

# Earth Science II

Solar Energy

Winds

Ocean Currents

## Solar Energy

Solar energy comes from the Sun.

The solar energy that reaches Earth can either be absorbed and/or reflected by Earth's atmosphere and its surface.

## The Greenhouse Effect

Some solar energy is reflected by Earth and the atmosphere.

Some of the energy passes through the atmosphere, and some is absorbed and re-emitted in all directions by greenhouse gas molecules. The effect of this is to warm Earth's surface and the lower atmosphere.

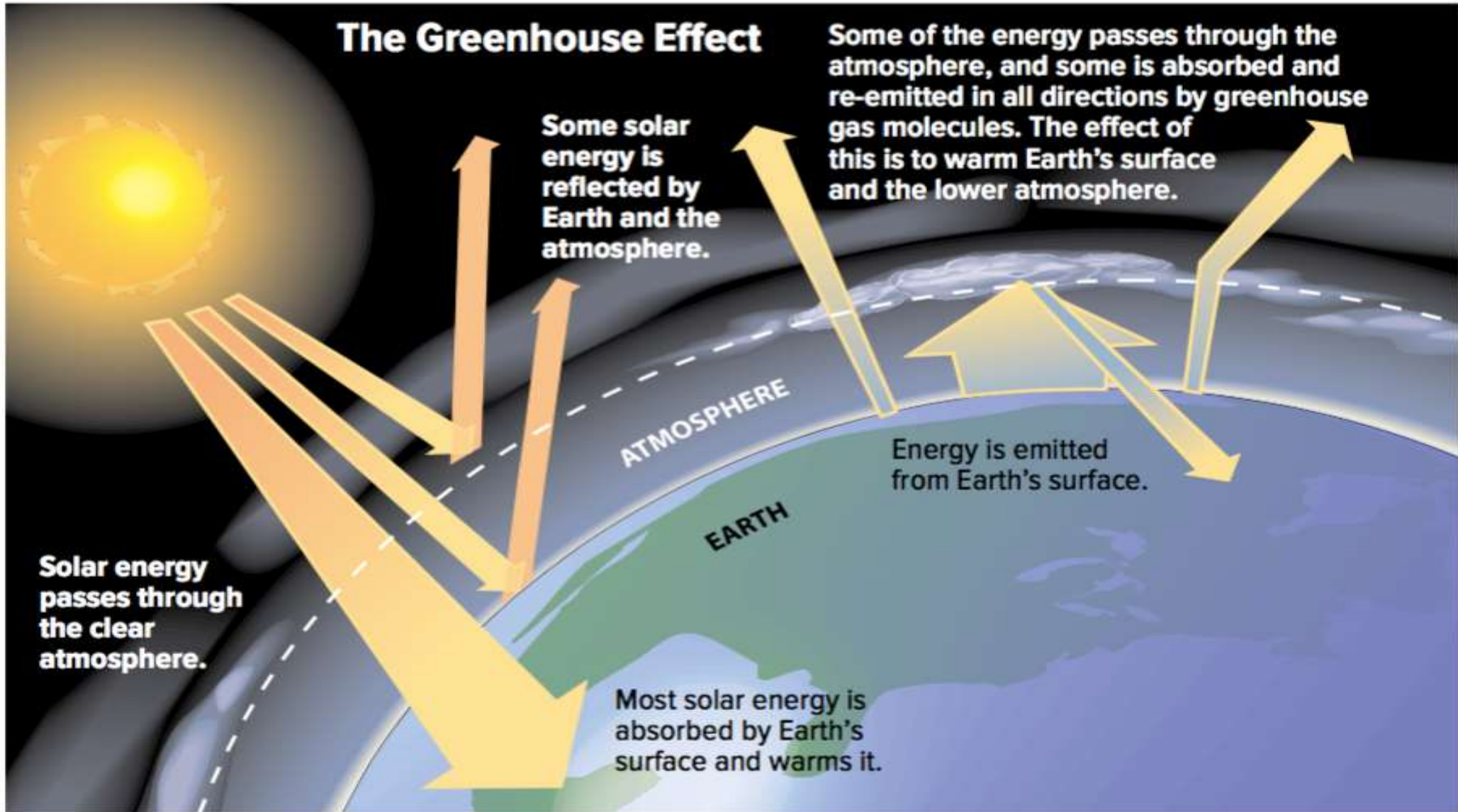
Solar energy passes through the clear atmosphere.

