Empirical forecasting of All-India rainfall for the year 2009

In earlier publications[1,2], we had explained how the monsoon seasonal time series data of regional and All-India rainfall (AIRF) can be decomposed into its six basic modes by the method of empirical mode decomposition. This method helps one to recognize the first mode due to ENSO as being highly non-Gaussian, whereas the remaining progressively less important modes tend to be Gaussian. An advantage of this recognition is the possibility of forecasting the first mode by ANN techniques, whereas traditional time series approaches can be adopted for the data minus the first mode. One year ahead forecast made on independent data kept outside the training part has been demonstrated to be highly significant statistically. We report here the forecast of AIRF for the current monsoon season (June–September 2009) based on the standard data series available at the website (www.tropmet.res.in) of Indian Institute of Tropical Meteorology, Pune. A limitation of this exercise needs to be pointed out. The rainfall data series available at the website is up to 2006 only. Since the data for 2007 and 2008 are required for the present method, we have used the public information provided by India Meteorological Department that the AIRF was respectively 105% and 98% of normal (long-term average) in the previous two years. Figure 1 shows the long-term probability distribution of monsoon AIRF along with the forecast for 2009. It is noted that our method leads to rainfall of 79.32 cm as the point forecast. The standard deviation of the forecast is 3.5 cm. A caution in interpreting the present result is necessary. It is valid for the data series used. Slightly different results could be obtained if other AIRF data series are used. Also, this exercise does not provide any clue to what may happen in individual regions of the country. As is well known, even when AIRF is nearly normal, there can be droughts and floods in various districts of the country. To give a picture of how the present method of forecast has fared in the past, we have constructed in Figure 2, a comparison series between the percentage departure from the normal for actual reported data and the results of one-step-ahead forecast. According to our analysis, the year 2009 will not be a severe drought year like 2002, but would receive less rainfall than the near normal year 2005. In fact, the probability of the rainfall being less than the normal value or the long-term (1871–2006) average of 84.84 cm is as high as 95%.

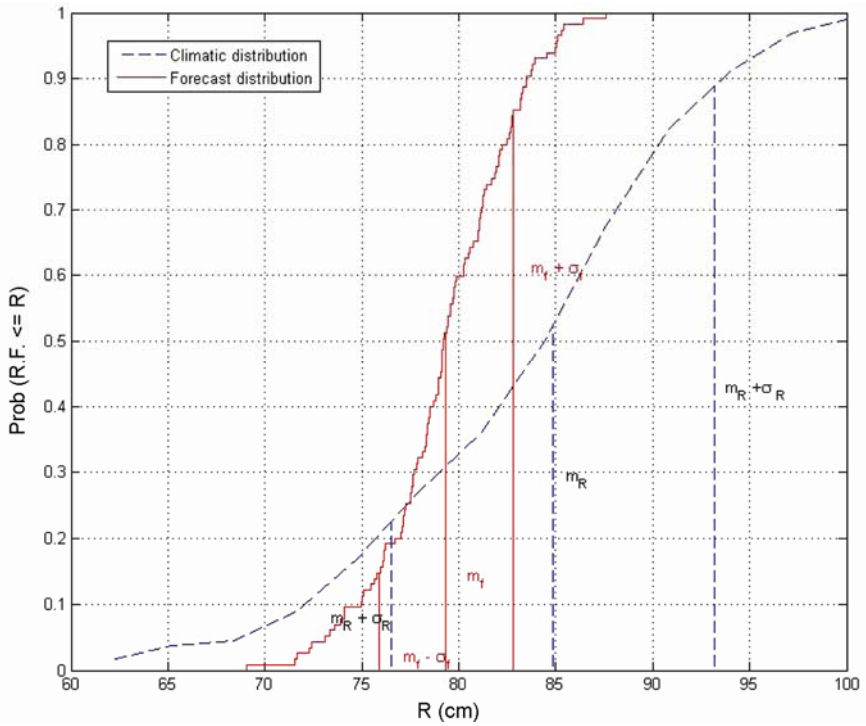

Figure 1. Comparison between probability distribution of long-term (1871–2006) AIRF and the forecast random variable for 2009. Expected rainfall for 2009: m_f = 79.32 cm; σ_f = 3.5 cm.

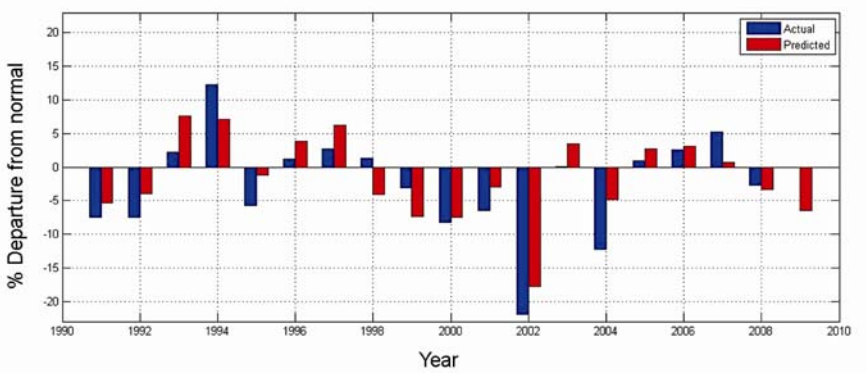

Figure 2. Percentage departure from the normal value of 84.84 cm. Comparison between the one-step-ahead point forecast and actual data since 1991.

1. Iyengar, R. N. and Raghukanth, S. T. G., *Meteorol. Atmos. Phys.*, 2005, **90**, 17–36.
2. Iyengar, R. N. and Raghu Kanth, S. T. G., *Curr. Sci.*, 2006, **91**, 350–356.

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