Japan Geoscience Union Meeting 2010
(May 23-28 2010 at Makuhari, Chiba, Japan)

SSS018-07 会場:国際会議室 時間: 5月25日13:45-14:00

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

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

亀井 理映[1*], R. Gerhard Pratt[2], 辻 健[2]

Rie Kamei[1*], R. Gerhard Pratt[2], Takeshi Tsuji[2]

[1]University of Western Ontario, [2]京都大学工学研究科社会基盤工学専攻

[1]University of Western Ontario, [2]Kyoto University

High resolution quantitative velocity imaging plays a key role in understanding the detailed structure of seismogenic subduction zones. Ray-based traveltime 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 traveltime 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 traveltime 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 traveltime inversion result.

キーワード:波形インバージョン,南海トラフ,分岐断層

Keywords: Waveform inversion, Nankai Trough, splay fault