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Investigation of rainfall kinetic energy in Central Europe and New Zealand

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Soil erosion has been recognized as the largest threat to soil resources globally. The initial detachment of soil particles through splash erosion is dependent on rainfall kinetic energy (KE), which is a function of drop size distribution and fall velocity. Recent technological progress on disdrometers has enabled improved measurement of rainfall kinetic energy.
The aim of this study was 1) to increase knowledge about erosive rainstorms and their KE/erosivity and 2) to derive KE-intensity (I) relationships for rainfall erosivity estimation.
Measurement of rainfall was carried out at two sites in the eastern part of Austria (Mistelbach and Petzenkirchen), one site in the Czech Republic (Prague) and another site in New Zealand (Christchurch), allowing evaluation and interpretation of possible differences between the investigated sites.
Rainfall data were collected in 1-minute intervals using Campbell PWS100 (Mistelbach/Petzenkirchen), Thies Clima (Prague), and Parsivel OTT (Christchurch) disdrometers, which measure a matrix of drop sizes and drop fall velocities and thereby enable direct calculation of kinetic energy. To compare disdrometer performance, rain gauges were also installed at the measurement sites.
Rainfall for the period April-October 2017 was 296 and 460 mm in Mistelbach and Petzenkirchen, respectively, where 23 and 20 events exceeding 5 mm were recorded. Data for the sites in the Czech Republic and New Zealand still needs to be analysed.
The precipitation measured by the disdrometer in Petzenkirchen matched that measured by the rain gauges very well. In Mistelbach rainfall was underestimated by approximately 10%.
The kinetic energy of rain events was calculated from the drop size/velocity matrix. For the investigation period, total kinetic energy values of 51 and 60 MJ/ha were calculated for Mistelbach and Petzenkirchen, respectively. In Petzenkirchen, the average kinetic energy of storms was about 25 % higher than in Mistelbach. For both sites data show very similar relationships between rainfall amount and KE with R2 between 0.83 and 0.91. In addition, the two sites showed also very similar KE-I relationships within the measured intensity range.
The kinetic energy of the measured rain events was compared to that found by KE-I equations from other studies. Results show that these equations describe KE well or slightly underestimated our observations.