Runup height distribution of large-amplitude waves climbing a plane beach

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The freak wave phenomenon is usually discussed for waves in seas and oceans far from the shores. Such unusual waves are observed also in the coastal zone and on beaches. Excellent photos of freak waves on rock coasts are given in literature, when a freak wave reached height of 25 m approximately 4 sec after it was visible near the coast (Vancouver Island, Canada). A freak wave attacked the breakwater in Kalk Bay (South Africa) on April 21, 1996 and August 26, 2005. In both events the freak wave washed off the breakwater and some people were injured. The freak waves induced panic at Maracas Beach (Trinidad Island, Lesser Antilles) on October 16, 2005, when a series of towering waves, many more than 25 feet high (maximal height of 8 m), flooded the beach exposing to danger sea-bathers, vendors and lifeguards.

In this research a runup of irregular incident wave field on a plane beach is studied within an analytical nonlinear long wave theory. Various statistics of the incident waves are used. Distribution functions of runup characteristics for the narrow-band incident wave field are described by the Rayleigh distribution, according to well-known linear expressions for extreme characteristics. For the wide-band process distribution functions differ from Rayleigh , and the mean value of runup amplitude changes. Generally, the wave field in shallow waters contains many coherent wave components, and an idea to present it as a random assembly of solitary waves is very popular (Brocchini and Gentile, 2001). The runup of the soliton on a plane beach is studied by Synolakis

(1987); its runup height is proportional to the 5/4 power of the amplitude . The distribution function for runup heights is calculated for the wave field that consisted of almost non-interacted solitons. It predicts the deviation from the Rayleigh function and the increasing of the high-amplitude wave probability.