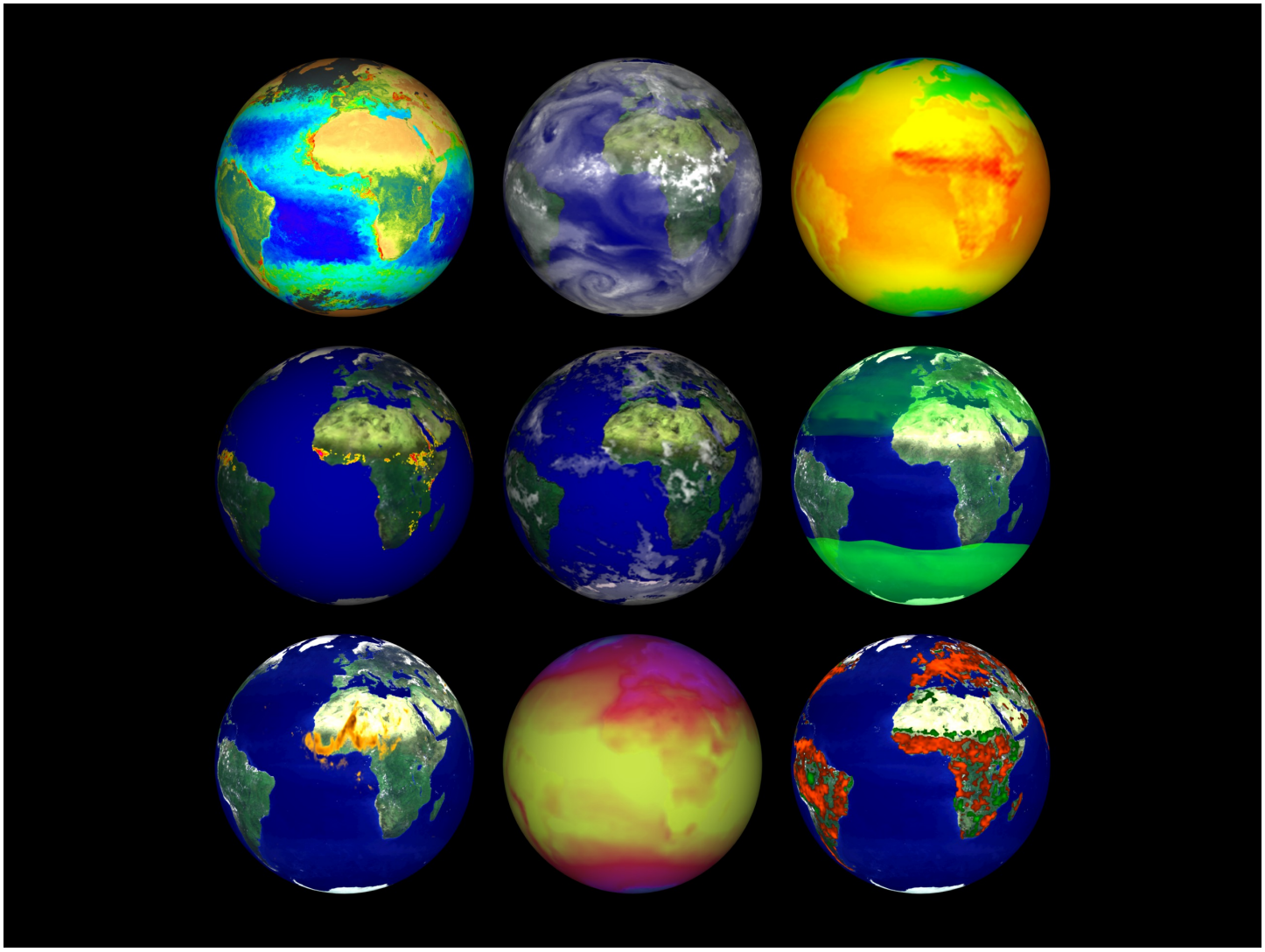
Earth System Interactions: Background Information



Helping students build their understanding of Earth's spheres and how they are connected is difficult. Review the graphics below to help identify the parts of the Earth System and the processes that connect them at the local, regional, and global scales.

