ENVIS-SDNP-NEWSLETTER

"Climate Change"

Annual issue dedicated to Sustainable Development Network Program-2006

(Funded by Indo-Canadian Environmental Facility-ICEF)

Indian Institute of Tropical Meteorology, Pune

Editors's Desk:

We are very happy to present this issue of ENVIS Newsletter which is dedicated to SDNP (**S**ustainable **D**evelopment **N**etwork **P**rogramme) of IITM on the subject area "Climate Change". The SDNP is operational at our institute for the past one year. Since it is the introductory issue for SDNP, a basic article on "climate change" is included. It was very timely that an International event on climate change was organized at IITM during March 2006. A brief summary of this event covering the scientific highlights are included in this issue. This issue also focuses on some new and basic aspects related to air pollution: Vehicular pollution problems in India and the atmospheric pollutants. In addition to this some regular features related to Antarctic ozone hole and particulate matters which forms the integral part of air pollution in recent time are also included. We are pleased to mention that an independent website devoted to SDNP of IITM has been launched . The main ENVIS site in two other languages Hindi and Marathi has also been developed. Another feature of the website is the inclusion of web based abstracting service. Contributions based on air pollution and related projects from various scientific communities and research groups are always welcome to improve the depth of the bulletin.

G. Beig **G. B. Pant**

Editors

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ENVIS Support TEAM:

Programme officer:
Shilpa Jain

Technical support:
Abhishek Solanki
Himanshu Pathak

Atmospheric Pollution and Climate Change via Energy Lifeline: Are they two different issues?

"The major culprit for both atmospheric pollution and climate change to a large extent, is common namely, emissions from fossil fuel burning. However, these two problems have been largely addressed by separate community of scientists and policies. This article deliberates upon the reasons for this separation, but also describes the need of integrated approach for effective policy."

Our demands for energy, transport and commodities have been easily satisfied by the availability of gasoline, petrol and diesel what we commonly name as 'fossil fuel', The fossil fuel may also be termed as lifeline for energy as it provides over 80% of the current global energy supply. In recent time, it is increasingly becoming expensive due to hike in crude oil cost but there is no problem in its availability. The combustion of fossil fuel leads to emissions of several greenhouse gases (GHGs) lead by carbon dioxide followed by methane (CH_4) and nitrous oxide (N_2O). These GHGs accumulate in the atmosphere by transport, warming its lower layers and cools upper layer above 15 km causing knock-on effects in the Earth System. All these gases are chemically rather inert due to their longer lifetime and hence difficult to remove from combustion emissions. Carbon dioxide is the major problem. The main strategy for reducing carbon dioxide emission which is the cornerstone of any long-term climate policy is - emission prevention. Prevention can be achieved broadly by two processes in terms of structural changes in the energy sector: (1) improved efficiency and carbon-free renewable energies. So try to use more and more non-conventional sources of energy; and (2) by behavioral changes that is reduced energy use. This is difficult in this modern age of fast life and technology enhancement.

The above aspect is related to long-lived species and hence addressed the climate change issues. However, as we all know that fossil fuel combustion also emits conventional air pollutants like carbon monoxide, volatile organic compounds, carbonaceous aerosols called soots, oxides of nitrogen and sulfur dioxide. Some of these gases / compounds react in the atmosphere to form secondary pollutants such as ozone, suspended particulate matters, nitrate and organic matter, which impact on ecosystems and human health. All these compounds have relatively very short life time as compared to above mentioned GHGs but very effective for immediate local damage. Changing levels of ozone have implications for human health and vegetation growth while increasing NO_X level can adversely affect the quality of ground water and contribute to eutrophication processes. Breathing ozone, even at relatively low abundances, is correlated with pulmonary damage and asthma attacks. It is estimated that by year 2010 over 4 billion people will be living in eastern and southern Asia. India dominates this region in terms of population growth. India has a high economic potential, and industrial activities as well as transportation are growing rapidly. At current growth rates, Asia energy demand will be doubling every 12 years. Developed countries have reduced these impacts initially by improving energy production efficiency and, more recently, using cheap end-of-pipe emission control technologies. The developing countries are in the process of improving technology and implementing some standard norms but, still long way to go.

