A FULLY NONLINEAR MODEL FOR LONG WAVES GENERATED BY SUBMERGED MOVING DISTURBANCES

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A joint theoretical, numerical and experimental study is carried out to investigate the phenomenon of nonlinear long waves generated by submerged moving disturbances such as submarine landslides. Assuming inviscid and incompressible fluid and permeable bed, an extended fully nonlinear wave model is developed by using perturbation expansion based on the Euler equation and the equations for flow inside the permeable bed developed by Hsiao et al. [1]. To model submerged moving disturbances, the water depth is allowed to vary both in space and in time ([2], [3]).

After the wave model is derived, numerical computations are performed to simulate long waves generated by submarine landslides and other submerged disturbances moving at different speed based on the new wave model and also on an earlier lower order generalized Boussinesq (gB) model by Wu [2]. The numerical results are then compared with the experimental results from the present and previous studies [4] for model validation and for achieving a better understanding of the fundamental mechanism of long wave generation by submerged disturbances. In the study, the order and physical significance of different terms in the equations are carefully examined and analyzed by using the numerical and experimental results. The advantage and limitations of the fully nonlinear model and the gB model are compared and discussed. The objectives of the study are to determine which physical effects are the most important in generating nonlinear long waves and to develop the most suitable wave model (i.e., accurate, efficient and with a broad application range) for predicting wave generation. Specific physical factors investigated include the height, speed, and length of a moving disturbance, and bed slope on which a landslide occurs.

The detailed results and conclusions will be presented at the USNCTAM-2006 conference.

References

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