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Array Back-Projection Imaging of the 2007 Niigataken Chuetsu-oki Earthquake Striking the World's Largest Nuclear Power Plant

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Abstract

The 2007 Niigataken Chuetsu-oki earthquake occurred near the Kashiwazaki–Kariwa nuclear power plant in Japan, the largest in the world. The strong motions were recorded by seven seismometers installed at the foundation slab (base-mat) of the plant and exceeded the design level of the ground motion for the plant. The strong motion observed by the seismographs in and around the plant show high coherency with three significant pulses. In order to understand the cause of these pulses, the rupture process of the earthquake was estimated using these seismograms. The seismograph network was taken into account as a dense array and semblance-enhanced waveform stacking was performed. By projecting the power of the stacked waveforms onto the fault plane, the asperities that generated significant pulses were successfully separated. The first and third pulses were generated at the hypocenter and the southwest edge of the rupture zone, respectively. The rupture propagated toward the southwest and terminated offshore from the power plant. The overall pattern of the imaged asperities coincides well with the slip distribution determined by conventional waveform inversions.

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Index Terms/Descriptors

algorithms | arrays | arrival time | aseismic design | Asia | earthquakes | elastic waves | Far East | focus | foundations | geologic hazards | ground motion | Honshu | Japan | magnitude | main shocks | Niigata Japan | power plants | risk assessment | seismic risk | seismicity | strong motion | Chuetsu-Oki earthquake 2007

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