

Earth Systems

3rd semester/paper-302

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EARTH

- ▶ is the third planet from the Sun, the densest planet in the Solar System's, the largest of the Solar System's four terrestrial planet, and the only astronomical object known to harbor life.



- ▶ According to radiometric dating and other sources of evidence, Earth formed about 4.54 billion years ago. Earth gravitationally interacts with other objects in space, especially the Sun and the Moon. During one orbit around the Sun, Earth rotates about its axis 366.26 times, creating 365.26 solar days or one sidereal year. Earth's axis of rotation is tilted 23.4° away from the perpendicular of its orbital plane, producing seasonal variations on the planet's surface within a period of one tropical year (365.24 solar days). The Moon is the Earth's only permanent natural satellite; their gravitational interaction causes ocean tides, stabilizes the orientation of Earth's rotational axis, and gradually slows Earth's rotational rate.

- ▶ Earth's lithosphere is divided into several rigid tectonic plates that migrate across the surface over periods of many millions of years. 71% of Earth's surface is covered with water. The remaining 29% is land mass consisting of continents and islands that together has many lakes, rivers, and other sources of water that contribute to the hydrosphere. The majority of Earth's polar regions are covered in ice, including the Antarctic ice sheet and the sea ice of the Arctic ice pack. Earth's interior remains active with a solid iron inner core, a liquid outer core that generates the Earth's Magnetic field, and a convecting mantle that drives plate tectonics.

Earth Layers

The Earth is divided into three main layers .

