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## INTEGRATION OF SEDIMENTS TRANSPORT MECHANISMS UNDER RAINFALL IN A GLOBAL WATER EROSION MODEL

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Hillslope erosion by water is damaging for environment and agricultural soils. The modeling of the problem helps to understand and limit the phenomenon. Current models include the different processes involved in water erosion: detachment, transport and deposition of sediments. In particular, the transport and deposition processes are taken into account through the settling velocities of sediments. However, for rainfall erosion, the influence of rain on this parameter is unknown. We have carried out experimental studies to understand the effect of rainfall on the travel distance of particles. These experiments allow to separate detachment by raindrops from the agitation of the flow by the drops. Different particle sizes and rainfall kinetic energies are investigated. The results assess the exact role of rainfall on sediment transport.

The experiment results are used to calibrate a single and unified model of transfer equations which encompasses the previous models of Gao et al. (2004) [1], Hairsine and Rose (1992, 1991) [2, 3] and Lajeunesse et al. (2013) [4]. This model describes the spatial and temporal variation of the amount of soil loss in both interrill and rill erosion. The dynamic of the granular-flow is described by an exchange between the granular-fluid mixture flow and the layer of deposited sediments (crusts). This exchange can account for multi-class particle transport and is able to simulate both linear and non-linear behaviors.

### References

- [1] Gao, B., Walter, M. T., Steenhuis, T. S., Hogarth, W. L. and Parlange, J.-Y. *Rainfall Induced Chemical Transport from Soil to Runoff: Theory And Experiments*, Journal of Hydrology **295**, 291-304 (2004).
- [2] Hairsine, P. B. and Rose, C. W. *Modeling Water Erosion Due To Overland Flow Using Physical Principals — 1. Sheet Flow*, Water Resources Research **28**, 237-243 (1992).
- [3] Hairsine, P. B. and Rose, C. W. *Rainfall Detachment and Deposition: Sediment Transport in the Absence of Flow-driven Processes*, Soil Science Society of America Journal **55**, 320-424 (1991).
- [4] Lajeunesse, E., Devauchelle, O., Houssais, M. and Seizilles, G. *Tracer Dispersion in Bedload Transport*, Advances in Geosciences **37**, 1-6 (2013).