ATMOSPHERE

EARTH

Energy is emitted from Earth's surface.

Most solar energy is absorbed by Earth's surface and warms it.



## Solar Energy

Within Earth's atmosphere, there are a number of greenhouse gases that help to trap heat and keep the Earth's surface warm.

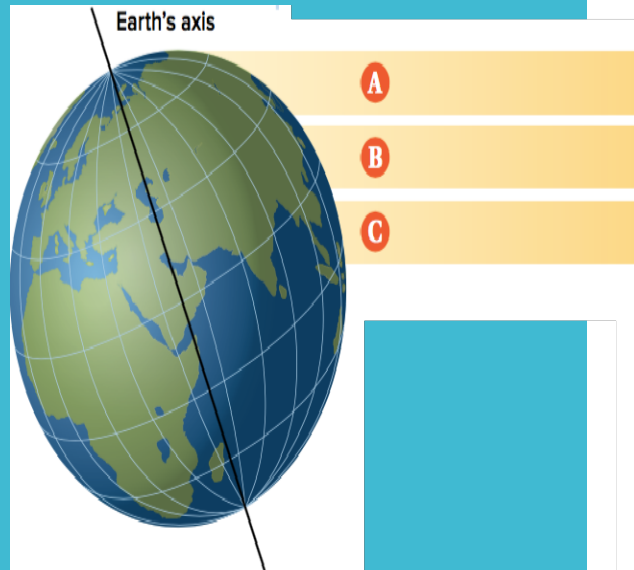
Greenhouse gases absorb solar energy in Earth's atmosphere. Greenhouse gases can occur both naturally and through human activities.

**Table 4.3 Natural Greenhouse Gases**

Greenhouse Gas	Sources	Other Details
water vapour	<ul style="list-style-type: none"> <li>• evaporation from water</li> <li>• given off by plants, animals, and other organisms</li> </ul>	<ul style="list-style-type: none"> <li>• most abundant greenhouse gas</li> <li>• produced during cellular respiration and certain plant processes</li> </ul>
carbon dioxide	<ul style="list-style-type: none"> <li>• living organisms</li> <li>• volcanoes, forest fires, decaying organisms, release from oceans</li> </ul>	<ul style="list-style-type: none"> <li>• second most abundant greenhouse gas</li> <li>• produced in and by the cells of most living organisms through cellular respiration</li> </ul>
methane	<ul style="list-style-type: none"> <li>• certain species of bacteria and other micro-organisms that live in and around bogs, wetlands, melting permafrost</li> <li>• certain species of bacteria that live in the gut of animals such as cows and termites</li> <li>• vents and other openings in Earth's crust on land and the ocean floor</li> </ul>	<ul style="list-style-type: none"> <li>• a by-product of cellular processes used by some micro-organisms to extract energy from food in the absence of oxygen</li> </ul>
nitrous oxide	<ul style="list-style-type: none"> <li>• bacteria that live in oceans and wet, warm soils such as those in the tropics</li> </ul>	<ul style="list-style-type: none"> <li>• produced when certain species of bacteria break down nitrogen-rich compounds for food</li> </ul>

Greenhouse Gases from Human Activities	Sources
Carbon dioxide	<ul style="list-style-type: none"> <li>• Released from burning fossil fuels (coal, natural gas, oil)</li> </ul>
Nitrous oxide	<ul style="list-style-type: none"> <li>• Enters the atmosphere when fertilizers are applied to crops</li> </ul>
Methane	<ul style="list-style-type: none"> <li>• Released in large amounts by herds of cattle</li> </ul>

# Winds



Winds occur when the surface of the Earth is heated unevenly.