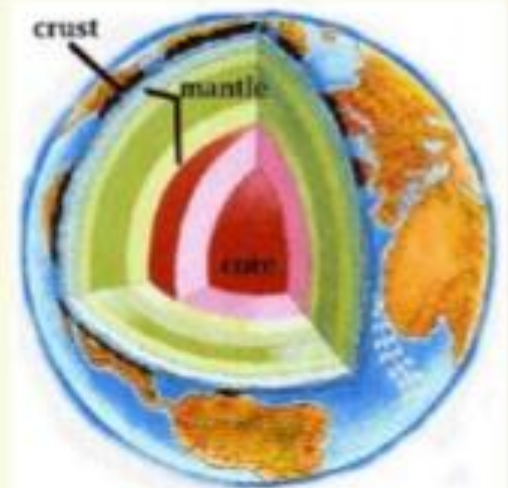
Crust

Mantle

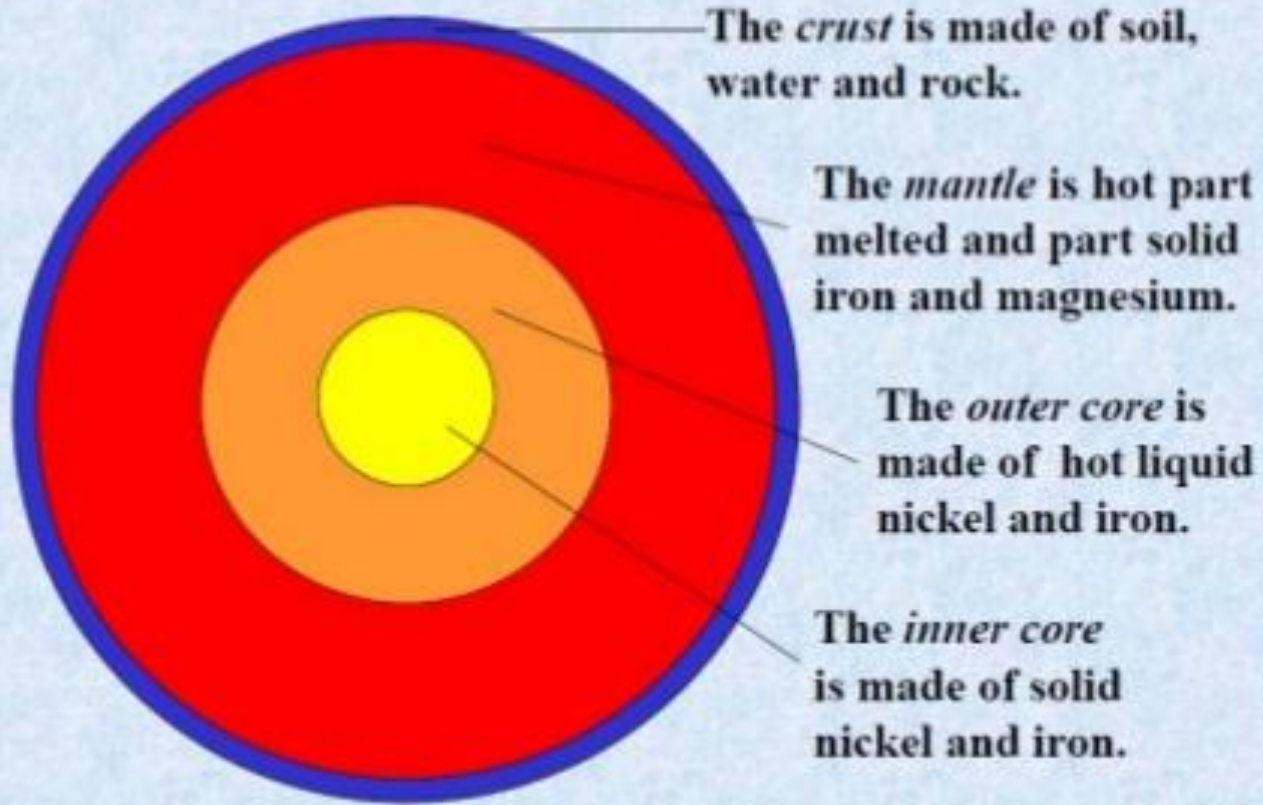
Core

Composition (What it is made of)

