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CLIMATIC CLASSIFICATION OF TAMILNADU

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Different approaches were tested in classifying the climate of TamiNadu. Thornthwaite and Mather (1955) approach gave broader classification of the state as semi-arid. Salem and Tuticorin are identified as tropical and semi-deserts as per Troll's approach. Madurai, Coimbatore and Tondi are grouped as arid zone areas according to Hargreave's classification.

The classification of climate provides a useful index about the ecological conditicns, agri cultural potentialities and general envioromental information of a location. Hence it has been a subject of interest to scientific researchers in many areas of investigation. As a result, a number of different climatic classifications have been evolved using different approaches. In this paper, an attempt has been made to review some of the approaches used in classifying the climate with an objective to adopt a suitable classification for the state of TamilNadu.

MATERIALS AND METHODS

Any classification system using precipitation and potential evapotranspiration as inputs has definite advantages because an evaluation of moisture adequacy could easily be made using these parameters. This has special significance in arid and semi-arid areas of the world where water is the basic climatic constraint (ICRISAT, 1978). Of the different classification approaches available, the following four methods appear to be more meaningful and have been chosen for the study.

1. Thornthwaite (1948)
2. Thornthwaite and Mather (1955)
3. Troll (1965)
4. Hargreaves (1971)

The Thornthwaite's approach is based on four factors (1) Moisture index (ii) seasonal variation of effective moisture (iii) an index of thermal efficiency and (iv) summer concentration of thermal efficiency.

The moisture index (I_m) is calculated as follows :

According to Thornthwaite (1948)

$$I_m = \frac{100\ s + 60\ D}{PE}$$ where

S = moisture surplus (mm)

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D = moisture deficit (mm)

PE = Potenital evapotranspiration (mm)

and according to Thornthwaite and Mather (1955),

$$Im = \frac{S + D}{PE}$$

The moisture regimes and their limits in Thornthwaite's classification are as follows :

Climate type	Moisture index range Thornthwaite (1948)	Thornthwaite and Mather (1955)
Per humid	⩾100	⩾100
Humid	20 to 100	20 to 100
Moist subhumid	0 to 20	0 to 20
Dry subhumid	-20 to 0	-33.3 to 0
Semi-arid	40 to -20	66.7 to -33.3
Arid	60 to -40	100 to - 66.6

Troll (1965) classified the tropical climates on the basis of broad ranifall groups in relation to potential evapotranspiration. Number of humid months is taken as the criteria, where humid month is defined as a month with mean rainfall exceeding potential evapotranspiration. The various group in Troll's approacn include

Tropical rainy climate - $9\frac{1}{2}$ to 12 humid months

Tropical humid summer or Tropical winter humid climate } - 7 to $9\frac{1}{2}$ humid months

Wet-dry tropical climate - $4\frac{1}{2}$ to 7 humid months

Tropical dry climate - 2 to $4\frac{1}{2}$ humid months

Tropical semi-desert and desert - <2 humid months

Hargreaves (1971) defined moisture availability index(MAI) as (PD/PE) where PD is the 75 per cent probability precipitation based on an analysis of long term precipitation records and PE is the estimated potential evapotranspiration. The relationship between MAI and moisture deficit classification is given as follows :-

MAI	Moisture deficit classification
0.0 - 0.33	Very deficit
0.34 - 0.67	Moderately deficit
0.68 - 1.00	Somewhat deficit
1.00 - 1.33	Adequate moisture
> 1.34	Excessive moisture

Hargreaves based his classification on the length of the period of moisture adequacy, given below :

All months with MAI in the range of 0. 0 - 0.33	Very arid
One or two months with MAI of 0.34 or above	Arid
Three or four consecutive months with MAI of 0.34 or above	Semi-arid
Five or more consecutive months with MAI of 0.34 or above	Wet-arid

The four methods as described above are used to classify the climate of Tamil Nadu. The data on potential evapotranspiration and precipitation for vairous centres of Tamil Nadu are collected and presented in Table 1 and the same data are used for the analysis.

RESULTS AND DISCUSSION

The climate at the different centres of Tamil Nadu was classified as per Thornthwaite (1948). Thornthwaite and Mather (1955) and Troll (1965) and the groups into which they fall along with the estimated I_m or number of humid months is presented in Table 2.

