

**AN INVESTIGATION OF PRECIPITATION PATTERNS IN
SRI LANKA**

L D. S. Samarasuriya.

This dissertation was submitted in requirements for the Master of Engineering degree in Water Resources Engineering and Management.

Department of Civil Engineering,

University of Moratuwa.

Sri Lanka.

April 2002

92950

Summary.

There is increasing scientific evidence that humans are gradually but certainly changing the earth's climate. The earth's climate is affected by factors that cause a change in the redistribution of energy within the atmosphere or between the atmosphere, land and ocean. Greenhouse gas emissions are altering the atmosphere, creating an uncertain future of global warming, altered patterns of precipitation, and sea level rise for the generations to come.

Therefore, the potential threat of global climate change is a very serious problem collectively faced by humanity as a result of its own activities.

When the hydrological cycle is predisposed by global warming, naturally-occurring droughts will set in quicker, plants will wilt sooner and the droughts will likely become more extensive and longer lasting.

The impact of climate change and increase in extreme climate events on water resources will affect human well-being to various degrees, depending on how country-specific water management methods can accommodate such change. Wealthier countries with sophisticated water management systems will be better prepared to deal with the consequences of climate change, whereas poorer nations that are more dependent on seasonal rainfall will be more vulnerable. In general, irrigation may be the first activity to be significantly affected in many countries facing water shortages.

Therefore, a reliable quantification of the potential impacts of climate change on hydrology and water resources is essential for the effective and efficient management of water resources.

Precipitation is the major driving force of the hydrological system. As indicated earlier, a warming trend will intensify the hydrological cycle and significantly affect regional conditions. Changes of precipitation in the amount, intensity, duration and timing during the year will affect river flows and groundwater recharge, but to what degree will depend on the amount of change and the type of catchments. For example, changes in short- duration rainfall characteristics will have a large effect on flood regimes in highly-responsive catchments, but less impact in large, unresponsive catchments, which will be more affected by changes in the rate of occurrence of prolonged wet spells.

The main objective of this research is to investigate & detect any statistically significant trend, periodicity, variability or change in the annual and seasonal precipitation at several meteorological

stations in Sri Lanka. A comparison is also made using synthetically generated data, based on the statistical characteristics of the historical data. Despite its tropical nature, the annual rainfall of Sri Lanka exhibits remarkably large spatial and temporal variability. In order to find out the changes, statistical tests had to be applied to analyze historical precipitation records. The method of moving averages is used in the calculations in order to reduce the amount of variation present in the data. For simulation, six sets of synthetic time series have been generated for each meteorological station using pseudo random numbers.

Declaration by the candidate :

I declare that the work included in this dissertation in part or whole, has not been previously presented for any other academic qualification at any institution for a higher degree.

Eng. I. D. S. Samarasinghe.

April 2002.



University of Moratuwa, Sri Lanka.
Electronic Theses & Dissertations
www.lib.mrt.ac.lk

Acknowledgement :

The study for this project was carried out as an integral part of the Master of Engineering course in Water Resources Engineering and Management, at the University of Moratuwa, Sri Lanka.

I would like to express my heartfelt gratitude to Eng.(Dr.) S. S. Wickramasuriya, my wonderful supervisor, for his valuable guidance and constant encouragement throughout this study. The successful completion of this project was possible because of his precious advises and support.

My deepest gratitude goes to my employer, the Department of Irrigation, Sri Lanka, which gave me the opportunity to pursue higher studies. I must specially thank Eng. W. P. Jinadasa- the Director General, Eng V Regunathan – former Director (Regional Development & Construction), Eng S. Jayawarna -Deputy Director (Training) and Eng. G.V. Ratnasara – Deputy Director (Planning) for their support, guidance and encouragement.

I must specially thank my mother because, when my father passed away when I was seven years old, she single handedly brought up my two brothers and myself and educated us. Without her courage and commitment, which laid the foundation for my professional carrier, this study would not have been possible.

Finally, I thank my husband Keerthi Sirisinghe who is a tower of strength to me and my adorable son Bhasara who constantly reminded me that I have spent so much time on this work than with him.

IDSS/2002

Contents:

	Page
Acknowledgement.	
Summary	
Chapter 1.0 :	Introduction. 1
	The changing climate. 1
	Problems due to climate change. 2
Chapter 2.0 :	The objectives of the research. 9
	Data & methodology. 9
	Meteorological stations. 10
	Historical data. 10
Chapter 3.0 :	General Background 12
	Sri Lanka ; Location, topography and climate. 12
	Influence of rainfall on agriculture in Sri Lanka. 15
Chapter 4.0 :	Statistical Techniques Adopted. 17
	Statistical characteristics 17
	Mean annual precipitation 17
	Standard Deviation. 18
	Variance; 18
	Coefficient of variation 18
	Test of hypothesis and significance; 19
	“Student’s” t distribution test. 19
	Moving average of precipitation. 20
	Moving standard deviation of precipitation. 20
	Moving coefficient of variation of precipitation. 20
	Generating normally distributed precipitation data using pseudo-random numbers, for simulation. 21
Chapter 5.0 :	Results and Discussion 22
	Normality of the annual & seasonal precipitation. 22
	Visual observations. 23
	Annual Rainfall 23
	Seasonal Rainfall 24
	Statistical calculations. 26
	Tests of Hypothesis & significance. 26
	Observations of Moving Standard Deviation & Moving Coefficient of Variation. 27
	Observations of Meteorological station at Nuwara-Eliya. 27
Chapter 6.0 :	Conclusions 28
Bibliography:	31

List of Tables :

Table 1 - District wise paddy production in Sri Lanka.

Table 2 – Statistical characteristics of Annual and Seasonal Rainfall for 100 years. (1899-1998)

Table 2a – Statistical characteristics of Monthly Rainfall for 100 years.(1899-1998)

Table 3 - Statistical characteristics of Annual rainfall for 30 years.

Table 3a- Statistical characteristics of Seasonal rainfall –Anuradhapura-for 30 years.

Table 3b- Statistical characteristics of Seasonal rainfall –Hambantota-for 30 years.

Table 3c- Statistical characteristics of Seasonal rainfall –Puttalam-for 30 years.

Table 3d- Statistical characteristics of Seasonal rainfall –Galle-for 30 years.

Table 3e- Statistical characteristics of Seasonal rainfall –Ratnapura-for 30 years.

Table 3f- Statistical characteristics of Seasonal rainfall –Kurunegala-for 30 years.

Table 4- Annual rainfall-30 year Moving Average.

Table 5- Annual rainfall-30 year Moving Standard Deviation & Moving Coefficient of Variation.

Table 6- Seasonal rainfall-30 year Moving Average.

Table 7- Seasonal rainfall-30 year Moving Standard Deviation

Table 8- Seasonal rainfall-30 year Moving Coefficient of Variation.

Table 9- Observations for the meteorological station at Nuwara-Eliya.

List of Annexes :

- Annex 1** -Normality of the Annual and Seasonal rainfall.
Annex 2 -Monthly Average of rainfall for the six meteorological stations.
Annex 3 -30 year Moving Average of Annual rainfall
Annex 4 -30 year Moving Average of Seasonal rainfall.
Annex 5 -Moving Average of generated annual rainfall-5000 years
Annex 6 -“Student’s” t-Distribution test results.
Annex 7 -Moving Standard Deviation and Moving Co-efficient of Variation of Annual & Seasonal rainfall.
Annex 8 -Moving Average, Moving Standard Deviation & Moving Co-efficient of Variation plots of Nuwara-Eliya .

