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In-depth analysis of extreme event of rainfall erosivity over mainland China

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The majority of soil loss was triggered by several extreme rainfall events. Global warming may lead to an intensification of the surface water cycle and an increase in the probability and intensity of extreme rainfall events. An in-depth analysis of extreme event rainfall erosivity is valuable to help decision-makers take targeted measures to deal with future risks to soil and water resources protection. Cumulative rainfall erosivity from extreme events and characteristics of the 20- largest extreme events were analyzed based on the hourly rainfall data of 2420 meteorological stations over mainland China from 1951 to 2020. We sorted events at each site in descending order and calculated the percentage of events with accumulated erosivity (rainfall) accounting for 80% of total erosivity (rainfall) to all events (D80). Analysis on D80 shows 57% and 27% of extreme events of total events contribute 80% of rainfall and rainfall erosivity averaged over China, respectively, which indicates the impact of extreme erosivity is more predominant than that of extreme rainfall. The northern rock soil region (NR) and southwestern rock mountain region (SWR) were two regions with the least D80 among the six water erosion regions, which indicated fewer extreme events contributed to 80% of rainfall or rainfall erosivity compared with the other regions. D50 varies from 3% to 25% with a mean of 8% averaged over mainland China, which is more extreme than Europe (from 1% to 24 with a mean of 11%). TOP20_erosivity for extreme events with a descending order of event erosivity accumulates 29% of total erosivity, which is compared with 12% of TOP20_erosive for extreme events with a descending order of event rainfall. The average amount, duration and peak hourly intensity for TOP20_erosivity extreme events in summer are 14.6 mm,2.8 h, and 5.0 mm/h, respectively, while those for TOP20_rainfall are 16.5 mm, 4.4 h, and 3.4 mm/h, respectively, which indicate extreme erosive events are with a larger amount, shorter duration and greater peak intensity, comparing with extreme rainfall events. We further compared the synchronicity of the month with the maximum occurring frequency of extreme erosivity events and extreme rainfall events and found there are 33% of stations with not the same month. There were 19% of stations with the maximum month for erosive events preceding that for rainfall events and 14% of stations with the maximum month for erosive events lag behind rainfall events.