# Practical Thresholds for Separating Erosive and Non–Erosive Storms

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**Abstract.** *Determination of a practical threshold for separating erosive and non–erosive rainfall events can reduce the amount of work necessary to read rainfall charts and to calculate rainfall erosivity. The objective of this study was to develop a method of determining practical thresholds for erosive rainfall events and to evaluate its effectiveness for calculation of erosivity. Rainfall and runoff data measured for three plots and a small watershed from 1961 to 1969 at the Zizhou experimental station of the Yellow River Basin in China were used. Three thresholds for separating erosive events were given by using different types of rainfall data: (1) 12 mm for storm rainfall amount, (2) 2.4 mm h$^{-1}$ for average rainfall intensity, and (3) 13.3 mm h$^{-1}$ for the maximum 30–minute rainfall intensity. All methods had less than 0.1% overall error in the prediction of the erosivity value. Peak intensity provided the greatest accuracy for separating erosive rains, followed by rainfall intensity and then rainfall amount. A total of 79%, 77%, and 88% of the total number of events were omitted from the calculations using rainfall amount, average rainfall intensity, and 30–minute peak intensity, respectively. Any of the above three thresholds may be used according to data availability and desired accuracy of the erosivity estimation.*

**Keywords.** *Soil erosion, Soil loss, Rainfall erosivity, Sediment, USLE, RUSLE.*

Rainfall is an important factor in causing soil erosion, and its ability to cause erosion is referred to as rainfall erosivity. Wischmeier and Smith (1958) introduced the EI index in the universal soil loss equation (USLE) to measure erosivity for predicting annual average soil loss. It is the product of rainfall energy and maximum 30–minute intensity, and it can be computed for rainfall events summed over periods of weeks, months, or years. However, not all rainfall events cause soil erosion. Only rains that produce enough runoff to transport sediment are erosive. According to the estimation of Wischmeier (1962), at Guthrie, Oklahoma, 51% of the soil loss from a plot in continuous cotton occurred in 3 of the 27 years, while only 14% of the total rainfall occurred during those 3 years. At Blacksburg, Virginia, 81% of the total soil loss from a corn–wheat–meadow rotation occurred during 3 years that had only 18% of the 17–year rainfall. At Clarinda, Iowa, 40% of the total soil loss during 12 years of continuous corn occurred during the 2 years that accounted for 20% of the 12–year rainfall. Similarly, in China, only 45% of total rainfall was found to cause runoff during a 22–year period at Suide on the loess plateau (Jia and Xu, 1992). Thus, there are many small rainfall events that do not erode soil.

Omitting these non–erosive rainfalls is routinely done because it enormously eases the calculation of rainfall erosivity, particularly in terms of the necessity for reading and digitizing rainfall charts. However, there remains significant discrepancy among scientists as to exactly how this screening process should be done. Wischmeier and Smith (1978) omitted rains of less than 12.7 mm (0.5 in) in erosion index computations, unless as much as 6.4 mm (0.25 in) of rain fell in 15 minutes. By adopting this threshold value, the cost of analyzing 4,000 gage–years worth of rainfall intensity data was greatly reduced. Experiments with splash cups carried out by Hudson (1995) also indicated the existence of a threshold point. Tests showed that although there was variation from one storm to another, a maximum intensity of 25 mm h$^{-1}$ could be taken as a practical threshold separating erosive and non–erosive rains. The threshold value of 12.7 mm total rainfall suggested by Wischmeier and Smith (1978) is often used in making isoerodent maps in many countries (Renard and Freimund, 1994; Yu and Rosewell, 1996; Elsenbeer et al., 1993), although the criterion of 25 mm h$^{-1}$ maximum intensity has also been used as a threshold (Hudson, 1995; Joshua, 1977). Elwell and Stocking (1975) chose threshold criteria of both the daily rainfall of 25 mm and maximum intensity of 25 mm h$^{-1}$ to estimate annual soil loss and runoff in Rhodesia.

In China, threshold values have been studied based on either rainfall characteristics alone or on the relationships between soil loss and rainfall. Fang (1958) and Liu (1982) considered events not exceeding 50 mm of daily rainfall as non–erosive. According to the measured runoff and rainfall data for a bare plot with an 18% slope on cropland, Zhang and Wang (1982) set threshold criteria values to 49.8 mm h$^{-1}$ of maximum rain intensity within a 5–minute period and 55 mm of total daily rainfall. Based on similar data and methodology, Jiang and Li (1988) suggested 10 mm of event rainfall as a criterion for an erosive rain. Wang (1984) presented threshold values for rainfall amount, average intensity, and

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peak intensity of storm events after considering relationships between soil loss and rainfall characteristics.

