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EXPERIMENTAL AND NUMERICAL SIMULATION OF GRAVITY CURRENTS ON SLOPING BEDS

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Summary. The aim of this paper is the investigation of gravity currents moving on a sloping bottom by both laboratory experiments and numerical simulations. Four full-depth lock exchange release experiments were realized to compare laboratory results to numerical simulations keeping constant the initial density of gravity current, the initial position of the vertical gate and the initial depth of the two fluids, and changing the bed's slope. The experiments were conducted in a Perspex tank of rectangular cross-section divided into two parts, one filled with tap water and the other one with salt water to the same height separated by a sliding gate, which is suddenly removed at the beginning of the experiment. The desired slope was obtained by placing the tank above a tilting structure. A quantity of dye was dissolved into the salt water to allow the visualization of the gravity current. All the experiments were recorded by a camera and an image analysis technique was applied to measure the space-time evolution of the gravity current's profile. A two-layers, 1D, shallow-water model was used to simulate gravity currents. The mathematical model takes into account the space-time evolution of the free surface. The entrainment between the two fluids was modeled by a modified Ellison and Turner's formula (1959). Several numerical tests were run to calibrate an entrainment parameter in order to reproduce gravity currents moving both on a horizontal and upsloping beds. The comparison between numerical and experimental results shows that the developed model is a valid tool to reproduce gravity current's dynamics.