ESS2: Earth's Systems
ESS2.A: Earth Materials and Systems

2nd Grade	4th Grade	5th Grade	8th Grade	Earth & Space Science & Environmental Science
Wind and water can change the shape of the land.	Rainfall helps to shape the land and affects the types of living things found in a region. Water, ice, wind, living organisms, and gravity break rocks, soils, and sediments into smaller particles and move them around.	Earth's major systems are the geosphere (solid and molten rock, soil, and sediments), the hydrosphere (water and ice), the atmosphere (air), and the biosphere (living things, including humans). These systems interact in multiple ways to affect Earth's surface materials and processes. The ocean supports a variety of ecosystems and organisms, shapes landforms, and influences climate. Winds and clouds in the atmosphere interact with the landforms to determine patterns of weather.	All Earth processes are the result of energy flowing and matter cycling within and among the planet's systems. This energy is derived from the sun and Earth's hot interior. The energy that flows and matter that cycles produce chemical and physical changes in Earth's materials and living organisms. The planet's systems interact over scales that range from microscopic to global in size. these interactions have shaped Earth's history and will determine its future.	Earth's systems, being dynamic and interacting, cause feedback effects that can increase or decrease the original changes. Evidence from deep probes and seismic waves, reconstructions of historical changes in Earth's surface features, its magnetic field, and chemical processes lead to a model of Earth with a hot but solid inner core, a liquid outer core, a solid mantle and crust. Motions of the mantle and its plates occur primarily through thermal convection, which involves the cycling of matter due to the outward flow of energy from the Earth's interior and gravitational movement of denser materials toward the interior. The geological record shows that changes to global and regional climate can be caused by interactions among changes in the sun's energy output or Earth's orbit, tectonic events, ocean circulation, volcanic activity, glaciers, vegetation, and human activities. These changes can occur on a variety of time-scale from sudden (e.g., volcanic ash clouds) to intermediate (ice ages) to very long-term tectonic cycles.

ESS2: Earth's Systems

ESS2.B: Plate Tectonics and Large-Scale System Interactions

2nd Grade	4th Grade	8th Grade	Earth & Space Science & Environmental Science
Maps show where things are located. One can map the shapes and kinds of land and water in any area.	The locations of mountain ranges, deep ocean trenches, ocean floor structures, earthquakes, and volcanoes occur in patterns. Most earthquakes and volcanoes occur in bands that are often along the boundaries between continents and oceans. Major mountain chains form inside continents or near their edges. Maps can help locate the different land and water features areas of Earth.	Maps of ancient land and water patterns, based on investigations of rocks and fossils, make clear how Earth's plates have moved great distances, collided, and spread apart.	Plate tectonics is the unifying theory that explains the past and current movements of rocks at the Earth's surface and provides a framework for understanding it geologic history. Plate movements are responsible for most continental and ocean-floor features and for the distribution of most rocks and minerals within Earth's crust. The radioactive decay of unstable isotopes continually generates new energy within Earth's crust and mantle, providing the primary source of the heat that drives mantle convection. Plate tectonics can be viewed as the surface expression or mantle convection.

ESS2: Earth's Systems

ESS2.C: The Role of Water in the Earth's Surface Processes

2nd Grade	5th Grade	6th Grade	7th Grade	8th Grade	Earth & Space Science & Environmental Science
Water is found in the ocean, rivers, lakes, and ponds. Water exists as solid ice and liquid form.	Nearly all of Earth's available water is in the ocean. Most fresh water is in glaciers or underground; only a tiny fraction is in streams, lakes, wetlands, and the atmosphere.	Water continually cycles among land, ocean, and atmosphere via transpiration, evaporation, condensation and crystallization, precipitation, as well as downhill on land. Global movements of water and its changes in form are propelled by sunlight and gravity.	Variations in density due to variations in temperature and salinity drive a global pattern of interconnected ocean currents.	Water's movements both on the land and underground cause weathering and erosion, which change the land's surface features and create underground formations.	The abundance of liquid water on Earth's surface and its unique combination of physical and chemical properties are central to the planet's dynamics. These properties include water's exceptional capacity to absorb, store, and release large amounts of energy, transmit sunlight, expand upon freezing, dissolve and transport materials, and lower viscosities and melting points.

ESS2: Earth's Systems
ESS2.D: Weather and Climate

Kindergarten	3rd Grade	7th Grade	Earth & Space Science & Environmental Science
Weather is the combination of sunlight, wind, snow or rain, and temperature in a particular region at a particular time. People measure these conditions to describe and record the weather and to notice patterns over time.	Scientists record patterns of the weather across different times and areas so that they can make predictions about what kind of weather might happen next. Climate describes a range of an area's typical weather conditions and the extent to which those conditions vary over years.	Because these patterns are so complex, weather can only be predicted probabilistically. 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. The ocean exerts a major influence on weather and climate by absorbing energy from the sun, and globally redistributing it through ocean currents.	The foundation for Earth's: global climate system is the electromagnetic radiation from the sun, as well as its reflection, absorption, storage, and redistribution among the atmosphere, ocean, and land systems, and this energy's re-radiation into space. Gradual atmospheric changes were due to plants and other organisms that captured carbon dioxide and released oxygen.

ESS2: Earth's Systems
ESS2.E: Biogeology

Kindergarten	Earth & Space Science & Environmental Science
Plants and animals can change their environment.	Organisms ranging from bacteria to human beings are a major driver of the global carbon and they influence global climate by modifying the chemical makeup of the atmosphere. The abundance of carbon in the atmosphere is reduced through the ocean floor accumulation of marine sediments and the accumulation of plant biomass. The many dynamic and delicate feedback mechanisms between the biosphere and other Earth systems cause a continual co-evolution of Earth's surface and the life that exists on it.