ABSTRACT

SUBMARINE LANDSLIDE FLOWS SIMULATION THROUGH CENTRIFUGE MODELLING

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Landslides occur both onshore and offshore. However, little attention has been given to offshore landslides (submarine landslides). Submarine landslides have significant impacts and consequences on offshore and coastal facilities. The unique characteristics of submarine landslides include large mass movements and long travel distances at very gentle slopes. This thesis is concerned with developing centrifuge scaling laws for submarine landslide flows through the study of modelling submarine landslide flows in a mini-drum centrifuge. A series of tests are conducted at different gravity fields in order to understand the scaling laws involved in the simulation of submarine landslide flows. The model slope is instrumented with miniature sensors for measurements of pore pressures at different locations beneath the landslide flow. A series of digital cameras are used to capture the landslide flow in flight. Numerical studies are also carried out in order to compare the results obtained with the data from the centrifuge tests. The Depth Averaged Material Point Method (DAMPM) is used in the numerical simulations to deal with large deformation (such as the long runout of submarine landslide flows). Parametric studies are performed to investigate the validity of the developed centrifuge scaling laws under the initial and boundary conditions given in the centrifuge tests. Both the results from the centrifuge tests and numerical simulations appear to follow the proposed centrifuge scaling laws, which differ from the conventional centrifuge scaling laws. The results provide a better understanding of the centrifuge scaling laws that need to be adopted for centrifuge experiments involving submarine landslide flows, as well as giving an insight into the flow mechanism involved in submarine landslide flows.