- Crust
- Mantle
- Core

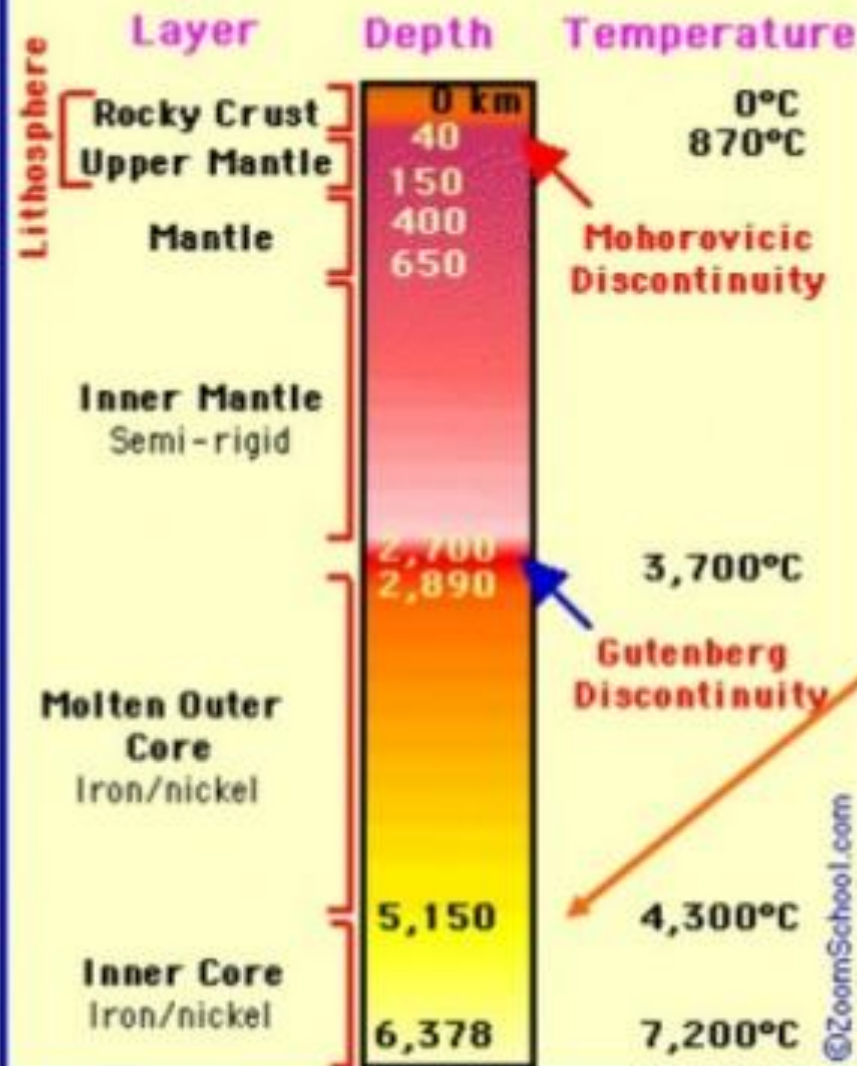


Earth Layers



Composition of the Earth's Layers

Layers from Crust to Core



How HOT is it?



