NUMERICAL MODELING OF SHIP-INDUCED WAVE PROPAGATION

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Abstract: A procedure is presented for the modeling of the propagation of waves induced by a sailing ship in shallow water. The method investigated consists of the coupling of two existing models: a 3D potential flow model to calculate the wave field near the ship; and a 2D Boussinesq-type model for the calculation of the wave propagation away from the ship. The study of this type of problems is important in situations where ship-induced waves may cause damage to revetments or hindrance to moored ships. Depending on the bottom topography and the distance at which the ship passes, the wave height near the location of interest may be substantially larger than in the direct vicinity of the sailing ship. Also the wave pattern may change significantly as a result of the shoaling and refraction over an uneven bottom in combination with nonlinear effects and possible wave breaking, and diffraction and reflection at groins and quay walls. The results of several feasibility and validation studies indicate that by combining the strength of both models through a coupling, a powerful tool is obtained for the prediction of ship-induced wave characteristics.

INTRODUCTION

Ship-induced water motions are important because of their influence on the stability of banks and the bed of waterways on the one hand, and the safety of moored or freely floating ships on the other hand. For both categories of aspects the consequences of ship-induced water motions depend on the following chain of events: 1) ship wave generation, 2) wave propagation away from the ship, 3) wave conditions at a bank or at a moored vessel, and 4) influence on bank stability or response of moored vessel. In Figure 1 this mechanism is shown schematically.

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