

**Integrating Landsat ETM+ and TRMM images for estimating of runoff  
volume and depth using SCS-CN model  
A case study: Hirmand river basin**

**Abstract**

Accurate surface runoff estimation techniques suitable for ungauged watersheds are relevant to areas such as Hirmand basin where hydrologic gauging stations are not widely available. The soil conservation services curve number (SCS-CN) method is one of the most widely used methods for quick and accurate estimation of surface runoff from ungauged watersheds. The approach used in this research integrates data derived from satellite images (e.g. land cover, precipitation, and digital elevation model) with hydrological data in a Geographic Information System (GIS) model to quantify surface runoff areas on a pixel-by-pixel basis using SCS-CN method. SCS-CN method was applied to time series of precipitation derived from Tropical Rainfall Measuring Mission (TRMM) to estimate monthly rainfall-runoff; land cover was derived from supervised classification of Landsat ETM+ images and map of curve numbers was generated based on the hydrological soil groups and land cover grid surfaces. Rainfall-runoff was quantified from March 2005 until February 2006. Runoff modeling showed that runoff occurs mostly in northern and eastern parts of the study area during March, January and May. It was found that using remote sensing based model results a runoff estimate of  $16.64 \text{ km}^3 \text{ yr}^{-1}$ . Comparison between measured volume in Kahak Dam and estimated volume of rainfall-runoff in Hirmand river basin show that only  $0.5 \text{ km}^3$  of total rainfall-runoff flows into the Kahak Dam. This volume equals to about 3% of the total runoff and shows that Iran country has a low portion of runoff volume, generated in Hirmand river basin.

**Keywords:** Hirmand river; SCS-CN method; Rainfall-runoff depth; TRMM; Landsat ETM+



University zabol  
graduate school  
Faculty of Engineering  
Department of Civil Engineering

The thesis submitted for master's degree  
Of master of science (M. Sc)

**Integrating Landsat ETM+ and  
TRMM images for estimating of runoff  
volume and depth using SCS-CN model  
A case study: Hirmand river basin**

**Supervisor:**

Dr . m . r . mollaienia

**Advisor:**

Mr . H . r . hosseinabadi

**By :**

A . kahkhamoghaddam

September 2015