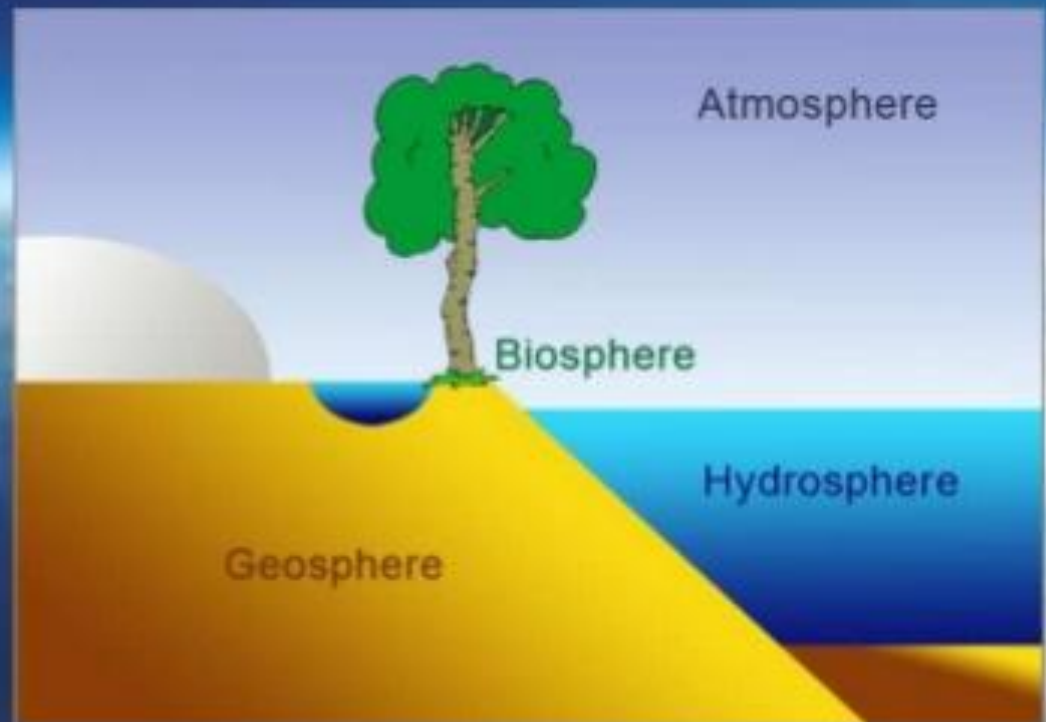
Surface of Sun!
5,500°C

Sun Core
15,000,000°C

Earth Systems Overview

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

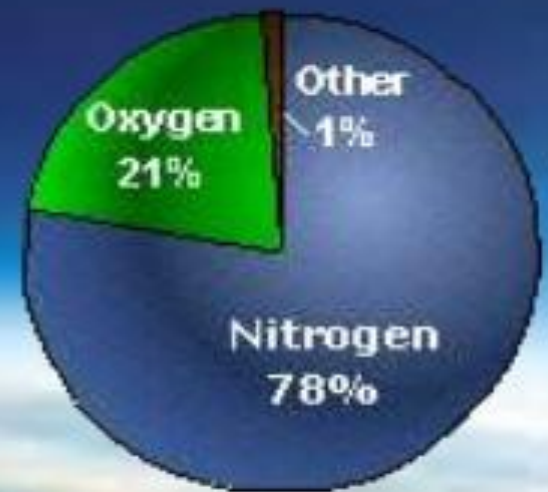
- **the atmosphere**
- **the biosphere**
- **the hydrosphere**
- **the geosphere**



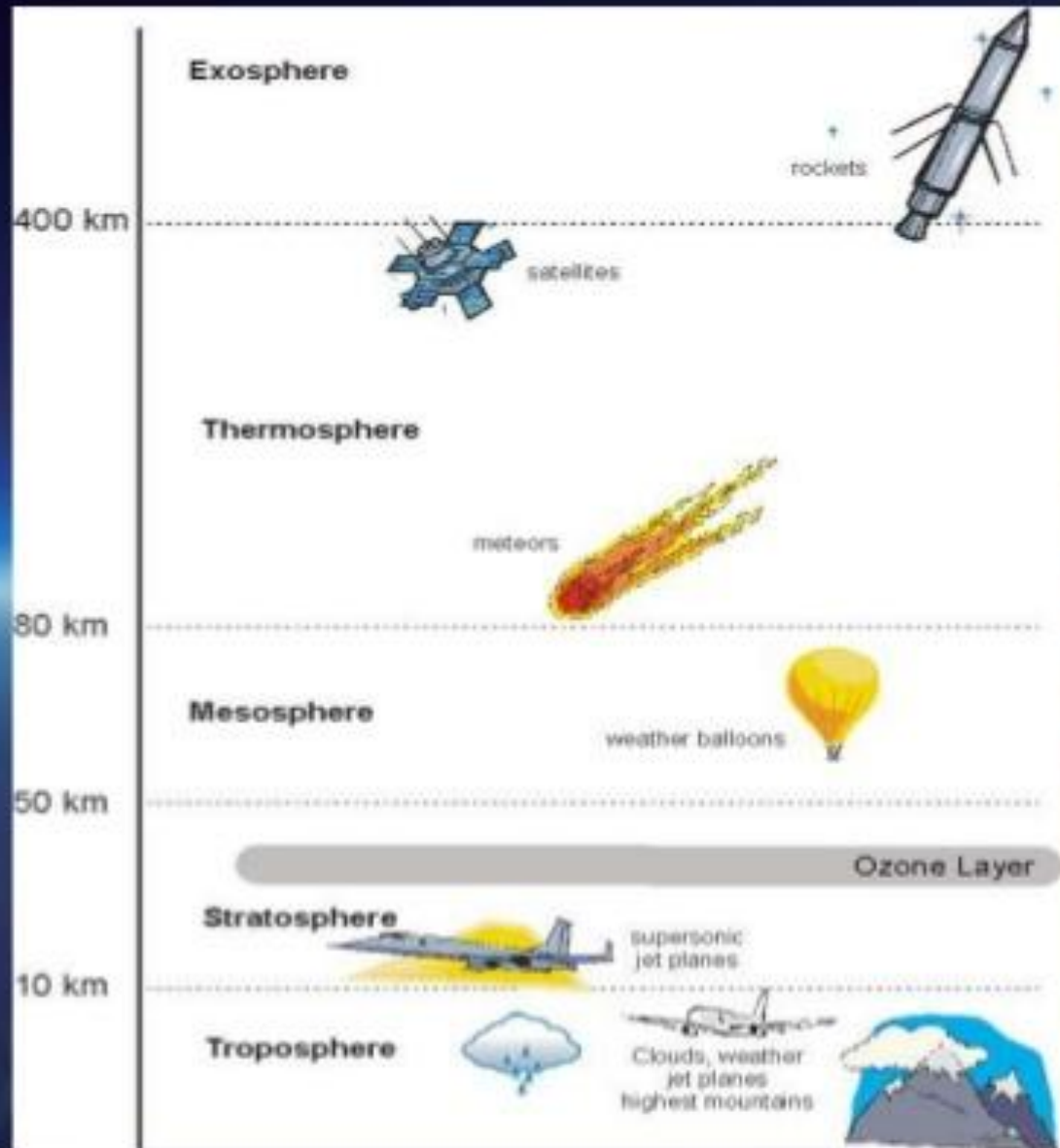
The Atmosphere: a blanket of air that surrounds the Earth