As per Thornthwaite (1948), Tirupattur, Cuddalore and Nagapattinam are classified to have dry sub-humid climate, and all the other centres are grouped under semi-arid climate. But Thornthwaite and Mather (1955) approach showed Cuddalore alone to be under dry sub-humid climate and rest of the state under semi-arid climate. From the total rainfall data, it is seen that Madras, Cuddalore and Nagapattinam stations record more than 1100 mm of rainfall. In spite of more or less uniform rainfall the classification tends to be different because of variations in the PE, which is high at Madras compared to Cuddalore, The annual rainfall at

Table 1 Data on Potential Evapotranspiration (PE) and Rainfall (R) for Various Centres

Centre		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
MADRAS	PE	130	131	170	189	212	203	190	185	174	153	136	130	2003
(MDS)	R	30	13	10	18	43	56	97	130	137	244	290	119	1188
VELLORE	PE	112	125	169	178	184	163	153	148	136	119	100	100	1687
(VLR)	R	20	8	10	23	71	66	86	127	155	165	145	56	932
TIRUPATTUR	PE	98	111	147	148	146	136	126	132	120	99	91	87	1441
(TPT)	R	20	8	10	23	71	66	86	127	155	165	145	56	932
CUDDLORE	PE	113	116	151	159	177	164	150	145	139	121	103	106	1644
(CDL)	R	36	13	13	25	56	46	79	135	142	213	252	127	1135
SALEM	PE	139	152	190	175	171	147	135	135	133	120	112	120	1729
(SLM)	R	10	7	12	47	104	61	70	128	132	161	107	33	871
COIMBATORE	PE	122	132	170	157	158	140	132	139	138	118	104	110	1620
(CMB)	R	13	10	15	56	81	41	48	50	68	160	114	33	691
NAGAPATNAM	PE	134	136	167	164	177	172	163	157	149	127	112	118	1776
(NGT)	R	46	18	15	36	53	37	51	102	110	198	287	165	1115
TRICHY	PE	131	137	177	179	210	239	248	219	188	135	110	118	2091
(TRP)	R	20	10	10	46	84	33	46	97	117	178	142	64	846

Table 1 (Contd.)

1		2	3	4	5	6	7	8	9	10	11	12	13	14
MADURAI	PE	124	131	117	151	152	163	160	149	141	123	107	114	1682
(MDR)	R	23	15	23	63	71	33	38	74	91	190	150	58	831
TONDI	PE	126	126	152	152	155	160	148	155	155	131	113	122	1695
(PTND)	R	33	20	23	61	46	18	28	53	61	173	193	97	805
PAMBAN	PE	138	137	163	161	182	171	164	164	158	140	122	126	1826
(PMB)	R	33	20	23	61	46	18	28	53	61	173	193	97	805
TUTICORIN	PE	149	148	179	172	189	204	216	219	201	161	122	135	2095
(TTC)	R	36	28	36	61	41	23	18	23	53	160	188	94	740
PALAYAMKOTTAI	PE	131	136	171	155	175	176	186	194	177	144	108	121	1874
(PLM)	R	36	28	36	61	41	23	18	23	53	160	188	94	740
KANYAKUMARI	PE	174	163	175	158	164	131	138	147	142	135	137	151	1815
(KYK)	R	20	15	31	79	99	152	89	41	51	178	178	51	978
PUDUKOTTAI	PE	127	126	152	152	155	160	148	155	155	131	113	122	1696
(PDK)	R	36	14	14	41	61	49	57	110	129	155	151	81	897
DHARMAPURI	PE	139	162	190	175	171	147	135	135	133	120	112	120	1729
(DMP)	R	14	8	11	40	111	55	65	100	145	153	104	32	836

Tirupattur and Velloro is the same and yet these two stations are under different groups as per Thornthwaite (1948). However Thornthwaite and Mather (1955) classification brought them together under semi-arid group. Nagapattinam with more than 1100mm annual precipitation is classified differently in these two approaches. Except ng for Naga attinam, Thornthwaite and Mather (1955) classification seems to be more appropriate than Thornthwaite (1948).

According to Troll's approach entire state except Salem and Tuticorin comes under tropical dry climate these two stations being classified as tropical semi-deserts. Cuddalore which is grouped as dry sub-humid in the earlier two methods is classified as tropical dry along with other stations as per Troll's approach. At Cuddalore, the humid months are four. On carefu- observation, we can see that August month also has considerably higer ranfall, and probably it could be clasil fied as wet dry tropical climate, had fortnightly data been considered. Salem and Tuticorin have only one humid month and as such are classified as tropical semi deserts. These two come under semi-arid group in

