Geophysical Research Abstracts
Vol. 14, EGU2012-752, 2012
EGU General Assembly 2012

A typical wave wake from high-speed vessels: its group structure and run-up

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High-amplitude water waves induced by high-speed vessels 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 may be a result of a certain group structure of the wave wake and it is studied experimentally at Pikakari beach, Tallinn Bay. The most energetic vessel waves at this location (100 m from the coast at the water depth 2.7 m) have amplitudes of about 1 m and periods of 8-10 sec and cause maximum run-up heights on a beach up to 1.4 m. These waves represent frequency modulated packets 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 wave wake event. The wave heights within a wake are well-described by the Weibull distribution, which has different parameters for wakes from different vessels. Wave run-up heights can also be described by Weibull distribution and its parameters can be connected to the parameters of the distribution of wave heights 100 m from the coast. Finally, the run-up of individual waves within a packet is studied. It is shown that the specific structure of frequency modulated wave packets induced by high-speed vessels leads to a sequence of high wave run-ups at the coast, even when the original wave heights are rather moderate. This feature can be a key to understanding of the significant impact on coast caused by fast vessels.