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## A study of the generation mechanism of the ocean gravity waves excited by seismic surface waves, based on the comparison of the numerical experiments results and observation data

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The DONET (Dense Oceanfloor Network System for Earthquakes and Tsunamis) is a submarine cabled real-time seafloor observatory network for precise earthquake and tsunami monitoring. Ten DONET observatories were in operation during the 2011 Tohoku-Oki event near the Pacific coast of Honshu Island. Each observatory was equipped with an ocean bottom pressure gauge (PG) and a three-component ocean bottom seismometer (OBS). A comparative analysis of the PG and OBS records revealed that shortly after seismic surface waves traversed the DONET region, free gravity waves were observed within the water layer. The period of these gravity waves was approximately 170 s, the peak-to-peak amplitude was approximately 3.5 cm, the length was on the order of 22 km, and the phase velocity was 134 m/s. We performed numerical simulations of the observed gravity waves using a combined 2D/3D numerical model. The ground motions required for the simulation were reconstructed from records provided by the DONET OBSs and the nearest ground-based GPS stations. The synthetic bottom pressure variations are in good agreement with the DONET PG records. The synthetic displacements of the ocean surface throughout the simulation domain showed that the observed gravity waves were excited directly above the submarine slopes. Theoretical estimates and numerical experiments revealed the generation mechanism of the observed gravity waves. The results showed that (1) horizontal, rather than vertical, bottom movements play a key role in their generation, (2) the amplitude of the excited gravity waves is determined by the amplitude of the dynamic horizontal bottom motions, while the contribution of horizontal static bottom displacements is insignificant, and (3) the amplitude of the excited gravity waves depends on the relative orientation of the slope and the propagation direction of the seismic surface waves.

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