Unit 1: Formation of the Earth

Objectives:

E2.1A - Explain why the Earth is essentially a closed system.

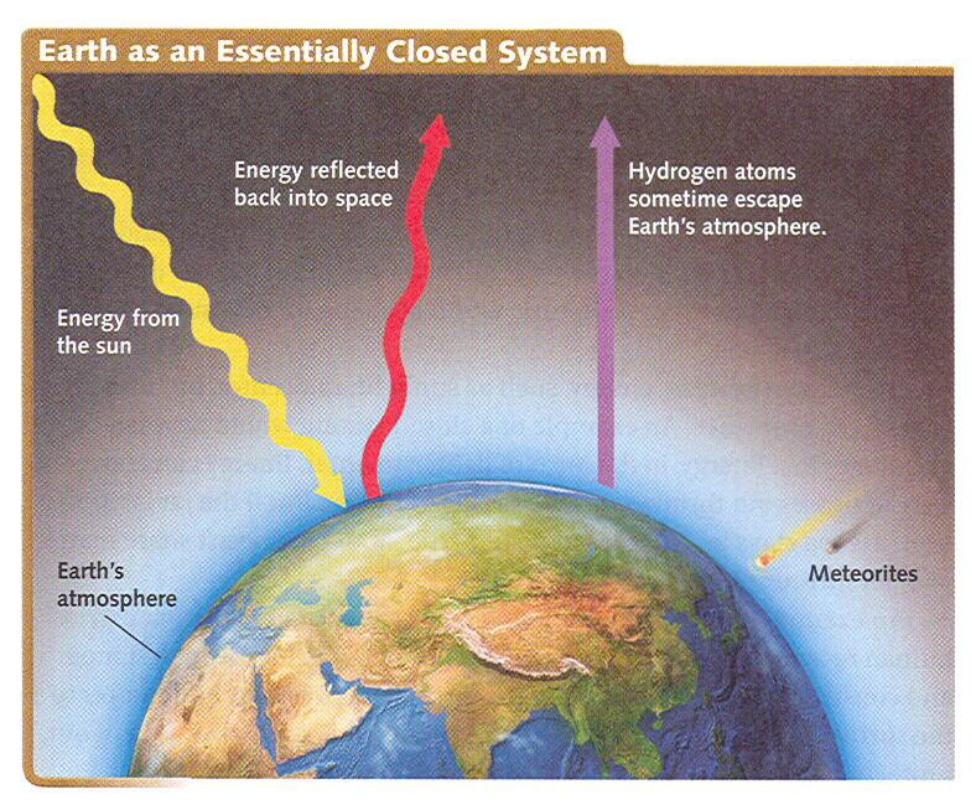
E2.1B - Analyze the interactions between the major systems (geosphere, atmosphere, hydrosphere, biosphere) that make up the Earth.

E2.1C - Explain, using specific examples, how a change in one system affects other Earth systems.

The Earth System*

Scientists consider Earth to be an essentially closed system.

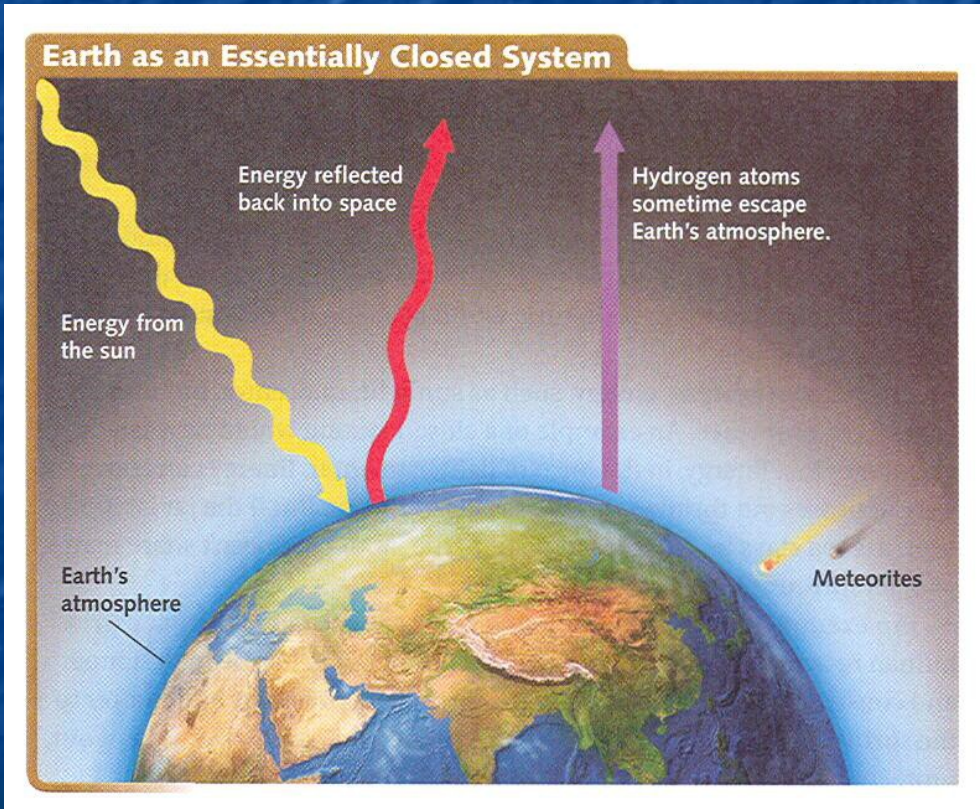
However, we know that Earth is not an entirely closed system as our atmosphere loses hydrogen atoms to space and asteroids, comets, and meteoroids enter the atmosphere from space.