The reason why Earth's surface is heated unevenly is because of Earth's spherical shape.

The Earth is closer to the Sun at the equator which will result in more solar energy reaching that part of the Earth; this will cause areas at the equator to be warmer.

Less direct sunlight is able to reach the north and south poles of the Earth; this will cause areas at the poles to be colder.

## Winds

Warm air (less dense) near the Earth's surface rises and eventually cool downs while cool air is denser and sinks.

This movement of the air is what causes winds to form. This phenomenon is called convection currents.

## Winds

Along with the rising and sinking of the air, the Coriolis effect plays a part in how wind is distributed around the Earth.

The Coriolis effect occurs due to Earth's rotation; Earth tends to rotate faster at the equator than at the poles.

The Coriolis effect makes things (like planes or air) travelling around the Earth appear to move in a curved fashion.



Video

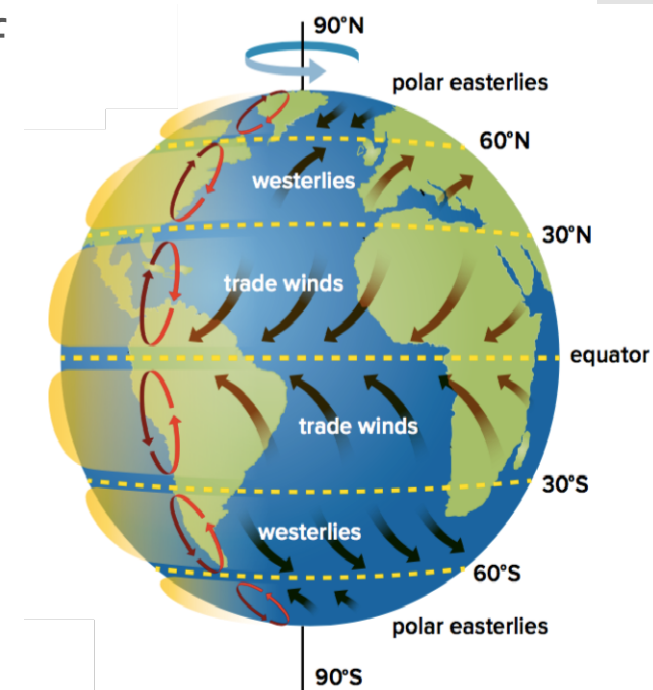
[https://www.youtube.com/watch?v=HlyBpi7B-dE&ab\\_channel=AtlasPro](https://www.youtube.com/watch?v=HlyBpi7B-dE&ab_channel=AtlasPro)

# Winds

There are three major types of winds that the Earth has:

1. Trade winds:

- Move east to west
- Air near the equator warms, rises, and travels north or south
- At the north or south, the air cools, sinks, and moves west

