

Analysis of Rainfall Data for Arni Station

Yashwanth Krishna Gunasekaran, Abhishek Senthil, Diwakaran Ramesh Babu

Abstract— Rainfall is an important part of hydrological cycle and this proves to be a vital variable in dry-land areas. In order to develop an effective management it important to understand this resource by analyzing the data recorded by Indian Meteorological Society. In this study, monthly rainfall data from 1973-2002 is collected for Arni station, Thiruvannamalai district and observed. Analysis of yearly rainfall data is done and also analysis of variation of rainfall in time and amounts is performed. These analysis will help us in interpreting the rainfall variations among different seasons in the year.

The average yearly rainfall in Arni ranges from 80mm to 85mm in recent years. This results in scarcity of water which leads to problems in agricultural purposes. However during monsoon months, which is from July to October, the average rainfall intensity ranges from 120mm- 175mm. Water resources in Arni are rare and the surface run-off is often low because of high evaporation rates. Although rainfall is a natural resource, but with the rainfall analysis data from past years can be really helpful in deduction of approximate rainfall data for the following years. Rain in excess is very rare in Arni although when it does occur it causes serious consequences such as flash flooding, human catastrophes and land degradation. From this analysis, the seasons such as Pre-Monsoon, Monsoon, Post-Monsoon and their variations are compared for three decades from 1973-2002. Also the Maximum and Minimum rainfall intensity in these thirty years is also calculated.

Index Terms— Rainfall, Analysis, Intensity, Variation, Monsoon and Water resources.

I. INTRODUCTION

Rainfall is a scarce and an important hydrological variable in dry land areas. The need for water in these areas increases daily due to population growth, economic developments, urbanization, and consequently, water management using all the available resources is becoming increasing crucial.

Yashwanth Krishna Gunasekaran, Abhishek Senthil, Diwakaran Ramesh Babu, Department Of Civil Engineering Faculty Of Engineering And Technology SRM University Kancheepuram

In order to develop an effective management strategy, it is paramount to understand and assess the impact of this resource on the ecosystem. The study and understanding of climate, variation of rainfall in space, time and amounts, and their attendant effects on the ecosystem is vital. Plant productivity in these regions is primarily limited by the availability of adequate water.

Arid and semi-arid regions of Tamil nadu is characterized by the by rainfall which is highly variable in space, time, quantity and duration. Arni is characterized by hyper-arid (<100mm rainfall), through the arid (100-250mm rainfall) and semi-arid (250-500mm rainfall) environments that are experienced in different parts of country. The abundance of vegetation among Arni region highly depends upon the scarcity and erraticism of rainfall. In the event of heavy rains, surface runoff lasts for a few hours to a few days due to the high evaporation rate.

Most of the regions in Tamil nadu experiences periods of rainfall between June to September which is also termed as South-West monsoon. The normal annual rainfall of the state is about 945 mm (37.2 in) of which 48% is through the North East monsoon and 32% through the South West monsoon. Since the state is entirely dependent on rains for recharging its water resources, monsoon failures lead to acute water scarcity and severe drought. Most of the agricultural purposes in Tamilnadu depend upon the seasonal and annual rainfall.

Tamilnadu received an average annual rainfall of 1304.1 mm during the year 2005-06, which is higher by 36.1% over the normal rainfall of 958.5 mm. The comparison of rainfall recorded during 05-06 with the normal rainfall shows that the rainfall was excess in 26 districts and normal in 4 districts. During the year 2005-2006, the highest rainfall of 2356.5 mm. was recorded in Chennai district and the lowest rainfall of 678.0 mm was recorded in Thoothukudi district.

In this study the analysis of rainfall data in Arni region is done on the basis of the rainfall data observation from 1973-2003. Interpretation of analysis of yearly rainfall data and seasonal variation is also performed. These analysis of rainfall data will be really helpful for agricultural and other purposes which requires rainfall.



Figure 1.1 This is the satellite image of Arni region of Thiruvanamallai district of Tamilnadu.

