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Effects of water compressibility in the Tokachi-Oki 2003 tsunami source: in-situ observations and numerical modeling

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At the close of XX century, Japan Agency for Marine-Earth Science and Technology (JAMSTEC) deployed a set of real-time observatories at the continental slope close to the islands of Japan. As a result it became possible to investigate a tsunami generation directly at its source. The Tokachi-Oki earthquake of 2003 turned out to be the first strong tsunamigenic seismic event, the epicenter of which was located in the immediate vicinity of the JAMSTEC sensors. Analysis of the records of bottom pressure variations obtained during this event provided a unique opportunity to reveal manifestations of compressibility of water column in tsunami source. In this study we try to reproduce bottom pressure variations in the Tokachi-Oki 2003 tsunami source by means of 3D numerical simulations technique taking into account dynamic bottom deformations, water compressibility and real bathymetry. In the present technique, a total system consisting of the water column and the underlying ground is assumed to be a weakly coupled system. On this assumption, earthquake ground motion due to seismic fault rupturing is first simulated by the boundary element method. Then, disturbance of water column including tsunamis resulting from the seismic ground motion is simulated using the ground motion velocity as an input to the hydrodynamic model. Water column behavior is simulated within the framework of linear potential theory with use of explicit finite difference method. Comparison between JAMSTEC in-situ measurements and synthetic signals is carried out.