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# Continentality and Rainfall over Cauvery Delta Region of Tamil Nadu

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**Abstract:** *Continentality plays the key role in the climate of the region. Surface of the land is heat up quickly than the water bodies because land will not allow penetrating the heat into the deep so the temperature of the land is raised quickly. An effect of Continentality is reduced by the onshore winds of ocean, sea or river. In this study we tried to calculate the continentality by using Conrad's Coefficient of Continentality index for the period 1901 to 2000 and the relationship between Continentality and precipitation of the five districts of Cauvery delta region of Thanjavur, Thiruvarur, Nagapattinam, Pudukkottai and Trichy districts in Tamil Nadu. This study concludes that whenever the coefficient of continentality increases the rainfall of the study region are also increases and it's vice versa. The analysis of the data during the period 1901-2000 indicated that low coefficient of continentality in the decade 1951-1960 and high coefficient of continentality in the decade 1981-1990.*

**Keywords:** *Continentality, Coefficient of continentality, precipitation, climate, temperature*

## INTRODUCTION

Tamil Nadu is entirely depends on spatio-temporal distribution of various climatic indices such as rainfall, temperature, pressure, etc for better performance of economic, industrial and agricultural growth. Temperature and rainfall are the most important aspects which directly affect the climatic condition of any region. There is a slow and steady increase in the temperature which has a direct impact on rainfall distribution. In this particular study, climatic indices such as temperature and rainfall were used to calculate Index of continentality and its relationship with rainfall in the study area. The effects of continents and oceans play a vital role in deciding the climate of the region Brunt (1924), Johansson (1926), Conrad (1946). The temperature on the same latitudes varies moving inward from the coast which was termed as continentality Humboldt

(1803). Continentality usually refers to climate and its immediate consequences. The surfaces of continents heat up quickly and intensely during the day and in summer and cool off at night and in winter. This process occurs more slowly over the oceans because the water masses accumulated a large quantity of heat in the deep layers during the warm periods of the day or year and the heat is gradually released into the atmosphere during cold periods. The air temperature and other climatic characteristics thus vary more sharply (from day to night and from summer to winter) over the continents than over the oceans. Because of the movement of air masses, oceans influence the climate of adjacent parts of continents, and continents influence the climate of oceans. Usually, Continentality is nothing but the ratio of the range of temperature, either the daily range or the difference between the average temperatures of the warmest and coldest months to the geographic latitude of the region Conrad (1946) Gorczyński (1920).

## OBJECTIVES

- To calculate the Index of Continentality for the study region.
- To find the variability of continentality for the study region.
- To study the relationship between Continentality and Precipitation.

## STUDY AREA

For the study we take Nagapattinam, Thiruvarur, Thanjavur, Thiruchirapalli and Pudukkottai which are in the Cauvery delta region of Tamil Nadu shown in the Fig. No. 1. These five districts situated between Tropic of cancer and Equator. The rivers Cauvery and Kollidama start branching out from Thiruchirapalli districts to form the Cauvery delta irrigating vast tracts of land. Thanjavur district lies at the Cauvery delta region, the most fertile region in the state. The district is the main rice producing

region in the state and hence known as the Rice Bowl of Tamil Nadu. Cauvery River and its tributaries irrigate the district. Apart from paddy, farmers here grow coconut and sugarcane and it is the largest producer of coconut in Tamil Nadu. The district of Nagapattinam lies on the shores of the Bay of Bengal. As of 2011 census, the total population of the study area is 96, 27,252 and total area of 17558 sq.km.

## DATA BASE

For the study we used secondary data such as temperature and precipitation. The total monthly precipitation (mm) and total monthly maximum and minimum temperature (°C) data for Nagapattinam, Thiruvarur, Thanjavur, Thiruchirapalli and Pudukkottai districts were utilised to calculate the indices. This data has been collected from the website www.indiawaterportal.org for the study period 1901-2000.

## METHODOLOGY

Continental, a measure of the difference between continental and marine climates characterized by the increased range of temperatures that occurs over land compared with water. This difference is a consequence of the much lower effective heat capacities of land surfaces as well as of their generally reduced evaporation rates. One of the most striking effects of the continentality on climate is presumably the gradual increase of annual range of temperature of the region. This contrast of continentality and oceanic climates can be determined numerically by indices of continentality (K). The formula for continentality suggested by Conrad (1946).

$$K = \frac{1.7 A}{\sin(\theta + 10)} - 14$$

Where, K is coefficient of continentality;  
A is annual range of temperature; and  
 $\theta$  is the geographical latitudes.

