

Sixth Grade Earth Science Unit

Weather and Climate

Teacher Background Information

Weather and climate involve the transfer of energy in and out of the atmosphere. Solar radiation heats the landmasses, oceans and air. This results in layers of different densities in the ocean and the atmosphere. Gravitational forces acting on areas of differing densities cause them to rise or fall. This circulation, influenced by the rotation of the Earth, creates winds and ocean currents. Read pages 42-44 in *Science for All Americans* for information on atmosphere, climate, water cycle

Read pages 196-201 in *Science Matters* for information on oceans, glaciers, and fresh water, pages 202-205 for information on the atmospheric cycle, and pages 270-274 for information on the greenhouse effect.

Read pages 66-70 in *Benchmarks for Science Literacy* for information on what to focus on with students

Read pages 158-159 in *National Science Education Standards* for an overview.

Instructional Implications

The cause of the seasons is a combination of the earth's rotation, tilt, and orbit. Students should be introduced to the topic but are not yet expected to understand how they all work together.

Gravity, earlier thought of as acting toward the ground, can by now be thought of as acting toward the center of the spherical earth and reaching indefinitely into space. Students should begin to look at the planet's role in sustaining life.

The concept of evaporation can be understood as the conservation of matter combined with a beginning idea of particles and the idea that air is real. Condensation is less well understood.

Students are engaged by studying catastrophic events such as tsunamis, tornados, and hurricane.

Possible Student Misconceptions/ Difficulties

- Students have a hard time understanding the phases of the moon and correct explanations for the seasons
- The mechanism of condensation is not fully understood until high school
- Students have a hard time understanding that water is in our atmosphere and that water is a permanent substance
- Students have difficulty with the motion of particles in solids, liquids, and gasses

Big Idea

Daily weather and climate patterns are the outcome of interactions between water, air, sun and land.

Essential Question

How do climate and weather affect each other?

AAAS Benchmarks:

- * Thermal energy carried by ocean currents has a strong influence on [world] climates.... Areas near oceans tend to have more moderate temperatures because water in the oceans can hold a large amount of thermal energy. 4B/M9
- * Water evaporates from the surface of the earth, rises and cools, condenses into rain or snow, and falls again to the surface. ...The cycling of water in and out of the atmosphere is a significant aspect of the weather patterns on Earth. 4B/M7
- * The atmosphere is a mixture of nitrogen, oxygen, and trace amounts of water vapor, carbon dioxide, and other gases. 4B/M15
- * ... Thermal energy can also be transferred by means of currents in air, water, or other fluids. ... As a result, a material tends to cool down unless some other form of energy is converted to thermal energy in the material. 4E/M3*
- * Human activities... increase the amount and variety of chemicals released into the atmosphere, and have changed the earth's land, oceans, and atmosphere. Some of these changes have decreased the capacity of the environment to support some life forms. 4C/M7
- * The number of hours of daylight and the intensity of the sunlight both vary in a predictable pattern that depends on ...[latitude] ... 4B/M13**
- * Energy can be transferred from one system to another ... (1) thermally, when a warmer object is in contact with a cooler one; ... 4E/MC*1
- * Climates have changed abruptly from volcanic eruptions and meteors 4B/M6*
- * Clouds formed by the condensation of water vapor, affect weather and climate (NSES)
- * Global patterns of atmospheric movement influence local weather (NSES)

Additional concepts:

- * The earth's tilt and movement relative to the sun creates a difference in heating which produces seasons and weather patterns (light and temperature).
- * Small changes in atmospheric or ocean content can have widespread effects on climate.
- * Surface conditions (e.g., snow cover, asphalt, vegetation) affect energy transfer and weather.

Materials/Resources

FOSS Weather and Water
Science Explorer: Weather and Climate
NOAA Connections/Marine Weather Maps
US Weather Service – on Back Loop Road (Matt Heffner - UAS Environmental Sciences Prof.
GLOBE Protocols
Project Budburst
http://www.windows.ucar.edu/citizen_science/budburst/

ASSESSMENTS

Science Notebooks

Uncovering Student Ideas in Science

Volume 1 Probe 21: Wet Jeans

Volume 3 Probe 20: What Are Clouds Made Of?

Volume 3 Probe 22: Rainfall

Local Connections:

GLOBE Phrenology Studies
Affects on the glacier and succession (could lead to biodiversity unit)
Historical and cultural perspectives
Seasonal turnover in local lakes

Alaska GLE's

The student demonstrates an understanding of cycles influenced by energy from the sun and by Earth's position and motion in our solar system by:

[6] SD3.1 connecting the water cycle to weather phenomena.

[7] SD3.1 describing the weather using accepted meteorological terms (e.g., pressure systems, fronts, precipitation)

[6] SD3.2 identifying that energy transfer is affected by surface conditions (e.g., snow cover, asphalt, vegetation) and that this affects weather.

[7] SD3.2 recognizing the relationship between phase changes (i.e., sublimation condensation, evaporation) and energy transfer.

[8] SD3.1 recognizing the relationship between the seasons and Earth's tilt relative to the sun and describing the day/night cycle as caused by the rotation of the Earth every 24 hrs.

The student demonstrates an understanding of geochemical cycles by:

[7] [8] SD1.2 applying knowledge of the water cycle to explain changes in the Earth's surface

Connections to other Topics

- Flow of matter and energy in ecosystems
- Heat transfer
- Structure of matter – phase changes
- Role of water cycle in erosion
- Climate change