ABSTRACT

The study was conducted in Central Sudan (Gezira and Khartoum states) in the period from 2005 to 2007. Site I was in the west of Gezira in Elhorga and Nor eldin scheme and site II was in Khartoum state Shambat area.

Some soil physical properties, soil constants and (shrink-swell) indices were measured. The soil physical properties show spatial variation in the fields. The best fit relationships between measured (shrink-swell) indices and some selected soil properties for study sites were found. All trend lines gave high significant relationships. Also all the characteristics of the soil cracks were measured in forty representative unit surface area. The results of investigations show the cracks volume was 350 m^3/ha and 210 m^3/ha for sites I and II respectively. Also the shrinkage curves and shrinkage characteristics for the two sites were developed.

Empirical models were developed, which calculate the cracks area per unit soil surface, the average crack width and the crack depth. The predicted and measured values were agreed, indicating that the empirical models satisfactorily described the cracked soils.

Water balance was developed to quantify flow processes during irrigated cracks fields. All components of water balance were measured. The results show the amount of water that bypassed the top soil accounted for 30.6%- 44.2 % of total water applied. Also, the method of estimation of soil cracks characteristics is described. Estimated cracks porosity in the field was ranged from (4.3% to 22 %). This method can be used as routine predictor for cracks porosity.

The analytical model proposed in this study is build by coupling Green-Ampt model for vertical infiltration with modified Green-Ampt model for horizontal infiltration. The analytical model satisfactorily predicts the infiltration process in cracked soil. Also, the numerical model was developed. The one dimensional Richards's equation assumed to describe water flow in the soil matrix. Flow in cracks are mutually linked using an extension of the Richard's equation by adding the sink term to represent the contribution of the cracks to infiltration. The extension of the Richard's equation was solved using the finite difference technique implicit option. This model can be used to simulate water movement in cracked soil.