K (Index of continentality) should acquire a value of 100 for purely continentality and 0 for purely maritime climate. The climate is classified as extreme oceanic when K is in the range 0 to 30, as continental when k in the range of 34 to 66 and as extreme continentality when k in the range of 67 to 100.

## RESULT AND DISCUSSION

Geographically, study region is located in between Tropic of cancer and Equator. Being a Tropical climate, the sun is overhead its ray fall almost vertically on the study region concentrating its heat on a small area; temperature therefore rises and summers are always warm. The analysis of the data during the period 1901-2000 indicated that the coefficient of continentality index in the study region increases from the decade 1901-1910 and attain maximum coefficient of continentality in the decade 1911-1920 and this was the maximum in the in the first half of the 20<sup>th</sup> century. From the decade 1911-1920 index of coefficient of continentality starts to decrease decade by decade and attain minimum of coefficient in the decade 1951-1960 and this was the highest minimum in this century. Since 1951-1960 index of coefficient of continentality had been increasing and attain the highest maximum in this century in the decade 1981-1990. From the decade 1991-2000 there has been decreasing trends of coefficient of continentality in the study region.

Index of continentality for Thiruvarur in the range with maximum 49.52071 and minimum of 47.72649 which is high as we compare to Thanjavur with range of 49.00448 to 46.75552 even though Thiruvarur is located nearer to ocean than Thanjavur because river Cauvery spread large part in the Thanjavur and also large cultivable area of Thanjavur make to reduce the range of temperature. Shown in the **Fig No.2** and **Table No.1**

Thiruchirapalli shows that it having high index of continentality with the range of maximum 55.12647 and minimum of 51.92212 because it is located far away for the ocean. Pudukkottai have lowest index of coefficient of continentality with range of maximum 48.2734 and minimum of 45.03639. Shown in the **Fig No. 2** and **Table No. 1**

In the case of Nagapattinam, we found that it having highest index of continentality as we compare to Thanjavur, Thiruvarur and Pudukkottai even though it located in the coastal region. Nagapattinam have the coefficient of continentality with range of maximum 53.12273 and minimum of 51.31207. Shown in the **Fig No. 2** and **Table No. 1**

We also attempted to found the relationship between index of coefficient of continentality and precipitation for Thanjavur, Thiruvarur, Nagapattinam, Pudukkottai and Thiruchirapalli for the period 1991-2002. Shown in the **Table No. 2**

**Fig No. 3** shows that Thanjavur received maximum precipitation in the years 1993, 1996, 1997 and 2000 in that same year the coefficient of continentality was also high and in the year 1991, 1994 and 1999 it

receive minimum rainfall where the coefficient of continentality was also low.

**Fig No. 4** shows that Thiruvarur received maximum precipitation in the year 1993, 1996, 1997, and 2000 in that same year the coefficient of continentality was high. In the year 1991, 1995 and 1999 Thiruvarur received minimum precipitation and the same year the coefficient of continentality was low.

**Fig No. 5** indicated that in the year 1993, 1997, 1998 and 2000 Trichy received maximum rainfall and maximum coefficient of continentality and in the year 1991, 1994, 1999 and 2002 received minimum rainfall along with minimum coefficient of continentality.

Similar to the other districts Pudukkottai and Nagapattinam received maximum rainfall in the year 1993, 1996, 1997 and 2000 along with high coefficient of continentality and in the year 1991, 1994 and 1999 received minimum rainfall compared to other years with low coefficient of continentality. Show in the **Fig No. 6** and **Fig No. 7**

## CONCLUSION

From the Fig No. 2 shows clearly that except Nagapattinam, all the other four districts have sharp edge for both maximum and minimum. In the case of Nagapattinam there is no such sharp edge because of ocean influence. Here we found that there is erroneous in the result even though Nagapattinam located in the coastal region it fails to show the oceanic character. But in the case of Thiruchirappalli, it located far away from the ocean shows maximum coefficient of continentality.

