



Controls of the water and sediment fluxes on alluvial fans morphology: theory and experiments

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Alluvial fans are major sedimentary bodies that make the transition between the reliefs in erosion and the sedimentary basins, where deposition occurs. Understanding their dynamics of formation and evolution is a great problem of sediment transport, which leads to a better understanding of the control exerted by the water and sediment fluxes on the fan morphology.

At the cost of several simplifications, we propose a totally predictive model for one-dimensional fans composed by one grain size and built under laminar flow. In this simplified context, it is possible to propose a unique relationship between the water flux, the sediment flux, the grain size and the slope of the fan. The theory is validated by one-dimension experiments, performed with glass beads and glycerine: the fan grows quasi-statically and maintains its slope just above the threshold for sediment transport. In addition, at leading order, the sediment discharge only controls the velocity at which the fan grows. These main predictions are then successfully tested in two-dimensional experiments.