Are they two different issues?: Policy Separation

So with the above discussion we can categorically conclude that reducing fossil fuel use would address both climate change and atmospheric pollution. However, fossil fuels provide over 80% of the current global energy supply, and will continue to be the dominant energy source for decades to come. Furthermore, greenhouse gases differ from conventional atmospheric pollutants in their physico-chemical properties, leading to differences in the relative atmospheric longevity and ease of removal from combustion effluents. This is the major reason that in recent decades, separate policy frameworks have been developed for atmospheric pollution and climate change. A difference based on the impacts caused by purely long and short life atmospheric species.

Atmospheric pollution policy has developed faster than climate change policy, primarily because of cheap end-of-pipe control technologies for air pollution derived from fossil fuel combustion. Successful air pollution abatement is also due to short pollutant lifetimes, which mean impacts occur relatively close to emission sources, hence allowing local-regional scale solutions. Conversely, greenhouse gases are well mix throughout the global atmosphere due to their long life. As a result, GHG induced climatic effects cannot be traced back to specific sources or regions. Climate change policy therefore requires global commitment, irrespective of local regional emissions and impacts whereas the air pollution problem is rather a regional problem and local commitment is easier to achieve.

Why Policy Integration?

In recent years, it has been increasingly recognized that air pollution and climate change are linked in several ways, and that they could be beneficially addressed by integrated policy. The push for policy integration comes mainly from consideration of implementation costs. This is particularly true in developed countries, where cheap air pollution control technologies are already widely implemented, and further reductions are likely to require structural and behavioral measures. In developing countries, current economic growth and the supporting development of energy production systems, provide the

opportunity to tackle atmospheric pollution and GHG emissions problem simultaneously. Immediate investments in conventional sources of energy or existing carbon-free energy technologies would seem to be the solution. However, for major developing countries it is economically attractive to use large domestic coal reserves as found in India, hence end-of-pipe technologies will be required both for air pollution and for GHGs. However, it should be noted here that coal also provides the emissions of several pollutants, in particular, the black carbon and CO. For GHGs, end-of-pipe technologies such as carbon dioxide capture and storage are still in the research and development stage and one can not wait endlessly.

Is policy integration a challenge?

The real meaning of policy integration is finding the mix of endofpipe, structural and behavioral measures that meet atmospheric pollution and climate change targets at the lowest optimal cost. However, the ultimate goal of climate change policy is not to reduce GHG emissions, but to avoid dangerous anthropogenic interference with the climate system. For integration, several processes in the atmosphere-climate system must be considered. As for example, processes by which air pollution can affect climate, and by which climate change can affect air pollution. In the integrated system, policies are a feedback that is targeted to control the effects of fossil fuel combustion. There are also inherent feedbacks in such a system; for example, the effects of pollution or global warming on various components of the system such as the biosphere or society. Considerable research is required to understand just how strong policies can or should be, given the existence of such inherent feedbacks. However, integrated models are emerging that couple economics, atmospheric chemistry, climate and ecosystems, and which through sensitivity runs, are starting to explore the effects of policies and inherent feedbacks. It appears therefore, that atmospheric pollution and climate change policy and science are now mature enough to allow a systematic approach to policy integration. In India, our scientific progress on the coupled chemistry-climate models which takes into account the local emission inventory of air pollutants as input to provide the climate change scenario, is quite adequate and such models are being run e.g. at Indian Institute of Tropical Meteorology, Pune (see, Beig and Brasseur, Influence of anthropogenic emissions on tropospheric ozone and its precursors over the Indian tropical region during a Monsoon, Geophysical Research Letters, **33**, L07808, 2006). The atmospheric pollutant emission inventory are also being developed in India under different scientific programmes like NATCOM project of MoEF, New Delhi. However, the integration of such chemistry-climate models with socio-economic and ecosystem module is lacking which should be the immediate priority. Thereafter the joint integrated effort by both active scientists using those models with that of policy makers would be required.