The Earth System

Why do we care that Earth is considered a closed system?

Being an essentially closed system, we must remember that Earth's planetary resources are finite: new matter will not form and existing matter will not go away.

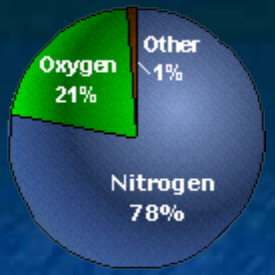


Earth Systems Overview*

The Earth is a system consisting of four major interacting components:

- the atmosphere,
- the biosphere,
- the hydrosphere, and
- the geosphere

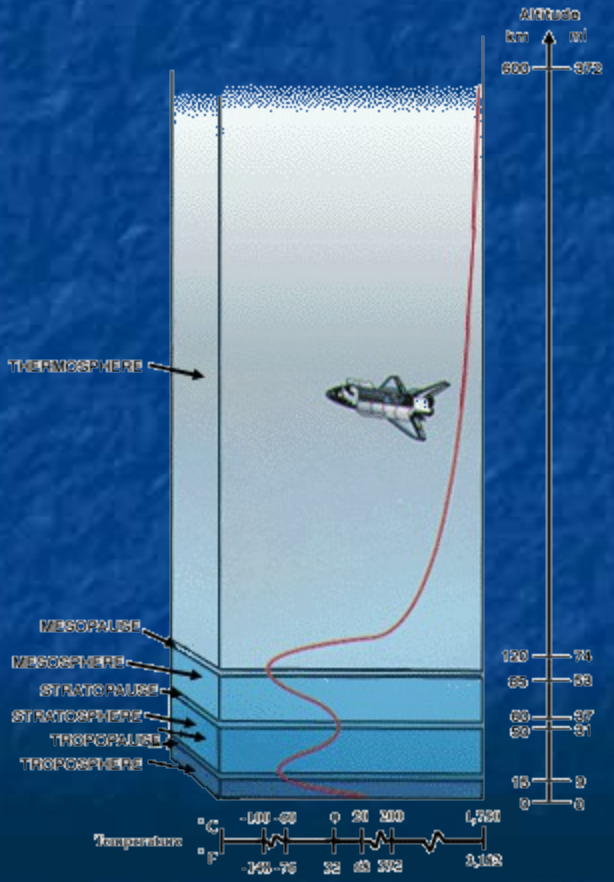
Let’s examine each of these four spheres in detail……



The Atmosphere

The Earth is surrounded by a blanket of air, which we call the ***atmosphere***.

