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How useful is experimental hydrology in understanding overland flow and associated transport processes?

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During the last decades, more and more researchers have concentrated their work on the study of overland flow and associated transport processes: new developments, innovative techniques and breakthroughs are being presented year after year, which is noteworthy. Whilst experimental hydrology has played an important role in many of these studies, it is not always acknowledged the main difficulties, limitations, challenges, but also advantages and opportunities in this study approach.

Bearing on personal involvement in three decades of experimental work in surface hydrology that contributed to improve our understanding of several hydrological processes (e.g. overland flow, sediment transport, rill and interrill erosion, infiltration), this presentation addresses shortly main issues related to the experimental part of that work, conducted in two continents. The work used experimental setups that focused mainly in the study of rainfall-runoff, overland flow and associated transport processes, namely water erosion. Experiments were conducted in natural, agricultural and urban surfaces, both in disturbed and undisturbed conditions or samples. Special attention has been given to mulching, wind-driven rain, and on the use of thermal tracers. The input in field-based studies was natural rainfall, whereas simulated rainfall simulators and/or runoff have been applied within laboratory-based experiments. In fact, the adaptability of rainfall simulators to different temporal and spatial scales allowed many experimental designs to suit specific research objectives.

This presentation highlights the inherent problems and difficulties in conducting studies to encompass such diverse situations as observed in natural and human-modified surfaces. However, the main objective is to stimulate the discussion and enhance understanding of the requirements of experimental research, both in the laboratory and in the field, since that can contribute to achieve further clarifications in surface hydrology. For example, runoff responses of urban, rural and periurban areas are still not well understood. Experimental research is also essential in multidisciplinary approaches aiming at further improving our knowledge on transports associated with runoff (e.g. litter, virus, microbial contaminants, emerging chemicals found in pharmaceuticals, personal care products, pesticides, industrial and household products,

surfactants, metals).