CLIMATE CHANGE

For future climate impact assessment estimation, emissions for various atmospheric constituents is very essential. In recent years, there has been a increased interest in the influence of anthropogenic aerosols on the climate through both direct and indirect radiative effects. Several extensive investigations and coordinated field campaigns have been carried out to assess the impact of anthropogenic aerosols on climate. Determination of the radiative effects of aerosols is currently one of the challenging problems in climate research. Aerosols influence the earth's radiative balance directly by scattering incoming short-wave radiation back to space and indirectly through their influence on cloud properties. The indirect effect is considered to be one of the largest uncertainties in current global climate models (GCM's). Accurately estimating the indirect radiative effect of aerosols requires understanding of the role of aerosols in influencing cloud properties. Several investigations have focused on the determination of indirect effect, but most of them were confined to the anthropogenic sulphate aerosols.

While there exist a few studies on the direct radiative forcing, studies on indirect effect of aerosols are rather a few over South Asian regions. Several experiments and simulations have attempted to quantify the radiative impacts of natural aerosols, particularly sea salt, dust and oceanic sulphate, yet large uncertainties persist in these estimates especially due to fewer data over oceans, especially on sea salt aerosols. To accurately predict the impact of dust aerosols on climate, the spatial and temporal distribution of dust is essential. Many global models do not accurately simulate regional distribution of dust due to their low grid resolution and inaccuracy of dust source function. More extensive measurements of the dust optical properties, along with the vertical distribution of the dust layer, are needed to reduce the uncertainty of the climate response to dust aerosols.

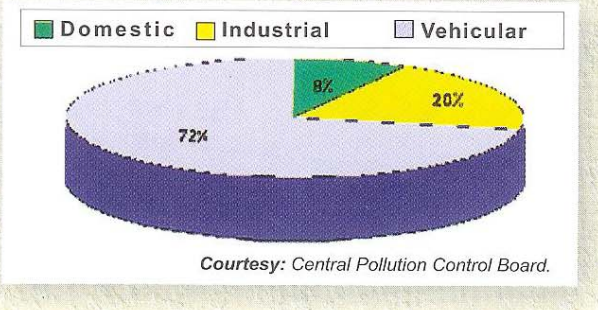
In the South Asian region increasing concentration of suspended particulate matter poses a serious threat to the atmospheric composition and air quality than compared to gaseous pollutants. While the decrease in the oxidising capacity of the tropical troposphere is becoming a serious issue in the near future, presently it is the large atmospheric radiative forcing caused by absorbing aerosols and its possible effect on the regional climate change is of concern.

The International Panel on Climate Change (IPCC) has concluded that human activity is interfering with the planet's climate system, causing the Earth to become warmer. The increased concentrations of greenhouse gases (GHG) in the atmosphere are the leading cause of global warming which is enhancing the planet's natural 'greenhouse effect'. These increased levels of GHG are a result of intense industrial activity. The planet has been getting warmer over the past 100 years. In

fact, the 1980's and 1990's were the warmest decades on record, and the 20th century was the warmest in the past 1000 years. All estimates indicate that the warming will continue. According to the IPCC, average global temperatures are expected to rise by 1.4° to 5.8°Celsius over the next century. To put that into perspective, today's average temperatures are only about 5° warmer than they were during the last Ice Age. However, this small change in average temperature was enough to melt the vast ice sheets that once covered much of North America. India's energy-related carbon emissions have grown nine-fold over the past four decades.

Vehicular Pollution Problems in India

CONTRIBUTION OF VARIOUS SECTORS TO AMBIENT AIR QUALITY IN MAJOR CITIES



Courtesy: Central Pollution Control Board.

There are three major sources of air pollution from human activities: stationary or point, mobile, and indoor. In developing countries especially in the rural area, indoor air pollution from using open fires for cooking and heating may be a serious problem. Industries, power plants etc. are the causes of stationary air pollution. But in urban areas both developing and developed countries, it is predominately mobile or vehicular pollution that contributes to air quality problem. The worst thing about vehicular pollution is that it cannot be avoided as the vehicular emissions are emitted at the near-ground level where we breathe. Pollution from vehicles gets revealed through symptoms like cough, headache, nausea, irritation of eyes, various bronchial problems and visibility and are due to discharges like CO, unburned HC, Pb compounds, NO_X, soot and aldehydes, among others, from the tail pipes of vehicles.

VEHICULAR POLLUTION

- High vehicle density in Indian urban centers.
- Older vehicles predominant in vehicle vintage.
- Inadequate inspection and maintenance facilities.
- Predominance of two stroke two wheelers.
- Adulteration of fuel and fuel products.
- Improper traffic management system and road conditions.
- High levels of pollution at traffic intersections.
- Absence of effective mass rapid transport system & intra-city railway networks.
- High population exodus to the urban centers.

