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# Momentum or kinetic energy – how do substrate properties influence the calculation of rainfall erosivity?

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Rainfall erosivity is a key component in soil erosion by water. In principle, two ways exist to describe erosivity, namely kinetic energy and momentum. However, the role of mass and velocity of raindrops in relation to properties of the substrates to be eroded is not yet clear. In our study we conducted rainfall simulation experiments to determine splash detachment amounts of five substrates (coarse sand, medium sand, fine sand, PE balls, silt) for seven different rainfall intensities (52-116 mm/h). We used linear mixed-effect modeling (LME) to calculate erosivity predictors for each substrate. Additionally, we separated drop size distribution into 1st and 3rd quartile to investigate the effect of small and slow respectively big and fast raindrops on splash detachment amounts.
We suggest using momentum divided by drop diameter as a substrate-independent erosivity predictor. To consider different substrates specific erosivity parameters are needed. Heavier substrates like sand are best described by kinetic energy multiplied by diameter whereas lighter substrates like silt point to momentum divided by diameter to the power of 1.5. Further, our results show that the first quartile of the drop size distribution is best in describing splash detachment rates of light substrates whereas for heavier substrates like sand the influence of drop size distribution is indifferent.