**Earth's Spheres**

Everything in Earth's system can be placed into one of its major subsystems: **outer space, land, water and ice, living things and humans, or air.** In fact many things can fit into more than one of these subsystems, and very likely are involved in interactions between different subsystems. These subsystems are often referred to as Earth’s "spheres." Specifically, they include the **geosphere** (sometimes called the “lithosphere”), the **hydrosphere** (which also includes the “**cryosphere**”), the **atmosphere**, and the **biosphere**. ****Since humans have made such an impact on the Earth’s natural systems and processes, many Scientists think there is also a special sphere for these impacts, changes, and interactions, called the “**anthrosphere**” (or sometimes called the “anthroposphere.”). Outer space also plays an important role in understanding the Earth and its systems, so there is often even another sphere that we can think of called the “**exosphere**.” Each of these spheres can be further divided into subspheres... but that’s for a later time.

**Geosphere - Earth**

The geosphere contains all of the cold, hard solid land of the planet's crust (surface), the semi-solid land underneath the crust, and the liquid land near the center of the planet. The surface of the lithosphere is very uneven (see image on right). There are high mountain ranges like the Rockies and Andes (shown in red), huge plains or flat areas like those in the central United States and Brazil (shown in green), and deep valleys along the ocean floor (shown in blue).

The solid, semi-solid, and liquid land of the geosphere form layers that are physically and chemically different. If someone were to cut through Earth to its center, these layers would be revealed like the layers of an onion (see right image above). The outermost layer of the lithosphere consists of loose soil rich in nutrients, oxygen, and silicon. Beneath that layer lies a very thin, solid crust of oxygen and silicon. Next is a thick, semi-solid mantle of oxygen, silicon, iron, and magnesium. Below that is a liquid outer core of nickel and iron. At the center of Earth is a solid inner core of nickel and iron.

**Atmosphere - Air**

The atmosphere contains all the air in Earth's system. It extends from less than 1 m below the planet's surface to more than 10,000 km above the planet's surface. The upper portion of the atmosphere protects the organisms of the biosphere from the sun's ultraviolet radiation. It also traps heat. When air temperature in the lower portion of this sphere changes, weather occurs. As air in the lower atmosphere is heated or cooled, it moves around the planet. The result can be as simple as a breeze or as complex as a tornado.

**Hydrosphere - Water**

The hydrosphere contains all the water of the planet. It ranges from 10 to 20 kilometers in thickness in different places on the Earth and different forms. The hydrosphere extends from Earth's surface downward several kilometers into the geosphere and upward about 12 kilometers into the atmosphere.

A small portion of the water in the hydrosphere is freshwater (not saltwater). This water flows as precipitation from the atmosphere down to Earth's surface, as rivers and streams along Earth's surface, and as groundwater beneath Earth's surface. Most of Earth's fresh water, however, is frozen. This frozen water plays such an important role in maintaining Earth’s climate and other systems, that it has it’s own special sphere nickname – the “**cryosphere**.”

Ninety-seven percent of Earth's water is salty. The salty water collects in deep valleys along Earth's surface. These large collections of salty water are referred to as oceans. The image above depicts the different temperatures one would find on oceans' surfaces. Water near the poles is very cold (shown in dark purple), while water near the equator is very warm (shown in light blue). The differences in temperature cause water to change physical states. Extremely low temperatures like those found at the poles cause water to freeze into a solid such as a polar icecap, a glacier, or an iceberg. Extremely high temperatures like those found at the equator cause water to evaporate into a gas.

**Biosphere - Living Things**

The biosphere contains all the planet's living things. This sphere includes all of the microorganisms, plants, and animals of Earth.

Within the biosphere, living things form ecological communities based on the physical surroundings of an area. These communities are referred to as biomes. Deserts, grasslands, and tropical rainforests are three of the many types of biomes that exist within the biosphere.

It is impossible to detect from space each individual organism within the biosphere. However, biomes can be seen from space. For example, the image above distinguishes between lands covered with plants (shown in shades of green) and those that are not (shown in brown).

**How do these “spheres” overlap and interact to create the complex “system” of *Earth*?**