STUDY AREA- Arni is located at 12.67°N 79.28°E on the banks of the Kamandala Naaga river. It has an average elevation of 151 metres (495 ft.). It is located about 38 kilometres (24 mi) from Vellore and 60 kilometres (37 mi) from Thiruvannamalai district.

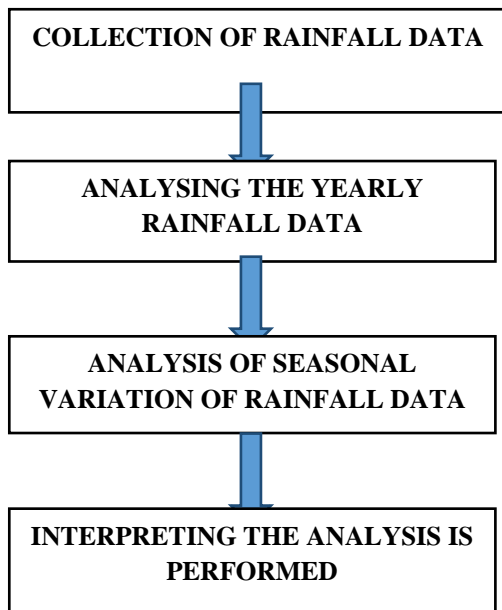
Throughout the year daytime temperatures will generally reach highs of around 41°C that's about 106°F. At night the average minimum temperature drops down to around 24°C, that's 76°F. In recent times, the highest recorded temperature through the year has been 45°C (112°F), with the lowest recorded temperature 19°C (67°F).

II. OBJECTIVE

- A) To analyze the yearly rainfall data for Arni station.
- B) Comparing different seasons, the interpretation of rainfall data analysis is done.

III. SCOPE

- A) Analyzing the rainfall data for a particular region can be very useful in rain-fed irrigation purposes.
- B) These analysis are important especially in rural areas where major source for vegetation and agricultural purposes comes due to proper rainfall.



IV. COLLECTION OF RAINFALL DATA

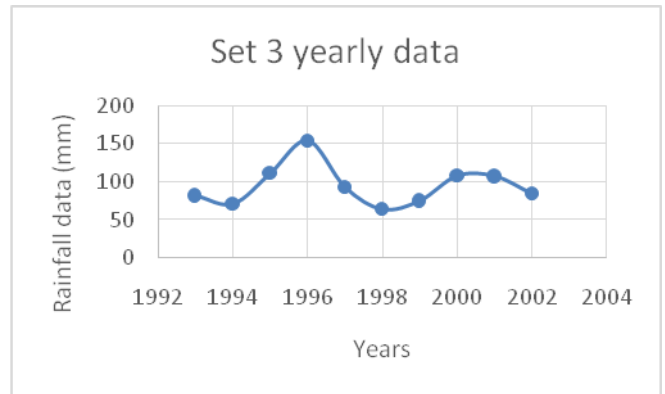
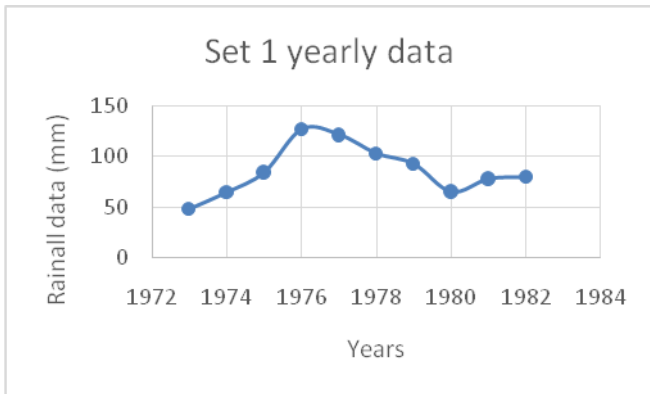
The rainfall data for Arni station in Tamilnadu is collected for the yeas 1973- 2002 and is shown in Table.

