Large-scale high-resolution seismic studies in the Nankai seismogenic zone

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Active-source seismic studies in the Nankai subduction zone have revealed that structures of the plate boundary play a key role for controlling rupture synchronization and segmentation along the seismogenic zone. Onshore - offshore active-source seismic surveys crossing the Tokai segment and the Nankai segment revealed a large scale subducted ridge and seamount, which are interpreted as northwestward members of the rear-arc seamount chains on the Izu arc and the Kinan seamount chain on the Shikoku basin, respectively. Those ridge and seamount are imaged at non-rupture areas of the last megathrust earthquakes. We proposed, from those observations, that the large scale convex structures may prevent lateral rupture propagation of the magathrust earthquakes. In the Nankai - Tonankai segment boundary which is clearly shown by an inversion of tsunami data, active-source seismic imaging detected a high seismic velocity body forming a strongly coupled patch at the segment boundary. The numerical simulation incorporating those structural variations explained the historic rupture patterns, and shows the occurrence of a giant earthquake along the entire Nankai trough. Although, the numerical simulation well demonstrated the historic rupture patterns of each segment, the simulated slip distributions within each segment does not coincide with those obtained by observed earthquake and tsunami data. Moreover, the inversions of the earthquake and the tsunami data showed different rupture patters within the Tonankai segment; i.e., in the east of the Shima peninsula both data showed large slips, but beneath the Kumano basin (i.e., in the west of the Shima peninsula) large slips were only obtained by the tsunami data. This indicates that slip having a long time constant may only occurred beneath the Kumano basin where the seismic imaging showed a smooth geometry along the plate boundary. In order to further improve the physical model of the plate boundary which explains the detailed rupture pattern and cycles, a 5-years large-scale high-resolution seismic study densely covered in the entire Nankai seismogenic zone has started from FY2008. In this presentation, we summarize the result of the active-source seismic surveys since the last a decade and introduce a newly obtained active-source seismic data from the new survey which has done at the western edge of the Nankai trough.