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A "low-cost" hydraulic system to assure constant (rain) intensity produced by rainfall simulators

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Rainfall simulators are used to produce artificial rainfall both in the laboratory and in the field, and are particularly useful in soil erosion and surface hydrology studies. Although permitting a controllable, reliable and predictable simulation of rainfall events, rainfall simulators cannot replicate the unpredictable variability of natural rainfall. However, they provide a helpful tool to study the rainfall-runoff process at small scales.

The aim of any rainfall simulator is the collection of accurate and useful data. However, better simulators will allow attaining data that is more accurate, thus leading to more consistent and useful models or to a better visualization and understanding of the physical processes. This study describes a hydraulic system to be attached to the nozzle of a rainfall simulator in order to eliminate pressure fluctuations, even if water supply pressure fluctuates.

The hydraulic system consists of a chamber with steady pressure which supplies the nozzle, achieved by combining a pressure reduction valve after the water intake and a headloss valve before the outflow hose, thus ensuring a constant pressure level (and so a constant rainfall intensity) throughout each rainfall event. This hydraulic system was developed at the Laboratory of Hydraulics, Water Resources and Environment of the Department of Civil Engineering of the University of Coimbra.

The system's ability to control the rainfall intensity is demonstrated by carrying out a set of laboratory rainfall simulations. In these simulations, high precision pressure transducers were used to measure, at a rate of 0.01s, the pressure at the water supply intake and at the nozzle. The results show that, with this hydraulic system, rainfall simulators can operate with constant (rainfall) intensity during the entire simulations.