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1973	0.0	0.0	0.0	0.0	0.0	0.0	0.0	98.3	175.6	186.6	20.8	105.0
1974	0.0	0.0	2.4	0.0	10.2	71.4	106.2	21.6	301.2	244.6	23.6	0.0
1975	31.0	31.0	11.9	0.0	105.2	59.0	129.2	152.0	194.0	183.5	114.0	5.4
1976	5.6	0.0	11.9	3.4	189.2	196.7	120.6	363.8	42.2	276.4	279.0	31.8
1977	0.0	0.0	0.0	0.0	64.7	113.2	120.8	332.1	74.5	253.0	492.6	6.8
1978	0.0	0.0	0.0	62.9	59.4	22.7	42.5	27.3	312.4	183.7	220.2	305.7
1979	0.0	0.0	14.0	0.0	36.4	138.4	90.4	58.0	160.4	61.6	532.2	22.4
1980	0.0	0.0	0.0	0.0	17.4	19.5	281.4	177.0	25.4	62.1	154.5	49.2
1981	0.0	0.0	0.0	0.0	59.9	54.9	202.6	166.5	243.4	24.2	100.2	86.0
1982	0.0	0.0	0.0	0.0	183.2	30.2	84.6	127.6	132.0	184.2	217.8	0.0
1983	0.0	0.0	11.0	14.0	63.6	123.4	203.6	336.4	391.6	115.8	58.2	403.2
1984	27.0	154.6	123.0	0.0	11.4	20.8	224.0	21.8	183.5	192.3	141.9	60.2
1985	38.4	0.0	0.0	2.0	0.0	78.7	249.1	204.9	326.2	136.1	356.9	8.8
1986	93.2	0.0	0.0	1.4	17.9	41.8	32.6	162.4	308.2	166.7	70.4	17.7
1987	8.2	0.0	24.8	0.0	70.6	250.6	26.2	145.0	173.4	341.8	131.0	156.8
1988	0.0	0.0	1.3	90.8	175.9	20.8	153.5	202.0	139.4	62.8	114.7	65.0
1989	0.0	0.0	12.2	0.0	37.4	130.5	131.8	5.7	96.4	91.4	117.8	58.0
1990	34.0	21.0	10.0	1.2	143.2	8.8	25.0	114.0	206.8	86.2	77.0	32.6
1991	0.0	0.0	0.0	0.0	0.0	80.2	8.8	142.4	145.8	313.4	226.6	6.8
1992	9.1	0.0	0.0	0.0	1.6	44.8	11.2	41.6	73.6	108.8	230.3	14.8
1993	0.0	0.0	0.0	0.0	53.2	75.8	59.8	73.4	149.2	146.4	313.5	110.9
1994	3.2	2.0	0.0	0.0	38.0	64.2	0.0	284.2	76.8	184.4	181.7	19.0
1995	0.0	0.0	0.0	0.0	240.0	436.0	91.6	63.3	278.1	163.9	59.4	0.0
1996	0.0	0.0	0.0	66.0	9.4	366.4	57.6	274.5	363.4	178.4	139.7	386.8
1997	10.4	0.0	0.0	0.0	26.6	225.6	106.8	131.5	21.0	278.2	311.2	0.0
1998	0.0	0.0	0.0	0.0	65.2	2.4	39.0	0.0	177.0	186.2	207.5	92.3
1999	0.0	0.0	0.0	9.2	150.4	33.2	25.2	253.0	77.4	133.0	140.0	80.0
2000	0.0	97.6	0.0	2.2	153.4	100.7	108.6	132.0	269.6	267.8	113.5	47.1
2001	0.0	0.0	0.0	50.0	24.4	47.8	208.6	74.6	320.4	379.8	60.8	122.2
2002	0.0	0.0	0.0	0.0	136.2	259.2	36.2	120.8	56.4	128.2	185.7	88.6

