

# Earth Systems

Earth has many cyclical processes that move at different rates and interact with each other  
**2-ESS1-1, MS-ESS2-2**

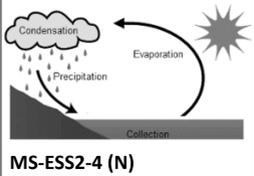
Earth processes happen in the geosphere, hydrosphere, biosphere, and atmosphere and are all connected  
**5-ESS2-1**

The hydrosphere refers to all water on Earth including ocean water, ground water, glaciers, icecaps, rivers, lakes, clouds, etc.

Water on Earth is recycled

Water can be found on earth in liquid, solid, and vapor form  
**2-ESS2-3**

The water cycle includes all forms of water and is driven by heat and gravity  
**MS-ESS2-4 (N)**



The diagram illustrates the water cycle with a sun on the right. An arrow labeled 'Evaporation' points from a body of water to a cloud. An arrow labeled 'Condensation' points from the cloud to a rain cloud. An arrow labeled 'Precipitation' points from the rain cloud to the ground. An arrow labeled 'Collection' points from the ground back to the body of water.

Liquid water can be "fresh" or "salt" water  
**5-ESS2-2 (O)**

Salt water covers 71% of Earth's surface

Oceans circulate water due to temperature differences. Cold water sinks while warm water rises  
**MS-ESS2-6 (K)**

Topography is the shape of the land. Topographic maps show the physical features, such as mountains and valleys, of the top region of the geosphere (lithosphere) and surface water, such as rivers and lakes, in the hydrosphere  
**2-ESS2-2, 4-ESS2-2 (G)**

The geosphere refers to the rocks, minerals, and landforms at Earth's surface and in its interior, including soil, sediments, and molten rocks

All rock on Earth is recycled through the rock cycle  
**MS-ESS2-1 (I)**

Rocks can be broken down

Weathering changes the shape of the land  
**4-ESS2-1 (H)**

Heat and pressure can return rocks to magma

Rocks are formed from the cooling of magma/lava

Rocks are formed by pressure

Rocks are formed in layers but these layers may be disturbed over time

You can determine relative geologic time scale by looking at an undisturbed cross-section of rock layers. Top layers are more recent, and bottom layers are older  
**MS-ESS1-4**

Mechanical weathering is caused by wind, water, or other physical processes that do **NOT** alter the chemical makeup of the rock

Chemical weathering is when the chemical composition of a rock changes due to a chemical reaction taking place. Example: rusting or acid rain

Erosion is the transportation of weathered rock  
**4-ESS2-1**

Weathering can cause problems for people but engineers can generate solutions to slow down weathering  
**2-ESS2-1 (A)**

Deposition is the settling of weathered rocks

Fossils are created when a plant/animal dies and is buried in mud or silt which then undergoes immense pressure

Scientists have found fossils in locations where the fossilized species would not have been able to survive in the present climate  
**4-ESS1-1**

Sea-floor spreading drives Plate Tectonics  
**(J)**

Plate Tectonics is the theory of how the surface of Earth is changing by slowly moving lithospheric plates on the mantle below  
**MS-ESS2-3**

Weather is atmospheric conditions that happen over a short period of time. Climate is atmospheric conditions over a long period of time

Climate describes a range of an area's typical weather conditions and the extent to which those conditions vary over years. Temperature and precipitation are the two most important factors that determine a region's climate

Climates have changed over time and continue to change

The climate in one part of the world is different than the climate in another, because climate changes with latitude and altitude. These differing regions are known as biomes  
**3-ESS2-2, MS-ESS2-6 (M)**

Evidence of climate changes can be seen in fossil records and rock formations  
**4-ESS1-1**

Earth's atmosphere is made of 4 layers, from closest to Earth to farthest: troposphere, stratosphere, mesosphere, and thermosphere

Most weather occurs in the troposphere because most of Earth's water vapor is found there

Weather is predictable  
**K-ESS2-1, K-ESS3-2, 3-ESS2-1 (L)**

Weather is driven by air masses and water vapor  
**MS-ESS2-5**

An air mass is a large body of air with uniform temperature and humidity. Air masses are moved by strongly moving air currents called jet streams

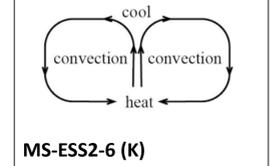
Weather happens when air masses interact

The atmosphere is the layer of gases surrounding the Earth  
**(K)**

The bottom-most layer is the troposphere. It exists 10 km above the surface and is the most dense layer of the atmosphere

Air is circulated around the Earth by convection currents (aka Hadley cells) found in troposphere

The circulation is caused by the uneven heating of the Earth. Cold air sinks and warm air rises  
**MS-ESS2-6 (K)**



The diagram shows a circular convection cell. On the right side, an arrow labeled 'heat' points upwards, and on the left side, an arrow labeled 'cool' points downwards. The arrows indicate the flow of air: rising on the right and sinking on the left.

**MS-ESS2-6 (K)**