Drought – National Drought Mitigation Center

Drought Network News (1994-2001)

University of Nebraska - Lincoln *Year* 1995

Long-Range Forecasts of Southwest Monsoon Rainfall Explored for India

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Long-Range Forecasts of Southwest Monsoon Rainfall Explored for India

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Southwest monsoon rainfall (received during June–September) determines the fate of millions of dryland farmers as well as the status of national food security in India almost every year. The need for information about southwest monsoon rainfall is great in these areas. An accurate long-range forecast can help farmers increase agricultural productivity in good rainfall years and negate the sudden downturns in agricultural production during anticipated drought years by giving farmers sufficient time to adopt drought-resistant crop varieties and appropriate crop, soil, and water management practices. The India Meteorological Department is now able to make all-India long-range forecasts of southwest monsoon rainfall accurately using a power regression model based on 16 regional and global parameters from 1988 on. However, these forecasts have seldom been used for strategic planning and management of agricultural production in any of the regions of the country, because the degree to which the all-India forecast is likely to hold true at microlevel is not known. The reliability of the forecast needs to be established at microlevel in order to make effective use of the long-range predictions for agricultural planning and management in rainfed areas. Therefore, an attempt has been made to examine the validity of the long-range forecast issued for the country as a whole for agricultural planning and management at the Jhansi and West Uttar Pradesh Plains meteorological subdivisions.

The present investigation is based on seasonal (June to September) rainfall data for the years 1958–92 at the West Uttar Pradesh Plains meteorological subdivision (subdivision no. 11). The seasonal rainfall data for the same period for Jhansi have also been considered to examine the extent to which the long-range forecast was relevant at microlevel.

Percent departures from average seasonal rainfall have been worked out for the West Uttar Pradesh Plains and Jhansi in order to examine the performance of summer monsoon rainfall in these areas. Further, individual years were identified as "normal" (seasonal rainfall greater than 90% of average seasonal rainfall) or "deficit" (seasonal rainfall less than 90% of average seasonal rainfall) following the criterion of Gowariker et al. (1991) for the prediction of long-range forecasts of summer monsoon rainfall for the country as a whole using a power regression model with 16 regional and global parameters. Their predicted values were found to be in agreement with the actual monsoon conditions over India. Further, the all-India predicted values for summer monsoon rainfall were compared with the rainfall conditions at both the subdivision level and the district level to determine the extent to which the long-range forecast is in agreement with actual rainfall. Finally, the probabilities of the all-India forecast to hold true at subdivision and district levels were estimated.

The reliability of long-range forecasts of southwest monsoon rainfall (1958–92) for the West Uttar Pradesh Plains is given in Table 1. It was found that for the West Uttar Pradesh Plains, the reliability of the all-India total forecast is 86%. Hence, for this region one can anticipate that all-India forecasts will hold true with a fair degree of accuracy. Further, deficit rainfall can be anticipated with a fair degree of reliability (89%) during seasons with deficit all-India forecasts. Therefore, in this subdivision, deficit rainfall is expected whenever the all-India forecast indicates the same. Forewarning of this kind provides ample time to arrange adequate contingency measures to minimize the impact of impending drought in this subdivision. The all-India normal forecast also holds true with greater certainty (85% reliability). Therefore, for the West Uttar Pradesh Plains, it can be anticipated that the all-India forecast is likely to hold true in most seasons.

To find out the validity of forecasts at the district level, researchers examined the extent to which the all-India forecast is in agreement with the actual rainfall received at Jhansi. Table 2 illustrates that the forecast reliability at Jhansi for all-India "deficit" forecasts is 78%. Therefore, one can anticipate that the all-India "deficit" forecast is likely to hold true, and Jhansi can expect deficit rainfall whenever the forecast for the whole country is deficit. Further, the reliability of normal forecasts is less than 70%. This implies that normal rain forecasts on an all-India basis may be shaky in one out of three years for Jhansi. Hence, the all-India normal forecast cannot be considered with confidence under such circumstances, and it may not be very helpful in planning agricultural strategies and management options at microlevel. Interestingly, the forecast reliability decreases at microlevel. Table 3, which shows forecast reliability for early, normal, and late commencement of the rainy season, provides a better understanding of the

Meteorological subdivision	Southwest monsoon conditions	Frequency of occurrence	Number of seasons with valid forecast	% reliability
West Uttar Pradesh Plains	Deficit	9	8	89
	Normal	26	22	85
Total		35	30	86

Table 1. Reliability of long-range southwest monsoon rainfall forecast for India in the West Uttar Pradesh Plains region of northern India (1958–92).

District	Southwest monsoon conditions	Frequency of occurrence	Number of seasons with valid forecast	% reliability
Jhansi	Deficit	9	7	78
	Normal	26	18	69
Total		35	25	71

Table 2. Reliability of long-range southwest monsoon rainfall forecast for India at Jhansi (1958–92).

Commencement of rainy season	Frequency of occurrence	Number of seasons with valid forecast	% reliability of forecast
12–24 June	14	11	79
25 June–1 July	7	5	71
2 July–	14	9	64

Table 3. Reliability of southwest monsoon rainfall forecast for India at Jhansi (1958–92) in relation to date of commencement of rainy season.

This article appeared in the October 1995 issue of ***Drought Network News****.*

southwest monsoon rainfall forecast in relation to actual precipitation. It reveals that with the delayed start of the rainy season, the reliability of forecasts decreases.

The detailed analysis of summer monsoon rainfall revealed that regardless of the anticipated deficit or normal rainfall, the long-range forecasts of southwest rainfall for the whole country are likely to be more reliable for the West Uttar Pradesh Plains. On the other hand, at microlevel, the all-India forecast on "deficit" rainfall is likely to be more accurate for Jhansi. However, long-range forecasts on normal rainfall cannot be considered with confidence. Interestingly, the forecast reliability decreases at microlevel. Therefore, when deficit rainfall is anticipated at microlevel, it becomes necessary to adopt in-situ moisture conservation practices, take adequate measures for contingency planning, switch to crops with high water-use efficiency, and emphasize fodder production. During seasons with normal forecasts in areas where forecast reliability is high, the information can be used for afforestation programs, wasteland development, improving cropping intensity with intercropping and sequence cropping systems, and improving ground water recharge.

Reference

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