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Statistics of waves within a ship wake

I. Didenkulova (1,2) and A. Rodin (1,3)

(1) Institute of Cybernetics, Tallinn University of Technology, Tallinn, Estonia, (2) Nizhny Novgorod State Technical University, Nizhny Novgorod, Russia, (3) Institute of Applied Physics, Nizhny Novgorod, Russia

High-amplitude water waves induced by high-speed ferries are regularly observed in Tallinn Bay, the Baltic Sea causing intense beach erosion and disturbing marine habitants in the coastal zone. Such a strong impact on coast can be a result of a group structure of the wake and it is studied experimentally at Pikakari beach, Tallinn Bay. The most energetic vessel waves at this location have amplitudes of about 1 m and periods of 8-10 sec with maximum run-up heights up to 1.4 m. These wakes represent a certain structure, where the largest and longest waves come first and waves of smaller amplitude and period after. Sometimes the groups of different heights and periods can be separated even within one wake. The wave heights within a wake are well-described by the Weibull distribution, which has different parameters for wakes from different ships. Wave runup heights can also be described by Weibull distribution and its parameters can be connected to the parameters of the distribution of wave heights. Finally, the runup of individual waves within a wake is studied. It is shown that the largest amplification occurs for waves of weak amplitude and is in a good agreement with an estimate for the nonbreaking runup of a sinusoidal wave. The largest waves are strongly affected by the wave breaking and their runup is modeled numerically in the framework of the nonlinear shallow-water theory.