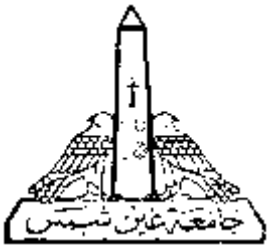

AIN SHAMS UNIVERSITY

FACULTY OF ENGINEERING

Irrigation and Hydraulics Department

Effect of Storm Kinematics on Runoff Hydrograph in Arid Regions Using a 2-D Model

A Thesis Submitted in Partial Fulfillment for the Requirements
Of the Degree of Master of Science in Civil Engineering
(Irrigation and Hydraulics)

By

MOHAMMED REFAAT MOHAMMED EL-GENDY

B.Sc. of Civil Engineering
(Irrigation and Hydraulics)
Ain Shams University, 2013

Supervised By

Prof. Dr. Nahla M. AbdelHamid AboulAtta
Professor of irrigation design
Irrigation and Hydraulics Department
Faculty of Engineering
Ain Shams University

Prof. Dr. Ayman Georges Awadallah
Professor of water resources engineering
Civil Engineering Department
Faculty of Engineering
Fayoum University

Cairo 2019

Ain Shams University
Faculty of Engineering
Irrigation & Hydraulics Department

Effect of Storm Kinematics on Runoff Hydrograph in Arid Regions Using a 2-D Model

By
Eng. Mohammed Refaat Mohammed El-Gendy
A thesis Submitted for the partial fulfillment of the
Master Degree

EXAMINERS COMMITTEE

Name	Signature
Dr. Alaa El¬Din M. El¬Zawahry Professor of Hydraulics Irrigation & Hydraulics Department Faculty of Engineering Cairo University	
Prof. Dr. Ashraf Mohamed El Moustafa Professor of Engineering Hydrology Irrigation & Hydraulics Department Faculty of Engineering Ain Shams University	
Prof. Dr. Nahla M. AbdelHamid AboulAtta Professor of Irrigation Design Irrigation & Hydraulics Department Faculty of Engineering Ain Shams University	
Prof. Dr. Ayman Georges Awadallah Professor of Water Resources Engineering Civil Engineering Department Faculty of Engineering Fayoum University	

Cairo, Egypt
2019

THE AUTHOR

Name: Mohammed Refaat Mohammed El-Gendy

Date of Birth: 1-December-1990

Place of Birth: Giza, Egypt

Scientific Degrees: B.Sc. Civil Engineering – Irrigation and Hydraulics, 2013

Current Job: Design Environmental Engineer
Dar Al-Handasah
Cairo, Egypt

STATEMENT

This thesis is submitted to the Irrigation and Hydraulics Department, Faculty of Engineering, Ain Shams University in the partial fulfillment of the requirements for the Degree of Master in Civil Engineering.

The work in this thesis was carried out in the Irrigation and Hydraulics Department, Faculty of Engineering, Ain Shams University from 2013 to 2019.

No part of this thesis has been submitted for a degree or a qualification at any other university or institution.

Name: Mohammed Refaat El-Gendy

Date: 5 / 8 /2019

Signature:

ACKNOWLEDGMENTS

At the beginning and end, thanks to Allah for everything

I would like with honor to thank my supervisors of the thesis, **Prof. Dr. Nahla M. Abdel Hamid AboulAtta** and **Prof. Dr. Ayman Georges Awadallah** for their continuous guidance, support and mentoring. I have learned a lot form them whether technical or managerial. They believed in me form the first day and helped me to overcome all the problems and obstacles which faced me through the preparation of this thesis.

I am very thankful also to examiners committee members **Prof. Dr. Alaa El¬Din M. El¬Zawahry** and **Prof. Dr. Ashraf Mohamed El Moustafa** who examined this thesis and enriched the content of this thesis by their constructive discussion with me. Their notes added values to the thesis and their compliments on the thesis were very appreciated. They gave hand in pushing the progress of this thesis forward.