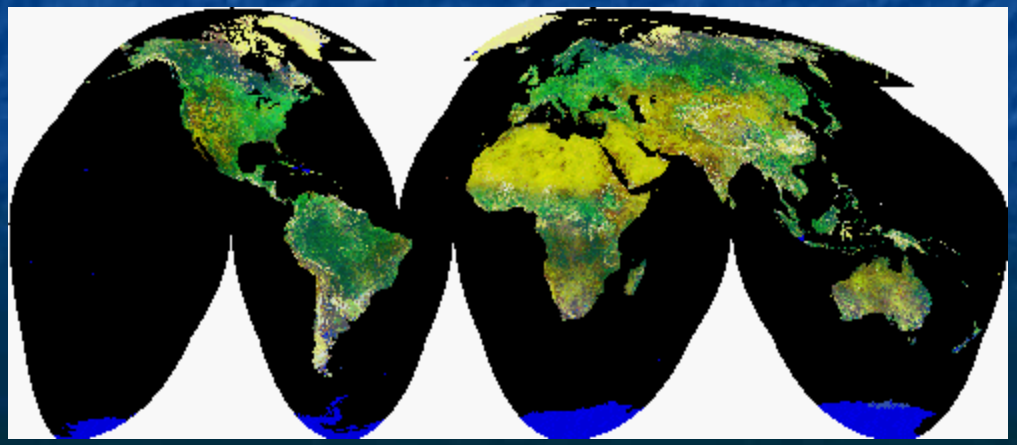
- The atmosphere consists of four unique layers (the troposphere, the stratosphere, the mesosphere, and the thermosphere).
- The atmosphere reaches over 560 kilometers (348 miles) up from the surface of the Earth.
- The atmosphere is primarily composed of nitrogen (about 78%) and oxygen (about 21%). Other components exist in small quantities.



The Biosphere

The ***biosphere*** is the "life zone" of the Earth, and includes all living organisms (including humans), and all organic matter that has not yet decomposed.

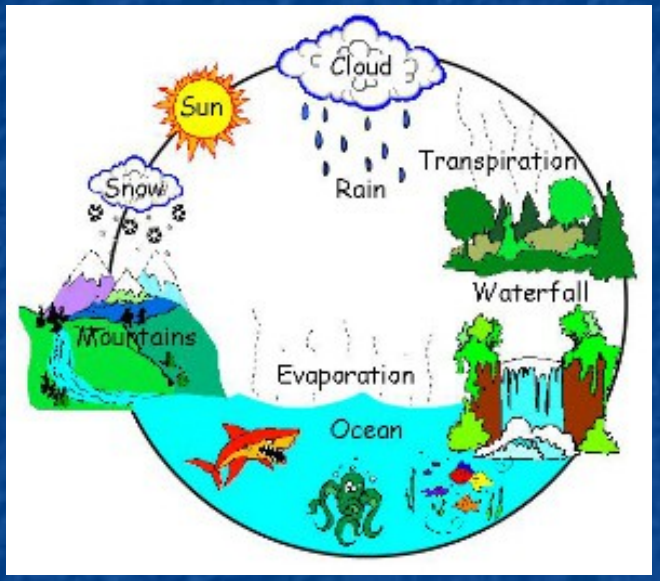
- The biosphere is structured into a hierarchy known as the food chain (all life is dependant on the first tier – mainly the primary producers that are capable of photosynthesis).
- Energy and mass is transferred from one level of the food chain to the next.



Hydrosphere

The ***hydrosphere*** contains all the water found on our planet.

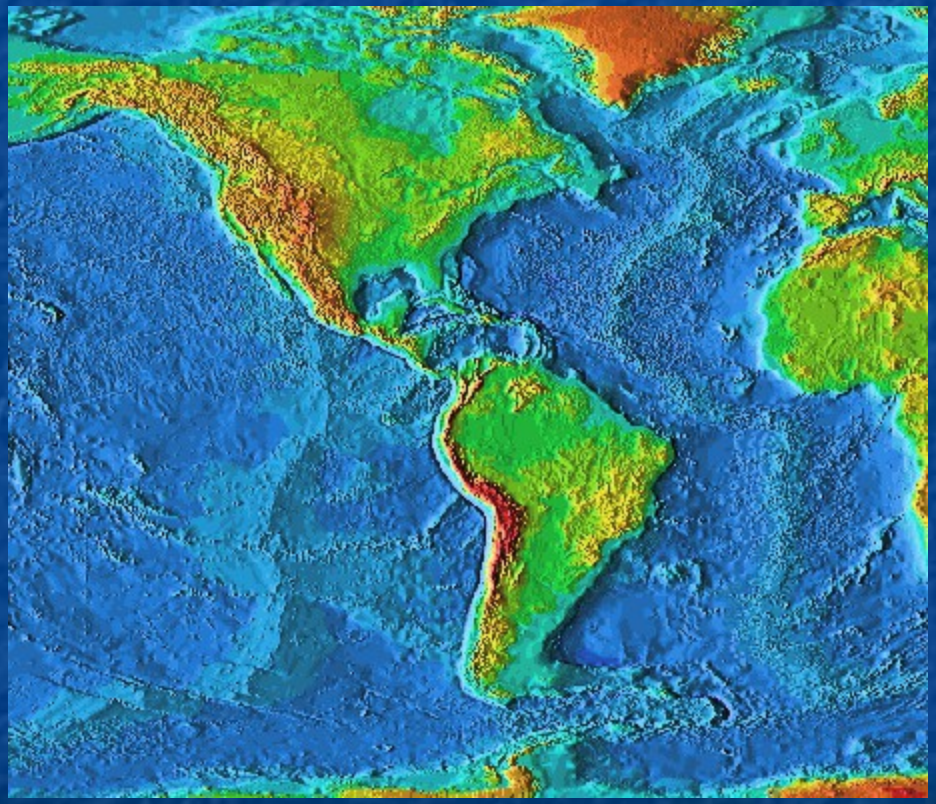
- Water found on the surface of our planet includes the ocean as well as water from lakes and rivers, streams, and creeks.
- Water found under the surface of our planet includes water trapped in the soil and groundwater.
- Water found in our atmosphere includes water vapor.
- Frozen water on our planet includes ice caps and glaciers.
- Only about 3% of the water on Earth is "fresh" water, and about 70% of the fresh water is frozen in the form of glacial ice.



