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Grain-size variation patterns of sediment transported by overland flow evaluated from experimental simulations of upstream and downstream moving storms

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Several studies have demonstrated that the volume and characteristics of sediments generated by a moving rainfall are dependent on storm movement in relation to the land surface. This study aims to describe and interpret the grain-size distribution of sediments generated during experimental simulations on a soil flume subjected to downstream and upstream moving storms. Storms were generated by moving a rain simulator, at a constant speed, in the upstream and downstream directions along a soil flume. The sediments transported by overland flow were collected at the flume outlet. Sediment grain-size distribution was obtained by conventional sieving and laser diffraction, using a Coulter LS 320.

The pattern of sediment grain-size evolution depends on the direction of storm movement. For downstream-moving storms a good relationship between discharge (and, consequently, stream power) and mean sediment size was found. However, as the

grain-size of transported sediments barely surpasses the grain-size of the original soil, there is an upper limit for the mean particle size, regardless of the energy involved.

For upstream-moving storms it is possible to identify two distinct phases in the relation between discharge and grain-size. The grain-size of sediments transported during the rising limb phase of the hydrograph is always coarser than during the recession of the hydrograph. In the earlier phase intense splash erosion is observed when the raindrops may impact directly on the soil, which justifies the coarser mean sediment sizes. A sudden decrease in grain-size occurs when discharge is still rising or close to its peak. From this time onwards the soil surface of the flume is covered by a thin layer of runoff water and the generated sediment will tend to be finer. Hence, a buffer effect created by the overland flow is expected to limit splash erosion.

The main conclusion of this study is that upstream and downstream moving storms produce different dynamic conditions and consequently the amount of generated sediments and the evolution pattern of grain-size distributions will be distinct.

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