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Influence of landslide initial localization to runup of induced tsunami wave

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The problem of tsunami wave induced by submarine landslide with various its localization for the same beach slope geometry and seismic or other actions, depending on rheological and geological properties of sediments, accumulated at slope is considered. The results obtained at numerical simulation of tsunami wave runup at motion of submarine landslide demonstrate that depending on initial landslide localization: at slope on shoreline, at submarine slope or partially located at the dry beach, the character of propagation and runup of tsunami wave, with essentially different characteristics at the beach is possible: from quiet inundation to destructive tsunami. So, at initial localization of the landslide body on the shoreline and at the submarine slope, first wave coming to a beach will be depression wave while at partial initial localization of the landslide at dry beach, first wave will be always as elevation wave. At initial localization of the landslide on the shoreline, during its sliding it occurs a shift of shoreline point towards dry beach what introduces additional complexity in calculation of runup value at such dynamical slope which is forming because of the sliding process, what, in first turn, is connected with point of moving shoreline. The calculation of runup was performed on the basis of known numerical scheme of Sielecki [Sielecki, Wurtele, 1970] modified for runup at sliding slope. It is demonstrated that for different rheological properties of landslide (maximum friction angles were 20 and 32 degrees) the value of maximum vertical shift for landslide in the first case is of the order 50 m but the same value in second case is only 10 m. If, in first case, the size of landslide zone is of the order 1500 m then in second case it is only near 700 m. The runup value for the first case is 10 m, and for the second case only near 5 m. At initial localization of landslide at the submarine slope the runup value for tsunami

wave coming to a beach is small essentially, what can be explained by decreasing of wave-forming power of submarine landslide with increase of depth of its initial localization. At initial localization of landslide partially at the dry beach, the character of runup on the beach is provided by only dynamics of submarine part of the landslide. The motion of the point of moving shoreline in this case is of quite another character as compared with previous case: after small oscillations, the shoreline point comes towards positive values, reaches of maximum, and wave runup in each time moment occurs to new slope, formed during the sliding, however the motion of shoreline point is principally another (as compared with the case of initial localization of landslide on the shoreline or on submarine slope) - shoreline point in this case is shifted towards deep water. So, it is demonstrated that landslide-induced surface water wave can provide the essentially different runup value and character, depending on initial localization of landslide body as well as on rheological properties of the landslide. Hence, existence of strong tsunami at slight earthquake can be explained, in particular, by taking into account the physical properties of landslide constituents as well as the initial localization of the landslide body.