

Global Warming

Due to the presence of greenhouse gases, the atmosphere is behaving like a *greenhouse*. The atmosphere also transmits the incoming solar radiation but absorbs the vast majority of long wave radiation emitted upwards by the earth's surface. The gases that absorb long wave radiation are called greenhouse gases. The processes that warm the atmosphere are often collectively referred to as the *greenhouse effect*.

The term *greenhouse* is derived from the analogy to a greenhouse used in cold areas for preserving heat. A *greenhouse* is made up of glass. The glass which is transparent to incoming short wave solar radiation is opaque to outgoing long wave radiation. The glass, therefore, traps more radiation and warms the interior. Long wave radiation going out of the house, causing the temperature inside the glasshouse structure to rise above the outside. When you enter a greenhouse during summers, when the doors are closed, you feel more warmth. Likewise during winters, when the doors are closed and windows are closed, you feel warmer than the temperature outside. This is another example of the

Greenhouse Gases (GHGs)

The primary GHGs of concern are carbon dioxide (CO_2), Chlorofluorocarbons (CFCs), methane (CH_4), nitrous oxide (N_2O), and ozone (O_3). Some other gases such as nitric oxide (NO) and carbon monoxide (CO) easily react with GHGs and affect their concentration in the atmosphere.

The effectiveness of any given GHG molecule will depend on the magnitude of the increase in its concentration, its life time in the atmosphere and the wavelength of radiation that it absorbs. The chlorofluorocarbons (CFCs) are highly effective. *Ozone* which absorbs ultra violet radiation in the stratosphere is very effective in absorbing terrestrial radiation when it is present in the lower troposphere. Another important point to be noted is that the more time the GHG molecule remains in the atmosphere, the longer

it will take for earth's atmospheric system to recover from any change brought about by the latter.

The *largest concentration* of GHGs in the atmosphere is *carbon dioxide*. The emission of CO_2 comes mainly from fossil fuel combustion (oil, gas and coal). Forests and oceans are the sinks for the carbon dioxide. Forests use CO_2 in their growth. So, deforestation due to changes in land use, also increases the concentration of CO_2 . The time taken for atmospheric CO_2 to adjust to changes in sources to sinks is 20-50 years. It is rising at about 0.5 per cent annually. Doubling of concentration of CO_2 over pre-industrial level is used as an index for estimating the changes in climate in climatic models.

Chlorofluorocarbons (CFCs) are products of modern industry. *Ozone* occurs in the stratosphere. Ultra-violet rays convert oxygen into ozone. Thus, ultra violet rays do not reach the earth's surface. The CFCs which rise into the stratosphere destroy the ozone. This process is called ozone depletion. The ozone concentration in the stratosphere has been called the *ozone hole*. This hole allows ultraviolet rays to pass through the

Efforts have been initiated for the reduction of GHGs into the atmosphere. The most important one is the Montreal Protocol, proclaimed in 1997. This protocol came into effect in 2005, ratified by 197 countries. The protocol bounds the 35 industrialised countries to reduce their GHG emissions by the year 2012 to 5 per cent less than the levels prevalent in the year 1990.

The increasing trend in the concentration of GHGs in the atmosphere may, in the long run, warm up the earth. Once the global warming sets in, it will be difficult to reverse it. The effect of global warming may not be uniform everywhere. Nevertheless, the adverse effect due to global warming will adversely affect the life supporting system. Rise in the sea level due to melting of glaciers and ice-caps and thermal expansion of the sea may inundate large parts of the coastal area and islands, leading to social problems. This is another cause for serious concern for the world

community. Efforts have already been initiated to control the emission of GHGs and to arrest the trend towards global warming. Let us hope the world community responds to this challenge and adopts a lifestyle that leaves behind a livable world for the generations to come.

One of the major concerns of the world today is global warming. Let us look at how much the planet has warmed up from the temperature records.

Temperature data are available from the middle of the 19th century mostly for western Europe. The reference period for this study is 1961-90. The temperature anomalies for the earlier and later periods are estimated from the average temperature for the period 1961-90. The annual average near-surface air temperature of the world is approximately 14°C. The time series show anomalies of

annual near surface temperature over land from 1856-2000, relative to the period 1961-90 as normal for the globe.

An increasing trend in temperature was discernible in the 20th century. The greatest warming of the 20th century was during the two periods, 1901-44 and 1977-99. Over each of these two periods, global temperatures rose by about 0.4°C. In between, there was a slight cooling, which was more marked in the Northern Hemisphere.

The globally averaged annual mean temperature at the end of the 20th century was about 0.6°C above that recorded at the end of the 19th century. The seven warmest years during the 1856-2000 were recorded in the last decade. The year 1998 was the warmest year, probably not only for the 20th century but also for the whole millennium.

