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Moving towards harmonisation in rainfall simulation

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Rainfall simulation experiments are widely used in soil science, geomorphology and hydrology research and teaching. Such experimental setups are particularly important in the study of rainfall-runoff, erosion and pollutant transport processes. Rainfall simulators have been applied within laboratory- and field-based studies and have the advantage of enabling controlled and reproducible rainfall events of varying intensity, duration and drop spectra. The flexibility and adaptability of rainfall simulators to examine diverse research applications of varying temporal and spatial scales means that hundreds of tailor-made rainfall simulator setups can be identified across the literature. Although it is beneficial for researchers to adapt their experimental designs to suit their specific research objectives, the diversity in the type, sizing, form, operation and methodologies of rainfall simulators ultimately results in complications when comparing results and outputs obtained between studies.

Currently, comparisons between studies can be very difficult, if not impossible, as the different measurement methods, artificial rainfall event characteristics and test conditions result in considerable difficulties when benchmarking results and findings obtained from rainfall simulation experiments. We recommend that the scientific community should establish a set of methodological procedures aimed at harmonising basic procedures in rainfall simulator-based studies in the fields of hydrological and geomorphological sciences. This would ensure that results obtained from different rainfall simulator studies and setups are harmonised, regulated and comparable. On the one hand, this process involves harmonising rainfall simulators design characteristics, whereas further steps should focus on measurement methods and metrics so results can be more readily compared.

This presentation highlights the inherent problems in benchmarking and comparing studies at present due to large variations in the way that researchers and institutions assess and quantify rainfall simulator performance and present results. Some degree of 'standardisation' of rainfall simulator approaches is needed. However, standardising approaches used within rainfall

simulation does not allow researchers to adapt their experimental setups to suit their specific research needs, which is one of the key benefits of using rainfall simulators. Instead, 'harmonisation' (i.e. ensuring that the scientific community develop a set of regulated and comparable methodological procedures and best practices for use in rainfall simulator studies whilst still allowing some degree of adaptability for specific research practices) is required. Here we present a series of harmonisation procedures, which should be developed to ensure that rainfall simulators are designed and constructed to allow for harmonisation, as well as suggesting a series of steps towards harmonising the methods and metrics used to quantify and compare experimental results.

With these objectives in mind, we aim to stimulate the discussion and enhance understanding of the difficulties and requirements of rainfall simulator based experimental research, namely by creating a platform that embraces and consults the International research community across multiple research facilities and institutes. This presentation will kick-start discussions (via web seminar sessions beginning in Summer 2021) leading up to a future international symposium addressing and acting upon these issues and disseminating the findings of this consultation period (Spring/Summer 2022 in Coimbra, Portugal). Everyone is invited to join this step towards harmonisation in rainfall simulation.