

Earth Systems

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

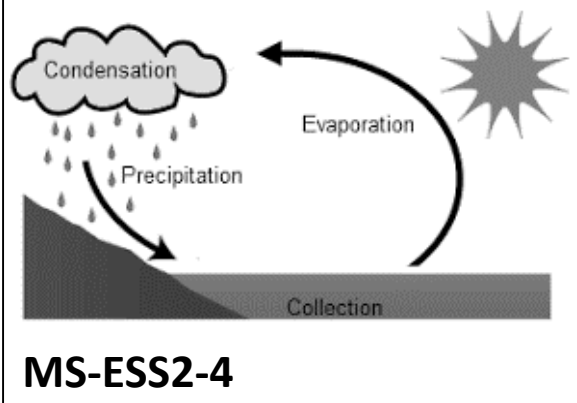
Earth processes happen in the geosphere, hydrosphere, biosphere, and atmosphere and are all connected
5-ESS2-1

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



The diagram illustrates the water cycle with four stages: Evaporation (water rising from the sun), Condensation (water forming clouds), Precipitation (water falling as rain or snow), and Collection (water gathering in bodies of water or on the ground).

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

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

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

Rocks can be broken down

Weathering changes the shape of the land
4-ESS2-1

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

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

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

Deposition is the settling of weathered rocks

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

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

The atmosphere is the layer of gases surrounding the Earth

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

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

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

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

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

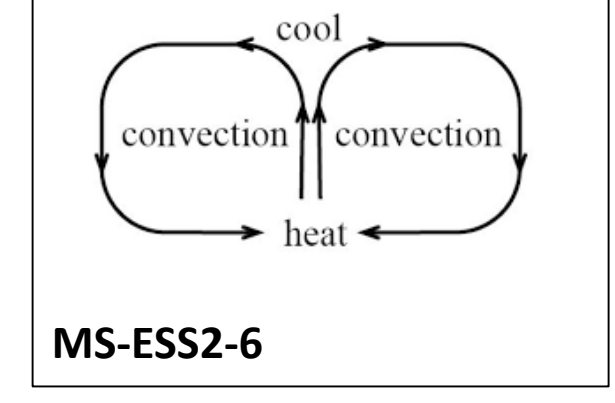
Air is circulated around the Earth by convection currents (aka Hadley cells) found in troposphere

Weather is predictable
K-ESS2-1, K-ESS3-2, 3-ESS2-1

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

The circulation is caused by the uneven heating of the Earth. Cold air sinks and warm air rises



The diagram shows a circular convection cell. On the left, air is labeled 'cool' and is sinking. On the right, air is labeled 'heat' and is rising. The rising and sinking air creates 'convection' currents.

MS-ESS2-6

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

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