UNIVERSITI TEKNOLOGI MARA

APPLICATION OF FUZZY LOGIC TO SIMULATION OF RAINFALL IN KERAYONG RIVER CATCHMENT

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Thesis submitted in fulfillment of the requirements for the degree of Master of Science in Civil Engineering

Faculty of Civil Engineering

March 2009

CANDIDATE'S DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of University Teknologi MARA. It is original and is the result of my own work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted to any other academic institution or non-academic institution for any order degree or qualification.

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Date	11-03-2009

APPLICATION OF FUZZY LOGIC TO SIMULATION OF RAINFALL IN KERAYONG RIVER CATCHMENT

Abstract

Short term rainfall characteristics of Kerayong River catchment, a tributary of Klang River were analysed in this research. As the urbanisation process and the population increased in this catchment is inevitable, therefore knowledge on rainfall characteristics is necessary and useful in designing future drainage system. There are four rainfall and five stage monitoring stations established in this catchment. The rainfall stations are equipped with data logger of 0.5 mm tipping bucket resolution and record the data based on event mode. Time Dependent Data Analysis (TIDEDA) program is used by Department of Irrigation and Drainage (DID) Malaysia to read and edit the data for further analysis. The available data of Kerayong River catchment were beginning from year 2001 and 2002 which continuous data were available for all stations. The spatial and temporal distribution for Kerayong River catchment is studied by plotting the storm event at one minute interval. The analysis shows that the daily rainfall temporal pattern for the year 2001 and 2002 was found to be relatively similar to all stations. However the magnitude of rainfall intensity varies considerably at short time intervals. The result shows that there are missing data occur during the thunderstorm at Kg. Cheras Baru station from 15th January to 16th May 2003. The missing data are related to the malfunctioning of the instruments and vandalism. Therefore, the potential of fuzzy logic modeling i.e. Fuzzy Rule Based Model (FRBM) and Normal Ratio Method (NRM) for filling the missing data at Kg. Cheras Baru was investigated. A total of 420 daily rainfall values i.e. data for year 2001 and 2002 are employed to construct the FRBM. The numbers of data sets are selected in randomly and divided into training and verification sets. The rules are adopted from the available daily rainfall record with the simple assumption. The

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CHAPTER 1

INTRODUCTION

1.1 General

Rapid urbanisation contributes to frequent detrimental effects to the hydrological cycle. The distinct impact is that change in the land use for development purpose result in decreasing infiltration, increasing run off volume and later on accompanied by changes in rainfall pattern. These factors contribute to critical flash flood in urban areas especially in Kuala Lumpur. Generally flooding happens within a short duration of time commonly resulted from high intensity storms. In the year of 2002, there are eight flash floods were recorded in Kuala Lumpur by the Department of Irrigation and Drainage (DID) Malaysia, an increase in number from previous year.
As such, it is important for engineers to be knowledgeable about the natural passage of excess runoff and the rainfall characteristics such as the intensity, duration and frequency in order to conceptualize and predict their effects to the drainage network design whereby any changes in space and time may influence the planning progress. Kerayong River catchments are chosen as the study area and as an experimental basin by DID, Malaysia because the surface characteristics are mainly dictated by urbanisation process as more than half of the areas are developed as business and commercial centers or organized residential areas. Most rainfall events in the area are of short durations which occur in only a small part of the total storm duration. For that reason the rainfall variability in space and time at this catchment area are being studied especially at short time scale where the storm events are analyze at one minute interval. Therefore, this knowledge is one of the ways in tackling the problems related to the storm drainage in the region of rapid urbanisation and the