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A study of aridity and droughts in the climatic spectrum of the south Indian region

A. A. L. N. SARMA and M. RAVINDRANATH

Department of Meteorology and Oceanography, Andhra University, Waltair

सार — इस लेख में जल संतुलन प्रक्रिया का उपयोग करते हुए दक्षिण भारतीय क्षेत्र के जलवायु के वर्गीकरण पर विचार किया गया है। चूंकि भारतीय क्षेत्र के लिये जल आपूर्ति का प्रमुख मौसम विज्ञानी स्रोत दक्षिण-पश्चिम मानसून है, इसलिए भारत की आर्द्रता व्यवस्था का अपना सशक्त ऋतु संबंधी पक्ष है। सूखे की किस्म और जलवायु के प्रतिरूप में चूंकि एक व्यापक संबंध है इसलिये यहां दक्षिण भारतीय क्षेत्र के जलवायु स्पैक्ट्रम में सूखे की घटनाओं के अध्ययन का प्रयास किया गया है। सूखा केवल शुष्क जलवायु क्षेत्रों की ही आम बात है, यह कहावत पुरानी हो चुकी है क्योंकि यह विदित है कि उसी बारम्बारता से आर्द्र जलवायु क्षेत्रों में भी सूखा पड़ सकता है और पड़ता भी है। सूखे की श्रेणी और उसकी बारम्बारता कृषि उत्पादन में कमी और वनस्पति-प्रतिरूपों में परिवर्तन लाते हैं।

जलवायु स्पैक्ट्रम के प्रत्येक क्षेत्र से एक स्टेशन का चयन करके, उसमें रिकार्ड किए वर्षों के मुकाबले वार्षिक शुष्कता सूचकांकों को आलेखित करके तथा सुब्रामणियम और शास्त्री (1969) के सुझावों के अनुसार सूखा वर्षों का वर्गीकरण करके दक्षिण भारत के विभिन्न जलवायु क्षेत्रों में सूखे के खतरे का पता लगाया गया है। फिर प्रत्येक स्टेशन पर सूखा वर्षों की दस-वर्षीय बारम्बारता का आकलन किया गया है तथा दक्षिण भारत के विभिन्न जलवायु क्षेत्रों में सूखे की सम्भावना की सूक्ष्म जानकारी प्राप्त करने के लिये इसका ग्राफ अंकित किया गया है।

ABSTRACT. The paper initially deals with the classification of the climates of the south Indian region employing water balance procedure. Since the main meteorological source of water supply to the Indian region is the southwest monsoon during the summer season, the moisture regime of the region has a strong seasonal aspect. An attempt has been made here to study the incidence of droughts in the climatic spectrum of the south Indian region since, there is a broad relationship between the type of drought and the pattern of climates. That droughts are a common feature of the dry climates only is a past saying, since it is now known that droughts can and do occur even in humid climates with equal frequency. The category and the frequency of droughts reduce the output from agricultural crops together with changes in the vegetation pattern.

Proneness of the different climatic types of the south Indian region to droughts is investigated by selecting one station from each zone of the climatic spectrum and plotting the yearly indices of aridity against years of record and categorizing the drought years as suggested by Subrahmanyam and Sastri (1969). Decennial frequency of drought years is then calculated at each station and graphically plotted to get an insight into drought occurrence in the various climatic zones of the south Indian region.

1. Introduction

In any climatic province incidence of droughts are as a consequence of failure of seasonal rains. The subcontinent of India is highly dominated by the southwest monsoon which varies in space and in time. Failure of seasonal rains triggers moisture deficit on whose magnitude the intensity of drought depends. The nature of drought depends upon the amount and distribution of rainfall and its matching with the water-need. Thus aridity and drought occur in the climatic spectrum of south India. To study the same aspect in each climatic type of the south Indian region, one representative station has been selected namely, Mangalore from perhumid, Cochin from humid, Balasore from moist subhumid, Bangalore from dry subhumid, Tiruchirapalli from semiarid, and Bellary from the arid zones. Elements of water balance on a yearly basis have been computed for these stations for the 75 year period from 1901-1975 using the revised book-keeping procedure of Thornthwaite and Mather (1955). Aridity indices (I_a) for the individual years at the selected stations have been obtained. Percentage departures of I_a (from the median) are shown graphically in Figs. 1 & 3. Categorization of droughts has been done according to Subrahmanyam and Sastri (1969).

