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Influence of underwater landslide localization on character of tsunami wave runup on the beach

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In this work it is considered the generation of tsunami wave at sliding of dry beach as well as underwater slope. At numerical simulation of landslide motion it was used method which permits to take into account mechanical properties of landslide constituents and detailed structure of landslide body [1,2]. Using the programming code FLAC there were estimated distributions of rest deformations and shifts in the whole ground volume with taking into account its possible liquefaction and disconsolidation. It was considered layer-by-layer sliding of upper part of elasto-plastic layer on slope surface forming during the sliding process. The ground was modeled by elasto-plastic sediment layer with Coulomb-Mohr yield criterion. For numerical simulation of surface water wave there were used nonlinear equations of shallow water with taking into account the bottom friction. The wave generation in each time moment was determined in fact by continuity equations. The process of formation of surface water wave was performed up to landslide stopping moment. Hereunder, the dynamical source considered generates the tsunami wave propagating towards beach as well as to deep water. There were considered following scenarios: landslide moves from water shoreline, landslide localized on underwater slope (various variants of shelf zones) and landslide coming to water from dry beach. All cases were considered for two maximum friction angle: 20 and 32 degrees. It was analyzed the influence of dry beach slope and shelf zone as well as dissipation to maximum value of wave runup to a beach. It was shown that with increasing of maximum friction angle the value of wave runup to a beach and distance of landslide motion is decreased. The results obtained at numerical simulation demonstrate that for the same geometry of the beach slope, at the same seismic or any action depending on rheological and geological properties of sediments accumulated at slope, there is possible generation, propagation and tsunami wave runup with essentially different characteristics at the beach – from smooth inundation to destructive tsunami.
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