There is strong relationship between Index of coefficient of continentality and Precipitation of the given region. Whenever the coefficient of continentality increases, Precipitation is also increasing and vice versa. Shown in the **Fig No. 3, 4, 5 and 6**

Entire study region received the maximum downpour in the year 1993, 1996, 1997 and 2000 along with highest coefficient of continentality and received minimum downpour in the year 1994, 1995 and 1999 with low coefficient of continentality.

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**COEFFICIENT OF CONTINENTALITY**

Year	Thiruvarur	Thanjavur	Trichy	Pudukkottai	Nagapattinam
1901-1910	48.8893997	48.08122955	53.34983623	46.85772645	52.38350891
1911-1920	49.5207097	48.95513395	54.65933794	47.80329678	52.63662675
1921-1930	49.4061439	48.50141275	53.67481857	47.27998682	53.12272805
1931-1940	48.8932345	48.0591903	52.85255104	46.34222709	52.52157319
1941-1950	47.9867751	47.32614549	52.28060129	45.69004229	51.46739492
1951-1960	47.7264856	46.75552041	51.92211562	45.036393	51.31207261
1961-1970	49.0873731	48.36246962	53.32064047	46.57947396	52.61888933
1971-1980	49.0734719	48.19525875	54.97522651	47.64171507	53.00671571
1981-1990	49.4540794	49.00448272	55.12647013	48.27339705	52.83317659
1991-2000	48.8299597	48.10853907	52.67785509	46.45889787	52.26701718

**Table No. 1**

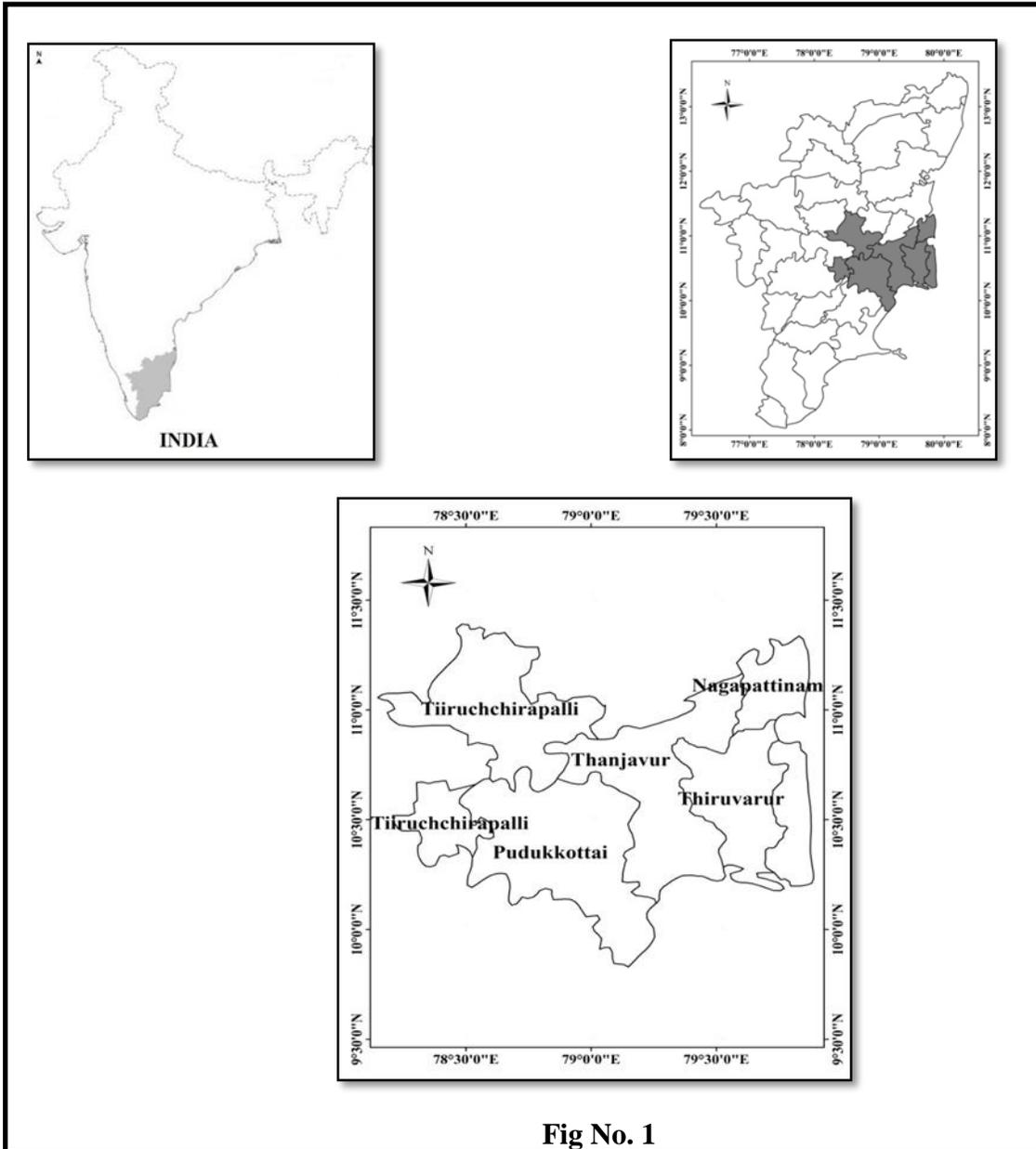
**RAINFALL AND COEFFICIENT OF CONTINENTALITY**