Rainfall erosivity can be over–estimated if non–erosive events are counted, or it can be under–estimated if erosive rainfalls are omitted. The objectives of determination of a practical threshold are to omit non–erosive rains in order to reduce calculation requirements while obtaining the most accurate possible value for erosivity. Although the 12.7 mm threshold value developed by Wischmeier and Smith (1978) reduced cost and work, the rationale for the selection of that value was not presented, nor was its influence on the accuracy of rainfall erosivity estimation evaluated. Renard et al. (1997) reported that the consideration of all storms in estimating EI, rather than only storms that result in more than 12.7 mm rainfall, increased EI by 28% to 59% on the Reynolds Creek watershed. However, runoff and erosion data for evaluating the significance of the difference were not available.

The objective of this study was to develop and evaluate practical threshold criteria for calculating rainfall erosivity values accurately and efficiently. The threshold must: (1) separate erosive and non–erosive rains, (2) be quantified for its effect on the calculation of rainfall erosivity, and (3) be evaluated using data from different conditions.

## Data and Methods

The study region, the Zizhou experimental station of the Yellow River basin, is located on the loess plateau of northern China (109° 47′ E and 37° 31′ N). Average annual precipitation from 1961 to 1990 was 400.1 mm. The elevation is 1010 m. Measured soil loss data collected during the rainfall season from 1961 to 1969 from plots 3, 7, and 9 and from the Tuan Shangou watershed within the station were analyzed. The rainfall data were recorded continuously using chart–type rain gauges. If the interval was less than 6 hours between two consecutive rain periods, then the two periods were regarded as one event. Plots 3, 7, and 9 were cropland with a uniform gradient, a three–segment slope with different gradients on each equal–length segment, and an irregular slope shape, respectively (table 1). The land management on the plots consisted of various grains, potato, soybeans, and alfalfa (details in table 2). From 1961 to 1969, 282 storms caused 40 occurrences of soil loss from plot 3, 305 storms caused 47 occurrences of soil loss from plot 7, 268 storms caused 40 occurrences of soil loss from plot 9, and 323 storms caused 108 occurrences of sediment delivery from the watershed (table 1). Land use on the watershed consisted of row–crops, natural vegetation, riverbed, and road. For every storm from all plots and the watershed, the average intensity and maximum intensities for 5, 10, 15, 20, 25, 30, 40, 50, and 60 minute periods were calculated.

Parameters of storm rainfall amount, average intensity, and peak intensity were used to determine the storm rainfall amount threshold, average intensity threshold, and peak intensity threshold. Under ideal conditions, these thresholds would separate erosive and non–erosive rainfalls completely, while the estimated value of the EI index would be unaffected by the omission of the events less than the threshold. In practicality, it is impossible to separate erosive and non–erosive rainfalls completely based on only one or two threshold values because of the complexity of rainfall characteristics and temporal variations in the system response in terms of runoff and soil loss. However, if the calculated EI value for the chosen rainfall events is equal to the erosivity for all of the erosive rainfalls, then the aim of determining the threshold is achieved. (The terms “chosen” and “non–chosen” refer to whether or not the rainfall erosivity for a particular rainfall event is used in the summation for calculating the rainfall erosivity for the location.) In order for this to happen, the threshold will be identified such that some events that actually caused erosion were omitted from the calculations, while certain events that do not cause erosion were included in the calculations in order to balance those omitted.

