Raindrop size distribution measurements for rainfall erosivity estimation in the Reka river basin, SW Slovenia

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Rainfall kinetic energy–intensity relationships for rainfall erosivity estimation were established on the basis of raindrop size distribution measurements performed in the Reka river basin situated in the Mediterranean part of Slovenia. A set of measurement instruments, an optical disdrometer coupled with a rain gauge, was installed on two locations: Koseze and Kozjane. The data set contained raindrop size distribution and rainfall intensity measurements of the rainfall events that occurred during a one-year period in the 2008/2009 season. The rainfall intensities obtained with the rain gauges were used for event rainfall depth control measured by the disdrometers and testing the established kinetic energy–intensity (KE–I) relationships. Two exponential KE–I relationships were established for each measuring site, for 1-minute and 5-minute rainfall intensity data, respectively. Their performances were tested and compared with the performances of other KE–I relationships proposed by authors throughout the world, which could be recognised as relatively suitable for kinetic energy estimation in the Mediterranean area. The comparison included 11 KE–I relationships expressed with linear, linear-log or exponential formulations. The analyses exposed the rainfall intensity overestimation by the disdrometers and the limited use of the tipping bucket rain gauge for kinetic energy estimation under such climate conditions. According to our results, the established KE–I relationship for 5-minute intensity data in Koseze is recommended to be used while estimating rainfall kinetic energy in the Mediterranean part of Slovenia. As input data, rainfall intensities measured with precise weighing rain gauges, as those installed in the Slovenian meteorological network, should be used. However, when using rainfall intensity data obtained with a tipping bucket rain gauge of lower accuracy or insufficient intensity range, the exponential relationship of Coutinho Tomas (1995) is expected to deliver better kinetic energy estimations.

Keywords: Rainfall erosivity; Raindrop size distribution; Rainfall intensity; Reka river basin; Optical disdrometer