

Lesson Topic: Unit 4-Weather and Climate

Grade level: 6

Timeline: 20 (50 minute class periods)

Content Standards

- **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 results in change in weather conditions.**
- **MS.ESS2-6: Develop and use a model to describe how unequal heating and rotation of the Earth causes patterns of atmospheric and oceanic circulation that determine regional climates.**

Big Ideas

- Solar energy powers the hydrological cycle.
- Coriolis Effect and uneven heating of Earth’s surface drive weather patterns.
- Ocean cooling and heating affects marine and human life.

Essential Question(s):

- How do water and solar energy interact to influence weather?
- How does the uneven heating of Earth’s surface and Earth’s rotation cause oceanic and atmospheric circulation?

Student objectives (outcomes):

Students will be able to:

- Collect and analyze data on current weather patterns to forecast weather.
- Develop a model that demonstrates how solar energy drives the hydrological cycle.

Assessment Evidence

Performance Task(s):

- Daily weather journal including
 - Air temperature data
 - Barometric pressure and trend data
 - Wind speed and direction data
 - Cloud cover data (percent of coverage)
 - Precipitation type
 - Dominant cloud type
 - Dew point
 - Surface temperature
- Daily draw the station model for the day (C106 see District Shared Folder: MS Science: 6th grade)
- Use a weather map (Example on C110) to interpret weather data and make weather forecast/predictions.

Other Evidence:

- Short Test on Water Cycle (See District Shared: Middle School Science: 6th grade folder)

Learning Plan

Learning Activities:

- Teach vocabulary concepts: hydrological cycle, circulation, atmospheric, oceanic, rotation, states of matter, evaporation, condensation, freezing, melting, precipitation, transpiration, sublimation, deposition (hoarfrost), troposphere, stratosphere, mesosphere, thermosphere, dew point
- Layers of the Atmosphere (Create a poster to scale and/or do a lab graphing temperature vs. altitude -see p. C92-93 Harcourt in District Shared: Middle School Science: 6th grade folder)
- Composition of the atmosphere (Direct instruction for note-taking-see resources)
- Water Cycle Lab, Game, Simulation
- Uneven Heating Labs (see District Shared: Middle School Science: 6th grade folder)
- Air Masses and Fronts-Station Models and Reading Weather Maps with guided note-taking (District Shared: Middle School Science: 6th grade folder)
- Predicting weather (District Shared: Middle School Science: 6th grade folder)
- Soldotna Water Treatment Plant Field Trip (Resource materials in District Shared: Middle School Science: 6th grade folder)

Resources:

- <http://www.starhop.com/library/pdf/studyguide/elementary/brsp-4layers.pdf>
- <http://forces.si.edu/atmosphere/pdf/Atmo-Activity-1.pdf>
- <http://teachertech.rice.edu/Participants/louviere/riddles.html>
- http://www.haystack.mit.edu/edu/pcr/climate_CHANGE/Earth'sAtmosphere/Layers%20of%20the%20Earth's%20Atmosphere%20Worksheet%20includes%20background%20info,%20student%20worksheet,%20answer%20key.pdf
- District Shared: Middle School Science: 6th Grade Folder
- <http://www.bozemanscience.com/ngs-ess2d-weather-climate>
- <http://www.bozemanscience.com/ngs-ess2a-earth-materials-systems>
- <http://www.bozemanscience.com/ngw-ess2c-the-role-of-water-in-earths-surface-processes>

Students who demonstrate understanding can:

- 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.** [Clarification Statement: Emphasis is on the ways water changes its state as it moves through the multiple pathways of the hydrologic cycle. Examples of models can be conceptual or physical.] [Assessment Boundary: A quantitative understanding of the latent heats of vaporization and fusion is not assessed.]
- MS-ESS2-5. Collect data to provide evidence for how the motions and complex interactions of air masses results in changes in weather conditions.** [Clarification Statement: Emphasis is on how air masses flow from regions of high pressure to low pressure, causing weather (defined by temperature, pressure, humidity, precipitation, and wind) at a fixed location to change over time, and how sudden changes in weather can result when different air masses collide. Emphasis is on how weather can be predicted within probabilistic ranges. Examples of data can be provided to students (such as weather maps, diagrams, and visualizations) or obtained through laboratory experiments (such as with condensation).] [Assessment Boundary: Assessment does not include recalling the names of cloud types or weather symbols used on weather maps or the reported diagrams from weather stations.]
- 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.** [Clarification Statement: Emphasis is on how patterns vary by latitude, altitude, and geographic land distribution. Emphasis of atmospheric circulation is on the sunlight-driven latitudinal banding, the Coriolis effect, and resulting prevailing winds; emphasis of ocean circulation is on the transfer of heat by the global ocean convection cycle, which is constrained by the Coriolis effect and the outlines of continents. Examples of models can be diagrams, maps and globes, or digital representations.] [Assessment Boundary: Assessment does not include the dynamics of the Coriolis effect.]