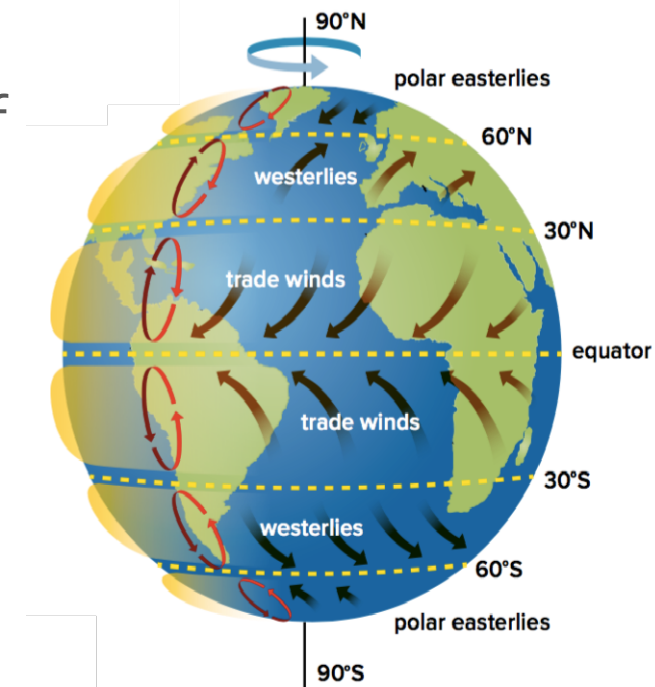


# Winds

There are three major types of winds that the Earth has:

## 2. Westerlies:

- Move from west to east
- Steady winds that move much of the weather across North America

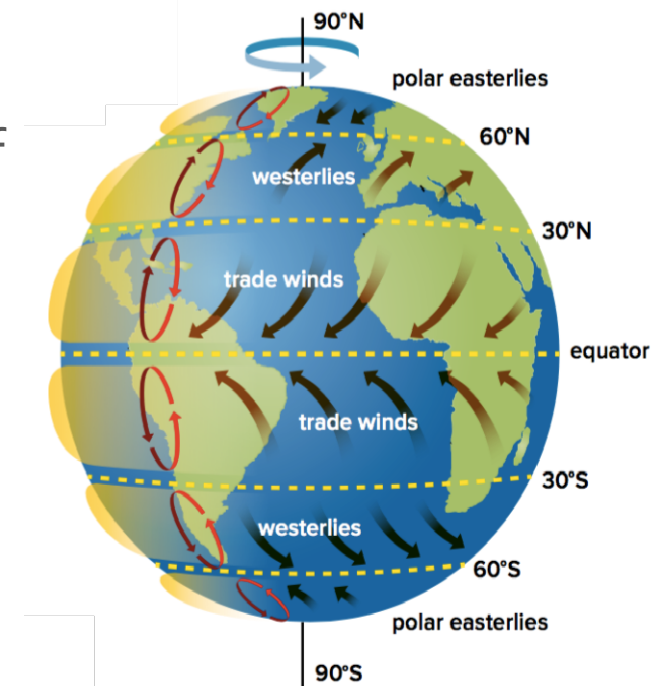


# Winds

There are three major types of winds that the Earth has:

### 3. Polar easterlies:

- Travel from east to west
- Move cold air from polar regions back toward equator



Video

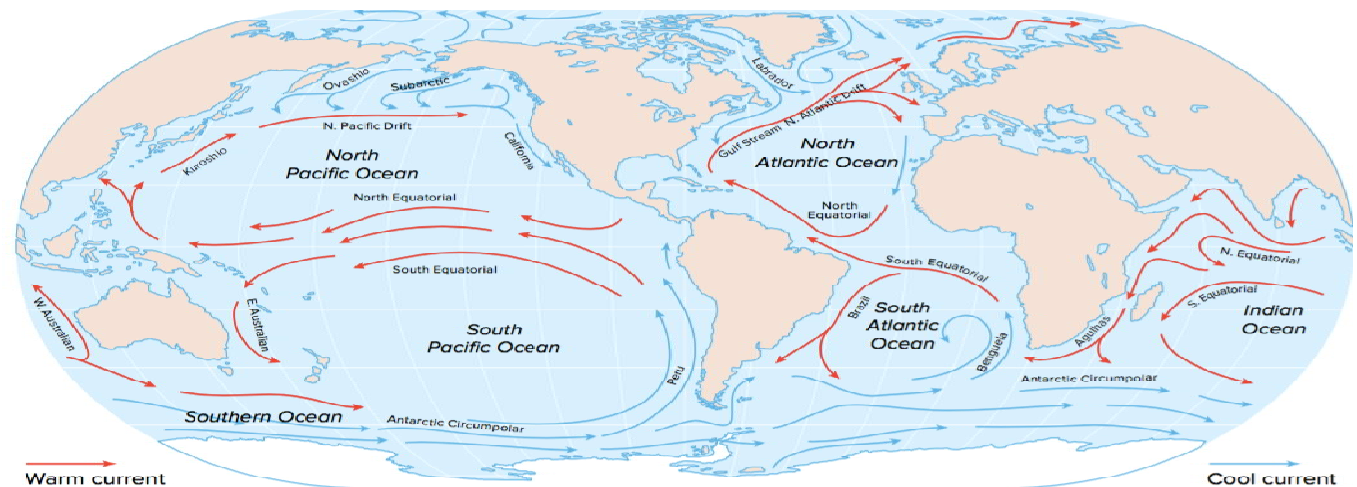
[https://www.youtube.com/watch?v=NQ3Tj-tdQIk&ab\\_channel=MooMooMathandScience](https://www.youtube.com/watch?v=NQ3Tj-tdQIk&ab_channel=MooMooMathandScience)