Dr. Refaat El-Gendy, my dad who have always been and will always be my idol who guided me how to work hard for adding values to myself, community and even the whole world. His continuous motivation encouraged me to face all types of challenged I have ever met whether through the thesis preparation or through my whole life.

My mother, you are a great gift from Allah. Thanks for taking care of me on the way that no one have ever done. You always give for no favor, for no reason, just to see me happy. I hope that I can make you always happy and proud of me. Watching your tears which fall when you see my success is a precious moment that I hope it could last forever.

Noha, Dr. Ahmed, Eng Mostafa, Mahmoud, Dr. Alhassan, my brothers and sister, only Allah knows how thankful I am for your kind feelings and supportive speeches through the hardest moments of my life. Your existence made it easier for me to face different types of obstacles and gave me the support which I always needed.

Eng. Radwa Ahmed, my fiancé and my beloved one who always supports me, you have lightened my whole life. Your existence in my life converted impossible matters

to possible, possible matters to real and made every difficult goal come true. You made me believe that beside every great man there is a great woman. I hope that we can make progress together and that your existence in my life last forever and after life.

I would like also to thank all of my relatives and friends who supported me in different spiritual and technical ways and celebrate with me those memorial moments.

Many thanks to my colleagues who helped me with solving many technical problems which faced me throughout the preparation of the thesis i.e. **Ahmed Madany**, **Abdullah El Mofty**, **Ahmed Hany**, **Mostafa Shebl**, **Mohamed Shams**, **Omar Zohny**, **Ahmed Teleb**, and many others who gave the support for no favor.

It is worth mentioning the appreciative role of the Department of Irrigation and Hydraulics, Ain Shams University staff and Water Resources and Environmental Engineering department staff in Dar Al-Handasah company in giving the continuous support and assistance.

Abstract of thesis

Effect of Storm Kinematics on Runoff Hydrograph in Arid Regions Using a 2-D Model

The right estimation of catchment peak flow due to a specific storm is very important. Based on the estimated peak flow, drainage and flood protection systems are proposed and designed. Meteorological data such as storm characteristics and storm return period are main factors that affect runoff hydrograph and peak flow discharging from a catchment.

The main objective of this research is to study the effect of storm kinematics i.e. storm speed and direction on the modelled runoff hydrograph using a 2D model. The computations have been carried out using InfoWorks Integrated Catchment Modeling (ICM) software.

The runoff hydrograph of the study catchment is estimated under different scenarios such as:

- The catchment is subjected to a commonly used stationary rainfall Storm (Without spatial Distribution).
- The catchment is subjected to a moving rainfall storm
    - In the direction of flow (downstream)
    - Opposite to the direction of flow with the same speed (upstream)
    - In the direction of flow with higher speed (change in speed)
- The catchment is subjected to a stationary rainfall storm (with spatial distribution) in order to evaluate the effect of simulating rainstorm spatial distribution separately.

Storm characteristics (such as rainfall total depth) are kept the same for all scenarios. As-Sulai catchment, located in Riyadh, Kingdom of Saudi Arabia KSA, is used as a case study.

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List of Symbols

The following symbols are used in this thesis. Usually each symbol has one meaning, but if there is more than one meaning for any symbol, then the meaning will be given in the context in which this symbol is used. Other symbols not listed here are defined in the main text.

AI	:	Aridity Index
CN	:	Curve Number
DBZ	:	Decibel relative to Z
ETP	:	Evapotranspiration
g	:	Acceleration due to gravity
h	:	Water depth
P	:	Rainfall Depth
Q	:	Accumulated depth of runoff
q	:	Source flow or sink per unit area
S	:	Potential maximum soil storage depth
S_{0x}	:	Bed slope variations in x direction
S_{0y}	:	Bed slope variations in y direction
S_{fx}	:	Friction slope due to boundary turbulent shear stress in the x-direction
S_{fy}	:	Friction slope due to boundary turbulent shear stress in the y-direction
t	:	Time
tc	:	Time of concentration
u & v	:	Depth average velocities in x- & y- directions respectively
x & y	:	Two space dimensions