

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

**Earth System Science Profound Ideas**

<i>Systems</i>	<i>Energy</i>	<i>Life</i>	<i>Change</i>	<i>Models</i>
<b>The Earth is a System of Systems.</b>	<b>The Flow of Energy Drives the Cycling of Matter.</b>	<b>Life, including human life, influences and is influenced by the environment.</b>	<b>Physical and chemical principles are unchanging and drive both gradual and rapid changes in the Earth system.</b>	<b>To Understand (Deep) Time and the Scale of Space, Models and Maps are Necessary.</b>
<p>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.</p>	<p>The Earth is an open system – it is the constant flow of solar radiation that powers most surface Earth processes and drives the cycling of most matter at or near the Earth’s surface. Earth’s internal heat is a driving force below the surface. Energy flows and cycles through the Earth system. Matter cycles within it. Convection drives weather and climate, ocean currents, the rock cycle and plate tectonics.</p>	<p>Photosynthetic bacteria reformulated the atmosphere making Earth habitable. 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.</p>	<p>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.</p>	<p>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.</p>