Year	Thanjavur		Thiruvaur		Trichy		Pudukottai		Nagapattinam	
	Rainfall	ICC	Rainfall	ICC	Rainfall	ICC	Rainfall	ICC	Rainfall	ICC
1991	696.4	47.06	779.1	46.61	770.7	53.21	677.9	46.43	749.4	49.68
1992	853.9	47.58	1010.2	48.19	839.8	54.01	802.5	46.18	937.6	52.46
1993	1066.8	51.45	1273.2	51.61	966.5	55.57	976.2	50.32	1245.6	53.46
1994	657.0	47.68	853.7	49.32	606.0	49.76	633.7	43.83	815.7	53.17
1995	709.6	45.46	805.7	45.89	777.2	52.22	668.5	45.25	784.6	51.65
1996	1050.4	49.93	1272.9	50.51	1019.9	53.61	958.5	46.81	1199.5	54.47
1997	1058.5	48.25	1216.6	49.52	1082.4	51.87	1022.4	46.08	1190.2	52.89
1998	940.0	48.51	994.8	49.22	1024.2	52.68	877.7	46.01	958.1	52.36
1999	637.2	45.65	720.4	46.37	721.7	51.93	653.1	45.85	673.7	49.20
2000	1126.5	49.51	1203.8	51.06	1135.4	51.92	1058.5	47.83	1094.7	53.32
2001	947.4	49.15	1173.0	49.71	915.3	51.38	886.2	46.32	1060.6	53.18
2002	865.4	48.53	1069.8	50.25	781.3	51.15	823.2	45.30	1000.3	53.12

