The following instructional plan is part of a GaDOE collection of Unit Frameworks, Performance Tasks, examples of Student Work, and Teacher Commentary. Many more GaDOE approved instructional plans are available by using the Search Standards feature located on GeorgiaStandards.Org.

### Georgia Performance Standards Framework for Science – Grade 6

#### Unit Organizer: Climate and Weather

*(Approximate Time: 5 Weeks)*

#### OVERVIEW:
This unit addresses the interaction of atmospheric conditions and the effects of these on weather and climate.

#### STANDARDS ADDRESSED IN THIS UNIT

**Focus Standards:**

- **S6E2. Students will understand the effects of the relative positions of the earth, moon and sun.**
  - c. Relate the tilt of the earth to the distribution of sunlight throughout the year and its effect on climate.

- **S6E4. Students will understand how the distribution of land and oceans affects climate and weather.**
  - a. Demonstrate that land and water absorb and lose heat at different rates and explain the resulting effects on weather patterns.
  - b. Relate unequal heating of land and water surfaces to form large global wind systems and weather events such as tornados and thunderstorms.
  - c. Relate how moisture evaporating from the oceans affects the weather patterns and weather events such as hurricanes.

- **S6E6. Students will describe various sources of energy and with their uses and conservation.**
  - a. Explain the role of the sun as the major source of energy and its relationship to wind and water energy.

**Supporting Standards:**

- **S6E3. Students will recognize the significant role of water in earth processes.**
  - a. Explain that a large portion of the Earth’s surface is water, consisting of oceans, rivers, lakes, underground water, and ice.
### ENDURING UNDERSTANDINGS

*Students will understand that:*

- Because the Earth turns daily on an axis that is tilted relative to the plane of the Earth's yearly orbit around the sun, sunlight falls more intensely on different parts of the Earth during the year. The difference in heating of the Earth's surface produces the planet's seasons and weather patterns.
- The cycling of water in and out of the atmosphere plays an important role in determining climatic patterns.
- Heat energy carried by ocean currents has a strong influence on climate around the world.
- The sun is the major source of energy for phenomena on the Earth's surface, including winds, ocean currents, and waves.
- Waves transfer energy from one place to another. Waves in oceans and lakes are caused by wind blowing over the surface of the water.
- Ocean currents influence the weather in coastal areas. Currents can be caused by wind, differences in salinity, differences in water temperatures caused by uneven heating of the Earth, the Coriolis Effect which is a consequence of the Earth's rotation, and the gravitational pull of celestial bodies (tidal currents).

### ESSENTIAL QUESTIONS:

**OVERARCHING ESSENTIAL QUESTION**

How does the sun interact with the earth to produce weather and climate?

**TOPICAL ESSENTIAL QUESTIONS**

How does the tilt of the earth affect the seasons and Earth’s climate?
How does an ocean affect the weather and climate of adjacent land?
How does the sun’s heating of water in the tropics affect climate in the rest of the world?
What happens to water after it evaporates from the oceans and land?
How does the sun’s energy cause winds and hurricanes?
**KNOWLEDGE:**

- Weather is the effect of the conditions of the atmosphere at a particular time and place.
- The earth has a layered atmosphere, and that weather takes place in the troposphere layer.
- The sun is the major source of energy for events on the surface of the earth including wind, ocean currents, and waves.
- Land heats up and cools down faster than water. As warm air rises, cooler air moves down, creating convection currents.
- Unequal heating of land and water forms wind systems and weather events. Wind is caused by differences in air pressure, going from an area of high pressure to lower pressure.

- Land heats up and cools down faster than water. During the day, land heats faster than a body of water, so the air above the land becomes warmer. The warm air expands and creates a low-pressure system. The cooler air above the body of water blows inland and under the warm air. At night, the opposite happens.

- Large convection currents are formed because of the temperature differences between the equator and the poles. This produces global wind systems. The equator receives the greatest amount of direct sunlight vs. the pole regions.

- The rotation of the earth makes the large wind systems curve which is the Coriolis Effect.

- Thunderstorms and tornadoes occur because of sudden changes in air pressure or as a fast moving cold front hits a slow moving warm front.

- Large thunderstorms and tornadoes occur most frequently in the spring and summer. The ground is warming and warm air masses move north from Mexico, while cold air masses move south from Canada.

- Oceans, holding a large amount of heat, have major effects on climate.

