Croissance de stries longitudinales dans des rivières de laboratoire

Anaïs Abramian[1], Olivier Devauchelle[1] & Eric Lajeunesse[1]

Institut de Physique du Globe de Paris, 1 rue Jussieu 75005 Paris
abramian@ipgp.fr

An alluvial river forms its bed with the sediment it transports, either in the bulk of the flow (suspended load) or in a thin layer near the bed surface (bedload). The channel bounds the flow, which in turns deforms the channel by erosion and sedimentation. This coupling between flow and bedload transport spontaneously selects the shape and size of the river.

The first ingredient of this coupling is gravity, which pulls the moving grains towards the center of the channel, thus eroding the banks continually [1]. However, laboratory observations show that, due to the roughness of the bed, the trajectory of a moving grain fluctuates in the transverse direction [2]. The bedload layer is therefore a collection of random walkers which diffuse towards the less active areas of the bed. In a river at equilibrium, bedload diffusion counteracts gravity to maintain the banks.

When gravity and diffusion are out of balance, their interaction causes an instability. Indeed, if an initially flat bed of sediment is perturbed with longitudinal streaks, the flow-induced shear stress is weaker where the flow is shallower. Therefore, we expect bedload diffusion to induce a flux of sediment towards the crests of the perturbation. This positive feedback induces an instability which can generate new channels. We suggest that this mechanism could explain the transition from single-thread rivers to braided ones.

Références

1. G. Parker, *Self-formed straight rivers with equilibrium banks and mobile bed.*, Journal of Fluid Mechanics **89**, 127-146 (1978).
2. G. Seizilles et. al, *Cross-stream diffusion in bedload transport*, Physique of Fluids **26**, 013302 (2014).