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GUEST EDITORIAL

Foretelling the monsoon: Freedom and responsibility

Contrasting monsoon forecast 'confusing' farmers

The India Meteorological Department (IMD) and Banglore based Centre for Mathematical Modelling and Computer Simulation (CMMACS) are at variance on the monsoon prospects that are crucial for the agriculture sector. Commenting on the discrepancy, Secretary General of Confederation of Indian Farmers Association, P. Chengal Reddy said 'such forecasts by two government departments lead to confusion amongst farmers down the line'.

—New Delhi, June 3 (PTI)

Should the IMD monopolise monsoon forecasts?

'The Department of Science and Technology's directive that no agency other than the IMD can make public the annual long-range monsoon forecast could set a dangerous precedent.'

—R. Ramachandran
The Hindu, 29 June 2005

In early June this year, as soon as it became clear that there would be some delay in the onset of the monsoon over Kerala, an extensive discussion began in the print and electronic media of the two publicly available forecasts made in April, for the forthcoming monsoon: one the 'official' forecast released by the IMD and the other, an 'experimental forecast' by the CMMACS. The forecast by CMMACS was revised on 2 June. IMD has predicted normal seasonal (June–September) rainfall (i.e. within one standard deviation) for the country as a whole. Whereas, the CMMACS forecast made in April had suggested excess rainfall for June, the revised forecast suggested a deficit of 34% from the average value, which is much larger than the standard deviation. CMMACS has also predicted a deficit of 12% in July, and an excess of 13% for August from the average values. These differences in the forecasts issued by two institutions within the same Ministry have reportedly created some confusion.

The onset occurred on 5 June, with less gusto than usual. The subdued tempo of the monsoon for the first two weeks of June triggered fears that we may be in for yet another drought in the wake of the one in 2004. Enthusiastic media coverage of the performance of the monsoon and the CMMACS forecast of large deficits in June and July contributed to this widespread concern. However, torrential rains in last ten days almost made up the shortfall in early June. The rainfall for June 2005 is well within the normal range, with the deficit of about 15%. Before the activity of the monsoon picked up, in mid-June came a report that the Department of Science and Technology (DST) had asserted that, only the IMD had the mandate to make public the long-range monsoon forecast. This has triggered a debate on whether this is a violation of the right of scientists to disseminate information on monsoon forecasts derived from models.

The official agency responsible for prediction of the monsoon is the IMD, which has been issuing monsoon forecasts for the government, from 1886. Since 1988, these have been made available to the public. For a run of fourteen years from 1988 onwards, there were no droughts. So, although there were large errors in the forecasts (*Current Science*, 2005, **88**, 1389–1400), there was hardly any criticism. The wake-up call came with the severe drought of 2002, which was not predicted by IMD. Until 2002, the IMD forecasts were primarily based on statistical models developed at IMD, using empirically determined predictors. The operational models at IMD have evolved over the years. Meanwhile several other statistical models based on different predictors and different methods have been investigated at IMD and other institutions. Predictions of the monsoon with models based on laws of physics, have become possible in the last two decades, because of the rapid developments in meteorology and high performance computers. Predictions based on such models of the atmosphere or the coupled ocean–atmosphere system, are readily available from the major international centres. Some 'experimental forecasts' with atmospheric models are also generated at CMMACS, the Indian Institute of Tropical Meteorology (IITM), IIT (Delhi), Space Applications Centre (in collaboration with the National Centre for Medium Range Weather Forecasting), and IMD (in collaboration with the Indian Institute of Science (IISc)). Of these, only the CMMACS forecast is posted on the web and is available to the public.

Despite major advances in atmospheric science, simulation and prediction of the Indian monsoon remains a tough challenge. An assessment of the performance of all the state-of-art atmospheric models in simulating the year-to-year variation of the monsoon rainfall was made possible by the Atmospheric Model Intercomparison Project (AMIP) under which all the models were run for several years with the observed sea surface temperature as boundary condition. Analysis of AMIP runs showed that while droughts occurring in association with El Nino over the Pacific were reasonably well simulated, other droughts (which are about 50% of the total number of droughts) could not be simulated. However, even these models could not predict the impact of the El Nino of 2002 using initial conditions obtained from the observations by May 2002. After the failure of the IMD monsoon forecast of 2002, a meeting was organized at IISc at the request of the then chief of IMD, to analyse the failure of statistical and dynamical forecasts. It was shown that, with the data available prior to the monsoon season, none of the atmospheric models with different groups in the country, could predict the drought. The experience in 2004 was no better (*ibid*). On the other hand, it appears that some of the recently developed statistical models could have predicted the drought of 2002 and deficit rainfall in 2004. Since 2003, the IMD forecasts are based on an evaluation of the various predictions generated from IMD's operational statistical model as well as predictions derived by different groups in the country from different atmospheric and statistical models. At this point, however, the weightages given to the different forecasts are not objectively determined.

The best course before us would appear to be, to make the predictions by all the models public and let the users exercise their own judgement. The problem is that while information on the predictions generated is readily available, critical information on the expected error levels, which is essential for making an appropriate decision, is seldom available for the atmospheric models. Statistical models use a part of the historical data to estimate the model parameters, and test their performance with the remaining data. So the information of their error levels is necessarily generated while developing the models. The atmospheric models are far more complex and extensive simulations are required for assessing their performance and reliability. However, announcing predictions of droughts about the forthcoming season based on models that have not been shown to generate reliable predictions of the monsoon is as unacceptable as arbitrary suppression of information about research results. In this, the meteorological predictions are more akin to results of research on impact of various factors (including drugs) on health, than those in mathematics and particle physics in which the preprint culture has thrived. The risks in publishing results, which can have a large impact on society, from what may be half-baked research were brought out in a recent dispute between the Royal Society and the *Lancet* (*The Hindu*, 24 June 2005). In an information age when, thanks to the '24/7' news cycle, people are constantly exposed to such predictions, there is a greater need for a more rigorous approach to evaluating the predictions which are likely to cause a scare, before putting them in public domain.

Since none of the atmospheric models were able to predict the recent droughts, an objective assessment of the performance of all the models used in the country for generating predictions of the fluctuations of the monsoon and particularly the droughts is a must. The performance and reliability of the models can be compared by running all the models for at least the last 20 years with identical initial and boundary conditions from data available before each monsoon season, in what is called the hindcast mode. The outputs of such an intercomparison should be available to anyone interested in analysing them. The error levels of each model should be objectively assessed from such an exercise. It would also suggest the appropriate weightage for each model in the operational forecast. Furthermore, it would lead to a more focused research effort in developing better models for monsoon prediction. We believe that organizing such an intercomparison should be given a very high priority by DST.

In order to ensure accountability and transparency, it is necessary to stipulate that forecasts from models can be made public, if and only if, information about the performance of the model and the objectively assessed error levels is included. After all, when a company makes a public offering, it is obliged to state the potential risks. Once the responsibility of including such information is accepted, freedom to make the predictions public, irrespective of whether they are generated by an agency of the government or private enterprise, should not be curtailed.

Sulochana Gadgil
J. Srinivasan