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Rainfall event profiles: importance in ecohydrology, geomorphology, and soil management

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The importance of the temporal structure of rainfall events is widely, but not universally, recognised. In agricultural research, the role of event structure has been quite well explored (e.g. in relation to leachates from manure, or in agrochemical washoff). However, in dryland hydrology, and in soil erosion research, much less attention has been paid to the role of aspects such as intensity variations or rain intermittency. Moreover, changes in rainfall event profiles form a little-explored aspect of ongoing climatic change, but one that may have great significance in ecohydrology and in geomorphology. The importance of rain event structure is clearly demonstrated from rainfall simulation experiments on dryland soils in arid NSW Australia. A series of small plot experiments using drop-forming rainfall simulation was established in order to explore the effects of varying event profiles on infiltration and the generation of runoff. Experiments all had the same rain event duration, the same mean rain rate, and the same total event depth. However, event profile, including peak intensity, and intermittency, were varied by using computer-controlled pumps. The rain rates and event profiles were designed to mimic the character of natural rainfall events in the study area. Results show that events with uniform rainfall rates, as widely used in rainfall simulations in soil erosion research and in hydrology, yield the highest apparent soil infiltrability and the least runoff volume. Events with peak intensity late in the event, when soils are already wet, yield the lowest apparent infiltrability and the highest runoff volume, as well as the highest runoff intensity. These results need to be confirmed for other soil types, but suggest that event profile is an important determinant of soil hydraulic behaviour that warrants increased attention in many fields, including ecohydrology, geomorphology, and soil management.