ICC- Index of Coefficient of Continentality

**Table No. 2**

## Location Map of Study area



**Fig No. 1**

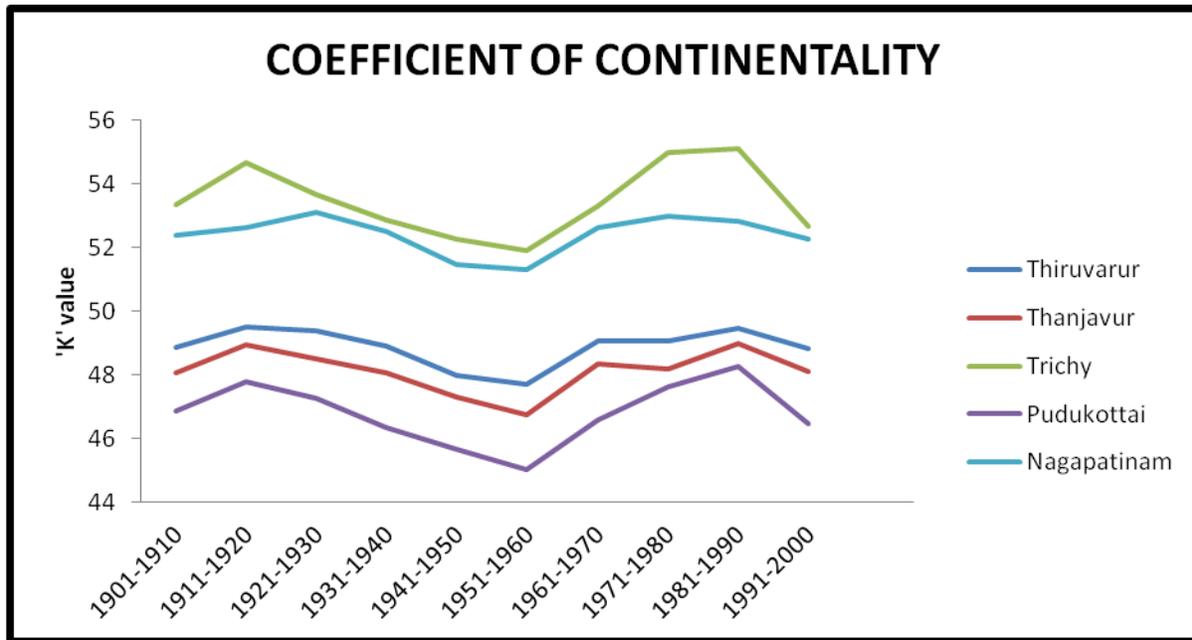


Fig No. 2

