Pre-stack depth imaging and pore-fluid pressure estimation along the Nankai Trough subduction zone off the Kii Peninsula, SW Japan

Fan Yu, Ehsan Jamali Hondori, and Jin-Oh Park

Atmosphere and Ocean Research Institute, The University of Tokyo

Introduction

At the Nankai Trough margin, the Philippine Sea Plate is being subducted beneath the Eurasian Plate to the northwest at a convergence rate ~4 cm/yr [Seno et al., 1993]. Historic, great megathrust earthquakes with a recurrence interval of 100–200 years [Ando, 1975] have generated strong motion and large tsunamis along the Nankai Trough subduction zone. The plate-boundary fault (i.e., décollement) is a source fault of the devastating Nankai megathrust earthquakes. While there were lots of seismic reflection studies across the Nankai Trough axis to reveal the mechanism of the Nankai megathrust earthquakes, only a few studies on pore-fluid pressure estimation were conducted. In order to figure out detailed crustal structure of the Nankai Trough subduction zone off the Kii Peninsula, southwest Japan, we carry out 2D pre-stack depth migration (PSDM) imaging by using multi-channel seismic (MCS) reflection data that were acquired by JAMSTEC. Moreover, we estimate pore-fluid pressure of the shallow underthrust sediments using the PSDM velocities and ODP/IODP drilling data.

MCS data acquisition and processing

The 2D MCS reflection data were acquired along line KI01 by R/V Kairei of the JAMSTEC in 2011. For deep-penetration seismic imaging, a large volume (~130 liters) tuned air gun array and air pressure (2000 psi) was used as the controlled sound source with 50 m shot interval and about 10 m towing depth standard. The MCS data were recorded by a 444-channel streamer with 12.5 m group spacing (~6 km maximum offset) and about 12 m towing depth standard. We tried to do pre-conditioning including air-gun bubble suppression, ghost suppression, FX deconvolution, demultiple filtering by surface-related multiple attenuation (SRMA) and parabolic radon transform (PRT). Then, we perform CDP sorting, stacking, and post-stack time migration.

Results and future work

The result of post-stack time migrated section is shown by Figure.1. We are going to perform layer stripping for velocity model building, Kirchhoff pre-stack depth migration (KPSDM), and semblance analysis for velocity QC. We will estimate pore-fluid pressure of the shallow underthrust sediments using the PSDM velocities and drilling data.
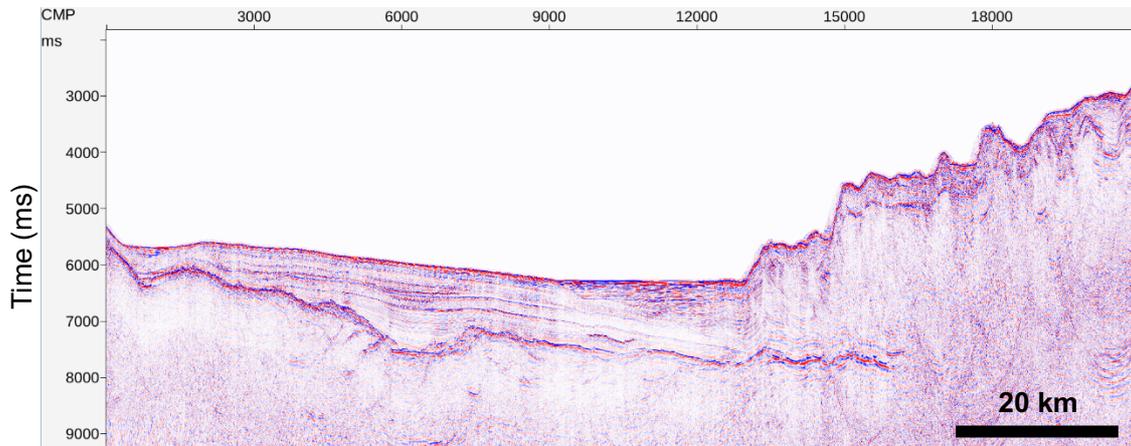
Figure 1. Post-stack time migrated section of the seismic line KI01.