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Kinetic energy of rainfall an important driver of soil erosion – how reliable are our estimates?

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The most important process initiating interrill erosion is the detachment of soil particles via splash processes. Splash erosion intensity is depending on soil and rainfall characteristics. Rainfall characteristics are essentially determined by the drop size and fall velocity, leading to a specific kinetic energy of rainfall. In consequence, the kinetic energy of rain events is often directly or indirectly included in erosion models to calculate splash erosion. Therefore, rainfall kinetic energy is commonly derived by empirical functions (e.g. RUSLE; Renard et al. 1997) from available rainfall intensity measurements. The aim of this study is to analyze the event type-specific uncertainties inherent in these empirical functions purely based on rainfall intensity measurements. Therefore, we compare rainfall energies calculated from rainfall intensities measured with a standard tipping bucket rain gauge to rainfall energy measurements taken by laser distrometers. These allow to calculate rainfall kinetic energy from a spectrum of measured drop sizes and fall velocities. The study was carried out in NE-Germany in a test area with an average annual precipitation of approximately 500 mm dominated by intense convective precipitation. We compare one year of data from two laser distrometers and two tipping buckets installed at two locations about 1 km apart. Our results show distinct differences for high intensity events between the measuring techniques. We found notably higher rainfall kinetic energy for high intensity events measured by the laser distrometer compared to the tipping bucked derived kinetic energy. This points to a measurement bias of high erosive rainfall events which would be of particular relevance for erosion studies.