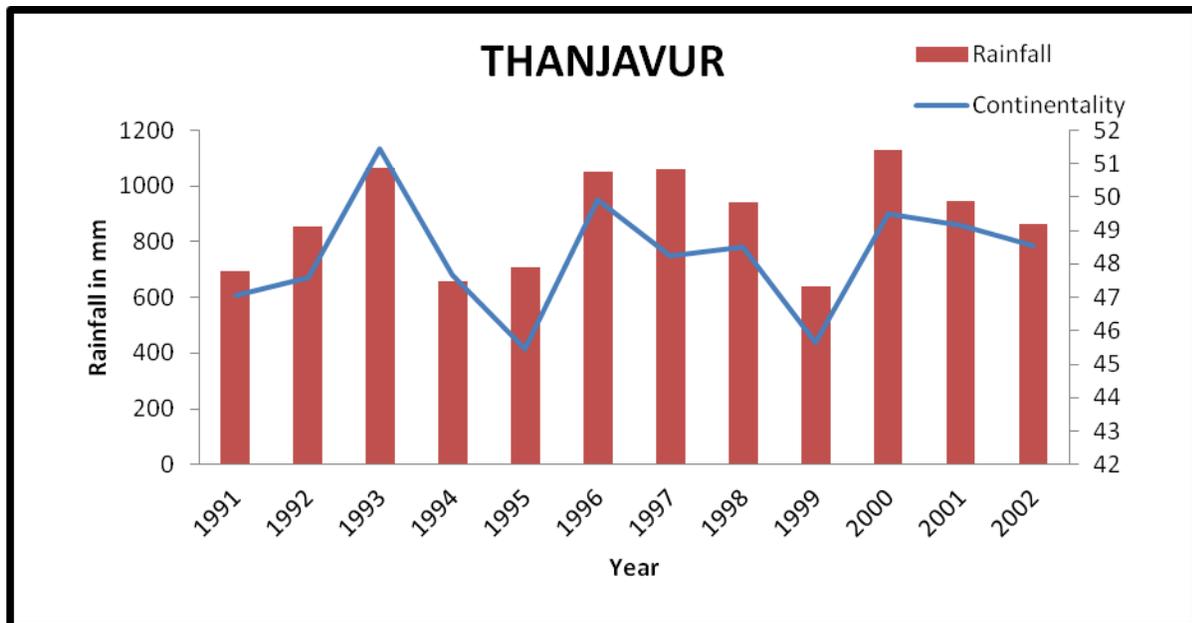


Fig No. 3

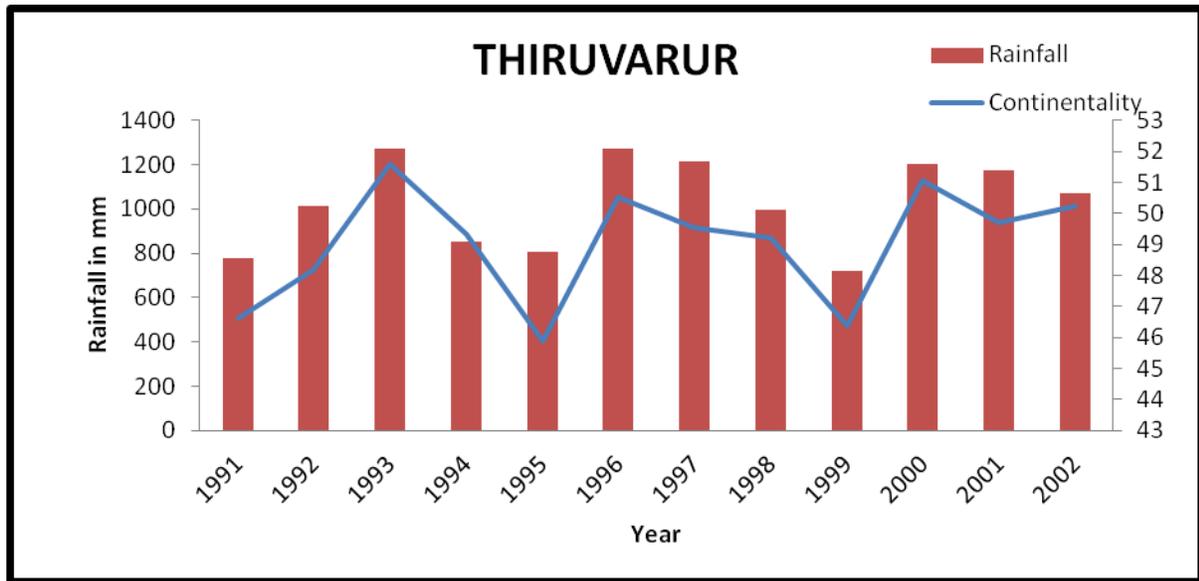


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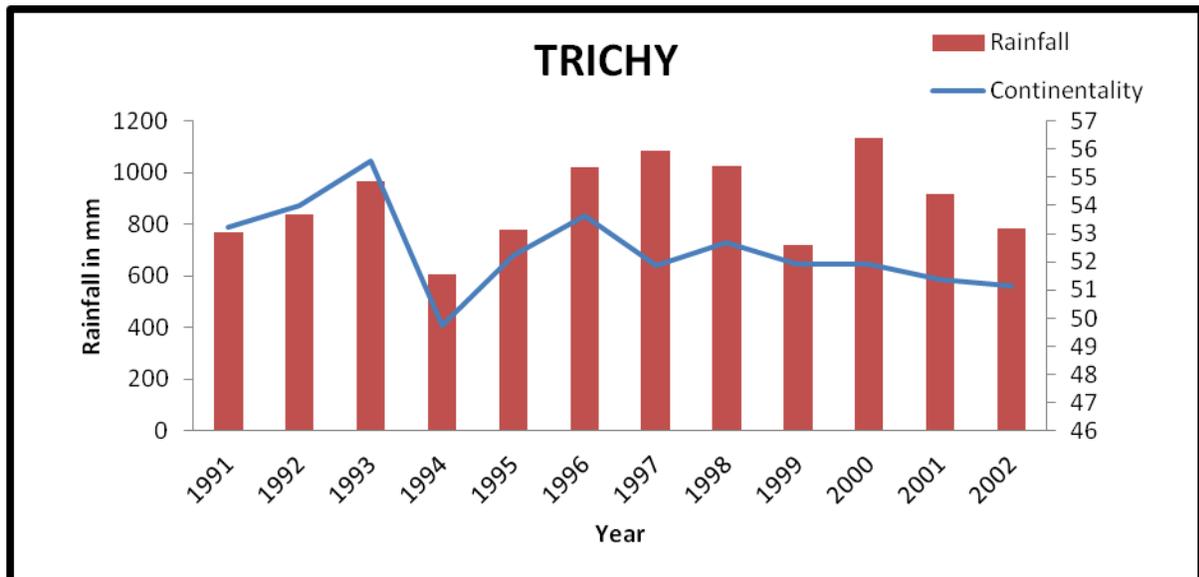