The first step in the process of determining thresholds was to calculate $EI_{30}$ values for every storm using the method described by Wischmeier and Smith (1978) and to sum the values for $EI_{30}$ for only the storms where soil loss occurred. This sum of $EI_{30}$ values (referred to herein as $EI_t$) was then the target value used to define the criterion for selection of thresholds. The determination of the threshold of rainfall amount for a plot or watershed was done as follows: (1) arrange all storms in descending order of rainfall amount, along with their corresponding calculated $EI_{30}$ values and

**Table 1. Characteristics of plots and the watershed and measured rainfall and soil loss data during 1961–1969 at the Zizhou experimental station.**

| | Plot 3 | Plot 7 | Plot 9 | Watershed |
|---|---|---|---|---|
| Area ($m^2$) | 900 | 5740 | 17200 | 180000 |
| Length (m) | 60 | 136 | 161 | 630 |
| Width (m) | 15 | 42<br>44.5[a]<br>173.0 | 107 | 290 |
| Slope gradient (%) | 40.4 | 34.4 | 53.5[b] | 13.5[c] |
| No. of rainfall events | 282 | 305 | 269 | 323 |
| No. of runoff events | 40 | 47 | 40 | 108 |

[a] Three slope segments in plot 7.
[b] Average slope for an irregular plot.
[c] Average slope for the main channel.

**Table 2. Cropping history for the plots and watershed from 1961 to 1969 at the Zizhou experimental station.**

| | Plot 3 | Plot 7 | Plot 9 |
|---|---|---|---|
| 1961 | Millet | Natural vegetation | Natural vegetation |
| 1962 | Millet | Natural vegetation | Natural vegetation |
| 1963 | Millet | Millet, sorghum, and alfalfa | Millet and alfalfa |
| 1964 | Potato | Potato, alfalfa, and millet | Soybean, millet and sorghum |
| 1965 | Millet intercropped with soybean | Millet, soybean and alfalfa | Soybean, pearl millet, sorghum, and alfalfa |
| 1966 | Potato | Potato, alfalfa, and pearl millet | Wheat, pearl millet, millet, and soybean |
| 1967 | Millet intercropped with soybean | Millet intercropped with soybean and alfalfa | Wheat, pearl millet, and soybean |
| 1968 | Pearl millet intercropped with soybean | Pearl millet intercropped with soybean and alfalfa | Wheat, sorghum, pearl millet, and soybean |
| 1969 | Alfalfa | Potato | Soybean and millet |

measured soil loss; (2) sum the cumulative $EI_{30}$ values from the greatest rainfall amount until the one where accumulated $EI_{30}$ was equal or nearest to the target $EI_{30}$ of all erosive rainfalls ($EI_t$), as described above. The rainfall amount at that point in the list was identified as the threshold value of rainfall amount. Events with rainfall amount above the threshold were considered "chosen" and events with rainfall amount below the threshold were considered "non–chosen." The sum of $EI_{30}$ values for the chosen events was taken as the estimated erosivity for the location. The same process was used to determine threshold values for average rainfall intensity and for each of the peak values of intensity (5, 10, 15, 20, 25, 30, 40, 50, and 60 min).

Rainfall amount data are generally more readily available and their estimation from rain gauge charts is simpler than rainfall intensity data. Peak rainfall intensities are particularly time consuming to calculate from charts. Thus, preliminary screening of the data using a relatively small rainfall amount as a preliminary threshold was done prior to determining peak intensity thresholds. To do this, all storms and associated soil losses were arranged in descending order of rainfall amount (for non–erosive rains, soil loss was set to zero), alongside which the associated cumulative percentage of soil loss was calculated. A response line fit to storm rainfall amount and cumulative percentage soil loss for non–chosen erosive rainfalls was regressed as:

$$P_i = a\, SL_{cum} + b \tag{1}$$

where

- $a$ and $b$ = regression coefficients
- $SL_{cum}$ = designated cumulative percentage of soil loss for non–chosen erosive rainfalls
- $P_i$ = storm rainfall amount used for the preliminary screening.

Given a cumulative percentage of soil loss for non–chosen erosive rainfalls, a preliminary threshold of storm rainfall was determined below which storms were omitted from further consideration. For example, if it is tolerant to omit rainfalls causing 1% of total soil loss in estimating rainfall erosivity, then $SL_{cum}$ is set to 0.01 in equation 1 and the resulting value of $P_i$ is used as the preliminary threshold. In this study, we used an $SL_{cum}$ value of 0.01 for the preliminary screening. After deleting a large number small rains by using this preliminary criterion, the peak intensity threshold was determined and then used to further delete non–erosive rains in calculating erosivity. Thus, the preliminary threshold was combined with peak intensity values for separating rainfalls to reduce the number of determinations of peak intensities required.

