

Visualization of seismic wave propagation and strong motions in Japan by a dense seismic observation and the Earth Simulator

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Following the Kobe earthquake, a nation-wide network of 1,800 strong-motion instruments (K-NET, KiK-net) were deployed across Japan in order to mitigate earthquake disasters by improving our understanding of site-specific wave propagation and amplification. Recent developments in high-performance computing, such as the Earth Simulator supercomputer have made it possible to perform realistic simulations of high-frequency seismic wave propagation on a regional scale. To exploit this computing power, our group has developed an efficient parallel FDM code and a set of volume visualization techniques for 3D seismic wavefields, which also allow the simulation results to be compared directly with observations recorded by the dense seismic array.

Large-scale simulations were conducted for modeling of the strong motions associated with recent damaging earthquakes in Japan; the 2004 Niigata-ken Chuetsu earthquake (Mw6.6). Through comparison with observations, the accuracy of the proposed simulation model with respect to the temporal evolution of long-period ground motions and the intensity distribution was confirmed. Thus, the model is considered to be suitable for predicting the strong ground motions associated with future earthquake scenarios such as events in the Nankai Trough. Historical documentation indicates that M8 earthquakes have occurred repeatedly along the Nankai Trough, at the southern coast of central Japan, at relatively uniform intervals of about 100 years, suggesting that the next series of Tokai and Nankai M8 earthquakes should occur within 30-40 years.