Geophysical Research Abstracts, Vol. 7, 03550, 2005
SRef-ID: 1607-7962/gra/EGU05-A-03550

Velocity structure of the gravity current in submarine channels experiments

P. Lancien (1), F. Metivier (1), E. Lajeunesse (1), M-C. Cacas (2)
(1) Institut de Physique du Globe de Paris, (2) Institut Français du Petrole

We report the results of laboratory experiments reproducing submarine straight canyons. Our experimental setup consists in a 2 m x 0.5 x 0.5 m 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.
We control the three main parameters of the experiment: the slope of the plane, the input flow rate, and the brine density. This allows us to test the reproducibility of the phenomenon and to roughly delineate a phase diagram specifying the channel incision conditions. 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. In this way we can choose physical quantities representative of different channel types and visualize their evolution.
Close movies of small parts of the plane allow us to establish the gravity current velocity structure, using two different methods:
- With global correlations on space-time diagrams, associated with large statistics because of the turbulence, we can visualize the influence of the slope and the flow rate on maximum velocities.
- With a particle tracking method, we measure the velocity profile in order to determine the Shields stresses exerced on the bed during the initial incision phase. We obtain the decreasing velocity in the lowest part of the flow with a good accuracy. The velocity gradient in the viscous sublayer gives then direct acces to the shear stress.