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SSS023-21 会場:国際会議室 時間:5 月 23 日 15:15-15:30

2007 年 8 月 15 日ペルー地震の強震動シミュレーション ―特異な強震動への地震波放射特性の影響―
Strong motion simulation of the 2007/9/15 Peru earthquake; Effect of radiation pattern on atypical strong ground motions

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The 2007 Mw8.0 Pisco earthquake was a thrust event originating at the interface of the Nazca and South-American plates, in a region slightly north of where the Nazca ridge encounters the trench and is being subducted beneath the Peru margin. The source area of the Pisco earthquake was located 160 km south-east of Lima, off-shore of the Pisco city, in a region filling the gap between the 1974, Mw8.0 Lima earthquake, and the 1996, Mw7.7 Nazca ridge earthquake. The source model of this earthquake displays two distinct asperities, the first one located near the hypocenter at a depth of 39 km, and the second one located 60 km to the South at a depth of 17km (Sladen et al., JGR, 2010). The source time function of this earthquake was also characterized by two episodes of moment release, the first one at 10s and the second and largest one at 80s, separated by a very low apparent rupture velocity of 1.5 km/s. These features suggest that the earthquake may have been characterized by a delayed rupture of two isolated events, each with a conventional rupture velocity. Ground motions from this earthquake are also characterized by two clear sub-events originating from each asperity, as can be observed from strong motion recordings of the mainshock at Lima (NNA), and Parcona (PCN) stations. The acceleration waveform at PCN station, which is located above the source area of the earthquake, is characterized by an atypical pattern, namely that the peak amplitude corresponding to the first sub-event is more than 5 times larger than the peak amplitude from the second sub-event, despite the fact that the second sub-event has a much larger moment release and is located closer to PCN. To explain this unusual pattern one may think of large differences in the propagation characteristics between asperities 1, 2 and PCN, or differences originating at the source. We may rule out the contribution of site-effects to explain this difference as we can assume it is the same for both sub-events.

Based on the aforementioned source model we simulated the strong ground motions at PCN and compare it with the observed record. Our simulations show that a variable radiation pattern across the fault plane can provide an appropriate explanation on the relative differences in amplitude for the two sub-events at PCN. The radiation pattern of S waves for a point source at the centroid of asperity 2 shows that the location of station PCN is coincident with a nodal plane of SH waves. Therefore the large seismic radiation released from this asperity is dramatically reduced at PCN by a very small radiation pattern coefficient. In contrast the seismic radiation from asperity 1 is modulated by a large radiation pattern coefficient, as its azimuth relative to PCN differs by approximately 45 degrees with respect to the asperity 2 to PCN azimuth, thus enhancing the source contribution to amplitudes from the first sub-event at PCN. On the other hand the source model of the Pisco earthquake displays a small average rise time for asperity 1 (around 1s), as compared to a large rise time for asperity 2 (around 7s), which may also have contributed to magnify the amplitudes from asperity 1.

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