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
<p>Developing and Using Models Modeling in 6–8 builds on K–5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems.</p> <ul style="list-style-type: none"> Develop and use a model to describe phenomena. (MS-ESS2-1),(MS-ESS2-6) Develop a model to describe unobservable mechanisms. (MS-ESS2-4) <p>Planning and Carrying Out Investigations Planning and carrying out investigations in 6-8 builds on K-5 experiences and progresses to include investigations that use multiple variables and provide evidence to support explanations or solutions.</p> <ul style="list-style-type: none"> Collect data to produce data to serve as the basis for evidence to answer scientific questions or test design solutions under a range of conditions. (MS-ESS2-5) 	<p>ESS2.C: The Roles of Water in Earth's Surface Processes</p> <ul style="list-style-type: none"> Water continually cycles among land, ocean, and atmosphere via transpiration, evaporation, condensation and crystallization, and precipitation, as well as downhill flows on land. (MS-ESS2-4) The complex patterns of the changes and the movement of water in the atmosphere, determined by winds, landforms, and ocean temperatures and currents, are major determinants of local weather patterns. (MS-ESS2-5) Global movements of water and its changes in form are propelled by sunlight and gravity. (MS-ESS2-4) <p>ESS2.D: Weather and Climate</p> <ul style="list-style-type: none"> Weather and climate are influenced by interactions involving sunlight, the ocean, the atmosphere, ice, landforms, and living things. These interactions vary with latitude, altitude, and local and regional geography, all of which can affect oceanic and atmospheric flow patterns. (MS-ESS2-6) Because these patterns are so complex, weather can only be predicted probabilistically. (MS-ESS2-5)The ocean exerts a major influence on weather and climate by absorbing energy from the sun, releasing it over time, 	<p>Cause and Effect</p> <ul style="list-style-type: none"> Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-ESS2-5) <p>Systems and System Models</p> <ul style="list-style-type: none"> Models can be used to represent systems and their interactions—such as inputs, processes and outputs—and energy, matter, and information flows within systems. (MS-ESS2-6) <p>Energy and Matter</p> <ul style="list-style-type: none"> Within a natural or designed system, the transfer of energy drives the motion and/or cycling of matter. (MS-ESS2-4)

and globally redistributing it through ocean currents.
(MS-ESS2-6)

Connections to other DCIs in this grade band:

MS.PS1.A (MS-ESS2-4),(MS-ESS2-5); **MS.PS2.A** (MS-ESS2-5),(MS-ESS2-6); **MS.PS2.B** (MS-ESS2-4); **MS.PS3.A** (MS-ESS2-4),(MS-ESS2-5); **MS.PS3.B** (MS-ESS2-5),(MS-ESS2-6); **MS.PS3.D** (MS-ESS2-4); **MS.PS4.B** (MS-ESS2-6)

Common Core State Standards Connections:

ELA/Literacy -

RST.6-8.1 Cite specific textual evidence to support analysis of science and technical texts. (MS-ESS2-2),(MS-ESS2-3),(MS-ESS2-5)

RST.6-8.9 Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic. (MS-ESS2-3),(MS-ESS2-5)

WHST.6-8.8 Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation. (MS-ESS2-5)

SL.8.5 Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest. (MS-ESS2-1),(MS-ESS2-2),(MS-ESS2-6)

Mathematics -

MP.2 Reason abstractly and quantitatively. (MS-ESS2-2),(MS-ESS2-3),(MS-ESS2-5)

6.NS.C.5 Understand that positive and negative numbers are used together to describe quantities having opposite directions or values (e.g., temperature above/below zero, elevation above/below sea level, credits/debits, positive/negative electric charge); use positive and negative numbers to represent quantities in real-world contexts, explaining the meaning of 0 in each situation. (MS-ESS2-5)