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Basic hydraulic experiment on the saturated concentration of suspended load due to tsunamis

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When tsunamis arrive in the shallow sea, a huge amount of suspended load is generated by large velocity and strong turbulence. The suspended load causes the geomorphic processes of erosion and deposition. Because the suspended load cannot be increased endlessly, it should have the saturated concentration. Many numerical models of sediment transport due to tsunamis have assumed a constant value of 1% for the saturated concentration empirically. However, it is supposed as a function of velocity. In this study, a hydraulic experiment was carried out to investigate a relationship between velocity and the saturated concentration of suspended load when tsunamis attack. A water circulation pipe used in the experiment was 10 cm in a diameter, 260 cm in length and 50 cm in width. A velocity of water flow in the pipe had been controlled by two pumps and two valves. It was changed from 0.24 to 1.22 m/s. Various amounts of sand was spread on the bottom of pipe. The amount of sand was changed from 0.1 to 10% as converted in the concentration of suspended load if all sand suspended. A diameter and a density of the sand were 0.267 mm and 2.64 x 10̂3 kg/m̂3. A condition of sediment transport in the pipe was recorded by video camera from a transparent window at the side of pipe. The condition was judged as all sand particles were suspended or not. The former condition indicates that the concentration of suspended load is saturated and the latter does it is not saturated. When velocity was smaller than 0.47 m/s, there was no suspended load because of a weak tractive force. When velocity became larger, the suspended load was generated and the concentration also became higher. However, the concentration had the upper limit and surplus sand appeared on the bed of pipe when velocity became much larger. The condition gave the saturated concentration of suspended load. When velocity was 0.665 m/s, the saturated concentration was smaller than 1% which is used in many numerical simulations mentioned above. However, it exceeded 1% when velocity was 0.921 m/s and it became 5% when velocity was over 1.16 m/s. Finally, a relationship between velocity and the saturated concentration of suspended load was obtained.