2. Moist climates

Among the three stations that are selected from the moist climates of south India, Mangalore with its highest median value (29.8%) and lowest standard deviation (13.2%) experienced a total of 34 drought years (Fig. 1a) of which 9 moderate, 12 large, 10 severe and 3 disastrous. On the other hand Balasore (Fig. 1c) a coastal moist subhumid station with its highest standard deviation value (34.3%) registered 8 moderate, 13 large, 6 severe and 3 disastrous drought years during its study period. Though the number was the same (34), at both Mangalore and Cochin

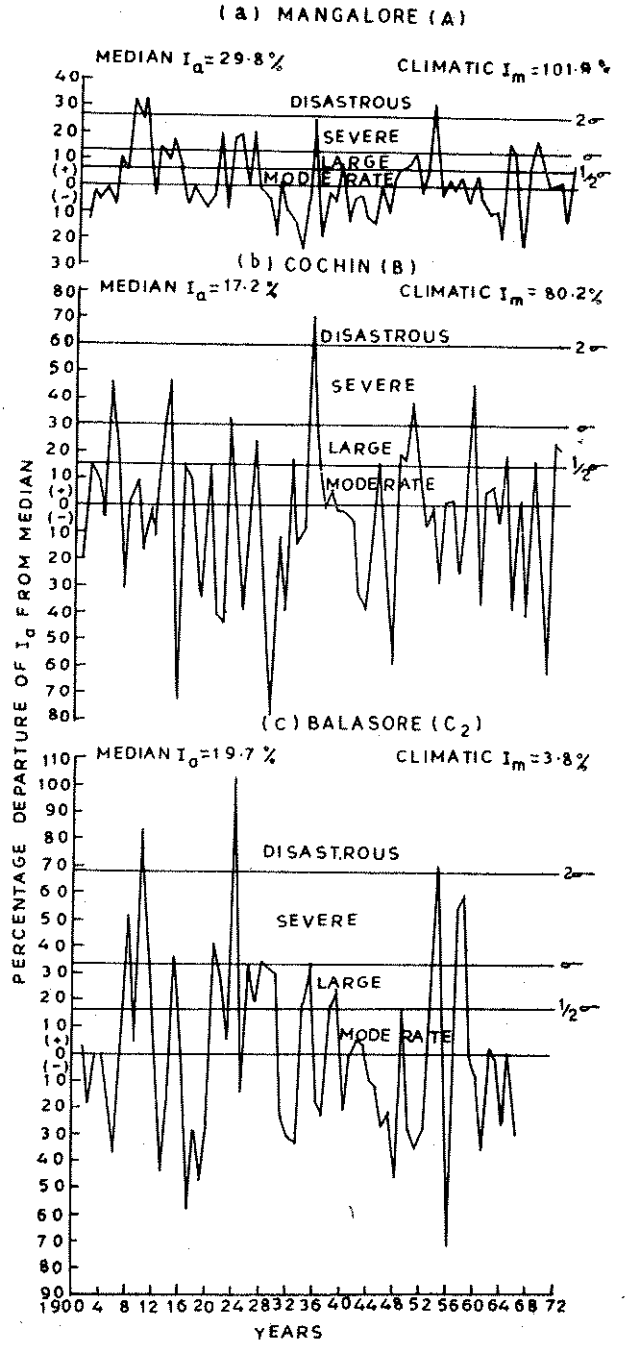

Fig. 1. March of aridity index in moist climates

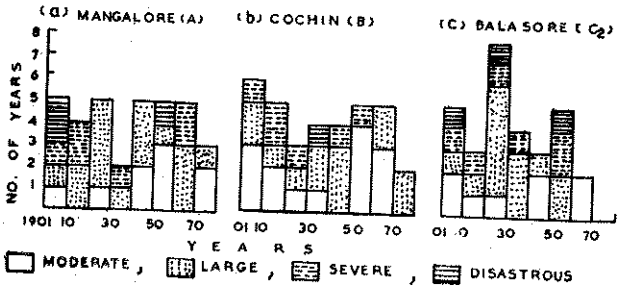

Fig. 2. Decennial frequency of drought years in moist climates

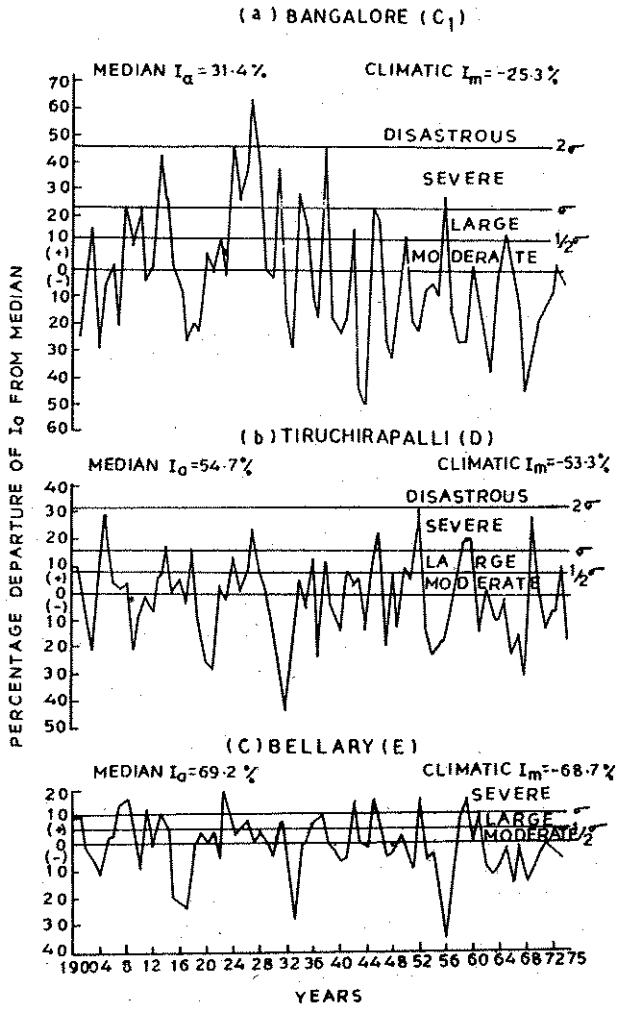

Fig. 3. March of aridity index in dry climates

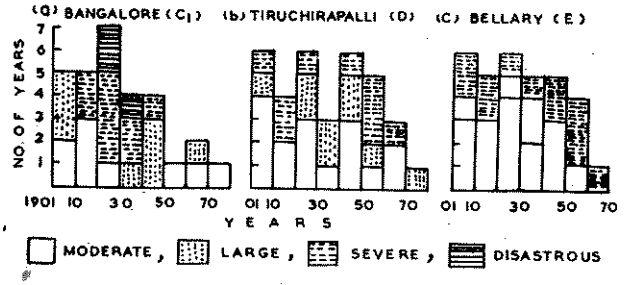

Fig. 4. Decennial frequency of drought years in dry climates

(Fig. 1b), the former registered higher number of severe (10) and disastrous (3) drought years than Cochin (6 and 1 respectively). But moderate and large droughts were larger in number at Cochin. The fluctuations in aridity from year to year were violent at Cochin and Balasore and were mild at Mangalore.

The drought frequency diagram for Mangalore (Fig. 2a) shows that the first decade (1901-1910) of it experienced all types of droughts with a frequency of 2 devastating, 1 severe, 1 large and 1 moderate and this decade can be considered as a severe decade compared to other decades. Cochin (Fig. 2b) has an interesting drought frequency diagram; the number of droughts here constantly decreasing from first decade to third decade, and maintained the number of droughts constant during fourth and fifth decades and thereafter increased. Balasore (Fig. 2c) has a rather interesting diagram with a sudden increase of drought frequency to a maximum of eight in the decade 1921-1930, in which one was disastrous, one was severe, five were large and one was moderate. There was abrupt fall in the subsequent two decades. The period 1951-1960 again showed a rise both in frequency and intensity of droughts with 1 disastrous, 2 severe and 2 large drought years.

