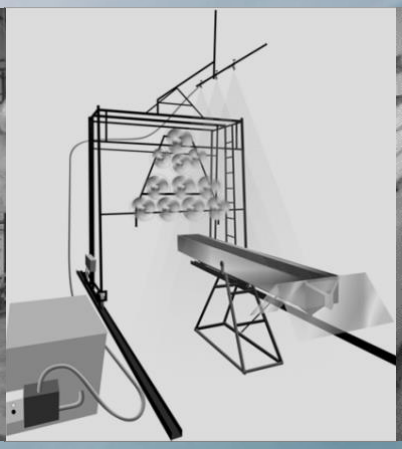
BOOK OF ABSTRACTS

2nd RAINFALL SIMULATOR WORKSHOP

Towards harmonisation in the use
of rainfall simulators

22-24 May, 2023
Coimbra, Portugal

***Edited by*:**
M. Isabel P. de Lima
João L. M. P. de Lima
Jorge M. G. P. Isidoro

Department of Civil Engineering
Faculty of Sciences and Technology of the University of Coimbra
MARE – Marine and Environmental Research Centre
ARNET – Aquatic Research Network

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Organized by:

Department of Civil Engineering, Faculty of Science and Technology, University of Coimbra

MARE – Marine and Environmental Research Centre / ARNET – Aquatic Research Network

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Editors: M. I. P. de Lima, J. L. M. P. de Lima e J. M. G. P. Isidoro

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Organization

The Workshop is organized by the Department of Civil Engineering of the Faculty of Sciences and Technology of the University of Coimbra and MARE – Marine and Environmental Sciences Centre / ARNET – Aquatic Research Network, Portugal.

Sponsorship & Collaboration

The Workshop has been sponsored by:

ACIV – Associação para o Desenvolvimento da Engenharia Civil
(*Portugal*)

Águas de Coimbra, E.E.M.
(*Portugal*)

Águas do Centro Litoral, S.A.
(*Portugal*)

Câmara Municipal de Coimbra
(*Portugal*)

Itecons – Institute for Research and Technological Development in Construction, Energy, Environment and Sustainability
(*Portugal*)

The Workshop also secured the collaboration of:

Federal University of Alfenas, *Brazil*

Heriot-Watt University, *United Kingdom*

Newcastle University, *United Kingdom*

Trier University, *Germany*

Universidade Federal Rural de Pernambuco, *Brazil*

University of Algarve, *Portugal*

General Information

Location and Workshop Address

The 2nd Rainfall Simulator Workshop is being held at the Department of Civil Engineering of the University of Coimbra, Coimbra, Portugal. The history of the University of Coimbra dates back to the century following the one in which the Portuguese nation itself was founded, since the University was established in 1290.

The workshop is organized by the Department of Civil Engineering of the Faculty of Sciences and Technology of the University of Coimbra, and MARE – Marine and Environmental Research Centre / ARNET – Aquatic Research Network, Portugal.

***Workshop Venue*:**

Department of Civil Engineering
Faculty of Science and Technology
Rua Luís Reis dos Santos - Pólo II Univ. Coimbra
3030-788 Coimbra, Portugal

Workshop Themes

The objective of this second edition of the Rainfall Simulator Workshop series is to continue promoting a focused interdisciplinary discussion of the present state of knowledge, and of the necessary advances in research and application disciplines related to experimental studies based on the use of rainfall simulators. This edition of the workshop is centred around a special theme:

Towards harmonisation in the use of rainfall simulators.

The workshop sessions will be dedicated to oral and porter presentations and to open discussions on the special theme.

The following main topics will be addressed:

1. Insights on rainfall simulators
2. Applications of rainfall simulators
3. Field and laboratory experiments
4. Scale issues in rainfall simulation studies
5. Harmonisation on the use of rainfall simulators

Workshop Organization

The workshop is organized by the Department of Civil Engineering of the Faculty of Sciences and Technology of the University of Coimbra and MARE – Marine and Environmental Sciences Centre / ARNET – Aquatic Research Network with the support of ACIV – Association for the Development of Civil Engineering, Portugal.