Fig No. 5

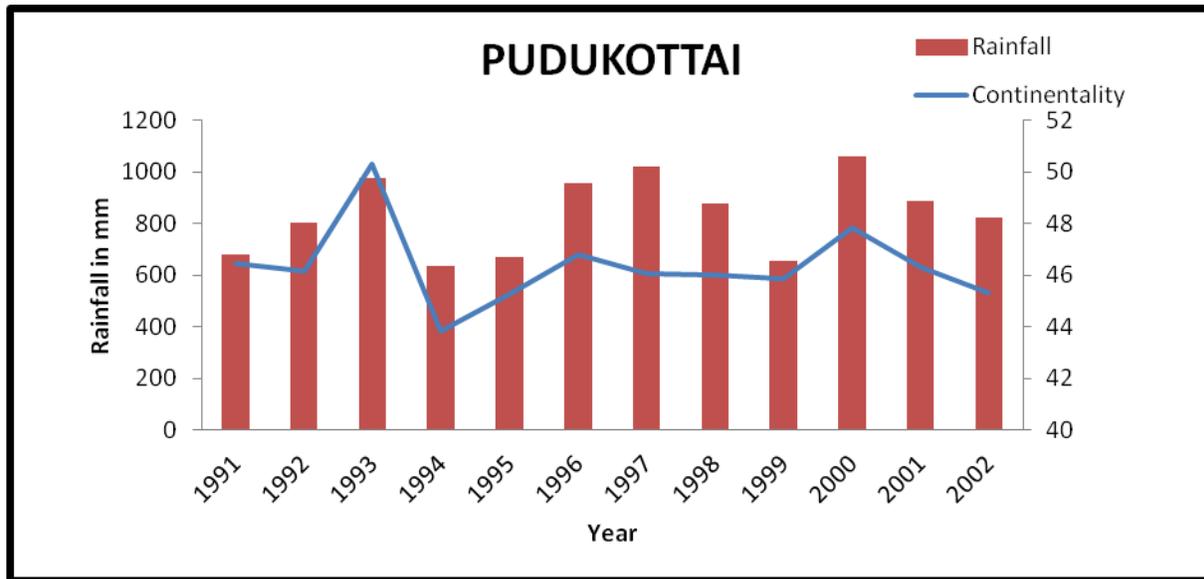


Fig No. 6

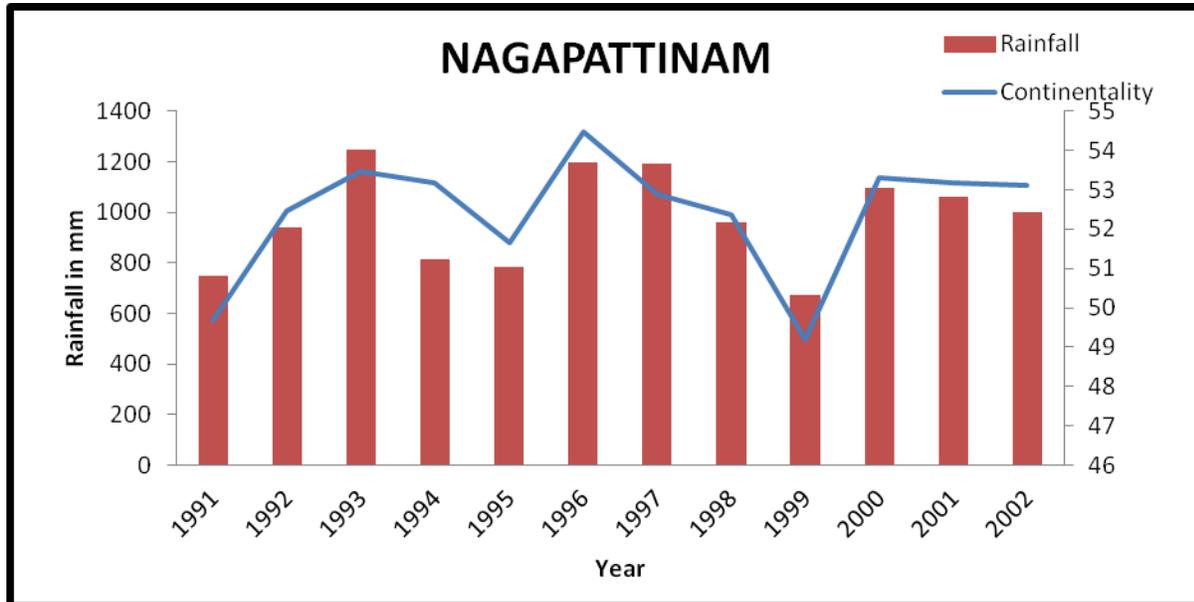


Fig No. 7