3. Dry climates

Bangalore (Fig. 3a) with its lowest median value (15.8%) experienced a maximum of 34 drought years among the three stations that are selected from the dry climates of south India. Tiruchirapalli was free from disastrous droughts during its period of study.

Bellary (Fig. 3c) has got highest median value (69.2%) out of the six stations studied in the climatic spectrum of the south Indian region. Like Tiruchirapalli from semiarid zone of south India, no disastrous drought as per the scheme adopted could be identified at Bellary. In total Bellary experienced 12 severe, 5 large and 15 moderate drought situations. The fluctuations in aridity index were violent at Bangalore and it were mild at Bellary.

At Bangalore (Fig. 4a) the most severe drought decade was 1921-1930 in which there were 7 drought years in all, 2 being disastrous, 4 severe and 1 was moderate. The third disastrous drought at the station occurred in the immediately following decade (1931-1940). Afterwards the frequency of droughts had come down not only in number but also in severity.

During the period of seven and half decades the frequency of droughts per decade at Tiruchirapalli (Fig. 4b) was undulating with higher and lower values, alternating from decade to decade. The frequency was lowest in the 4th and 7th decades. Interestingly at Tiruchirapalli the 3rd and 5th decades registered equal number of droughts with the same severity. The 6th decade at Tiruchirapalli is considered to be the severe decade which experienced 3 severe, 1 large and 1 moderate droughts. At Bellary (Fig. 4c) none of the decades were free from severe droughts.

A very interesting conclusion emerges out of the present study is that the fluctuations in aridity index from year to year are rather mild at perhumid and arid climates since these climates are at the moist and dry extremities of the hydrologic cycle.

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