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Combining spray nozzle simulators with meshes: characterization of rainfall intensity and drop properties

Sílvia C.P. Carvalho (1,2), João L.M.P. de Lima (1,2), M. Isabel P. de Lima (1,3)

(1) IMAR – CMA, Marine and Environmental Research Centre - Institute of Marine Research, Coimbra, Portugal, (2) Department of Civil Engineering, Faculty of Science and Technology, University of Coimbra, Coimbra, Portugal (silviacc@student.dec.uc.pt; plima@dec.uc.pt), (3) ESAC / Polytechnic Institute of Coimbra, Coimbra, Portugal (iplima@esac.pt)

Rainfall simulators can be a powerful tool to increase our understanding of hydrological and geomorphological processes. Nevertheless, rainfall simulators' design and operation might be rather demanding, for achieving specific rainfall intensity distributions and drop characteristics. The pressurized simulators have some advantages over the non-pressurized simulators: drops do not rely on gravity to reach terminal velocity, but are sprayed out under pressure; pressurized simulators also yield a broad range of drop sizes in comparison with drop-formers simulators.
The main purpose of this study was to explore in the laboratory the potential of combining spray nozzle simulators with meshes in order to change rainfall characteristics (rainfall intensity and diameters and fall speed of drops). Different types of spray nozzles were tested, such as single full-cone and multiple full-cone nozzles. The impact of the meshes on the simulated rain was studied by testing different materials (i.e. plastic and steel meshes), square apertures and wire thicknesses, and different vertical distances between the nozzle and the meshes underneath. The diameter and fall speed of the rain drops were measured using a Laser Precipitation Monitor (Thies Clima). The rainfall intensity range and coefficients of uniformity of the sprays and the drop size distribution, fall speed and kinetic energy were analysed. Results show that when meshes intercept drop trajectories the spatial distribution of rainfall intensity and the drop size distribution are affected. As the spray nozzles generate typically small drop sizes and narrow drop size distributions, meshes can be used to promote the formation of bigger drops and random their landing positions.