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 → CO₂, argon, ozone..)



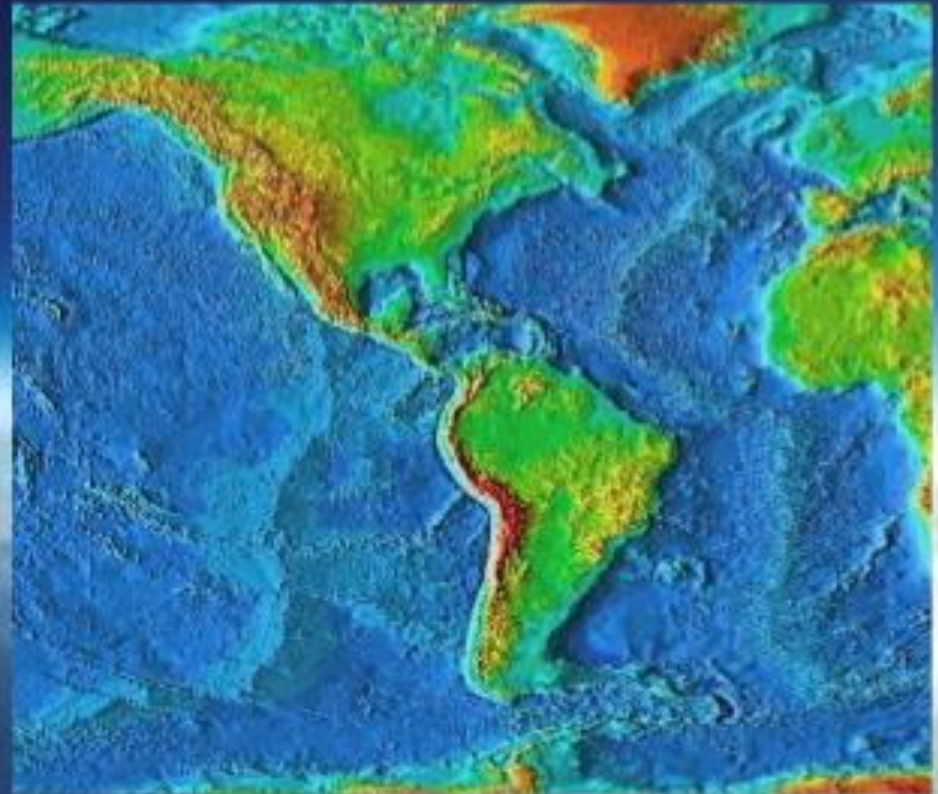
LAYERS OF THE ATMOSPHERE



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 geosphere is not static (unchanging), but its surface (crust) is in a constant state of motion.
- Mineral resources are mined from the geosphere.



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.