# Ocean Currents

Ocean currents are also able to move thermal energy around the Earth. There are two major types of ocean currents:

## 1. Surface currents

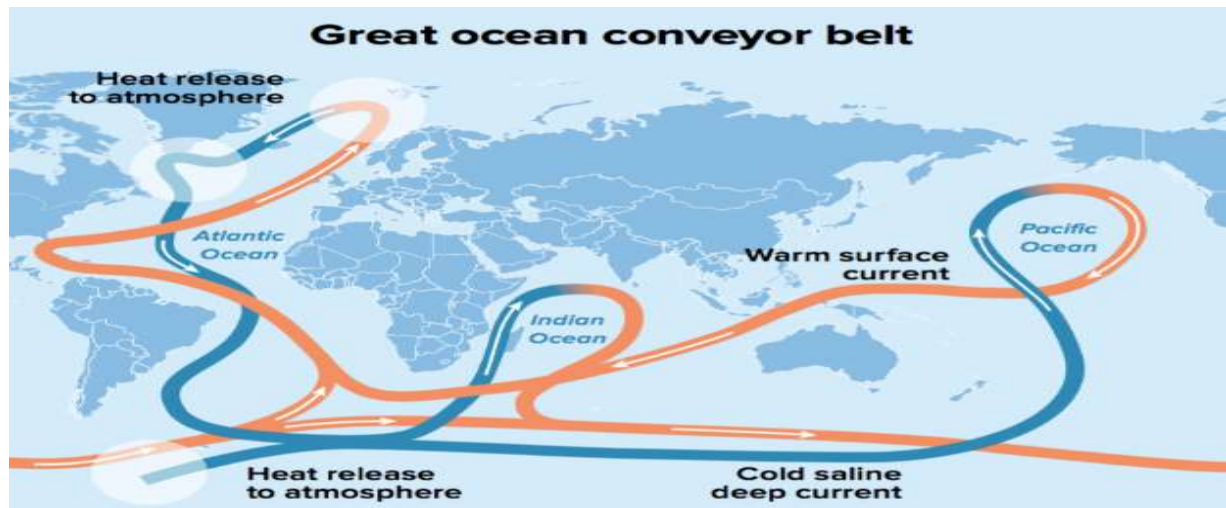
- These are created by the movement of the wind
- Warm currents move heat from the equator to the poles while cold currents move cold water from the poles to the equator



# Ocean Currents

## 2. Great Ocean Conveyor Belt

- A system of deep water currents that move deep water, heat, and nutrients around the Earth
- Movement of this water is based on the temperature of the water and the salt content
  - Cold water is denser than warm water so it will sink; warm water is less dense than cold water so it will rise
  - Saltier water is denser so it will sink and move the less salty water up



Video

[https://www.youtube.com/watch?v=p4pWafuvdrY&ab\\_channel=TED-Ed](https://www.youtube.com/watch?v=p4pWafuvdrY&ab_channel=TED-Ed)