Geosphere

The ***geosphere*** is the solid Earth that includes the continental and ocean crust as well the various layers of Earth's interior.

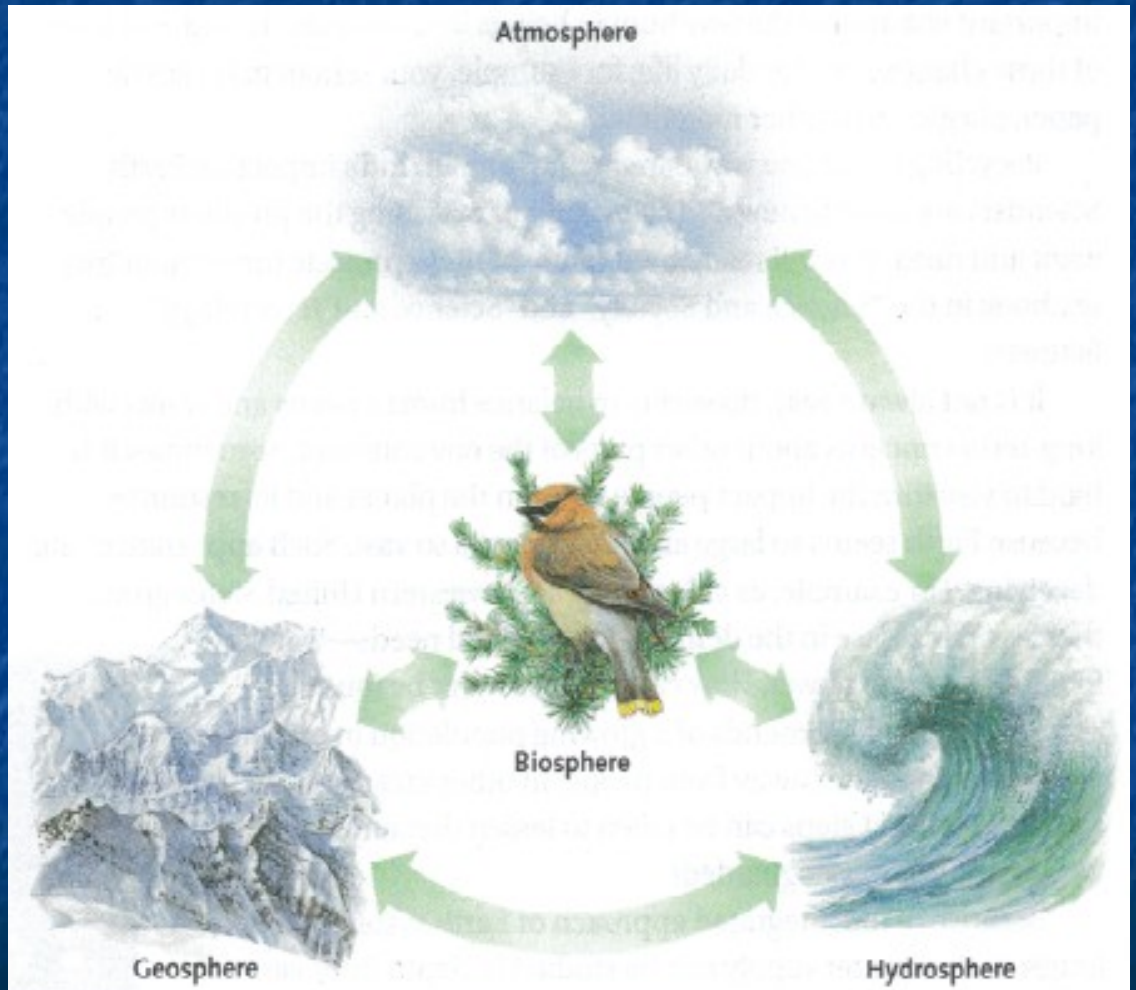
- 94% of the Earth is composed of the elements oxygen, silicon, and magnesium.
- The geopsphere is not static (unchanging), but its surface (crust) is in a constant state of motion.
- Mineral resources are mined from the geosphere.



