Studying the effect of seawater on seafloor strong ground motions using simulation method

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For the seismic design of offshore engineering, we need to estimate the design parameters of seafloor strong motion. Under the influence of seawater and seafloor soil, seafloor ground motion may present different characteristic from that of onshore ground motion. Until now, there have been very few researches on the seafloor strong motion and also very little seafloor strong motion data has been observed. Our present paper focuses on the effect of seawater on the engineering characteristics and attenuation characteristic of seafloor strong motion. Our main work includes two main parts: one is the effect on engineering characteristics (PGA, Fourier spectra and acceleration response spectra, and 90% energy duration)of seafloor strong motion under seawater of different depth; and the other is the effect of seawater for 50-meter depth on seafloor strong motion attenuation characteristic. Using the wavenumber integration method program of Computer Programs in Seismology (CPS), we perform numerical simulation of seafloor ground motions in six different conditions(water depth: 50 meter, 60 meter, 70 meter, 80 meter, 90 meter and 100 meter) for three kinds of fault types(Normal fault, Reverse fault and Strike-slip fault) and compare them with that without seawater on them. As a result, for whatever kind of fault types, the difference of effect on seafloor horizontal ground motions of seawater is little and can be ignored. However, the effect on seafloor vertical ground motions of seawater is obvious. For all the three kinds of fault types, with the increasing depth of seawater, the effects on vertical motions are similar: 1) waveform becomes more visually complicated; 2) PGA becomes smaller; 3) Fourier spectra decreases greatly near the P wave resonance frequencies of seawater, acceleration response spectra becomes smaller in short periods less than 0.1s. The effect on 90% energy duration time of seafloor vertical motion of seawater has something to do with fault types. We establish the attenuation characteristic relationships of PGA and acceleration response spectra for seafloor vertical ground motion with 50-meter depth of seawater using CPS software and compare them with that without seawater. We found that: the 50-meter depth of seawater has a great effect on the attenuation relationships of PGA and the acceleration response spectra in very short periods (not exceeding 0.04s), the PGA and acceleration response spectra values of seafloor vertical motion are obviously smaller than those without water.

Keywords: seawater, seafloor ground motion, numerical simulation, attenuation characteristic relationship