V. RESULTS AND DISCUSSIONS

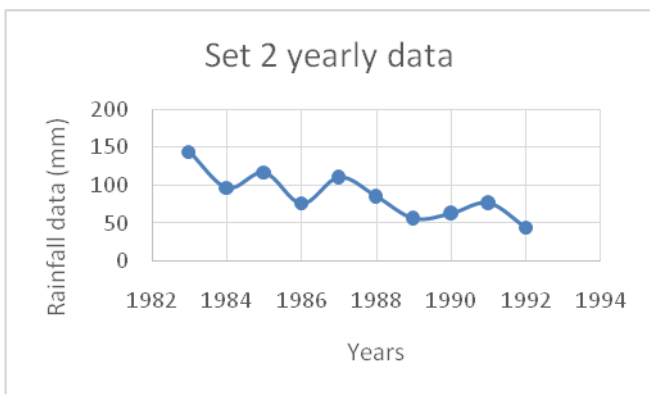
RAINFALL DATA ANALYSIS FOR THE YEARS 1973-1982

The observed rainfall pattern for Set 1, which represents years from 1973-1982, increases from 1973-1976. Then it decreases from 1976-1980 after which it remains constant for next two years as shown in Fig. 7.1.



RAINFALL DATA ANALYSIS FOR THE YEARS 1983-1992

The observed rainfall pattern for Set 2, which represents years from 1983-1992, decreases and increases consecutively from 1983-1989, then it increases for 2 years and is finally decreased in 1992 as shown in Fig. 7.2.

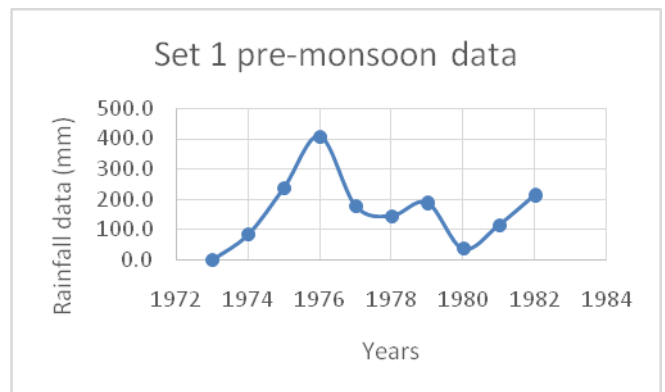


RAINFALL DATA ANALYSIS FOR THE YEARS 1993-2003

The observed rainfall pattern for Set 2, which represents years from 1993-2002, follows a pattern of increasing from 1993-1996 then decreasing for next 3 years. After that it again starts increasing from 1988-2000 and finally it decreases until 2002 as shown in Fig. 7.3.

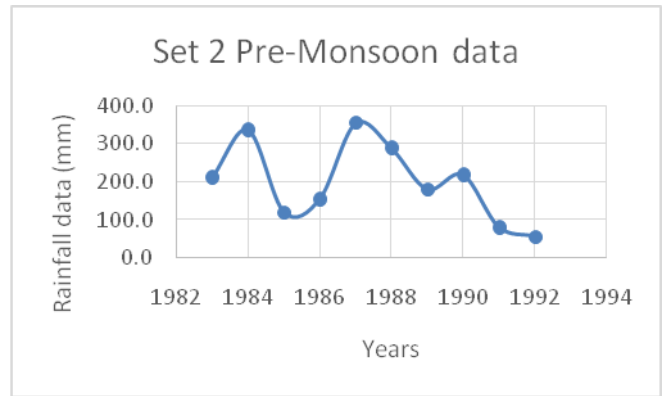
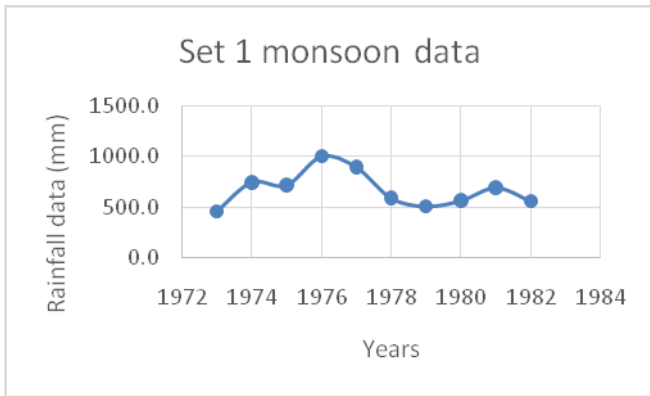
PRE- MONSOON RAINFALL DATA ANALYSIS FOR THE YEARS 1973-1982