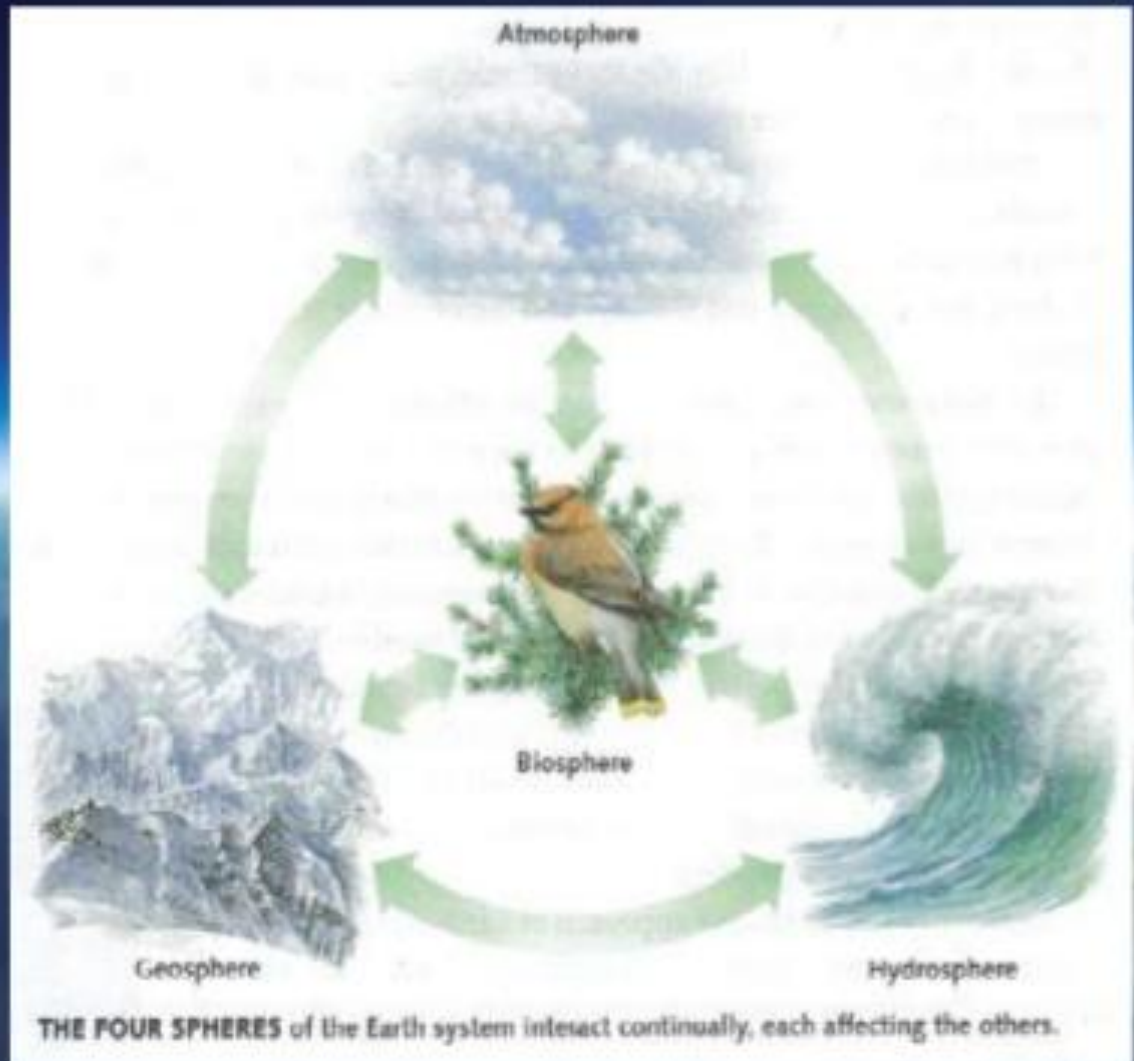


Earth System Science

Earth System Science

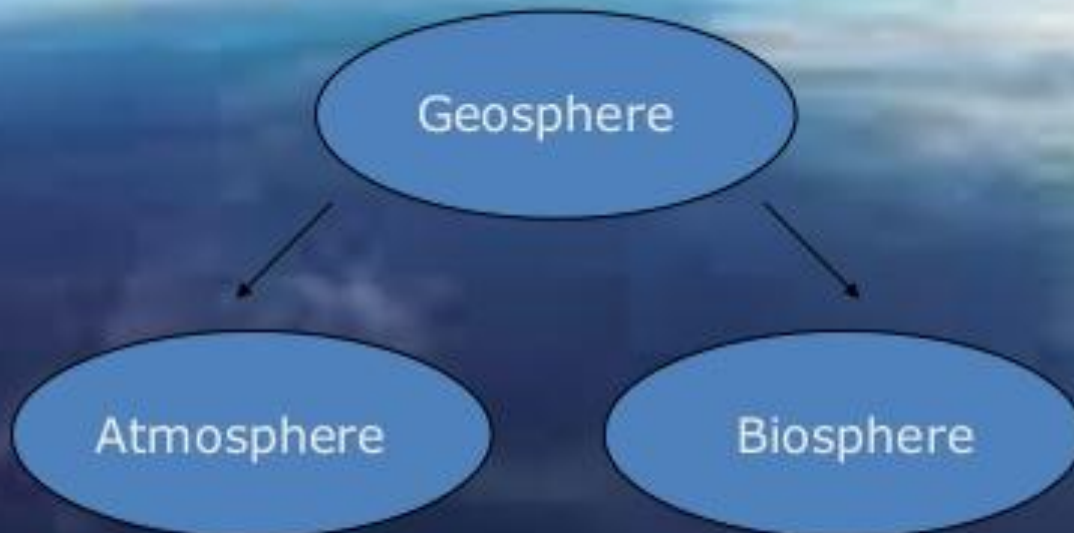
is the study of how the four spheres of the Earth system interact continually, each affecting the others.

