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The analysis of splash erosion depending on the degree of soil wettability - a preliminary study

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The soil splash phenomenon is the initial stage of the water erosion process. It occurs when a rain drop hits the soil surface and causes a few processes e.g. i) detachment of soil particles and their transport over different distances, ii) breakdown of soil aggregates, iii) surface runoff or iv) formation of a crusted surface.

The aim of the study was to carry out an analysis of the splash erosion in mineral soil in 4 variants of sample preparation: a) dry natural soil, b) wet natural soil, c) dry burnt soil, d) wet burnt soil.

In both cases (natural soil and soil modified with high temperature), full moistening was achieved by capillary rise. Fire simulation was carried out in several variants at varying temperature and duration. Variant that affected soil wettability to the greatest extent was selected for the splash analyses. "Natural" and "modified" wettability were measured using the water drop penetration time (WDPT) method. "Natural" wettability classified soil into the "wettable" group (WDPT < 5s), while the modification of the surface properties by high temperature changed the wettability group of the analyzed soil into "slightly to moderately repellent" (5 s > WDPT < 60s).

Each time, the soil material was placed in aluminum rings with an internal diameter of 36mm and a height of 10mm, and the surface was leveled without excessive compaction of the sample.

A single drop of distilled water with a diameter of 4.2 mm fell on the sample prepared in this way from a height of 1.5m. The drops were dosed with a peristaltic pump and reached the final velocity of 4.98 m/s.

Three synchronized Phantom Miro M310 cameras (Vision Research, USA) were used to register the splash phenomenon. The recorded films were used to analyze the splash phenomenon through measurements of the velocity, angle and distance of ejected particles.

A Scan3D UNIVERSE 10 MPiX structural light scanner (Smarttech 3d, Poland) was used to determine the magnitude of the surface deformation caused by the drops. The analyses made it possible to determine e.g. the depth, diameter, and volume of craters and the height of surrounding rims.

The analysis of the results showed significant differences in the size and dynamics of the emerging

splash depending on the degree of soil wettability.

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