A MEGA INTERNATIONAL EVENT ON CLIMATE CHANGE AT IITM

A major international scientific event took place at the Indian Institute of Tropical Meteorology, Pune during 3-11 March 2006. Two apex scientific bodies namely, the Scientific Committee of International Geosphere Biosphere Programme (IGBP) and the Joint Scientific Committee of the World Climate Research Programme (WCRP) had their deliberations during the week. This event was a historic one for Pune, being the largest gathering of world leaders on global change research ever to happen in the region attended by about 95 international delegates.

Several scientific policy decisions and priorities in climate change research at international levels have been discussed. As a part of this activity, a one-day "**IGBP workshop on Global Change**" was arranged on the opening day on 3rd March' 2006 which had direct relevance to the subject area of the IITM's Environmental Information System (ENVIS) center and Sustainable Development Network Programme (SDNP). The ENVIS and SDNP programmes at IITM are sponsored by Ministry of Environment and Forest, New Delhi. This event was planned on this occasion with an objective to have an opportunity to highlight our research activities and their progress in the field of global climate change.

The IGBP programme in India is coordinated by Indian National Science Academy (INSA), New Delhi. The workshop at Pune was targeted to provide a comprehensive and authoritative background of Indian research programmes on the IGBP specialized area and prioritization of tasks to address the relevant scientific concerns in general and national concerns in particular. It provided an exposure to wide spectrum of multidisciplinary, multi-institutional research on the subject being carried out in India. The workshop has been conducted in three sessions with eleven invited talks mostly delivered by the Indian scientists working in various disciplines of IGBP interest. About 95 delegates from India and abroad participated in the workshop. Dr. Gufran Beig (IITM, Pune), coordinated the proceedings of the inaugural function. The workshop was inaugurated by Padam Bhusan Prof. Madhav Gadgil who highlighted the human intervention in the geo-biosphere and urged the scientific community to take necessary steps to protect the ecosystem of the globe.

The workshop began with two key note presentations from Prof. Carlos Nobre ((Chairman, Scientific committee of International Geosphere-Biosphere Programme, SC-IGBP) and Prof. AP Mitra (Past Chair, Indian NC-IGBP): Prof. Nobre spoke on "Improving the Sustainability of the Living Earth: Challenges for the Next Decade of IGBP Science" and Prof. Mitra spoke on "India and IGBP: New Initiatives". Dr Nobre in his talk mentioned that India is a good example for developing country which tops in the environmental science research. He added that India can play model role in global change issues. He highlighted many tipping

points in Earth Science system. For example, Indian Summer Monsoon is one of them. Integrated approach and interdisciplinary understanding is needed for researching the earth system. Rapid changes are occurring on planet and human activity is the main driver. There are many issues that are of societal concerns and to tackle them many challenges are to be met in the next decade. To dealing with such issues earth system science partnership is essential to maintain global sustainability. The vital issues are water resources, food provision, human health, environment to be resolve with global collaboration. Finally, Prof. Nobre stressed the need of introducing human dynamics in the earth system modeling. He ended with the vision and goal of IGBP i.e. to provide scientific knowledge to improve the sustainability of the living earth. Prof. A.P. Mitra (National Physical Laboratory, New Delhi) in his key note address provided the brief overview of Indian research programme and scientific progress in the field of global change in India which include studies related to palaeo-climate, atmospheric sciences, oceans, urbanization, climate change and its impacts on vulnerable sectors (like agriculture, water resources, human health, coastal zones, energy and infra-structure), etc. In recent years, India has also actively participated in several South Asian regional programmes related to atmospheric aerosols, mega cities urbanization, impacts of climate change on mountain region and on water resources and helped the participating countries with its expertise in those areas. Under India's initial National Communication Project (NATCOM), a whole suite of activities were undertaken for preparation of national inventories of Greenhouse Gases in which development of India specific emission factors for several sectors was a key initiative undertook by India scientists. Some new initiatives relevant for the IGBP activities which have been recently undertaken in India include participation in international Anthropogenic Brown Cloud (ABC) program and South Asian Rapid Assessment Programme under MAIRS program. Following the keynote presentations, Prof. D. R. Sikka (Chair, Project monitoring committee of weather and climate research programme of department of science and technology, New Delhi) discussed "Global Change An Indian Perspective with respect to Weather and Climate". He described the major changes in the region over the last fifty years including population increase, industrialisation, deforestation and water resource development, and noted direct consequences such as increased anthropogenic aerosol loading. Other important changes include a 5% reduction in decadal monsoon rainfall over India in the last 30 years.

