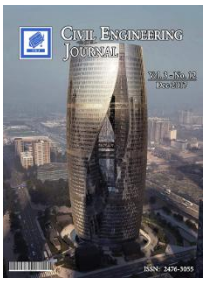
Available online at www.CivileJournal.org

Civil Engineering Journal

Vol. 3, No. 12, December, 2017



Calculation of the Spatial Flooding Intensity with Unit Flood Response Method in the Tangrah Watershed, Iran

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Received 10 November 2017; Accepted 28 December 2017

Abstract

Increased flooding in recent years indicates that most parts of the country are subjected to periodic and destructive flood attacks. Therefore, the identification of high-risk areas with potential runoff production within a watershed area is one of the most important measures in flood control and reduction of the damage caused by it. In this study, the quasi-distributional ModClark method was employed to simulate the hydrograph of flooding, and the unit flood response method was applied to determine the intensity of flooding of different areas of the Tangrah watershed, Iran. For this purpose, the ModClark model was first calibrated and verified. Thereafter, the design of rainfall with 50 and 100-year return periods (T_r) was extracted at the Tangrah station and the design flood was calculated with the above-mentioned return periods. By combining the curve number layers, slope, precipitation, and flow distance, homogeneous units were obtained in terms of the flood. The effect of each homogeneous unit on the total watershed output was obtained by the removal of each unit and implementation of the rainfall-runoff model. According to the 100-year return runoff production potential, homogeneous units of 116 with a *fi* (0.54 m^3/ s. km^2) were identified as the most effective cell in the Tangrah watershed area, which could be explained by the soil type, vegetation, and other physical factors of these units.

Keywords: ArcGIS; Distributed Model; Flooding Map; ModClark Model; Unit Flood Response.

1. Introduction

Flood management is carried out at four levels, these include prediction, preparation, prevention, and evaluation of damage [1]. One of the measures to reduce the risk of flood in the lower reaches is to resort to flood-control at its source. Therefore, it is important to identify flood-prone areas in watersheds for flood-control operations. In determining the flooding of large watersheds, it is essential to divide the watershed into hydrological units and investigate the potential of each unit in terms of flood participation at the outlet of the watershed. One of the methods for identifying flood-prone areas is the unit flood response method [2]. Generally, the flood-prone changes are controlled by three factors: soil, vegetation, and topography [3]. Several studies have been conducted on flooding. Juracek (2000) identified the priority of flood-prone sub-basins in large watershed areas of 150 to 6600 km^2 in the state of Kansas, USA. In this study, the effect of spatial distribution of rainfall intensity was studied. The results revealed that the differentiation of flood-prone sub-basins was very limited [4]. Saghafian et al. (2002) presented a novel method based on the development of the concept of time-area for distributed modeling. In this method, a digital elevation model, slope, flow direction, and flow

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http://dx.doi.org/10.28991/cej-030961