Table 2 Estimated values and classification

Centre	Thornthwarte		Thornthwaite and Mather		Troll	
	Im	Group	Im	Group	No. of humid months	Group
Madras	-21.3	Sem arid	-45	Semi-arid	2	Tropical dry
Vellore	-24.2	Semi arid	-45	Semi-arid	3	Tropical dry
Tiruppattur	-16.9	Dry sub-humid	-35	Semi-arrd	3	Tropical dry
Cuddalore	-12.0	Dry sub-humid	-31	Dry sub-humid	4	Tropical dry
Salem	-28.8	Semi-urid	-49	Semi arid	1	Tropical Semi-desert
Coimbatore	-33.3	Semi-arid	-57	Semi arid	2	Tropical dry
Nagapattinam	-15.6	Dry sub-humid	-37	Semi-arid	3	Tropical dry
Trichy	-34.5	Semi-arid	-60	Semi arid	2	Tropical dry
Madurai	-28.5	Semi-arid	-52	Semi arid	2	Tropical dry
Tondi	-28.5	Semi-arid	-52	Semi arid	2	Tropical dry
Pamban	-30.5	Semi-arid	-57	Semi arid	2	Tropical dry
Tuticorin	-35.8	Semi-arid	-61	Semi arid	1	Tropical semi-desert
Palayamkottai	-33.2	Semi arid	-59	Semi arid		Tropical dry
Kanyakumeri	-25.2	Semi-arid	-46	Semi arid		Tropical dry
Pudukottai	-26.7	Semi-arid	-47	Semi arid		Tropical dry
Dharmapuri	-30.1	Semi-arid	-52	Semi arid	2	Tropical dry

Table 3. Hargreave's approach

Centre		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
MADRAS	MAI	0	0	0	0	0.09	0 20	0.26	0.60	0.51	0.68	0.58	0.45
	Group	VD	VD	VD	VD	VD	VD	VD	MD	MD	MD	MD	MD
CUDDALORE	MAI	0	0	0	0	0.07	0.08	0.24	0.55	0.75	0.97	0.87	0.14
	Group	VD	VD	VD	VD	VD	VD	VD	MD	SD	SD	SD	VD
COIMBATORE	MAI	0	0	0	0.18	0.24	0.06	0 22	0.11	0.11	0.68	0.57	0.04
	Group	VD	VD	VD	VD	VD	VD	VD	VD	VD	SD	MD	VD
TRICHY	MAI	0	—	—	—	0.11	0.05	0.13	0.22	0.35	0.75	0.68	0.20
	Group	VD	—	—	—	VD	VD	VD	VD	MD	SD	SD	VD
MADURAI	MAI	0	0	0	0.04	0.05	0.01	0.02	0.15	0.22	1.13	0.24	0.05
	Group	VD	VD	VD	VD	VD	VD	VD	VD	VD	AM	VD	VD
TONDI	MAI	—	—	—	0.11	0.08	0.02	0.03	0.20	0.13	0.84	0.55	0.15
	Group	—	—	—	VD	VD	VD	VD	VD	VD	SD	MD	VD
KANYAKUMARI	MAI	0	0	0.6	0.21	0.43	0.40	0 53	0.14	0.12	1.11	0.62	0.10
	Group	VD	VD	VD	VD	MD	MD	MD	VD	VD	AM	MD	VD
DHARMAPURI	MAI	0	0	0	0.06	0.46	0.23	0.24	0.36	0.55	1.10	0.24	0.04
	Group	VD	VD	VD	VD	MD	VD	VD	MD	MD	AM	VD	VD

VD = Very deficit; MD = Moderately deficit; SD = Somewhat deficit; AM = Adequate moisture.

the earlier classification. Troll's approach, thus helps to demarcate the semi-arid group.

The monthly MAI values are worked out for 8 centres as per Hargreave's approach, and the data are presented in Table 3. The 75 percent probability rainfall data not avilable for other centres and as such are not tested.

The Madras centre which is grouped as semi arid or tropical dry in the earlier classification, now became wet arid with five consecutive months having MAI of more than 0.34. Madurai, Coimbatore and Tondi with one or two months of more than 0 34 MAI are grouped under arid climate Kanyakumari has another distinction. The MAI values from May to July are more than 0.34 and again after two months of very deficit periods. October and November months have MAI values greater than 0.34. This shows two distinct periods of wet weather.

Thornthwaite and Mather (1955) approach which is an improvement over Thornthwhite (1948) gava broader classification of the state as semi-arid. Troll's approach helped to identify Salem and Tuticorin as tropical semi-deserts. Hargreaves methodology utilising the moisture availability concept seem to be useful in defining the distribution of moisture during the growing season; and this brought out further classification of Madurai, Coimbatore and Tondi into arid zonel which is more appropriate

The classification schemes utilising precipitation and PE. for defining the humid period for crop growth provided generalised indices of the agriculture production possibilities. These when integrated with soil characteristics water balance and ground water. contribute substantially in developing suitable cropping systems and their packages.

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