Earth System Science

Earth System Science is the study of how the four spheres of the Earth system interact continually, each affecting the others.

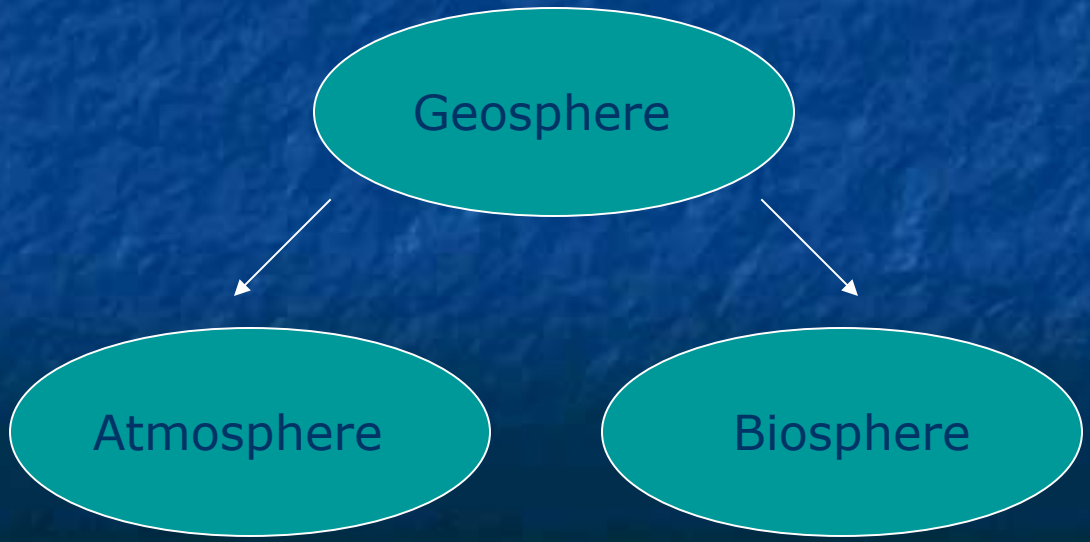
Let's look at a couple of examples of how a change in one system (or sphere) affects other Earth systems.



THE FOUR SPHERES of the Earth system interact continually, each affecting the others.