The Earth System interacts with the **Atmosphere** in the following ways:

Geosphere: Gases emitted from volcanic eruptions have warming and cooling impacts on the Atmosphere. On long time scales, weathering of rocks in the Geosphere changes the composition of the Atmosphere.

Biosphere: Exchanges of carbon dioxide and oxygen occur between the Atmosphere and Biosphere in a process called the photosynthesis-respiration cycle. The Biosphere also influences the amounts of some of the greenhouse gases that impact Earth's climate.

Hydrosphere: Evaporation of water in the Hydrosphere adds water vapor to the Atmosphere, a process that requires energy input.

Cryosphere: The presence of light-colored ice and snow reflect more of the Sun's energy at the surface than open ocean or bare ground, cooling the Earth's surface and the Atmosphere near the surface.

The Earth System interacts with the **Biosphere** in the following ways:

Atmosphere: The temperature of the Atmosphere close to the surface and precipitation determine the areas that different species contained within the Biosphere can survive and successfully thrive.

Hydrosphere: The Hydrosphere is an important medium for life, and a habitat for many species within the Biosphere. Dissolved nutrients and oxygen in the hydrosphere support the well-being of species within the Biosphere.

Geosphere: Plate tectonics continually change the global distribution of habitats for life in the Biosphere on long time scales. Volcanic islands and seamounts provide important habitats for coral and sea birds.

Cryosphere: The Cryosphere provides a habitat for many different living organisms. Also, many plants and animals depend upon the melting snow and ice during the spring and summer months for fresh water.

The Earth System interacts with **Cryosphere** in the following ways:

Atmosphere	Temperature and precipitation determine the location of snow and ice. If the temperatures of the Atmosphere near an ice or snow surface is above the freezing point, energy is transferred from the Atmosphere to warm and melt the snow or ice.
Hydrosphere	The Hydrosphere provides the water needed to form ice over lakes and oceans. If temperatures of the water in the Hydrosphere are near the freezing point, further cooling of the water forms ice.
Geosphere	The formation of mountains and areas of higher elevation through plate tectonics creates places where snow and ice can accumulate, forming glaciers.
Biosphere	The Biosphere contributes to the formation of snow. Bacteria and pollen are part of the group of particles that support the formation of snowflakes.

The Earth System interacts with the **Geosphere** in the following ways:

Atmosphere	Dissolved gases from the Atmosphere affect the chemistry of the Geosphere. For example, Carbon Dioxide dissolved in rainwater produces a weak acid that weathers rock at the Earth's surface
Biosphere	Organisms help for and weather rocks. Organisms in the ocean provide the material that form carbonate rocks at the bottom of the ocean. The roots of plants break up rocks to increase their weathering rates.
Hydrosphere	Water, the universal solvent, is a key agent of change causing chemical and mechanical erosion of the Earth's Geosphere. Eroded materials move down the watershed as water makes its way to the ocean.
Cryosphere	The Cryosphere's glacier and ice sheet erode the Geosphere's surface as the ice moves slowly across the land, eroding the surface, and then depositing the sediments in other places.

The Earth System interacts with the **Hydrosphere** in the following ways:

Atmosphere: Water and energy are transferred between the Hydrosphere and the Atmosphere through the water cycle, in the processes of evaporation and precipitation.

Biosphere: Plants remove water from the surface and move it throughout their vascular system.

Geosphere: Movements along faults and tectonic activity creates depressions that fill with water, forming lakes. Tectonic activity also forms the mountains and higher elevations that are sources for rivers.

Cryosphere: In many parts of the world, the seasonal melting of ice and snow provide water for lakes and rivers.