Generally Pre-Monsoon season includes months from January to June. During these months of Set 1 the maximum rainfall intensity is around 400mm. The range of rainfall usually varies between 0mm to 400mm as shown in fig 7.4.



MONSOON RAINFALL DATA ANALYSIS FOR THE YEARS 1973-1982

Generally Monsoon season includes months from July to October. During these months of Set 1 the maximum rainfall intensity is around 1000mm. The range of rainfall varies between 400mm to 1000mm as shown in Fig. 7.5.

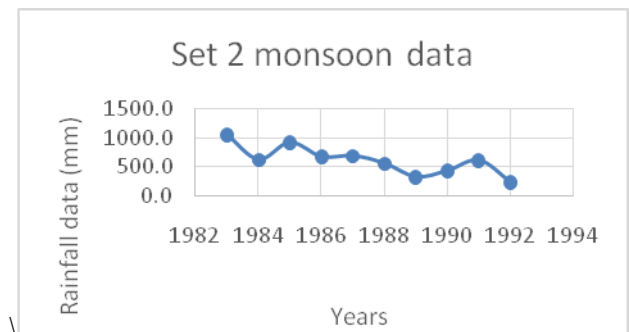
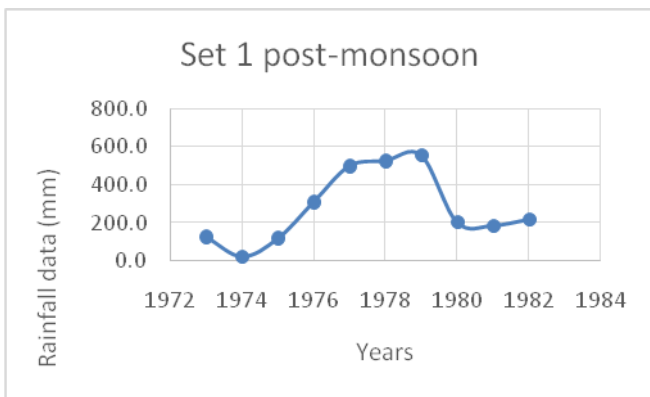


POST-MONSOON RAINFALL DATA ANALYSIS FOR THE YEARS 1973-1982

Generally Post-Monsoon season includes months November and December. During these two months of Set 1 the maximum rainfall intensity is around 550mm. During these months the rainfall range varies between 0mm to 550mm as shown in Fig.7.6.

MONSOON RAINFALL DATA ANALYSIS FOR THE YEARS 1983-1992

During the Monsoon season of Set 2, the maximum rainfall intensity is around 1100mm and the range of rainfall usually varies between 200mm to 1100mm as shown in Fig. 7.8.

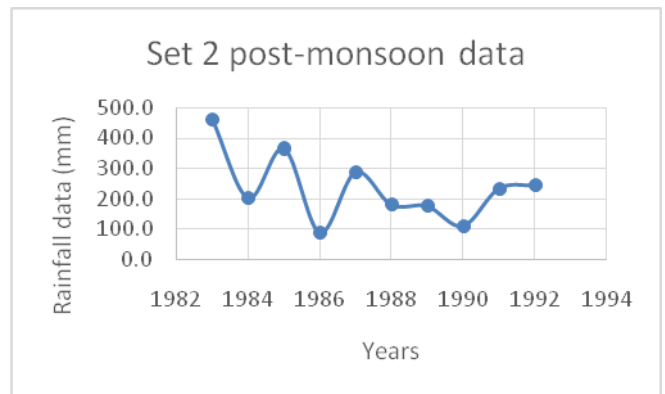


PRE- MONSOON RAINFALL DATA ANALYSIS FOR THE YEARS 1983-1992

During the Pre-Monsoon season of Set 2, the maximum rainfall intensity is around 350mm and the range of rainfall usually varies between 50mm to 350mm as shown in Fig. 7.7.

