Content: Earth & Space Science	**Grade or Course:** 6th	**Date Developed:** 08/10/18

Overview:

Earth and space sciences (ESS) investigates the Earth's place and history in the Universe, focusing on the interactions, scale and patterns within each system. The impact of human activity on Earth systems is examined and solutions to ongoing problems are investigated.

Essential Questions:

1. What are the major components of our universe, when and how did they form and how does classification and the concept of scale help us to understand them?
2. What are the strengths and limitations of using models to understand the universe?
3. What are the observable and predictable phenomena caused by the interaction of objects in our solar system (orbits, eclipses, seasons, lunar phases, tide)?
4. How old is the Earth and what is the scientific evidence that points toward its history?
5. What are the processes that continue to shape the surface of the Earth?
6. How do the interactions of the Earth's systems (geosphere, atmosphere, hydrosphere, biosphere) interact to affect both the Earth and its inhabitants?
7. How do human activities affect the Earth's spheres and how can we develop solutions to address negative impacts?

EO's addressed to proficiency level:

Students will understand that:

1. The Earth is part of a system we call the solar system, which itself is part of the Milky Way- one of billions of galactic systems contained in our Universe. Scientists learn about these systems through observation, inference, and classification.
2. The force of gravity explains many of the movements observed in our Universe. Models of these movements can explain and predict eclipses, lunar phases, seasons, and tides.
3. Energy flows and matter cycles within and among Earth's systems.
4. Plate tectonics is the unifying theory that explains movements of rocks at Earth's surface and its geological history. Analysis of rock layers and fossils can be used to support our current understanding of this history.
5. Water cycles among land, ocean, and atmosphere, and is propelled by sunlight and gravity. Density variations of sea water drive ocean currents.

Water movement causes weathering and erosion, changing landscape features.

6. Complex interactions determine local weather patterns and influence climate. Scientists use observation, inference and classification to predict weather and its impacts on the Earth.
7. Humans depend on the geosphere, hydrosphere, atmosphere, and biosphere for different resources, many of which are not renewable. Resources are distributed unevenly around the planet as a result of past geologic processes.
8. Mapping the history of natural hazards in a region helps scientists understand related geological forces.
9. Human activities have altered some aspects of Earth's systems, although changes to environments can have different impacts for different living things. Activities and technologies can be engineered to reduce human impacts on Earth.
10. Human activities affect global warming. Decisions to reduce the impact of global warming depend on understanding climate science, engineering capabilities, and social dynamics.

Standards:

MS-ESS1-1. Develop and use a model of the Earth-sun-moon system to describe the cyclic patterns of lunar phases, eclipses of the sun and moon, and seasons.
MS-ESS1-2. Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system.
MS-ESS1-3. Analyze and interpret data to determine scale properties of objects in the solar system.
MS-ESS1-4. Construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth's 4.6-billion-year-old history.
MS-ESS2-1. Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process
MS-ESS2-2. Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales
MS-ESS2-3. Analyze and interpret data on the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions.
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 result in changes in weather conditions.
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.
MS-ESS3-1. Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes.

MS-ESS3-2. Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.
MS-ESS3-3. Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.
MS-ESS3-4. Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems.
MS-ESS3-5. Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century.
MS-ETS1-1. Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.
MS-ETS1-2. Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem. MS-ETS1-3. Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.
MS-ETS1-4. Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.

Units:
Space systems
History of Earth
Earth's systems
Weather and climate
Human impacts

Assessments:
Space systems: solar and lunar eclipse 3-D models, Sky Time project, Gravity and orbits post-lab, pocket solar system model
History of Earth: Pangea project, plate tectonics report, fossil dig model, geography guide to Maine
Earth's systems: Water cycle poster
Weather and climate: climatology project, lab reports (cloud formation and classification)
Human Impact: wildfire project, water quality investigation, report and presentation, Climate change presentation.