

Practical No-6

Calculation of Rainfall Erosivity Index

Aim: To find intensity and compute rainfall erosivity index of storm by EI₃₀ and KE>25 method.

Theory:

Rainfall erosivity is a term that is used to describe the potential for soil to be washed off from disturbed, de-vegetated areas and move with into surface waters during storms. It may also be defined as the potential ability of rain to cause the erosion. It is dependent upon the physical characteristics of rainfall, which include raindrop size, drop size distribution, kinetic energy, terminal velocity, etc.

Factors Affecting Rainfall Erosivity:

The various factors, which affect the erosivity of rain storm, i.e. Rainfall Intensity;

Drop Size Distribution; Terminal Velocity; Wind Velocity and Direction of Slope.

The rainfall erosivity is related to the kinetic energy of rainfall.

Procedure:

1. EI₃₀ Index Method:

This method was introduced by Wischmeier (1965). It is based on the fact that the product of kinetic energy of the storm and the 30minute maximum rainfall intensity gives the best estimation of soil loss. The greatest average intensity experienced in any 30-minute period during the storm is computed from recording rain gauge charts by locating the maximum amount of rain which falls in 30-minute period and later converting the same to intensity in mm/hour. This measure of erosivity is referred to as the EI₃₀ index and can be computed for individual storms, and the storm values can be added over periods of time to give weekly, monthly or yearly values of erosivity.

The rainfall erosivity factor EI₃₀ value is computed as follows:

$$EI_{30} = \frac{KE \cdot I_{30}}{100}$$

Where,

EI₃₀ = Rainfall erosion index, KE = Kinetic energy of storm and I₃₀ = Maximum 30 min. rainfall intensity of storm.

Limitation

The EI₃₀ index method was developed under American condition and is not found suitable for tropical and subtropical zones for estimating the erosivity.

2. KE > 25 Index Method

This is an alternate method introduced by Hudson for computing the rainfall erosivity of tropical storms. This method is based on the concept that erosion takes place only at threshold value of rainfall intensity. From experiments, it was obtained that the rainfall intensities less than 25 mm/h are not able to yield the soil erosion in significant amount. Thus, this method takes care of only those rainfall intensities, which are greater than 25 mm/h. That is why the name is K.E. > 25 Index method. It is used in the same manner as the EI₃₀ index and the calculation procedure is also similar.

The estimation procedure is same for both the methods. However, K.E. > 25 method is more advantageous, because it sorts out many data less than 25 mm/h, hence uses less rainfall data. For both the methods, it is important to have data on rainfall amount and its intensity. The procedure involves the multiplication of rainfall amounts in each class of intensity to the computed kinetic energy values and then all these values are added together to get the total kinetic energy of the storm. The K.E. so obtained, is again multiplied by the maximum 30minute rainfall intensity to determine the rainfall erosivity value.

Question:

Using the following rainfall data of a particular storm, determine 30 min maximum rainfall depth and intensity, and also compute rainfall erosivity index of storm by EI₃₀ and KE > 2.5 methods

Time (min)	Rainfall (cm)	30 min rainfall depth	Rainfall intensity (cm/hr)	K.E= $210.3 + \log_{10} I$ (m.tones/ha.cm)	K.E (m.tones/ha)
0	0.00				
5	0.05				
10	0.87				
15	0.26				
20	0.10				
25	0.49				
30	1.23				
35	1.28				
40	1.28				
45	1.31				
50	0.41				

55	0.79				
60	1.69				
65	0.92				
70	1.00				
75	0.92				
80	1.38				
85	1.95				
90	1.31				
95	1.13				
100	0.64				
105	0.64				
110	0.56				
115	0.38				
120	0.23				
125	0.23				
130	0.31				
135	0.08				
140	0.03				
145	0.05				
150	0.03				
Total					

K.E > 2.5 method:

In this method, only those rainfall intensities are considered which are greater than 2.5 cm/h, as the intensities less than 2.5 cm/h are not effective to cause soil detachment from the soil mass, reported by Hudson (1981). Computation of 'R' is shown as under:

Rainfall depth (cm)	Rainfall intensity (cm/hr)	$K.E = 210.3 + \log_{10} I$ (m.tones/ha.cm)	K.E (m.tones/ha)
0.87	10.44		

0.26	3.12		
0.49	5.88		
1.23	14.76		
1.28	15.36		
1.31	15.72		
0.41	4.92		
0.79	9.48		
1.69	20.28		
0.92	11.04		
1.00	12.00		
0.92	11.04		
1.38	16.56		
1.95	23.40		
1.31	15.72		
1.13	13.56		
0.64	7.68		
0.64	7.68		
0.56	6.72		
0.38	4.56		
0.23	2.76		
0.23	2.76		
0.31	3.72		
Total			