Freak wave occurrence near vertical barriers

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The rigorous solution of the nonlinear shallow-water equations for the wave field near a vertical wall is derived; it is used to calculate the height of the water oscillations near the wall versus the height of the incident wave. This solution is used to find the exceedance probability of characteristics of the wave motion near the vertical wall. It is shown that the wave height and trough distributions of water oscillations near vertical structures are less than the Rayleigh distribution. Beside of this, the distribution of the crest heights exceeds the Rayleigh distribution (using normalization of the amplification factor for such geometry within the framework of the linear theory), and this explains the high frequency of freak wave events on breakwaters and coasts.