FAYOUM UNVERSITY
FACULTY OF ENGINEERING
CIVIL ENGINEERING

# Rainfall Erosivity Estimation in Arid Regions using Commonly Available Rainfall Characteristics

**By**

**Eng. Mahmoud Mohamed Ahmed Abdeltawab**

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A thesis submitted in partial fulfillment
of
the requirements for the degree of

*Master of Science*
in
*Civil Engineering*

**(Irrigation and Hydraulics Engineering)**

**Faculty of Engineering**
**202٢**

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# Abstract

Rainfall is considered the main reason for soil erosion. Determination of rainfall erosivity factor (R-factor) by the exact method requires raw-hyetograph data which are normally not available. Several studies were performed in arid regions to evaluate rainfall erosivity factor by using commonly available rainfall data (i.e. monthly and annual rainfall data) and previously published equations that evaluate the R-factor by these data. These studies did not calibrate the equations that they used and hence a calibrated equation is required to evaluate the rainfall erosivity factor using commonly available rainfall data in the study area.

The Arabian Peninsula was considered as the study area in this research. First, the R-factor wasevaluated with the exact method of RUSLE for 104 rainfall stations (50 stations with raw-hyetograph data and 54 stations with processed short-duration data) in the study area. These 104 stations were set as reference stations for calibration. Then the eleven previously published equations that evaluate the R-factor using available rainfall data were calibrated. None of the eleven previously published equations give good results for the study area. Then sixteen models of regression were tested to develop a new equation to estimate the R-factor. The performance criteria (the coefficient of determination, the root mean square error, the mean absolute error and the mean absolute percent error) were used to determine the best equation for estimating the R-factor.

The developed equation was applied for 225 stations in the study area that provide commonly available rainfall data to evaluate the R-factor. ArcGIS software was used to produce a spatial distribution map of rainfall erosivity for the study area by the data from the entire 329 rainfall stations.