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



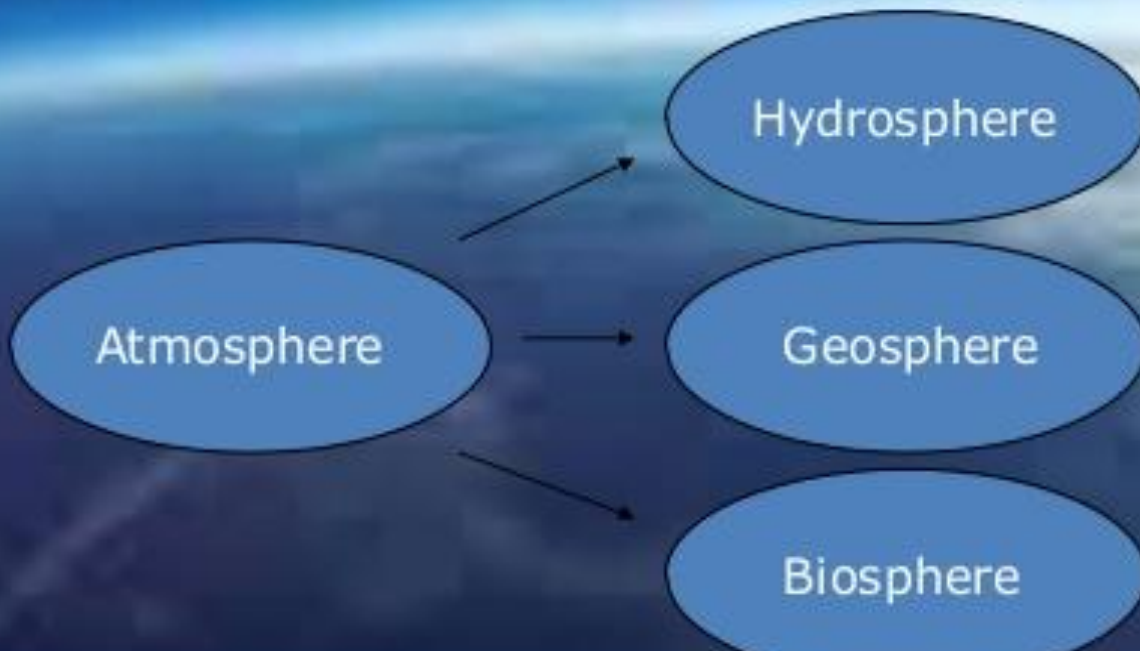
System Interactions

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).

