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A thermographic technique to characterize soil surface microrelief: application at the laboratory scale

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Estimation of soil surface microrelief with adequate resolution and precision can enhance the understanding of several hydrological processes (e.g. runoff, sediment transport, rill erosion, infiltration, evaporation, heat flux) and may provide detailed information required for their modelling. Despite the high resolution and precision of some of the measurement techniques used to estimate soil surface microrelief (e.g. laser techniques, photographic techniques), the presence of mulch covering the soil surface strongly affects the accuracy of the microrelief measurements. In fact, with high mulching covers, microrelief cannot be estimated by these techniques.

The main goal of this study was to develop a thermographic technique that could be used to characterize soil surface microrelief in the presence of mulch cover (i.e. identify preferential flow paths, identify different microrelief elements), allowing to obtain a 3D model of the soil surface with a reasonable accuracy. Laboratory tests were conducted on surfaces with different morphologies and microrelief elements both in bare soil conditions and in the presence of different mulching surface cover densities. Heated water was used to create a temperature gradient on the soil surface that was recorded with a portable hand-held infrared camera.

As the heated water flowed along the different studied surfaces, deeper topographic elements (e.g. rills, surface depressions) presented higher temperatures. The presence of higher mulching cover densities affected the performance of the technique. However, below densities of 4 ton/ha it was possible to visualize preferential flow paths and to identify different microrelief elements.