

An Introduction to the Climate System

Number 8/3

Fact Sheet

Climate is a system of complex interactions between various elements on the Earth's surface.

Climate Change

Introduction

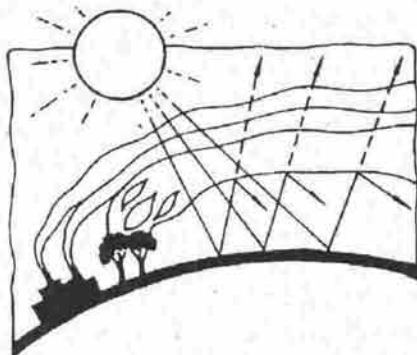
Climate is a system of complex interactions between the atmosphere, oceans, cryospheres (glaciers, sea ice, continental ice caps), geosphere (earth's solid surface) and biosphere (living organisms in oceans and land). It is very difficult to predict the interactions between these elements because of the widely differing time it takes for equilibrium to occur after a change in the system - from a single day to a few centuries

Solar radiation is the most significant source of energy driving the climate system. Simply, the sun's short wave radiation pass through unaffected by gases of the atmosphere, warms the earth's surface on contact and is re-emitted as long wave radiation. This is partly absorbed by atmospheric gases, thus warming the lower atmosphere.

Variations in the earth's surface

The amount of warming from solar radiation depends on the nature of the Earth's surface (i.e. ocean, land, vegetation, ice caps, and forest). Variations in these surfaces variations create a complex distribution of energy, which all affect climate and weather patterns.

Oceans are major regulators of climate. Ocean waters and currents absorb heat and gases, such as CO₂, from the atmosphere. When water descends into deep ocean regions the heat and gases are trapped, so storing "excess" energy and carbon for long periods of time.



Ice albedo reflects a significant amount of incoming solar energy back out into space. Changes in the cryosphere will directly affect the amounts of solar energy absorbed by the atmosphere.

The **biosphere**, made up of living organisms on land and in the sea, regulates climate through its role in the carbon cycle. However, because of the complex biological processes involved, the biosphere's role in the climate system is not well understood. More research is needed before the biosphere's contribution to climate variation and removal of GHGs from the atmosphere can be quantified.

More research is also needed on the **atmosphere**. Climate variability, despite the wide study and modelling by scientists, still has large uncertainties. One of the greatest unknowns is the role of clouds:

- Do clouds cool the earth by intercepting solar energy, or do they warm it by reducing outgoing terrestrial radiation?
- What effect will changes in the amount of cloud and its type have on global temperatures?
- How does the exchange of heat and gases between the atmosphere and other parts of the climate system take place?

More research needed

According to the Intergovernmental Panel on Climate Change (IPCC), more research are needed to allow scientists to better predict how climate change will come about. We need to better understand the various climate-related processes associated with clouds, oceans and the carbon cycle. We also need to:

- ♦ improve global observation systems for climate-related variables;
- ♦ investigate past climate changes;
- ♦ develop better models of the Earth's climate system;
- ♦ increase support for national and international climate research activities, especially in developing countries; and,
- ♦ facilitate the international exchange of climate data.



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