To evaluate the effectiveness of thresholds on estimations of rainfall erosivity, some indices were proposed. Two relative error indices were defined as follows:

$$REI = |EI_c - EI_t| / EI_t \tag{2}$$

$$MI = N_{cn} + N_{nce} / N_t \tag{3}$$

where

- REI = relative error index, representing the estimation accuracy of erosivity relative to the "true" value (i.e., $EI_t$)
- $EI_t$ = sum of $EI_{30}$ indices for all the rainfalls that caused erosion
- $EI_c$ = sum of $EI_{30}$ indices for chosen rainfalls (i.e., those exceeding the designated threshold).
- MI = mixing index, representing the total number of events that were "mis–classified" in the erosive and non–erosive categories
- $N_{cn}$ = number of incorrectly chosen (non–erosive) rain falls
- $N_{nce}$ = number of incorrectly non–chosen (erosive) rain falls
- $N_t$ = total number of rainfall events.

To evaluate the saving of time and labor, an efficiency index (EFF) was defined to estimate the reduction in calculation of $EI_{30}$ gained by omitting small rainfalls:

$$EFF = N_{tnc} / N_t \tag{4}$$

where $N_{tnc}$ is the number of total non–chosen rainfalls. The better threshold will have lower REI and MI, but higher EFF.

# RESULTS

## THRESHOLDS OF STORM RAINFALL AMOUNT

The thresholds of storm rainfall amount for the 3 plots were similar (table 3), ranging from 11.9 to 12.8 mm, and very close to the 12.7 mm threshold suggested by Wischmeier and Smith (1978). However, for the small watershed, the criterion was 7.5 mm, lower than that of plots. This difference may have been because of many small erosive rains that caused erosion in the channel or on roads in the watershed. Only 2.5%, 10.6%, and 10.0% of rain events caused soil erosion less than 10 t/km$^2$ from plots 3, 7, and 9, respectively, as compared to 39.8% of events for the watershed. The amount of soil erosion from events producing less than 10 t/km$^2$ was 0.0%, 0.0%, 0.01%, and 0.04% of the total erosion for plots 3, 7, 9, and the watershed, respectively. When erosive rains causing soil loss less than 10 t/km$^2$ were ignored, the threshold of storm rainfall amount for the watershed was 11.1 mm, which is approximately the same as for the plots.

A note on the use of the watershed results for determining the R–factor is needed here. The R–factor was developed for use in the USLE (and used in RUSLE) for hillslopes, not for watersheds. The calculation of the rainfall erosivity threshold for the watershed is not useful for application to hillslope erosion. It is nonetheless true that the USLE, and increasingly RUSLE, are applied in watershed assessments, and its inclusion in these analyses is considered relevant from that perspective. Its inclusion here does not imply a justification for the mis–application of the erosion prediction technology.

After using the thresholds for the plots, 79.8% to 80.9% of rains were omitted, which resulted in only 0.06% to 0.37% estimation errors of erosivity and 17.7% to 18.7% of event

**Table 3. Thresholds of storm rainfall amount and effectiveness for erosivity calculations for the plots and the watershed. REI is a relative error index representing the estimation accuracy of erosivity relative to the "true" value, MI is a mixing index representing the total number of events that were "mis–classified" in the erosive and non–erosive categories, and EFF is an efficiency index representing the relative number of events that need not be considered in estimating erosivity.**

| | Plot 3 | Plot 7 | Plot 9 | Watershed |
|---|---|---|---|---|
| Threshold (mm) | 12.8 | 12.8 | 11.9 | 7.5 |
| REI (%) | 0.06 | 0.11 | 0.37 | 0.03 |
| MI (%) | 17.7 | 18.7 | 17.7 | 15.5 |
| EFF (%) | 80.9 | 79.8 | 80.1 | 65.0 |

Table 4. Thresholds for the combined data set of the plots and watershed and their effectiveness for erosivity estimations using a single threshold value for all the data. REI is a relative error index representing the estimation accuracy of erosivity relative to the "true" value, MI is a mixing index representing the total number of events that were "mis–classified" in the erosive and non–erosive categories, and EFF is an efficiency index representing the relative number of events that need not be considered in estimating erosivity.

| | Rainfall Amount (mm) | Average Intensity (mm $h^{-1}$) | $I_{30}$ (mm $h^{-1}$) |
|---|---|---|---|
| Threshold | 12 | 2.4 | 13.3 |
| REI (%) | <0.1 | <0.1 | <0.1 |
| MI (%) | 18.5 | 14.3 | 9.7 |
| EFF (%) | 79.4 | 76.8 | 87.8 |

