

Low Clouds also reflect sunlight but have little effect on the escape of infrared radiation so they effectively cool the climate.

Currently, the net effect is an overall cooling effect. Global warming, however, may change the characteristics of clouds (their amount, height, and thickness) and alter their net cooling effect. This, in turn, could exert a powerful feedback on climate change.

Predicted Climate Change

If the level of greenhouse gases in the atmosphere continues to increase, the following consequences are predicted:

1. Global average temperature is predicted to increase by 3 degrees Celsius by the 2080's.
2. Large changes in precipitation (rainfall) patterns (both negative and positive) are expected as global warming enhances the hydrological cycle.
3. Changes in wind patterns because of changes in atmospheric circulation.
3. Increased frequency and/or climate events (such as floods, storms, droughts, El Nino).

A global rise in sea level of 40 centimetres is expected by the 2080's.

These changes could threaten the earth's ability to sustain life as we know it and have global impacts in almost every area of our lives!



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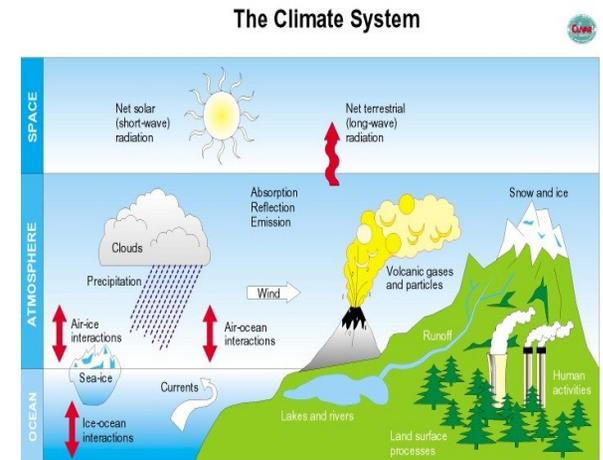
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The Climate System



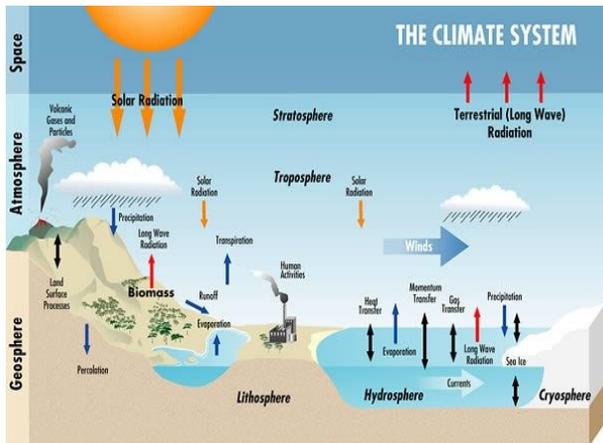
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Climate Change

Climate Change

What is Climate Change?

More and more we are realizing that the Industrial Revolution has permanently altered the balance between nature and humanity. There is growing concern that by the middle or the end of the 21st century, human activities will have changed the basic conditions that have allowed life to thrive on earth. Human activities have changed the way that energy from the sun interacts with and escapes from the earth's atmosphere thus creating the risk of altering the global climate. For a better understanding of climate change, it is first necessary to understand the earth's climate system, its components and the ways in which they interact.



Components of the Climate System

Atmosphere

Circulation of the atmosphere; Formation of clouds; Passage of solar and terrestrial radiation through the atmosphere.

Ocean (Water)

Exchange of heat, momentum and water vapour between the ocean and the atmosphere. Transfer of heat and salt by ocean currents.

Land

How the land affects the flow of air over it. The importance of land in the hydrological (water) cycle. In addition to the three main components, it is also necessary to consider the importance of the cryosphere (ice) on the land and on the ocean to the climate system.

All of these components interact to drive the various processes that determine the overall climate mechanism and how it could change in the future.

The Greenhouse Effect

A greenhouse is kept warm because energy coming in from the sun (visible sunlight) is able to pass easily through the glass of the greenhouse and heat the soil and plants inside. However, the energy emitted from the soil and plants (invisible infrared radiation) is not able to pass as easily through the glass, therefore some of this energy is trapped inside. Thus, the air inside the greenhouse is warmer than the air outside.

In the earth's atmosphere there is a layer of gases, primarily water vapour and carbon dioxide (CO₂) which acts similarly to the glass in a greenhouse. These gases are thus called "greenhouse gases".

The earth's temperature is determined by the balance between energy coming in from the sun in the form of visible radiation (sunlight) and energy

constantly being emitted from the surface of the earth to outer space (terrestrial radiation) in the form of invisible infrared radiation.

The sunlight passes through the clear atmosphere, essentially unchanged, and heats the surface of the earth.

However, the infrared radiation from the earth's surface is partly absorbed by the greenhouse gases in the atmosphere and some of it is re-emitted downwards. This results in the warming of the earth's surface and the lower atmosphere.

The natural greenhouse effect has operated for billions of years. Without it, the earth would be near 33 degrees (Celsius) cooler than it is and it would not be habitable.

Human activities have led to an increase in the concentration of greenhouse gases in the atmosphere, especially CO₂ and the addition of new ones such as chlorofluorocarbons (CFC's). Consequently, the layer of greenhouse gases has thickened. These changes have been observed since 1860 and have led to an increase in the surface temperature of the earth since the middle of the twentieth century.

Clouds and Climate

Clouds also have an impact on the earth's radiation balance. High clouds reflect sunlight but also trap infrared radiation; thus they act to warm the climate