

statements hold for the July forecast as well.

Figure 1 shows that the 'Varsha' code picked up the deficit rainfall 3–4 weeks in advance. Therefore, it is not correct to argue that atmospheric models in general do not have the skill of picking up the severe deficit in rainfall for the Indian summer monsoon.

The present author had written a similar letter in January 2010 when the issue regarding the predictive behaviour of Indian monsoon in June 2009 was raised³.

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author. I thank the members of the Monitoring Committee, especially Prof. V. S. Ramamurthy, Dr T. S. Prahlad and Prof. R. Narasimha (Chairman) for their support. It is gratifying that the outcome of the project has been a code that is capable of predicting correct trends more often (15 out of 20) than the other 'black box' codes in operation at various agencies.

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Extreme sea-level events in coastal regions

A recently published report¹ by the Intergovernmental Panel on Climate Change (IPCC) has made an assessment of the extreme climate events. Their past trends, future projections and vulnerability and adaptation to such events are discussed in the report. The report was based on the efforts of both the working groups of the IPCC, WG I, which deals with the science of climate change and WG II, dealing with impacts, vulnerability and adaptation. Extreme climate events such as cyclones, floods, heat waves and extreme rainfall, etc. were assessed.

In coastal regions, extreme sea-level occur in the form of storm surges, apart from tsunamis, which are not driven by climatic factors. Changes in storm surges can occur when there is a change in the forcing that causes the surges. The forcing is mostly caused by cyclones and in some regions by strong winds. Globally, future projections of tropical or extra tropical cyclones do not indicate a clear change in their frequency or intensity¹.

However, rise in mean sea level can affect the return levels of extreme sea-level, even if changes in frequency or intensity of cyclones do not alter considerably in future. Observations based on the analysis of hourly tide gauge data showed an increase in the occurrence of extreme sea-level worldwide². Similarly, various future projections in different ocean basins using regional climate models and storm surge models showed a similar result. Mean sea level rise can modulate extreme events, by which return periods of extreme sea-level events can reduce in future climate, irrespective

of whether changes in storminess occur or not. Many studies, as reported in the IPCC report¹ indicate that the projected changes are primarily due to changes in mean sea level, rather than any changes in storminess.

The east coast of India is particularly vulnerable to the occurrence of storm surges. For the Bay of Bengal, a slight negative trend was observed for the frequency of occurrence of tropical cyclones in the past century³. Projections of extreme sea-level using storm surge modelling by including a mean sea-level rise indicate higher return levels along the northeast coast of India, except in the head of the bay⁴.

For the coastal regions, to counter the impacts of climate change, adaptation practices are much more relevant and effective than mitigation options. It has now been realized that impacts of mean sea-level rise are long-term, but changes in the occurrence of extreme events are of greater concern at present as well.

Various catastrophic events had occurred in the past along the east coast of India, including the super cyclone, which hit the coast of Odisha in 1999 and the tsunami that mostly affected the southern part of the east coast of India in 2004. These events caused enormous damage and destruction and various steps were taken to restore normalcy in the affected regions. However, the question remains whether we have learnt enough lessons from these experiences? Or have we forgotten the lessons learnt from the past and whenever a new catastrophic event occurs in future, we will find out new ways of coping up with such situa-

tions? One way to overcome this problem is to document the practices followed in the past, which will be useful in case of similar situations in future. As part of the second National Communications report⁵, brought out by the Ministry of Environment and Forests, Government of India, various inventories, including those of GHG emissions, have been developed. Similarly, adaptation practices need to be documented, which will serve as a useful guide to be followed in future. This will help in planning future adaptation strategies for the coastal zone, which will be useful in countering impacts of climate change in coastal regions.

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