Dr. Sikka outlined past and future field campaigns focussed on the roles of land, atmosphere and ocean changes on the dynamics and long-term changes of the monsoon. He described how biogeochemical cycles, land use change, greenhouse gas emissions and aerosols can all affect the monsoon in different ways.

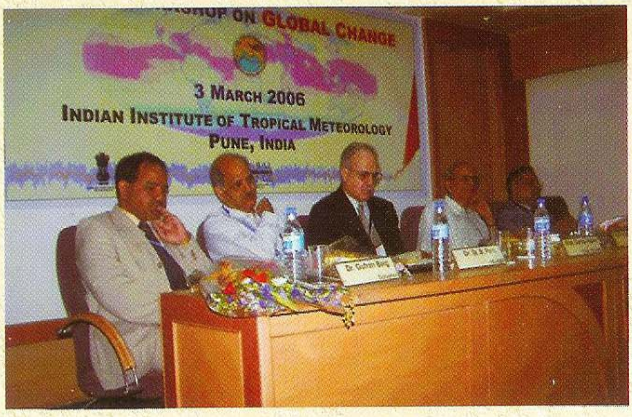
Prof. Sulochana Gadgil (Indian Institute of Science, Bangalore) spoke on "CLIMAG for Sustainable Development: The Challenges Ahead", noting the importance to agriculture of accurate predictions of both El Niño occurrence and characteristics. Analyses of crop yield variations clearly show that the largest yield variations occur in the growing seasons with the highest rainfall, thus improved prediction of these seasons is of greatest value to the agricultural sector. The interannual variation of the Indian Summer Monsoon Rainfall (ISMR) is known to be linked with the phases of ENSO with high propensity of droughts during El Nino, excess rainfall during La Nina. It is suggested that the link with ENSO had weakened in the recent decades.

Prof. BN Goswami (Indian Institute of Science, Bangalore) posed the question "How Does North Atlantic SST Influence the Indian Summer Monsoon on Decadal and Longer Timescales?" He explained the close link between the Atlantic Multi-decadal Oscillation (AMO) and multi-decadal variability of the Indian summer monsoon rainfall. The AMO, the monsoon multi-decadal oscillation and multi-decadal amplitude modulation of El Nino are now known to all follow a global quasi-sixty-year coupled ocean-atmosphere oscillation. This revelation should improve the predictability of monsoon multi-decadal oscillations. Furthermore, the deep first baroclinic vertical structure of the Indian monsoon indicates that the Indian summer monsoon is not driven by the north-south differences in surface temperature, but by the meridional gradient of tropospheric heating.

Dr. Gufran Beig (IITM, Pune) described Indian research in atmospheric chemistry, including work on greenhouse gas emissions and the resultant climate change. He described progress in global and regional scale atmospheric chemistry modelling, GIS-based statistical modelling for gridded emission inventories, and model simulations of the effects of anthropogenic emissions on monsoon and tropospheric pollutant levels (including ozone, nitrogen oxides, carbon monoxide and hydrocarbons) in the Indian tropics. The maximum variations simulated during 1990s in ozone concentrations are 5-20% near the surface, 5-7% in the lower free troposphere and 3-5% in the upper troposphere for the month of July. The decadal variation in carbon monoxide for July is highest (10-18%) in the boundary layer around 20-30°N, but in most of the free troposphere, the variation is around 4-8%. The maximum decadal increase in nitrogen oxides is 20-50% in the boundary layer.

The impact of pollutants on ozone concentrations is estimated to be largest during the monsoon, which is characterised by strong convective activity, when effects extend up into the free troposphere; this is in contrast to the early post monsoon. Pollutant emissions are country-specific and systematic inventories are rare in Asia. However, biofuels (wood, kerosene and coal) are a major energy source in rural India (72% of the population), and biofuel combustion is known to be the dominant source of Indian carbon monoxide emissions. The distribution of tropospheric ozone and its precursors over India are significantly affected by such emissions along with long-range transport.

