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Experimental study of a single channel alluvial fan

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At the outlet of mountain ranges, rivers reach a flat plain and start to depose their sediment load into a conical sedimentary structure called alluvial fan. To decipher these sedimentary records, we need to understand the dynamics of their growth.
Most natural fans are built by braided streams. However, to avoid the complexity of braided rivers, we develop a small-scale experiment in which an alluvial fan is formed by a single channel. We use a mixture of water and glycerol to produce a laminar river. The fluid is mixed with corindon sand ($\sim$ 300 μm) in a tilted channel and left free to form a fan around its outlet. The sediment and water discharges are constant during an experimental run. We record the fan progradation and the channel morphology with top-view pictures. We also generate an elevation map with an optical method based on the deformation of a moiré pattern.
We observe that, to leading order, the fan remains self-affine as it grows, with a constant slope. We compare two recent studies about the formation of one-dimensionnal fan [Guerit et al. 2014] and threshold rivers [Seizilles et al. 2013] to our experimental findings. In particular, we propose a theory witch relates the fan morphology to the control parameters (fluid and sediment discharges, grain size). Our observations accord with the predictions, suggesting that the fan is built near the threshold of sediment motion. At the first order, the fan profile is linear and control by the water discharge. The downstream decrease in sediment discharge add a curvature to this profile.
Finally, we intend to expand our interpretation to alluvial fans build by single-thread channels (Okavango, Bostwana; Taquari and Paraguay, Brasil).