Table 5. Thresholds of average rainfall intensity and effectiveness for erosivity estimation for the plots and watershed. REI is a relative error index representing the estimation accuracy of erosivity relative to the "true" value, MI is a mixing index representing the total number of events that were "mis–classified" in the erosive and non–erosive categories, and EFF is an efficiency index representing the relative number of events that need not be considered in estimating erosivity.

| | Plot 3 | Plot 7 | Plot 9 | Watershed[a] |
|---|---|---|---|---|
| Threshold (mm $h^{-1}$) | 2.76 | 2.70 | 2.46 | 1.74 |
| REI (%) | 0.11 | 0.20 | 0.03 | 0.003 |
| MI (%) | 9.6 | 10.8 | 12.0 | 16.7 |
| EFF (%) | 81.2 | 79.8 | 78.9 | 69.0 |

[a] Rains causing soil loss of less than 10 t km–2 were regarded as non–erosive rains.

errors in separating rains (table 3). The low error in estimation of erosivity was because $EI_{30}$ values for non–chosen erosive rains were effectively balanced by those of chosen non–erosive rains, as expected.

To be used conveniently, a 12 mm threshold for the storm rainfall amount was suggested for plots, which was similar to the threshold given by Wischmeier and Smith (1978). The use of a single rainfall amount threshold for all the data gave a result of less than 0.1% error in the estimation of erosivity while eliminating 79% of the storms from the calculations (table 4).

### Thresholds of Average Intensity

When average intensities of rainfall events were used to separate non–erosive rains, the thresholds ranged from 2.46 to 2.76 mm $h^{-1}$ for the plots (table 5). The value was 1.74 mm $h^{-1}$ for the watershed when defining events that caused soil loss less than 10 t $km^{-2}$ as non–erosive rainfalls. The threshold of the average intensity had an improved capability for separating erosive rainfalls compared to the threshold of storm rainfall amount. With almost the same percentage of omitted events, indices of REI and MI were less (table 4). This result showed that it was better to use average intensity in separating erosive rainfall than to use storm rainfall amount. We recommend using an average intensity value of 2.4 mm $h^{-1}$ (table 4) as a threshold for erosivity calculations for plots and watersheds.

### Thresholds of Maximum Intensity

As mentioned in the Data and Methods section, a preliminary screening using a relatively low rainfall amount threshold was used prior to determining the maximum intensity threshold. We will discuss plot 3 as an example. After 1% of accumulative soil loss to total soil loss was chosen to be the initial tolerant error ($SL_{cum}$ = 0.01 in eq. 1), the preliminary threshold ($P_i$) was calculated as 7.6 mm by regression, and from that we omitted 67.4% of the total number of rainfall events. The preliminary screening resulted in $P_i$ values ranging from 7.1 to 8.0 mm for the other plots and the watershed. This preliminary screening greatly reduced the number of storms (e.g., 67.4% of them for plot 3) for which it was required to extract peak intensities from the rainfall charts.

Table 6. Thresholds of maximum rainfall intensity (mm $h^{-1}$) over various intra–storm time periods for the plots and watershed.

| | $I_5$ | $I_{10}$ | $I_{15}$ | $I_{20}$ | $I_{25}$ | $I_{30}$ | $I_{40}$ | $I_{50}$ | $I_{60}$ |
|---|---|---|---|---|---|---|---|---|---|
| Plot 3 | 30.0 | 25.8 | 21.2 | 18.0 | 14.9 | 12.8 | 10.4 | 9.6 | 8.5 |
| Plot 7 | 28.8 | 22.7 | 18.8 | 14.7 | 13.8 | 12.2 | 10.2 | 9.0 | 8.2 |
| Plot 9 | 31.4 | 25.8 | 21.7 | 18.6 | 17.8 | 14.9 | 11.3 | 10.1 | 8.8 |
| Watershed | 17.2 | 13.4 | 12.0 | 11.4 | 9.7 | 8.8 | 7.1 | 6.5 | 5.6 |

Table 7. Average thresholds of maximum rainfall intensity (mm $h^{-1}$) over various intra–storm time periods and their effectiveness for erosivity calculations for the plots and watershed. REI is a relative error index representing the estimation accuracy of erosivity relative to the "true" value, MI is a mixing index representing the total number of events that were "mis–classified" in the erosive and non–erosive categories, and EFF is an efficiency index representing the relative number of events that need not be considered in estimating erosivity.

