Clouds over climate change

The IPCC is under a cloud, but the fact is that global temperatures are on the rise. That the study of climate change is an uncertain science does not mean that it can be discounted. The world should prepare for the worst-case scenario, says **BHASKAR BALAKRISHNAN.**

As global climate models become more accurate, it may be possible to predict changes more precisely. — Reuters

The Intergovernmental Panel for Climate Change's (IPCC) careless endorsement of the speculation that Himalayan glaciers would vanish by 2035 has raised questions about its credibility. The validity of its conclusions on climate change have come under question. It is, therefore, necessary to revisit the scientific basis of some of the more widely discussed conclusions, particularly as we are being called upon to make major adjustments in our way of life.

The atmospheric CO_2 equivalent levels have been accurately measured for a number of years, and it is a fact that the are increasing at two parts per million by volume (ppmv) annually, with the present level being 386 ppmv. It is also true that over the past 400,000 years, the CO2 levels have oscillated between 190 and 300 ppmv, so the situation today is unprecedented.

It is also a fact that global mean temperatures have risen over the years. The precise indicator, the five-year average global mean temperature, has gone up by 0.8°C since 1910, with the period 1945-1980 showing no increase, for reasons that remain to be understood. Around this trend, the annual average temperature variations are around 0.2°C. These are well-established scientific facts. Beyond this, we enter areas of varying uncertainty.

THE NATURAL SYSTEM

The actual climate on the earth is the result of many complex factors, driven largely by energy received from the sun. Solar radiation reaches the earth (1,366 Watts per sq metre), and this varies according to the activity of the sun (0.1 per cent), and distance from the sun (6.8 per cent) . Part of this incident radiation is absorbed (infra red and ultra violet) by the atmosphere, while a large part (visible light) reaches the earth's surface.

Here, it is again partly reflected back into space and partly absorbed, the exact proportion depending on the nature of the land surface, ocean, ice caps, and time of day. The earth's surface emits radiation (infrared) most of which is absorbed by the atmosphere, but some of it goes back into space. The earth's atmosphere itself emits radiation (infrared) both into space and back to the surface, producing the greenhouse effect that effectively raises the earth's average temperature by 33°C. Overall, the energy received from the sun must balance the total energy radiated into space, and this condition determines the average earth temperature.

The earth revolves around its axis in 24 hours, causing large changes in solar energy received at the surface. The atmosphere contains a number of gases, clouds of water, and suspended solid particles, all of which affect its absorption and reflection of radiation. In addition, the oceans, which cover 71 per cent of the earth's surface, can dissolve the gases present in the atmosphere, such as CO_2 and oxygen, essential for marine life. There is continuous and rapid exchange of water between the atmosphere, oceans, ice caps, and land surfaces. Several of the components of the weather system are linked through feedback loops, which are poorly understood.

This incredibly marvellous complex system is in equilibrium, producing the complicated global weather system across the Earth's surface. Into this system, mankind is injecting CO_2 into the atmosphere, raising its level. How will the equilibrium of the earth's climate system change in response? This is the key question facing climate change scientists, whose discipline is part of the study of planetary atmospheres.

CLIMATE SCENARIOS

The tools of science, though formidable, are not enough to measure the precise impact of human intervention on the natural system. While we can calculate with great precision things such as the magnetic moment of the electron (to 1 part in ten billion), or the movement of celestial bodies, we cannot calculate the behaviour of turbulent fluids.

In the case of global weather, the practice is to use a model to represent the earth, and divide the surface and atmosphere into a large number of cells (of size between 1 to 5 degrees latitude and longitude, and 19 vertical layers). A computer programme is used to calculate according to known science, the evolution of the weather in such models.

Similar models are used for weather forecasting.However, the problem is much smaller in time and space, but even so, they are not accurate, as we all know. Forecasts of climate change are inevitably uncertain. Even the degree of uncertainty is uncertain, a problem that stems from the fact that these climate models do not necessarily span the full range of known climate system behaviour.

A variety of global climate models have been used, and they give different predictions for climate change. Under the worst case scenario (a divided, ecologically unfriendly world), by 2100, the change of global average surface temperature compared with 2000 is 2.2°C-4.8°C. This is indeed a wide range and indicates the need for further work in this area.

GREY AREAS

The connection between rise in global average surface temperature, and major climate disturbances, such as heat waves, droughts, floods, cyclones, ocean acidification, and rise in sea levels, is an area of even greater uncertainty. All that can be said on a qualitative basis is that the probability of such events may increase with global warming. As global climate models become more accurate, we may be able to be more precise in predicting such events.

Meanwhile, it is prudent to follow the precautionary principle — preparing for the worst-case scenario — and reduce CO_2 emissions, and this is what the IPCC suggests. But the projected temperature rise of 2°C, arising from a CO_2 level of 450 ppmv, can certainly not be taken as a precise scientific calculation. Much more work needs to be done.

Human society must realise that it is dealing for the first time in history with a global problem which must be dealt with globally, as we would do if we were all passengers on a spaceship facing a problem. In this case, our spaceship is the Earth, and as time goes on, our fates will be increasingly linked together.

(The author is a former Ambassador to Cuba and Greece.
blfeedback@thehindu.co.in)