

Earth & Space Sciences

The following is paraphrased from the [Framework pgs. 169-170](#)

Earth and space sciences (ESS) investigate processes that operate on Earth and also address its place in the solar system and the galaxy. Thus ESS involve phenomena that range in scale from the unimaginably large to the invisibly small.

Earth and space sciences have much in common with the other branches of science, but they also include a unique set of scientific pursuits. Inquiries into the physical sciences (e.g., forces, energy, gravity, magnetism) were pursued in part as a means of understanding the size, age, structure, composition, and behavior of Earth, the sun, and the moon; physics and chemistry later developed as separate disciplines. The life sciences likewise are partially rooted in earth science, as Earth remains the only example of a biologically active planet, and the fossils found in the geological record of rocks are of interest to both life scientists and earth scientists. As a result, the majority of research in ESS is interdisciplinary in nature and falls under the categories of astrophysics, geophysics, geochemistry, and geobiology. However, the underlying traditional discipline of geology, involving the identification, analysis, and mapping of rocks, remains a cornerstone of ESS.

Earth consists of a set of systems—atmosphere, hydrosphere, geosphere, and biosphere—that are intricately interconnected. These systems have differing sources of energy, and matter cycles within and among them in multiple ways and on various time scales. Small changes in one part of one system can have large and sudden consequences in parts of other systems, or they can have no effect at all. Understanding the different processes that cause Earth to change over time (in a sense, how it “works”) therefore requires knowledge of the multiple

systems' interconnections and feedbacks. In addition, Earth is part of a broader system—the solar system—which is itself a small part of one of the many galaxies in the universe.

Because organizing ESS content is complex, given its broad scope and interdisciplinary nature, past efforts to promote earth sciences literacy have presented this content in a wide variety of ways. In this chapter, we begin at the largest spatial scales of the universe and move toward increasingly smaller scales and a more anthropocentric focus.

Core and Component Ideas in Earth & Space Sciences

Each core and component idea below is linked to the relevant section of the online [Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas](#) to provide additional background and grade band end points for each component.

- [Core Idea ESS1: Earth's Place in the Universe](#)
 - [ESS1.A: The Universe and Its Stars](#)
 - [ESS1.B: Earth and the Solar System](#)
 - [ESS1.C: The History of Planet Earth](#)
- [Core Idea ESS2: Earth's Systems](#)
 - [ESS2.A: Earth Materials and Systems](#)
 - [ESS2.B: Plate Tectonics and Large-Scale System Interactions](#)
 - [ESS2.C: The Roles of Water in Earth's Surface Processes](#)
 - [ESS2.D: Weather and Climate](#)
 - [ESS2.E: Biogeology](#)
- [Core Idea ESS3: Earth and Human Activity](#)
 - [ESS3.A: Natural Resources](#)
 - [ESS3.B: Natural Hazards](#)
 - [ESS3.C: Human Impacts on Earth Systems](#)
 - [ESS3.D: Global Climate Change](#)