

SSS018-07

Room: IC

Time: May 25 13:45-14:00

Imaging of deep crustal faults in the Nankai Trough with densely spaced OBS data, using Waveform Tomography

Rie Kamei^{1*}, R. Gerhard Pratt², Takeshi Tsuji²

¹University of Western Ontario, ²Kyoto University

High resolution quantitative velocity imaging plays a key role in understanding the detailed structure of seismogenic subduction zones. Ray-based traveltimes tomography is a conventional technique for velocity imaging, but uses distinct phases of early arrivals, resulting in the resolution limitations approximately related to the First Fresnel zone. Waveform Tomography exploits seismic waveforms, and has achieved much higher resolution than ray-based tomography. In this study we apply Waveform Tomography to high density ocean bottom seismograph (OBS) data acquired in the central Nankai Trough subduction zone off the Kii peninsula. We successfully image the area (60km width x 15km depth) around an active mega-splay fault, where 54 OBS were deployed with a 1km interval.

Waveform Tomography is acknowledged to behave non-linearly with respect to velocity structures. We adopted three strategies to mitigate the non-linearity (1) the frequency domain implementation is an implicit multi-scale approach in which the lowest frequencies and wavenumbers are inverted earliest, (2) a highly accurate traveltimes inversion result (Nakanishi et al., 2008) was used as a starting model, and (3) wavefields were time-damped with an exponential decay function to emphasize the contribution from early arrivals. Waveform Tomography results in a remarkable improvement over the previous traveltimes tomography result, clearly depicting a mega-splay fault, thrusts in the accretionary prisms, and the Moho at the approximately same location and resolution as in the reflection profile, with the added benefit of quantitative velocity imaging. The mega-splay fault accompanies a thin low velocity layer (<-500m/s), which is consistent with the previous observations of the reverse polarity in splay fault reflections, and suggests elevated pore pressures at the fault, or lithological differences due to the large displacement along the fault. Our results demonstrate the ability of Waveform Tomography for qualitative and quantitative deep crustal imaging from densely spaced OBS data.

Acknowledgement: We thank the Japan Agency for Marine-Earth Science and Technology (JAMSTEC) for providing the OBS data, and also thank A. Nakanishi for providing the traveltimes inversion result.

Keywords: Waveform inversion, Nankai Trough, splay fault