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El Niño's Effect on Southwest Monsoon Rainfall in Andhra Pradesh, India

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India is primarily an agricultural country, despite making rapid strides in industrialization in recent decades. The Indian economy is therefore highly dependent on the behavior of the summer monsoon, also known as the southwest monsoon, which occurs during four months (June–September). This accounts for 75% of the annual rainfall over most parts of the country and also generates great demand for rainfall forecasts in different time scales. For nearly a century, Indian meteorologists have been attempting to develop suitable techniques that could be used for preparing long-range forecasts of monsoon rains over India. Walker (1923) has done pioneering work in this field and has introduced the concept of correlation as a measure of interrelationship between preceding events anywhere in the world and subsequent monsoon rainfall over India. Since then, considerable efforts have been made to predict the behavior of monsoons by employing teleconnection signals depicted by the various features of general circulation. During the last seven years, the India Meteorological Department has been issuing forecasts on an all-India basis, accurately using a power regression model based on 16 regional and global parameters, including El Niño (Gowariker et al., 1991). However, these forecasts have seldom been used for precise agricultural planning in any one specific region of the country. The obvious drawback is the uncertainty about the reliability of an all-India forecast for a given meteorological subdivision. Ramana Rao et al. (1994) examined the validity of forecasts for the country as a whole in agricultural planning and management over different meteorological subdivisions. They have also examined the validity of long-range forecasts at the district level in the state of Andhra Pradesh, in southeast India. In this study, we have attempted to examine the behavior of monsoon rainfall in space and time in relation to the El Niño event at the district level in Andhra Pradesh during the years with long-range forecasts of both deficit and normal rainfall on an all-India basis.

The monthly rainfall data during 1960–89 for 20 districts in Andhra Pradesh were used to examine the relationships between El Niño and southwest monsoon rainfall in different districts of the state in an attempt to improve long-range forecasts. Because sufficient data were not available for Vizianagaram, Prakasam, and Ranga Reddy districts, these areas were excluded from the analysis.

During 1960–89, the El Niño phenomenon was observed during ten years, out of which Gowariker et al. (1991) predicted deficit rainfall on an all-India basis for 1965, 1972, 1982, 1986, and 1987 and normal or above-normal rainfall during 1969, 1973, 1976, 1983, and 1989. The performance of the summer monsoon (June–September) was assessed on the basis of the percentage departure from normal monthly as well as seasonal rainfall for the years with El Niño and forecasts of deficit rainfall and El Niño and forecasts of normal rainfall, as shown in Tables 1 and 2, respectively. Although Gowariker et al. (1991) considered a year with actual rainfall of less than 90% of the normal rainfall on an all-India basis to be a year with deficit rainfall for the whole country, in the present study, actual rainfall that is less than normal rainfall during a month or season is presumed to be a deficit in any district.

For the years with El Niño and a forecast of deficit rainfall for five years on an all-India basis (Table 1), the following observations were made:

1. Southwest monsoon rainfall was below normal in coastal Andhra Pradesh and Rayalaseema regions. The deficits in different districts ranged from -55.9% to -5.4%. However, in Telangana region, the seasonal rainfall was below normal in three districts during all five years; the remaining six districts experienced deficit rainfall in four out of five such years.

	Normal southwest monsoon rainfall (mm)	Percentage departure from normal SWM rainfall (range)		No. of years with below-normal rainfall during:				
		From	To	June	July	August	Sept.	June–Sept.
Coastal Andhra Pradesh								
Srikakulam	710	-55.9	-5.4	5	2	4	2	5
Visakhapatnam	598	-33.0	-10.6	4	5	2	3	5
East Godavari	694	-28.5	-13.9	4	5	2	5	5
West Godavari	743	-33.9	-14.8	4	4	4	4	5
Krishna	673	-35.7	-17.1	4	5	5	5	5
Guntur	533	-52.6	-21.1	5	5	5	5	5
Nellore	345	-43.6	-11.4	2	5	3	5	5
Rayalaseema								
Chittoor	393	-40.5	-18.1	3	5	3	5	5
Cuddapah	394	-43.8	-13.9	3	5	3	4	5
Anantapur	334	-37.8	-7.9	2	5	3	3	5
Kurnool	442	-32.2	-6.2	1	4	4	4	5
Telangana								
Mahaboobnagar	555	-41.4	5.3	2	4	4	4	4
Nalgonda	551	-55.9	-10.1	4	4	4	5	5
Hyderabad	663	-48.4	13.3	2	4	3	4	4
Medak	778	-46.5	6.7	2	4	4	3	4
Warangal	832	-51.0	2.5	5	3	4	5	4
Khammam	867	-38.2	-0.6	4	4	3	5	5
Karimnagar	789	-29.2	23.1	5	1	3	3	4
Nizamabad	934	-43.0	-9.1	3	3	3	4	5
Adilabad	915	-42.9	22.6	4	3	4	4	4

Table 1. Normal southwest monsoon rainfall, percentage departure from normal rainfall, and number of years with below-normal rainfall during years with El Niño and forecast deficit rainfall on an all-India basis in different districts of Andhra Pradesh (1960–89).