Dr. A Jayaraman (Physical Research laboratory, Ahmedabad) summarised "Present Understanding on Aerosols and Aerosol Radiative Forcing over the South Asian Region" focussing on Indian studies of aerosol radiative forcing and cloud properties. He made it clear that there exists a large aerosol radiative forcing, particularly the trapping of radiation within the atmosphere over the Indian main land and the surrounding ocean region during winter months. The values can be still larger during summer due to increased solar flux, higher concentration of wind blown dust particles, and higher mixed layer depth which helps in accommodating more aerosols in the vertical direction. The time is not very far when we can say in clear terms the effect of aerosols on climate to our policy makers.



Dr. G.B.Pant (IITM, Pune) discussed progress on "High Resolution Palaeo-Climatic Reconstructions over India", highlighting the potential of tropical tree-rings for inter-annual resolution climate reconstructions for India over the past few centuries. Dendroclimatic reconstructions of the pre-monsoon summer climate of the Western Himalaya since the early 18th century show no significant long-term trend, and suggest that the summer climate was not much different from the present. Tropical species like teak have shown good potential to reconstruct monsoon variability over the past 300-400 years. Dr. K Rupakumar (IITM, Pune) described climate change in India and concluded that, in spite of considerable interannual variability, the Indian summer monsoon has been relatively stable over the last two centuries on seasonal and countrywide scales. In addition to a general sharing of global warming, India displays a notable diurnal / seasonal asymmetry in temperature trends. All coupled models suggest general warming and enhanced rainfall over India towards the later half of the 21st century under increased greenhouse gases, although the details of rainfall enhancement especially regional distribution considerably differ between models. Dr.R.Krishnan (IITM, Pune) described "Coupled Air-Sea Interactions in the Tropical Indian Ocean and Monsoon Environment" stressing that the Indian Ocean is a major control on the dynamics of the Indian monsoon; a weakening of the monsoon over land leads to higher precipitation over the Indian Ocean. Krishnan outlined progress in Indian monsoon predictions (in particular, monsoon droughts and the intra-seasonal variations of the coupled ocean-atmosphere system) as well as remaining challenges. Finally, Dr. Dileep Kumar (National Institute of Oceanography, Goa) discussed IGBP-related marine research in India. He noted that the Arabian Sea is a carbon dioxide source while the Bay of Bengal is a sink, and he emphasised that integrated studies focussing on land-atmosphere-ocean interactions are required to monitor climate change in this region.

ANTARCTIC OZONE HOLE COULD CLOSE BY 2050

The hole in the ozone layer over Antarctica may close within 50 years as the level of destructive ozone-depleting CFCs in the atmosphere is now declining. The major culprit in the production of the ozone hole is CFCs and they have started to decline in the lower atmosphere. "We think the ozone hole will recover by about 2050", said Fraser, from CSIRO's atmospheric division and a lead author of UN report on the ozone layer released.

The report said ozone-depleting gases in the upper atmosphere had been at or near their peak in 2000, but the world was making steady progress towards the recovery of the ozone layer. It said scientific data showed levels of ozone-depleting gases in the lower atmosphere were "declining, albeit slowly", but the ozone would be vulnerable for a decade. The ozone layer is essential for life on earth, shielding the earth from the harmful ultraviolet-B-radiation from the sun and completely screening out lethal UV-C radiation. Chlorine from chlorofluorocarbons CFCs is responsible for destroying part of the ozone layer over Antarctica. CFCs have been widely used since the 1930s in refrigerators, and air conditioners and remain in the atmosphere for decades. Under the 1987 Montreal Protocol, developing countries committed themselves to halving consumption and production of CFCs by 2005 and to achieving an 85 percent cut by 2007. According to a report, in 1950 the atmospheric level of chlorine from CFCs had been zero, rose to a peak of 2.15 parts per million in 2000, but had fallen one percent a year since 2000. "We are now at a point where the atmosphere can actually remove CFCs faster than they are being released into the atmosphere," said Fraser, adding the actual decline in CFCs had not been measured when the UN report was compiled in 2000.

