

論文の内容の要旨

論文題目 Sand Dune Erosion Mechanism During Tsunami Overwash
(津波の越流による砂堆侵食機構に関する研究)

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Sand dune erosion mechanism is investigated in this study both by conducting laboratory experiments and numerical simulation. This is completely focusing on the erosion mechanism of subaerial sediments that constitute dune. Inundation overwash is reproduced in the laboratory by generating tsunami like wave. Laboratory experiments were conducted to investigate the mechanisms and parameters involved in dune sediment transport due to overwash. A total of 16 experimental runs have been conducted comprising of three types of sand on two different slopes for three bore condition. In each experiment, initial dune condition is set as: (i) dry and, (ii) wet. Up to the author's knowledge, this study considers this wet/dry condition for the first time.

Dune size and principal bore parameters are believed to be the essential factors in this transport process and simple analytical approach can reasonably represent this relationship. According to the analysis of the experimental results, it appears that air escaping behavior, incident bore parameters, bed slope, porosity, time scale, angle of repose have influence to generate difference in overwashed dune sediment transport for initially dry and wet condition as well as sediment types. Fine sand in wet condition exhibited highest erosion resistance. Coarse sand is dominated by porosity and the shorter time ratio for in/exfiltration.

Numerical modelling of hydrodynamics and dune morphology is performed based on the shallow water equations and energetics-based sand transport models. The model can predict the dune profile after the overwash by considering initial wet and dry condition. Effective shear stress is the key factor for sediment transport. For fine sand, higher stress is required to simulate dry dune profile than wet dune. This shear stress increases proportionally to grain sizes.

The outcome of this study is expected to draw detailed picture of dune erosion mechanism, both externally and internally along with the sediment transport characteristics in initially wet and initially dry sediments in sub-aerial part.