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Location of Fraction-Saturated Areas in Watershed Using Empirically Calculated Topographical Index

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Abstract

In engineering practice, simple methods are important for predicting runoff from watersheds particularly for flood forecasting and water balance calculations. In the present study, it is illustrated that the often used soil conservation services runoff curve–number (SCS-CN) approach in its most elementary form can be derived from assuming that only saturated areas contribute to direct runoff. With this approach the initial abstraction or the amount of water required before runoff starts is equal to air-filled pore space per unit area for most shallow soils in the watershed. Air-filled pore space throughout the year is calculated with aid of the simple water balance employing Throntwaite-Mather procedure. As per this procedure two user-friendly computer programmes ASH.FOR and DSW.FOR are developed and coded in FORTRAN language to determine daily water storage (S) and effective rainfall / initiation of runoff (Pe).The water storage and fraction saturated area for untreated wm1 and treated wm2 micro - watersheds of Mansadevi-watershed falling within Shivalik region of India is compared. Geographic Information System (GIS Arc-Info) software is used for digitizing the contour maps of untreated wm1 and treated wm2 micro-watersheds. Topographical index (?) is incorporated into modified (SCS-CN) method to find critical (?) values to locate fraction-saturated areas graphically as per (Lyon et. al 2004). Further, a concept of translating graphically calculated (?) values into empirically calculated (?) value is proposed in the present study for convenient practical application. Comparison of empirical solution with graphical solution confirms convenient application of locating fraction-saturated areas. The results show good agreement of predicted as well as estimated runoff values with the observe runoff values for modified (SCS-CN) method over traditional (SCS-CN) method. Finally, the study confirms that incorporating topographical index, into modified (SCS-CN) method also called variable source area (CN-VSA) method (Steenhuise et.al 1995) is simple enough to locate fraction-saturated areas within a watershed.

Keywords

VSA; Water balance; critical values; shallow soils; Shivalik region of India; India

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Refbacks

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