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Shallow water freak waves: the case of Tallinn Bay the Baltic Sea

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We study freak waves properties in shallow water at two different locations of Tallinn Bay, the Baltic Sea. One data set was collected in summer 2009 at the Pikakari beach and another one – in summer 2008 at Aegna Island. The water surface elevation was recorded by down looking ultrasonic echosounder with a frequency of 5 Hz, which was located 100 m from the shoreline at the water depth 2.7 m. Freak waves are identified as those, whose wave height is at least twice larger than the significant wave height. Both datasets were recorded in relatively calm weather conditions and contained sufficient number of freak waves: 97 events in 2008 and 55 events in 2009, most of which represented single wave events. The data are analyzed by both up-crossing and down-crossing methods. The statistics of freak wave heights is studied together with the statistics of freak wave crests and freak wave troughs and compared for different locations of the Tallinn Bay. It is shown that for a very low wave activity (amplitudes below 10 cm) it is more probable to meet freak waves of negative polarity (freak wave troughs) rather than the freak waves of positive polarity (freak wave crest), while for a more intense wind wave conditions (amplitudes above 40 cm) it is more probable to meet the freak wave crest rather than the freak wave trough.