Geophysical Research Abstracts
Vol. 21, EGU2019-16415-1, 2019
EGU General Assembly 2019

Assessing spatiotemporal uniformity in rainfall simulator experiments

Daniel Green (1), Ian Pattison (2), Jorge Isidoro (3,4)

(1) Department of Geography and International Department, University of Chester, UK (daniel.green@chester.ac.uk)., (2) School of Architecture, Building and Civil Engineering, Loughborough University, Loughborough, UK (i.pattison@lboro.ac.uk)., (3) Department of Civil Engineering, Institute of Engineering, University of Algarve (ISE/UAlg), Faro, Portugal (jisidoro@ualg.pt)., (4) Marine and Environmental Sciences Centre (MARE), Coimbra, Portugal.

Field- and laboratory-based rainfall simulators are used extensively within hydrological and geomorphological sciences. Rainfall simulators can recreate regulated and repeatable rainfall characteristics (e.g. intensity, duration, drop size distribution and falling kinetic energy), exempt from the unpredictability of natural precipitation regimes. Ensuring and quantifying spatially uniform simulated rainfall across the entirety of the plot area is of particular importance to researchers undertaking rainfall simulation. As a result, numerous studies have focused on the quantification and subsequent improvement of rainfall uniformity during experimentation. Despite this, no previous research has examined temporal variations in the uniformity of simulated rainfall and no consideration has been given to any changes in uniformity through time. Thus, researchers may be unaware of any temporal changes of rainfall delivery during experimentation and may only have an appreciation of the differences in spatial rainfall distribution during each rainfall event.

This work describes a novel method for assessing spatiotemporal uniformity within a laboratory-based rainfall simulator environment. A high-resolution grid of 25 tipping bucket rain gauges uniformly placed over a horizontal plot surface of 3.0m $\times$ 3.0m allowed the measurement of rainfall intensity and an assessment of the spatiotemporal uniformity of rainfall produced by an array of 64 pressurized nozzles. The tipping bucket rain gauges were connected to a data logging device to record each individual tip during a series of timed experimental runs with a duration of 10 minutes. These pulses were then post-processed to understand variations in the temporal delivery of simulated rainfall across the plot surface.

Results suggest that traditional, static uniformity testing procedures, where only the spatial distribution of rainfall is considered, produce a satisfactory rainfall uniformity coefficient value, using the Christiansen Uniformity Coefficient (%) metric. However, when considering rainfall as a fully temporal, dynamic variable, rainfall uniformity is show to vary significantly through an experimental run, prompting a shift on future research to consider the dynamic nature of simulated rainfall using the assessment criteria highlighted herein.