**CONCEPTS:**

Climate, weather, energy transformation, unequal heating and cooling, cycling of water and energy
<table>
<thead>
<tr>
<th>MISCONCEPTIONS</th>
<th>PROPER CONCEPTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clouds are only found in the sky.</td>
<td>Clouds can form very close to the surface of the Earth (fog).</td>
</tr>
<tr>
<td>Our atmosphere traps the heat from the sun.</td>
<td>Our atmosphere absorbs the radiation from the sun, heating the Earth.</td>
</tr>
<tr>
<td>Rain clouds move around the Earth and eventually come back to us.</td>
<td>Rain clouds form as water when droplets condense from water vapor in the atmosphere. When the atmosphere can no longer support the weight of the droplets, they fall.</td>
</tr>
<tr>
<td>Seasons are caused when the Earth moves closer to and farther from the Sun.</td>
<td>Seasons are caused by the tilt of the Earth on its axis as it rotates around the Sun. This tilt changes the angle of the Sun’s rays striking the Earth.</td>
</tr>
<tr>
<td>We should not be concerned with events that occur on the other side of the planet because they have no effect on us.</td>
<td>Events, such as volcanic eruptions and clear cutting of trees in the rainforest, can have global effects on weather patterns and climate throughout the world.</td>
</tr>
<tr>
<td>The air around the top of a very high mountain is exactly the same as the air around the bottom of the mountain.</td>
<td>The properties of the atmosphere, such as pressure and temperature, change as elevation changes.</td>
</tr>
<tr>
<td>Only clouds that produce rain contain water.</td>
<td>All clouds are condensed water molecules.</td>
</tr>
<tr>
<td>The oceans have no effect on our climate.</td>
<td>Because the oceans are such large bodies of water, they hold a large amount of heat. Therefore, the oceans have a great impact on</td>
</tr>
</tbody>
</table>
The Sun hits the Earth the same throughout the year. The angle of the Sun’s rays striking the Earth changes throughout the year due to the tilt of the Earth on its axis, causing our seasons.

### EVIDENCE OF LEARNING:

**By the conclusion of this unit, students should be able to demonstrate the following competencies:**

**Culminating Activity:**

Goal: Create a weather forecast and explain the effects of heat on weather patterns, wind systems, tornados, thunderstorms, hurricanes.

Role: You are a meteorologist that is producing a TV special on weather geared to 6th grade students.

Audience: Executives for the Weather Service and 6th grade students.

Situation: National test scores in science have indicated that teachers need resources to help them teach the National Standards on climate and weather. You will develop a teaching module that includes background information, labs and activities that will help teachers and students understand the National Standards.

Product: You will create a booklet with content information on climate and weather. You will need to explain how the tilt of the Earth affects the amount of solar energy, which will in turn affect the climate of an area. You will also explain how the heating of land and water affects weather patterns and weather events such as tornados, thunderstorms, and hurricanes. In addition to the booklet you will develop a weather forecast to demonstrate how this information helps to predict and forecast weather.

Standard: See rubric
### Meteorology

**Climate and Weather**

**GRASPS – Rubric**

<table>
<thead>
<tr>
<th>Scientific Information</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tilt of Earth/Effects on Climate</td>
<td>The student will relate the tilt of the Earth to the distribution of sunlight throughout the year. An explanation of the relationship between the sunlight distribution and the climate is included.</td>
<td>The student will relate the tilt of the Earth to the distribution of sunlight throughout the year.</td>
<td>The student will acknowledge that season occur about the same time every year.</td>
<td>The student did not show evidence of understanding of the relationship between the tilt of the earth and the climates.</td>
</tr>
<tr>
<td>Heat Absorption</td>
<td>The student will show understanding that land and water absorb heat at different rates and how this affects weather patterns.</td>
<td>The student will show understanding that land and water absorb heat at different rates.</td>
<td>The student will show understanding that sunlight heats land and water.</td>
<td>The student did not show evidence of understanding that land and water absorb heat at different rates.</td>
</tr>
<tr>
<td>Results of Uneven Heating</td>
<td>The student will show understanding that the uneven heating of the land and water causes weather and wind system. Show relationship to the uneven heating and tornados and thunderstorms.</td>
<td>The student will show understanding that the uneven heating of the land and water causes weather systems.</td>
<td>The student will show understanding that the uneven heating of the land or water causes weather systems.</td>
<td>The student did not show evidence of understanding that uneven heating of land and water causes weather and wind systems.</td>
</tr>
<tr>
<td>Moisture Evaporation and Weather Systems</td>
<td>The student will show understanding that the heating of air over water along with moisture evaporation help are need to create a hurricane.</td>
<td>The student will show understanding that the heating of air over water helps to create hurricanes.</td>
<td>The student will show understanding that hurricanes occur over warm water.</td>
<td>The student did not show evidence of understanding that the heating of air over water and the evaporation of water help to create hurricanes.</td>
</tr>
<tr>
<td>Energy uses of Wind and Water</td>
<td>The student will show understanding that wind and water can be used as a source of energy. An explanation and examples are given.</td>
<td>The student will show understanding that wind and water can be used as a source of energy.</td>
<td>The student will show understanding that wind or water can be used as a source of energy.</td>
<td>The student did not show evidence of understanding that wind or water can be used as an energy source</td>
</tr>
</tbody>
</table>
**TASKS**

The collection of the following tasks represents the level of depth, rigor and complexity expected of all physical science students to demonstrate evidence of learning.

<table>
<thead>
<tr>
<th>Task:</th>
<th>Description:</th>
<th>Discussion, Suggestions for use:</th>
<th>Possible Solution:</th>
</tr>
</thead>
</table>

**SAMPLE OF STUDENT WORK**