacts of Climate Change on Florida: Estimates from Two Studies](#). 2008. University of Florida Institute of Food and Agricultural Sciences.

[Hurricanes Stronger Due to Warming](#) 2007. Environmental Defense Fund.

Ekwurzel, Brenda. 2006. [Hurricanes in a Warmer World](#), Union of Concerned Scientists.

[Hurricanes... Unleashing Nature's Fury: A Preparedness Guide](#). 2001. National Weather Service.

[Global Warming and Extreme Weather: The Science, the Forecasts and the Impact on America](#).  
Environment America Research & Policy Center

Musil, Robert K., et al. 2001. [Death By Degrees: The Health Threats of Climate Change in Florida](#).  
Physicians for Social Responsibility.

Parkinson, Randall W. [Adapting to Climate Change & Extreme Weather Events: A Florida Perspective](#).  
2009. Presentation to the Town of Melbourne Beach, FL.

Robertson, Kevin. [Wildfire, Prescribed Fire and Climate Change in Florida](#). 2007. Tallahassee, FL: Tall  
Timbers Research Station.

Sherin, Kevin M. 2010. [Climate Change Adaptation Planning for Public Health in Orange County, Florida](#). Orange County Department of Public Health.

Other references:

[A Student's Guide to Climate Change](#). Website. Environmental Protection Agency. Accessed June 2011.

Cook, John. [Skeptical Science: Getting Skeptical About Global Warming Skepticism](#). Website. Accessed  
June 2011.

[Intergovernmental Panel on Climate Change](#). Website. Accessed June 2011.

Stanton, Elizabeth K., and Frank Ackerman. [Florida and Climate Change: The Cost of Inaction](#). 2007.  
Tufts University Global Development and Environment Institute and Stockholm Environment  
Institute—US Center.

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### Procedure

#### Engage/Elicit

- Ask students: What do we mean when we use the term “weather”? What do we mean when we use the term “climate”? What is the difference between the two?
- Tell students: Some have said that a better term for “climate change” might be “climate disruption,” because weather patterns will become more erratic, rather than gradually and predictably changing in a particular direction. In particular, scientists predict that the warming of the earth’s atmosphere will lead to more frequent and more extreme weather events.
- Ask students: What kind of extreme weather events might we experience here? Make a list on the board. Possible answers: hurricanes, tornadoes, drought, flood, wildfire, frost/extremely cold weather, heat waves.

#### Explore

Form students into groups of 3-4 students. Ask each group to choose one of the types of extreme weather on the list, and to investigate its implications. Have each group choose a different type of event, if possible. Tell students that their group is to identify sources, perform research, and report on:

1. How climate change would cause the intensity or frequency of these events to increase
2. Impacts of the event and ways they might be reduced, related to:
  - a. Human safety
  - b. Infrastructure (homes, businesses, transportation, utilities, etc.)
  - c. Agriculture (farming, forestry, horticulture, aquaculture)
  - d. Commerce (tourism, real estate/development,
  - e. Ecosystems and wildlife
  - f. Natural resource consumption (energy, water, food)
  - g. Some other area of impact identified by the students

The group should work together to address question #1. For question #2, each student in the group should choose a different area of impact and conduct a very thorough investigation of it.

#### Explain

Students in each group should combine their research results and produce a presentation about the extreme weather event they chose. Depending upon the technology available to your students you may wish to have them produce a poster presentation or a video. Give students a time limit for their presentation, taking into account the number of groups in your class and the time you have available.

- Posters: Display these in class and all students given a chance to peruse them for a few minutes. Then, each group should present their poster to the class, with each student briefly summarizing his or her individual findings.

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- Video: These can be played in class or posted on social media (YouTube, Vimeo, etc.) for students to view at their leisure, prior to class. If the latter, more class time can be devoted to discussion of the information presented.

After each group finishes, if there is time, allow the class to ask questions. You may wish to have the class vote on which group did the best presentation.

### **Extend**

Plan a class visit to the Orlando Science Center's Severe Weather Center. Have students post their field trip reports as stories on the Orlando Science Center's page on the [Orange County Watershed Excursion](#).

### **Exchange/Evaluate**

Have students interview several friends or relatives who have experienced a hurricane or other extreme weather event and prepare a "Lessons Learned" report. What preparations did their interview subjects take before the event to protect their safety and their property? What negative effects did they suffer, if any? What advice would they give to others in a similar situation? What would they do differently in preparing for future events? Have students share their reports with the class.

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