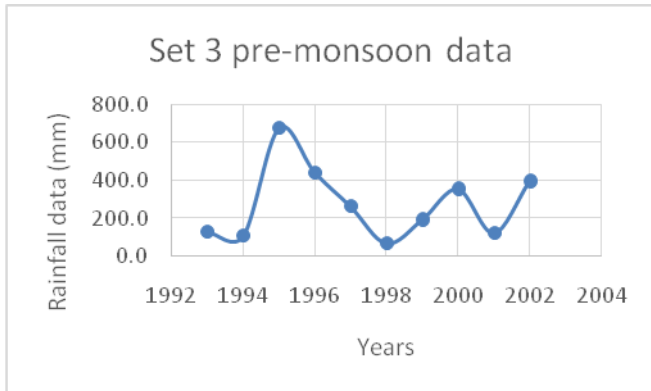
POST-MONSOON RAINFALL DATA ANALYSIS FOR THE YEARS 1983-1992

During the Post-Monsoon season of Set 2, the maximum rainfall intensity is around 475mm and the range of rainfall usual varies between 80mm to 475mm as shown in Fig. 7.9.



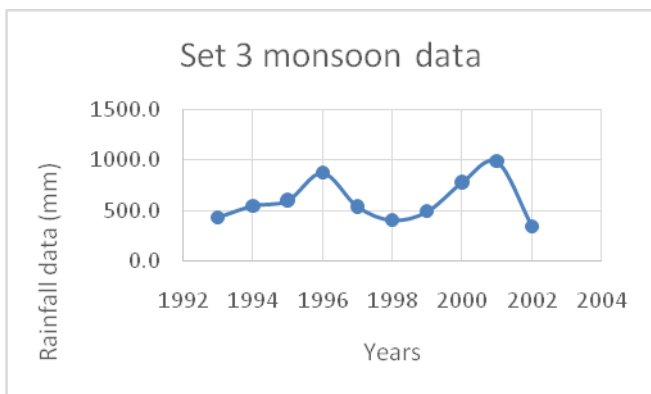
PRE-MONSOON RAINFALL DATA ANALYSIS FOR THE YEARS 1993-2002

During the Pre-Monsoon season of Set 3, the maximum rainfall intensity is around 680mm and the range of rainfall varies between 80mm to 680mm as shown in Fig. 7.10.



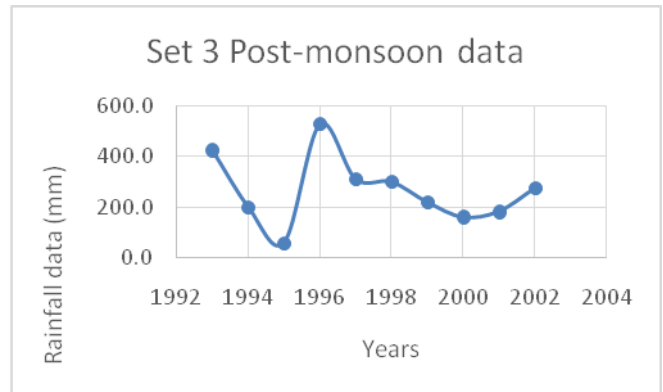
MONSOON RAINFALL DATA ANALYSIS FOR THE YEARS 1993-2002

During the Monsoon season of Set 3, the maximum rainfall intensity is around 1000mm and the range of rainfall usually varies between 380mm to 1000mm as shown in Fig. 7.11.



POST-MONSOON RAINFALL DATA ANALYSIS FOR THE YEARS 1993-2002

During the Post-Monsoon season of Set 3, the maximum rainfall intensity is around 500mm and the range of rainfall usually varies between 50mm to 500mm as shown in Fig. 7.12.



