Placing bets on future climate

Climatology in some respects is like futurology, says S.Ananthanarayanan.

In the1970s, Alwyn Toffler's book, Future Shock, drew attention to the science of predicting social and technological change in the modern world. It began to look like the number of factors that work at the same time makes prediction of how the world would evolve in 50 years to be nearly impossible.

Is climate predictable?

Scientists have doggedly looked at the factors that affect the world's climate, the histories of ice ages, geological records, and the like to get a picture of how the world will warm or cool. While predicting short-range climate change is a classic of uncertainty, on the long range, it is now clear that the earth is gradually warming up.

A major reason is the build up of carbon dioxide, the most abundant 'greenhouse gas', in the atmosphere. A quality of gases is that equal quantities (equal number of molecules) of different gases in the same space all exert the same pressure. But if one warms the gases, then the ones with more complex, and massive molecular structure absorb more heat to get warm. Hence if atmosphere is rich in gases like carbon dioxide or methane, then, it absorbs and retains the heat in sunlight more efficiently. The result is an atmosphere that gradually gets warmer. But the same effect could also affect winds, rainfall, cloud cover, growth of vegetation, which also affect the temperature of the atmosphere and progress in response to different factors. Vegetation, for instance, is a powerful agent that limits the carbon dioxide in the air and also affects rainfall. But vegetation grows more luxuriant in carbon dioxide rich, and hence warmer and moister climes.

There are thus factors that draw the temperature of the earth in both directions. While a trend to rising temperatures is unmistakable, just how fast the earth is warming is an open question.

Computer simulation

The past predictions of climate behavior were based on 'informed best estimates' of the huge number of factors that need to be taken into account. Some of the results were bizarre and the varying of even one factor to a small extent sometimes upset outcomes drastically. The uncertainty in knowing future temperatures to a narrow range frustrated long-range planners, economists, and scientists.

A new tack taken by researchers at the Hadley Centre for Climate Prediction and Research in Exeter is to rely on a range of values, provided by experts, for each variable. Powerful computers then work out the outcome of varying each variable over its range, starting from a hundred years

ago. The value sets that are off the mark in predicting the current state are weeded out and only the others allowed to go on to consider future decades.

The result has been that if current carbon dioxide levels double over the next hundred years, something many experts consider quite likely, then the temperature would rise by 2.4 to 5.4°C. This in turn leads us to how rainfall, vegetation, average sea levels would change and the implications for economy and investments.

Like the Derby?

The method is a lot like how computer savvy punters try to predict the outcome of a series of horse races based on what they know of the horses in each race. Considering that spectacular success at the races would have put an end to that industry, there are some who wonder if we should use the same method to predict climate. The scientists are Exter say that their method is better because it has a 'half-way' checkpoint, which is the current climate. And then, they are predicting a range of temperatures, not a specific result, which is what you need at the races.