Conveners

João de Lima, MARE/ARNET, *University of Coimbra, Portugal*
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Jorge Isidoro, MARE/ARNET, *University of Algarve, Portugal*

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RSW2023-18

Using portable field rainfall simulator for experimental research of soil resistance

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Due to the action of erosion processes, degraded areas of forests have a reduced capacity to perform ecosystem services and a reduced production potential of wood mass. In an attempt to reduce such negative effects, one of the steps is to determine the elements of the mechanisms of erosion processes in order to achieve an appropriate solution for remediation by analysing the physical and mechanical parameters of the soil. Using a portable field rainfall simulator in the forest area in the gullies and the conditionally stable zone of the gullies' banks, experimental soil testing has conducted. The simulator that was used is based on the pop up sprinkler system described in detail by Živanović *et al*. (2022). The limited amount of water on the field, as well as the duration of the pouring rain for the study area, affected the duration of each test to be limited to 10 minutes. During the experiment, the effects of changes in soil moisture on changes in the parameters of soil shear resistance and resistance to penetration, as well as the formation of surface runoff and soil erosion, have been observed. Research has been conducted during the spring and autumn. It was established that the change in the current soil moisture affects the change in the mechanical parameters of the soil. Compared to tests on gullies' banks, the values of soil shear resistance and resistance to penetration are lower in tests in gullies. The presence of cracks and macropores influenced the appearance of rapid infiltration into the soil of part of the precipitation, which resulted in small amounts of runoff water on the exit profile (3.76–32.71% of the total volume of rain). Surface erosion occurs in the form of tearing off entire microaggregates and their transport via micro-furrows to the outlet profile. The concentration of sediments in the water, during tests on the banks, tended to decrease with each subsequent repetition. It's been determined that soils of the research area are sensitive to erosion processes when they are in a state of low natural humidity. With an increase in water content above 20%, the soil becomes more sensitive to erosion processes and other forms of physical degradation. After an increase in the current water content above 42% (the average value of the liquid limit), the soil was in a saturated state when the resistance forces cease to act.

References:

Živanović N., Rončević V., Spasić M., Ćorluka S., Polovina S. (2022). Construction and calibration of a portable rain simulator designed for the in situ research of soil resistance to erosion. Soil & Water Res., 17(3):158-169. DOI: 10.17221/148/2021-SWR

RSW2023-19

The influence of rainfall simulators dripper size, type and dripping speed on generated drop size

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The choice of drippers for dripping rainfall simulators (DRS) is often based on the experience of previous research or personal empirical knowledge, under the assumption that drippers in form of tubes and holes with a smaller internal diameter (ID) generate water drops of a smaller diameter and vice versa, neglecting other factors that affect the size of the drops. The aim of research is to provide insight into the influence of DRS dripper size, type and dripping speed (i.e., the number of water drops dripped out from a dripper per unit of time) on generating different water drop size. A search was conducted for all available scientific papers describing DRS and papers that include a wide range of thematically related papers to soil research in which DRS are used starting from 1941 until today. Out of a total of 188 scientific papers included in the analysis, 76 different types and 31 subtypes of DRS have been singled out. The analyses of DRS drippers design and performance was conducted in terms of the drops' sizes that they are able to generate. The analysis was conducted integrally, for simulators with more than one dripper and with one dripper. Metal and plastic tubes (MT and PT), which are the most common drippers' type, showed a strong relationship between the outer diameter (OD) with the drop size, while the ID relationship was moderate to weak. However, when increasing the range of MT drippers' diameter size, the relationship significance became very strong for both ID and OD. It is observed that with the increase of the ID of PT the relationship deviates from the logarithmic curve that represents all dripper types together. Although the applied dripping intensity difference is quite big for MT, drop size does not differ much. On the other hand, PT generate much bigger difference in drop size for a less drastic change in intensity. It is suggested that a possible reason for such a deviation and difference in the functional forms that describes drop and drippers size relations could be the dripper material, but considering that MT drippers generally have a thinner wall than PT or glass tubes (GT), drippers material type rather determines the thickness of the tube wall.