| | $I_5$ | $I_{10}$ | $I_{15}$ | $I_{20}$ | $I_{25}$ | $I_{30}$ | $I_{40}$ | $I_{50}$ | $I_{60}$ |
|---|---|---|---|---|---|---|---|---|---|
| Plot average | | | | | | | | | |
| Threshold (mm $h^{-1}$) | 30.1 | 24.8 | 20.6 | 17.1 | 15.5 | 13.3 | 10.6 | 9.6 | 8.5 |
| REI (%) | 0.1 | 0.1 | 0.1 | 0.2 | 0.0 | 0.0 | 0.1 | 0.1 | 0.1 |
| MI (%) | 4.3 | 4.9 | 5.0 | 4.9 | 5.3 | 5.4 | 5.3 | 5.1 | 5.3 |
| EFF (%) | 85.9 | 87.0 | 86.9 | 87.5 | 87.7 | 87.7 | 90.0 | 90.3 | 90.4 |
| Watershed | | | | | | | | | |
| Threshold (mm $h^{-1}$) | 17.2 | 13.4 | 12.0 | 11.4 | 9.7 | 8.8 | 7.1 | 6.5 | 5.6 |
| REI (%) | 0.1 | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 0.0 |
| MI (%) | 7.1 | 8.0 | 8.0 | 8.0 | 7.4 | 6.5 | 7.3 | 7.3 | 8.3 |
| EFF (%) | 79.3 | 78.9 | 78.9 | 80.2 | 80.8 | 81.1 | 82.9 | 83.7 | 83.7 |

After omitting these small rainfall events, it became much quicker to calculate maximum intensities and to determine the threshold of peak intensity for the remaining larger storms. The thresholds of maximum intensity for 5, 10, 15, 20, 25, 30, 40, 50, and 60 minutes ($I_5$ through $I_{60}$, respectively) were determined and are listed in table 6. If, for example, the index $I_{30}$ is to be used for hillslopes, then the suggested threshold of 30–minute peak intensity is 13.3 mm $h^{-1}$, which is an average for the values for the three plots (table 6). As with average intensity, the threshold of peak intensity for the watershed was smaller than that for the plots.

The results of using thresholds of peak intensity for separation of erosive rainfall events were even better than the results of using average intensity. Average thresholds of peak intensity and their effectiveness on estimation of rainfall erosivity for the 3 plots and the watershed are listed in table 7. Peak intensities had higher effectiveness in separating erosive rainfall events than did the thresholds of storm amount or average intensity. For the three plots, an average of more than 88% of the rainfall events were omitted by using thresholds of peak intensity, while the average mixing index (MI) was only 5.0%, which was lower than the MI for thresholds of storm rainfall amount or average intensity. For the small watershed, an average of more than 81.1% of rainfall events were omitted with an average MI of 7.6%. The effectiveness of thresholds for the different periods of peak intensities was similar. We recommend using a peak 30–minute intensity threshold of 13.3 mm $h^{-1}$ (table 4).

## Conclusion and Discussions

Methods for determining practical thresholds to separate erosive rain events were discussed in this article by using data of rainfall and soil loss from 1961 to 1969 from the Zizhou experimental station of the Yellow River Basin in China. Three types of thresholds were developed by using different kinds of data. Thresholds determined were 12 mm for storm rainfall amount, 2.4 mm $h^{-1}$ for average rainfall intensity, and 13.3 mm $h^{-1}$ for 30–minute maximum rainfall intensity. The threshold value of rainfall amount recommended here is very similar to the value of 12.7 mm used by Wischmeier and Smith (1958). Several other values for other periods of maximum rainfall intensity were found (table 7). Peak intensity was the most effective of the thresholds for separating erosive rainfall events, followed by average intensity and rainfall amount (table 4). To reduce the tedious work of extracting peak rainfall intensities, a preliminary threshold based on a relatively low rainfall amount threshold was used prior to using peak intensity for separating erosive rains. Based on different kinds of rainfall data available, any one of the three thresholds may be used to separate erosive rainfall events.

The three thresholds were somewhat lower for the watershed than for the plots. This might be related to the surfaces in the watershed that were highly susceptible to erosion, such as roads and channel within the watershed.

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