The UN report, the latest in a series of four-yearly reports reviewing the ozone layer since the Montreal Protocol, said the reduction in CFCs proved the protocol was working. But the report warned that the hole over Antarctica would only close fully if countries continued to adhere to the protocol and if there were no other factors adversely affecting the ozone layer like a major increase in greenhouse gases. "These results confirm that the Montreal Protocol is achieving its objectives. During the next decades we should see a recovery of the ozone layer," said a report.

DID YOU KNOW ?

The average temperature of the Earth's surface with the greenhouse effect is 15°C. Without the natural greenhouse effect, the temperature would be -18°C.
Fact: Greenhouse gases are both natural and manmade.

Carbondioxide: CO_2 is the most important natural and manmade greenhouse gas, and the major contributor to global warming. Plants and animals release CO_2 as they breathe. The burning of fossil fuels and global deforestation are the major manmade sources of CO_2.

Methane: It is produced naturally when vegetation is burned, digested or rotted without the presence of oxygen. Today, large amounts of methane are released by rice paddies, grazing cattle, rotting material in garbage dumps or landfills, and by fossil fuels.

CFCs: Chlorofluorocarbons are manmade industrial chemicals used as refrigerants in refrigerators, Propellants in aerosol cans, Foaming agents and cleaning solvents. CFCs damage the ozone layer.

Nitrous-oxide: It also occurs naturally in the environment. In recent years, quantities have increased significantly due to human activities. Today, large amounts are released from the use of chemical fertilizers and the burning of fossil fuels.

The Greenhouse Effect and Global Warming For hundreds of years the Earth's atmosphere has changed very little. It has kept the right temperature for plants and animals, including humans, to survive quite comfortably. Our modern lifestyle and the growth in global population are causing a huge increase in the world's use of energy. Much of the energy we use to power our vehicles, produce electricity and manufacture products comes from fossil fuels. Much of the energy we use to power our vehicles, produce electricity and manufacture products comes from fossil fuels. When burned, these fossil fuels add large amounts of greenhouse gases especially carbon dioxide.If we keep going the way we are today, humans will be responsible for doubling the amount of carbon dioxide in the air before the year 2050.The addition of greenhouse gases from human or manmade sources is throwing our atmosphere and the natural greenhouse effect out of balance. It would appear that the atmosphere is trapping too much heat and causing the Earth to heat up. This is known as GLOBAL WARMING.

Fact: By the year 2050, if we keep increasing the amount of greenhouse gases in the atmosphere, the world could be 3 degrees Celsius warmer than it is today.

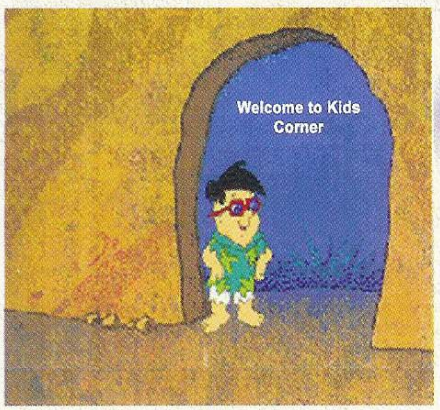
Did You Know? Some of our energy sources, known as fossil fuels like coal, oil, natural gas have been trapped beneath the ground for millions of years. They release large quantities of greenhouse gases.

Did You Know? Plants and trees are natural regulators of the atmosphere. They help keep things in balance. Destroying our forests, or deforestation, upsets this balance and actually results in increasing amounts of carbon dioxide in the atmosphere.

Fact: Saving energy helps to slow global warming. Saving energy also helps solve other environmental problems like acid rain and smog.

Recent update in ENVIS-Page : Kids Corner

The ENVIS centre WEB page of IITM has been greatly enriched in recent time in terms of its content and information to attract the attention of the society and common person. A most needed addition is the designing totally a new WEB page in regional (Marathi) and national language (Hindi) which is one of its kind for this subject area. The details of this WEB site will be included in the subsequent newsletters.



The kid's corner on the main ENVIS site has been totally revampled after getting feedback from several quarters. It is innovative and made much more colourful. The information related to weather and climate, in the form of questions and answers has been added with animated pictures to make it illustrative. Please do visit. We hope that you will like our latest effort.