MODELING OF SPATIO-TEMPORAL DISTRIBUTION OF RAINFALL

By

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Submitted

in fulfillment of the requirements for the Award of the Degree of

DOCTOR OF PHILOSOPHY

to the

INDIAN INSTITUTE OF TECHNOLOGY, DELHI

OCTOBER, 1999

Dedicated
to
My Parents

CERTIFICATE

This is to certify that the thesis entitled *Modeling of Spatio-Tempoval Distribution of Rainfall* being submitted by Elizabeth C Kuruvilla for the award of the Degree of Philosophy, is a record of bonafide research work carried out by her. Mrs. Elizabeth C. Kuruvilla has worked under my guidance and supervision for submission of this thesis, which to my knowledge, has reached the requisite standard. This thesis, or any part thereof, has not been submitted to any other University or Institute for the award of any degree or diploma.

Dr. (Mrs.) REMA DEVI
Professor

ACKNOWLEDGEMENT

It is indeed a great pleasure for me to express my profound gratitude to my supervisor, Prof. Rema Devi, who has shown much sincerity and cooperation in the completion of this thesis. Her guidance, advice, and valuable suggestions will be of great help to me in my professional career and personal life.

I take this opportunity to place on record my thanks to the Executive Director, CWRDM, Kozhikode, Kerala for helping me to get the required data. I express my gratitude to Dr. E.J. James and other staff members of SWD, CWRDM for the cooperation they have extended. I am also grateful to the Principal, Karunya Institute of Technology, Coimbatore and the staff of the Civil Engineering Department for the encouragement they have given. My sincere thanks are also due to Dr. (Ms) Sandhya Rao, who has given valuable technical suggestions in the capacity of a personal friend.

The list of friends to whom I owe my thanks in the completion of this thesis is very long and I cannot do full justice in this context. However, I would like to place on records my gratitude and thanks to the following:

The Faculty and Research Scholars in the Water Resources Section, IIT Delhi; Ms. Anitha, CWRDM; Padma Kumari, EED REC; Elizabeth, EED, REC; Ratna and Bhatt; Mr. Reji and Unnikrishnan; and Miss Swapnaja.

I express my heartful thanks to Mr. Naved Ahsan, Research Scholar, IIT Delhi, who helped me in bringing the thesis in the present form.

I am fortunate to be in a family of parents, sisters and in-laws who always care and help each other. Is there a need to thank one's own family? Still a word. There is not a little bit exaggeration, if I say, I would not have been able to do my work without the abundant support of my husband. I am happy to say that, our kids Nirmal and Kripal have shown much cooperation and understanding during the busy schedule in the preparation of the thesis.

Above all, everything was possible only because of the Grace of God to whom I am submitting my whole.

ELIZABETH' C KURUV1LLA

ABSTRACT

Rainfall is a major weather parameter that is often required to be forecast for proper utilisation of water resources. The response of the catchment in transforming the rainfall to component phases in the hydrological cycle have received considerable attention from research workers and many kinds of models have emerged over the years. The primary requirement of all these models is information on the sole input, the precipitation, particularly its temporal and spatial distribution. The present study is focused on this aspect of modeling and forecasting of rainfall in the spatial, temporal and space-time domains.

Main objectives of the study are the modeling of rainfall with interpolation and forecasting in the spatial and temporal domains. Space-time modeling of rainfall wherein information in either domain can be effectively used is also another important aim of the study. Yet another objective is interercomparison of techniques.

The study area chosen is part of the catchment area of one of the largest wetland system, the Vembanad Lake, in Kerala. The five river basins in the catchment area have been considered as a single unit.

For spatial interpolation, conventional techniques such as Optimal Interpolation, Kriging, Multiquadric Interpolation and ANN with and without Genetic Algorithm have been applied. Also, Factor Analysis has been used to identify homogeneous hydrometeorologic units.

ANN has outperformed the other conventional techniques such as Optimal Interpolation, Kriging and Multiquadric. Amongst these four techniques, Multiquadric has given the poorest results. It has also been found out that it is better to identify groups of homogeneous rainfall stations using factor analysis prior to the use of any modeling techniques, The techniques can further be applied to each group separately rather than taking all the stations together.

Monthly rainfall values have been regressed with latitude, longitude, altitude and suitable relationships have been established. Also, interpolation and forecasting of rainfall at ungauged locations are made possible through use of geographic variables in modeling. Relationships between different groups of stations have also been established. This finding may help to decrease the number of raingauge stations and hence conserve financial resources.

Both SARIMA and ANN are found to give comparable results on short term forecasts. However, as the forecast horizon extends, ANN gives better results. Genetic algorithm has been used for optimizing weights for neural networks and has given promising results when compared with the random weight based neural network.

Reliable good quality forecasting techniques for rainfall in temporal and spatial domains and combined space and time domains have been reached from this study. The results from the study are also expected to serve in formulating improved water management practices in the basins of rivers draining into the Vembanad wetland. The study is expected to serve as a guidance for rainfall analysis in the region, west of Western ghats.

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