Earth Science Bigger Ideas & Overarching Questions

Overarching Questions:

How do we know what we know?
How does what we know inform our decision-making?

The Earth is a System of Systems.	***The Flow of Energy Drives the Cycling of Matter***	***Life, Including Human Life, Influences and is Influenced by the Environment.***	***Physical and chemical principles are unchanging and drive both gradual and rapid changes in the Earth system.***	***To Understand (Deep) Time and the Scale of Space, Models and Maps are Necessary.***
The Earth System is composed of and part of a multitude of systems, which cycle and interact resulting in dynamic equilibrium (though the system evolves). The Earth is also nested in larger systems including the solar system and the universe. However there is an inherent unpredictability in systems, which are composed of an (effectively) infinite number of interacting parts that follow simple rules. Each system is qualitatively different from, but not necessarily greater than the sum of its parts.	The Earth is an open system. The constant flow of solar radiation powers much of Earth's ocean and atmospheric processes on the surface of the system, flow of heat from inside the Earth from radioactivity drives plate tectonics. Energy flows and cycles through the Earth system. Matter cycles within it. Cycling is largely driven by the interaction of the differential distribution of solar radiation and internal heat, and gravity. Convection drives weather and climate, ocean currents, the rock cycle and plate tectonics.	Photosynthetic bacteria released free oxygen into the early oceans and atmosphere, making Earth habitable for later animals. Humans have changed the lay of the land, altered the distribution of flora and fauna and are changing atmospheric chemistry in ways that alter the climate. Earth system processes affect where and how humans live. For example, many people live in the shadow of volcanoes because of the fertile farmland found there, however they must keep a constant vigil to maintain their safety. The human impact on the environment is growing as population increases and the use of technology expands.	Earth processes (erosion, evolution or plate tectonics, for example) operating today are the same as those operating since they arose in Earth history and they are obedient to the laws of chemistry and physics. While the processes constantly changing the Earth are essentially fixed, their rates are not. Tipping points are reached that can result in rapid changes cascading through Earth systems.	The use of models is fundamental to all of the Earth Sciences. Maps and models aid in the understanding of aspects of the Earth system for which direct observation is not possible. Models assist in the comprehension of time and space at both immense and sub-microscopic scales. When compared to the size and age of the universe, humanity is a speck in space and a blip in time.

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Bigger Ideas	Ocean	Climate	Atmosphere	Earth Science
Earth is a system of systems.	The ocean is a major influence on weather and climate.	Climate is regulated by complex interactions among components of the Earth system.	Earth's atmosphere continuously interacts with the other components of the Earth System.	Earth is a complex system of interacting rock, water, air, and life.
The flow of energy drives the cycling of matter.	The ocean supports a great diversity of life and ecosystems.	Life on Earth depends on, has been shaped by, and affects climate.	Energy from the Sun drives atmospheric processes.	Humans significantly alter the Earth.
Life, including human life, influences and is influenced by the environment.	The ocean makes Earth habitable.	The Sun is the primary source of energy for Earth's climate system.	Atmospheric circulations transport matter and energy.	Humans depend on Earth for resources.
Physical and chemical principles are unchanging and drive both gradual and rapid changes in the Earth system.	The ocean and humans are inextricably interconnected.	Climate change will have consequences for the Earth system and human lives.	Earth's atmosphere and humans are inextricably linked.	Natural hazards pose risks to humans.
To understand (deep) space and time, models and maps are necessary.	The ocean and life in the ocean shape the features of the Earth.	Human activities are impacting the climate system.	Earth has a thin atmosphere that sustains life.	Earth scientists use repeatable observations and testable ideas to understand and explain our planet.
	The Earth has one big ocean with many features.	**Humans can take actions to reduce climate change and its impacts.**	Earth's atmosphere changes over time and space, giving rise to weather and climate.	Life evolves on a dynamic Earth and continuously modifies Earth.
	The ocean is largely unexplored.	Climate varies over space and time through both natural and man-made processes.	We seek to understand the past, present, and future behavior of Earth's atmosphere through scientific observation and reasoning.	Earth is continually changing.
		Our understanding of the climate system is improved through observation, theoretical studies and		Earth is 4.6 billion years old.
				Earth is the water planet.

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