PRE-MONSOON RAINFALL DATA ANALYSIS FOR THREE SET 1, SET 2 AND SET 3.

- As observed in above graphs, for the 3rd decade (1993-2002) rainfall data, during pre-monsoon the rainfall range varies between 100mm to 700mm.
- For the 2nd decade (1983-1992) rainfall data, during pre-monsoon the rainfall range varies between 50mm to 350mm.
- For the 1st decade (1973-1982) rainfall data, during pre-monsoon the rainfall range varies between 0mm to 400mm.
- Even though it is Pre-Monsoon, the rainfall value is greater for Set 3, which is almost twice of the maximum value of Set 2 range.

MONSOON RAINFALL DATA ANALYSIS FOR THREE SET 1, SET 2 AND SET 3.

- As observed in above graphs, for the 3rd decade (1993-2002) rainfall data, during monsoon the rainfall range varies between 100mm to 700mm.
- For the 2nd decade (1983-1992) rainfall data, during monsoon the rainfall range varies between 200mm to 1100mm.
- For the 1st decade (1973-1982) rainfall data, during monsoon the rainfall range varies between 380mm to 1000mm.
- Even though it is Monsoon, the rainfall value is greater for Set 2, although the maximum range for all three Sets is almost equal and is close to 1000mm.

POST-MONSOON RAINFALL DATA ANALYSIS FOR THREE SET 1, SET 2 AND SET 3.

- As observed in above graphs, for the 3rd decade (1993-2002) rainfall data, during post-monsoon the rainfall range varies between 0mm to 550mm.
- For the 2nd decade (1983-1992) rainfall data, during post-monsoon the rainfall range varies between 80mm to 475mm.

- c) For the 1st decade (1973-1982) rainfall data, during post-monsoon the rainfall range varies between 50mm to 500mm.
- d) Even though it is Post-Monsoon, the rainfall value is Set 1, although the maximum range for all three Sets is almost equal and close to range of 500mm.

VI. CONCLUSIONS

- a) The Arni region of Tamil nadu is quite diversified in terms of climatic conditions.
- b) From the analysis of rainfall data for Arni station, it is observed that rainfall in Arni is highly variable, irregular and diversified.
- c) The yearly rainfall data for 1st decade ranges between 35mm to 130mm, while the yearly rainfall data for 2nd decade ranges between 40mm to 140mm and the yearly rainfall data for 3rd decade ranges between 60mm to 160mm.
- d) From the analysis the standard deviations of Set 1, Set 2 and Set 3 are 108.32mm, 98.83mm and 108.07mm respectively.
- e) Also the mean value for Set 1, Set 2 and Set 3 are 86.63mm, 87.08mm and 94.87mm respectively.

ACKNOWLEDGMENT

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We record our sincere thanks to our parents for the support and motivation. We thank all our friends, who freely helped us in many ways towards the successful completion of this project work.

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- [2] **Andy Y. Kwarteng, a Atsu S. Dorvlo and Ganiga T. Vijaya Kumara. Analysis of a 27-year rainfall data (1977–2003) in the Sultanate of Oman.** This journal focuses on the analysis of rainfall intensities around the country of Oman. This study was performed to develop the water resources around the region. The study concluded by saying that rainfall in Oman is highly irregular and unstable. Although the region is scarce but

if there is a sudden and extreme rainfall, it can lead to serious consequences around this region.

- [3] **M. Rajeevan, Jyoti Bhate and A. K. Jaswal. Analysis of variability and trends of extreme rainfall events over India using 104 years of gridded daily rainfall data.** In this study, using 104 years (1901 – 2004) of high resolution daily gridded rainfall data, variability and long-term trends of extreme rainfall events over central India have been examined. Detailed analysis shows that inter-annual, inter-decadal and long-term trends of extreme rainfall events are modulated by the SST variations over the tropical Indian Ocean.