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Incision dynamics and shear stress measurements in submarine channels experiments

P. Lancien(1), E. Lajeunesse(1), F. Metivier(1)
(1) Institut de Physique du Globe de Paris (lancien@ipgp.jussieu.fr)

We report observations on the incision dynamics of subaqueous channels in small-scale laboratory experiments. Our experimental setup consists in a 2m x0.5m x0.5m flume filled with fresh water. The flume bottom simulates a submarine ramp draped by a sediment blanket. A sustained density flow is simulated by a continuous brine stream injected at the top of the ramp. An optical acquisition technique enables us to measure instantaneously the topography of the sediment surface at successive times, during the canyon formation and frontal lobe deposition. The space-time diagrams constructed from these data shows the initial incision phase, followed by a widening phase associated with an erosion-deposition wave progradation. In order to better characterize the inception phase, we make measurements on the gravity current prior to incision. Thanks to the particle-with-shadow tracking, a new technique using settling particles to gather information on the velocity field, we obtain the lowest part of the downstream velocity vertical profile with a good accuracy. The velocity gradient in the viscous sublayer gave us access to the first direct shear stress measurements in a gravity current. Varying the incline slope and the input flow rate, we observed the dependance of channel width on the shear stress and on the gravity current width.