

Flow Transformation of Debris-Flows Flowing from Subaerial to Subaqueous Environments

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Subaerial debris-flows often flow directly into marine environments especially in fan-delta of tectonically active areas. To investigate behavior of debris-flows transiting into subaqueous environments, we conducted flume experiments and observed them detail by the high-speed camera (1000 frames/sec.). As a result of experiments, we revealed that a debris-flow transforms into multiply surging turbidity currents.

Experimental procedures are following. Water filled an experimental flume (60 x 200 x 8 cm) up to 30 cm in depth. Sand, clay (kaolin) and water was mixed. Sediment concentration is 65-75 w.%. Then, sediment/water mixture flowed as a debris-flow on the slope inclined 10-40 degree in the flume.

Based on our observation, subaerial debris-flows occasionally transformed into high-concentration turbidity currents when they touched standing water. Mode of flow transformation depends on head velocity of the flow. If velocity is below the critical velocity, subaerial debris-flows transit to subaqueous debris-flows. In contrast, when they exceed critical velocity, they transform into turbidity currents instantaneously. Flow transformation occurs only in the head of the flow, and body of a flow remains to be a debris-flow state.

When debris-flows transformed, turbidity current surges were repeatedly produced from a debris-flow. Produced turbidity currents of the flow head split off from debris-flows of the flow body because of their velocity difference, and head of a split debris-flow then transformed repeatedly into a turbidity current. Result of our experiments suggests that turbidites exhibiting evidences of multiply surging may also be produced as results of flow transformations of debris-flows.