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Hydrodynamic loads of tsunamis in the inundation zone

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The amplification of tsunami amplitudes at coasts and resulting strong flow velocities are main cause of hydrodynamic loads by tsunami waves. Tsunami waves can (1) drag the whole structures or their units at land or vessels in the sea, (2) damage the buildings with accumulated shoreline debris carried on the advancing wave fronts, (3) undercut foundations and pilings with erosion caused by the receding waves, (4) overturn structures by suction of receding or thrust of advancing waves.

To calculate potential damage to structures several factors must be considered including tsunami characteristics, exposure of coastline, type and distribution of structures, area of inundation of the coastal zone, and the value and characteristics of the property near the coastal zones.

In this study two different dimensionless parameters representing i) the ratio of drag force to hydrostatic force and ii) the ratio of wave front velocity to flow velocity are computed from the simulations are investigated using regular shaped bathymetry topography with several structures (such as slender, wall type and barrier type) in the numerical model. A simple dimensionless relation describing the level of hydrodynamic load as the ratio of drag force to hydrostatic force is developed. The spatial distribution of maximum values of dimensionless hydrodynamic load parameter, amplitude and velocities in relation to the distribution of marine structures under different shape, amplitude and period combinations of tsunami waves are compared and discussed.