Greenhouse gases rising alarmingly

Ancient Air Bubbles Buried In Antarctic Ice To Shed More Light On Global Warming

It has happened in the North Atlantic and may happen again. According to scientists, global warming could lead to prolonged chill



ICE AGE cometh

Air pollution biggest killer in Southeast Asia, says WHO

A smoky haze that shrouded parts of Southeast Asia this month, forcing schools and businesses to close, is just one element of an air pollution problem that kills hundreds of thousands of people in the region annually, the World Health Organisation said.

Air pollution in major Southeast Asian and Chinese cities ranks among the worst in the world and contributes to the deaths of about 500,000 people each year, said Michal Krzyzanowski, an air quality specialist at the WHO's European Center for Environment and Health in Bonn.

Drifting smoke from purposely set forest fires in Indonesia caused Malaysia to declare a state of emergency last week in two areas outside Kuala Lumpur. Parts of Thailand were also blanketed in the haze.

Malaysia said hospitals reported a 150% increase in breathing problems and seven people who had a history of respiratory problems reportedly died. The government could not comment on the deaths.

Worldwide, air pollution contributes to some 2.5 million deaths each year, the agency in Malaysia said. It said air pollution is predicted to become a major health problem in the region.

The haze, blamed on dry-season burnt land on Sumatra island, is an annual problem.



...the research station for the European Project for Ice Coring in Antarctica.

...carbon dioxide and other greenhouse gases collected at the station.

...did not get as far as humans have," said Richard B Alley, a geosciences professor at Pennsylvania State University who is an expert on ice cores. "We're changing the world really hugely — way past where it's been for a long time."

James White, a geology professor at the University of Colorado, Boulder, not involved with the study, said that although the ice-age evidence showed that levels of carbon dioxide and the other greenhouse gases rose and fell in response to warming and cooling, the gases could clearly take the lead as well.



This file photo shows dead fish lying on the dried bottom of the Ding An reservoir in China's Hainan island. An island gets a large part of its rain during the typhoon season. The problem is, for two years now, there has not been a single typhoon, and


Gangotri is shrinking 23m every year

Geneva: Himalayan glaciers, including the Gangotri, are receding at among the fastest rates in the world due to global warming, threatening water shortages for millions of people in India, China and Nepal, a leading conservation group said on Monday.

The Worldwide Fund for Nature (WWF) said in a new study that Himalayan glaciers were receding 10-15 metres per year on average and that the rate was accelerating as global warming increases.

In India, the Gangotri glacier is receding at an average rate of 23 metres per year, the study said.

"Himalayan glaciers are among the fastest retreating glaciers globally due to the effects of global warming," the WWF said in a statement. "This will eventually result in water shortages for hundreds of millions of people who rely



This image shows how the Gangotri glacier terminus has retracted since 1780. The contour lines are approximate. (Image by Jesse Allen, Earth Observatory; based on data provided by the ASTER Science Team)

"The rapid retreat of Himalayan glaciers will increase the vulnerability, causing the WWF's programme. This situation means that water levels in the northern region are a concern. The WWF is a leading conservation group. The study is a statement. This will eventually result in water shortages for hundreds of millions of people who rely on glacier-dependent rivers in India, China and Nepal," it said.

Himalayan glaciers feed seven of Asia's greatest rivers — Ganga, Indus, Brahmaputra, Salween, Mekong, Yangtze and Huang He

Write an explanatory note on "global warming".

EXERCISES

1. Multiple choice questions.
 - (i) Which one of the following is suitable for Koeppen's "A" type of climate?
 - (a) High rainfall in all the months
 - (b) Mean monthly temperature of the coldest month more than freezing point
 - (c) Mean monthly temperature of all the months more than 18° C
 - (d) Average temperature for all the months below 10° C
 - (ii) Koeppen's system of classification of climates can be termed as :
 - (a) Applied (b) Systematic (c) Genetic (d) Empirical
 - (iii) Most of the Indian Peninsula will be grouped according to Koeppen's system under:
 - (a) "Af" (b) "BSh" (c) "Cfb" (d) "Am"
 - (iv) Which one of the following years is supposed to have recorded the warmest temperature the world over?
 - (a) 1990 (b) 1998 (c) 1885 (d) 1950
 - (v) Which one of the following groups of four climates represents humid conditions?
 - (a) A—B—C—E
 - (b) A—C—D—E
 - (c) B—C—D—E
 - (d) A—C—D—F
2. Answer the following questions in about 30 words.
 - (i) Which two climatic variables are used by Koeppen for classification of the climate?
 - (ii) How is the "genetic" system of classification different from the "empirical one"?
 - (iii) Which types of climates have very low range of temperature?
 - (iv) What type of climatic conditions would prevail if the sun spots increase?
3. Answer the following questions in about 150 words.
 - (i) Make a comparison of the climatic conditions between the "A" and "B" types of climate.
 - (ii) What type of vegetation would you find in the "C" and "A" type(s) of climate?
 - (iii) What do you understand by the term "Greenhouse Gases"? Make a list of greenhouse gases.

Project Work

Collect information about Kyoto declaration related to global climate changes.