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Splash and interrill erosion research: Current needs and future prospects

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The impact of falling raindrops on soil surfaces (splash effect) marks the first stage of water erosion. The kinetic energy of these drops ejects soil particles and is able to trigger sediment translocation over distances up to 1.2 m. Interrill or sheet erosion occurs subsequently when soil surfaces become saturated with water and loosened soil particles are transported by overland flow outside concentrated flow paths. It has been shown that soil structure and composition, (micro-)topography and, even more importantly, vegetation patterns such as plant architecture or leaf shapes strongly influence the initiation of these erosion processes. Yet, the complex mechanisms behind them are still not fully understood.

Recent investigations on freefall and throughfall drop size distribution as well as rain splash effects on the soil surface allowed to identify major research voids. Hence, it is of high interest to better describe how drop size distribution is affected by tree architecture and canopy structure of different tree species in different climate zones and by different plant and leaf surfaces. Moreover, variations due to different meteorological conditions such as e.g. changes in drop sizes by snow melt are rarely investigated. Nevertheless, more than 16 different measurement devices are currently used in splash erosion research and thus a lack of standardisation is evident. At the same time, recent methodological progress introduced new techniques such as image recording, microphones or computed micro-tomography to the scientific toolbox, but these tools still need further improvement. Moreover, studies on raindrop kinetic energy and splash erosion should more often be combined with measurements of interrill sediment transport. In this context, soil physical properties such as particle aggregation are of high importance. This liaison becomes of particular importance, when different plant traits like e.g. root systems are compared. Interrill erosion is generally determined with small-scale runoff plots. These runoff plots raise certain constraints due to their little size. Nevertheless, recent studies showed that with close control and maintenance of the measurement setup and high replication rates, satisfying comparison of soil and vegetation treatments is obtained. At the same time, recent progress in the adaption of photogrammetric techniques with Structure from Motion (SfM) to small-scale soil surfaces paved the way to advancements in interrill erosion measurements. Even if some studies still illustrate shortcomings in the accuracy of measurements, the general approach and technical progress is highly promising.

This introduction to the EGU session on initial soil erosion aims to summarize these recent developments and to illustrate gaps in our current knowledge in order to stimulate the discussion on future research scopes.