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2. Rainfall during the months July-September was continuously less than normal, particularly in Krishna and Guntur districts in coastal Andhra Pradesh. The monthly deficits in rainfall were observed in four out of five years in the adjoining Nalgonda and Mahaboobnagar districts of the Telangana region and Kurnool district in the Rayalaseema region.
3. The rainfall during the month of September was below normal in all five years in the southeastern districts of Krishna, Guntur, Khammam, Nalgonda, Warangal, and Chittoor.
4. The rainfall during the month of June was less than normal in four or five out five years in Srikakulam, Visakhapatnam, East and West Godavari, Krishna, Guntur, Khammam, Warangal, Nalgonda, Karimnagar, and Adilabad districts.

For the years with El Niño and forecasts of normal rainfall (Table 2), the following observations were made:

1. The departures in seasonal rainfall were more positive compared to the years with forecasts of drought in all the districts concerned.
2. Below-normal seasonal rainfall occurred in one or two out of five years in all the districts of the Rayalaseema and Telangana regions.
3. Below-normal monthly rainfall occurred during August in only one out of five years in all four districts of the Rayalaseema region.
4. Below-normal monthly rainfall occurred in one out of five years during July and August in Warangal, Khammam, Karimnagar, and Nizamabad districts in the Telangana region and Krishna and Guntur districts in the coastal region.
5. Northern coastal districts of Srikakulam, Visakhapatnam, and East Godavari experienced deficit rainfall conditions during September in four or five out of five years.

An improved understanding of the relationship between El Niño events and the southwest monsoon will be helpful in the development of long-range forecasts. This advanced information on the possibility of occurrence of deficit rainfall is useful for government in preparing contingency plans.

References

Gowariker, V.; V. Tapliyal; S. M. Kulshtrestha; G. S. Mandal; N. Sen Roy; and D. R. Sikka. 1991. A power regression model for long range forecast of Southwest monsoon rainfall over India. *Mausam* 42 (2):125–30.

Ramana Rao, B. V.; J. C. Katyal; J. B. Singh; A. V. M. Subba Rao; U. S. Victor; N. N. Srivastava; and P. Vijayakumar. 1994. Applicability of long range forecast of southwest monsoon rainfall in different parts of India with special reference to Andhra Pradesh. Central Research Institute for Dryland Agriculture, Santoshnagar, Hyderabad – 500 659, India.

Walker, G. T. 1923. Correlation in seasonal variation of weather VIII: A preliminary study of world weather. *Mem. Indian Met. Dept.* 24:75–131.

	Percentage departure from normal SWM rainfall (range)		No. of years with below-normal rainfall during:				
	From	To	June	July	August	Sept.	June–Sept.
Coastal Andhra Pradesh							
Srikakulam	-14.8	33.5	3	2	2	4	4
Visakhapatnam	-16.0	28.9	3	1	2	5	3
East Godavari	-24.1	62.8	2	3	2	4	3
West Godavari	-29.1	78.4	2	3	1	3	2
Krishna	-22.1	59.1	4	1	1	3	3
Guntur	-27.9	56.6	5	1	1	3	2
Nellore	-18.6	72.2	3	1	2	4	3
Rayalaseema							
Chittoor	-25.9	56.6	2	2	1	3	1
Cuddapah	-15.0	71.5	3	2	1	2	1
Anantapur	-31.5	67.2	2	4	1	2	2
Kurnool	-13.7	55.6	3	2	1	2	2
Telangana							
Mahaboobnagar	-21.4	48.0	2	2	2	3	2
Nalgonda	-23.0	42.5	2	2	2	3	2
Hyderabad	-18.5	33.4	3	2	2	4	2
Medak	-16.7	58.7	3	2	1	3	2
Warangal	-12.3	46.3	4	1	1	3	1
Khammam	-11.6	57.1	2	1	1	2	1
Karimnagar	-5.2	68.7	3	1	0	3	1
Nizamabad	-3.3	75.8	4	1	1	3	2
Adilabad	-7.2	44.2	3	2	1	1	2

Table 2. Percentage departure from normal southwest monsoon rainfall and number of years with below-normal rainfall during different months with El Niño and forecast of normal rainfall.