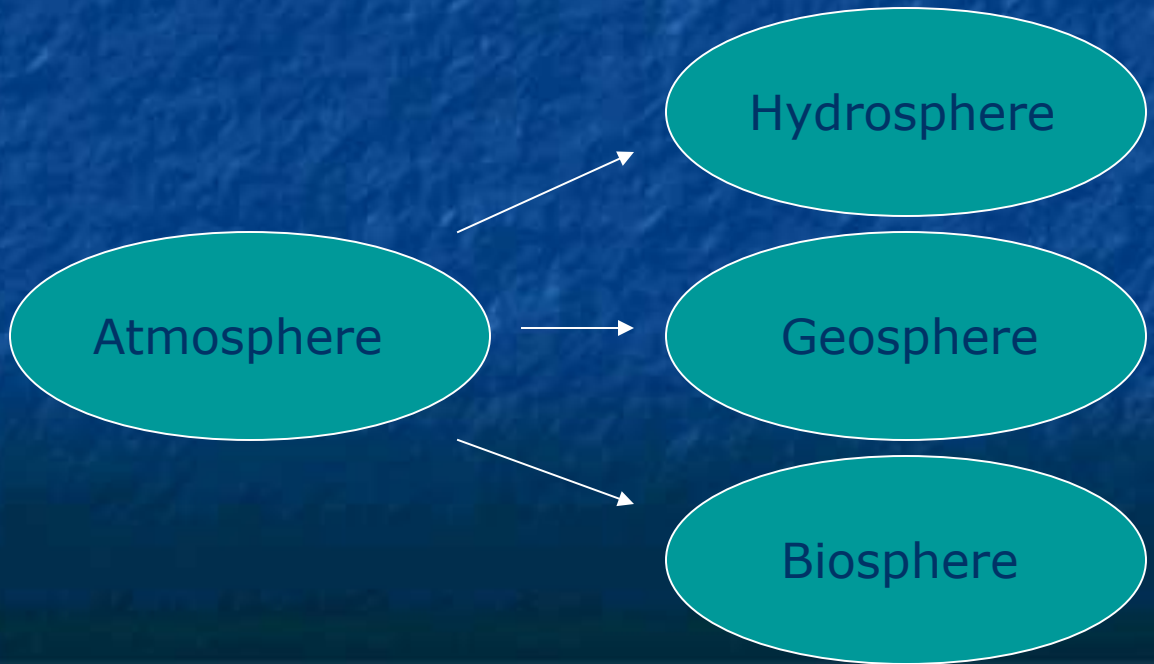
System Interactions*

Volcanoes (geosphere) erupt, sending ash and gases into the air (atmosphere) and sending lava and ash down onto surrounding forests (biosphere) and human habitations (biosphere).



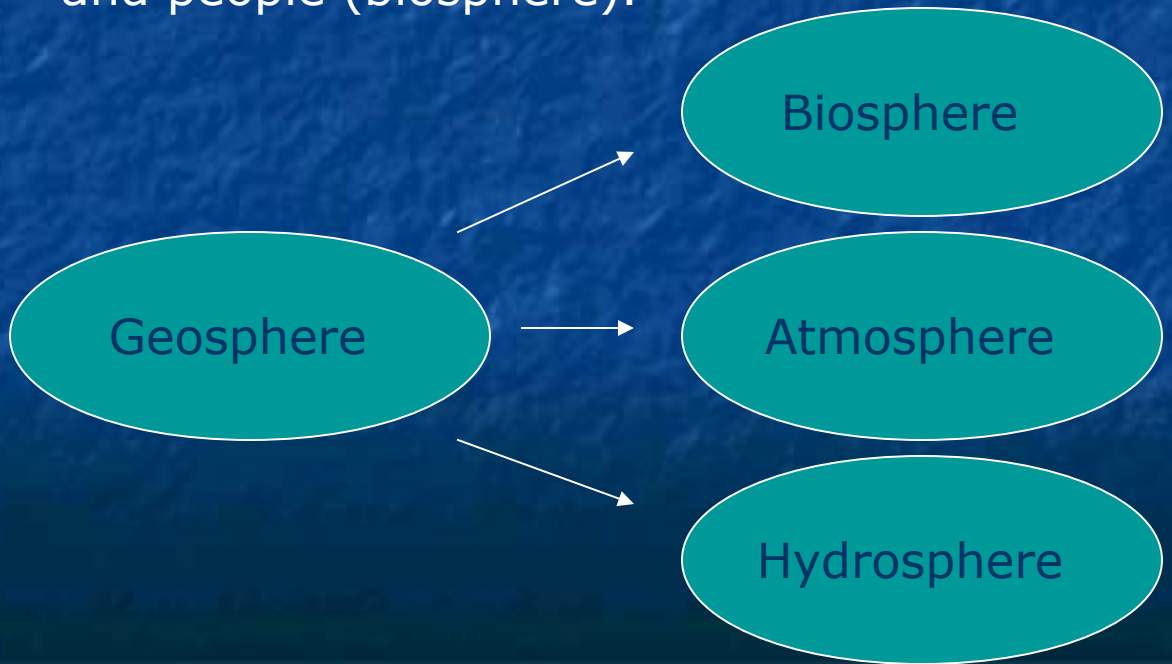
System Interactions*

Hurricanes (atmosphere) sweep across the ocean (hydrosphere) and onto the land (geosphere), damaging the dwellings of people (biosphere) who live along the coast.



System Interactions*

Earthquakes (geosphere) can damage buildings which may kill people (biosphere), as well as cause fires which release gases into the air (atmosphere). Earthquakes in the ocean may cause a tsunami (hydrosphere) which can eventually hit land and kill both animals and people (biosphere).



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